First record of *Oestrus ovis* Linnaeus, 1758 from Malta, and case reports of myiasis from the Maltese Islands (Diptera: Brachycera)

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ABSTRACT. *Oestrus ovis* is reported for the first time from Malta. An account is given of four cases of myiasis in Malta, one nasopharyngeal in a sheep host involving *O. ovis*, and three cutaneous in a human host and in domestic cats, the latter all involving *Lucilia sericata*.

KEY WORDS. Malta, Myiasis, *Oestrus ovis*, *Lucilia sericata.*

INTRODUCTION

The term myiasis was first used by Hope (1840) to refer to diseases of humans caused specifically by larvae of diptera. It has since then been defined as "the infestation of live vertebrate animals with dipterous larvae, which, at least for a certain period, feed on the host's dead or living tissue, liquid body substances, or ingested food" (Zumpt, 1965).

Two classifications of myiasis have emerged. The first, an anatomical classification, was proposed by Bishopp (Patton, 1922) and later modified by James (1947). It is based on the anatomical site of the infestation of the host, and is still widely used as it is simple and practical. The second, a parasitological classification proposed by Patton (1922), takes into account the degree of the parasitic dependency of the fly on the host, and is based on evolutionary and biological considerations.

Dermal or subdermal myiasis, also known as cutaneous myiasis, is the invasion of the skin by larvae of Diptera that cause burrows or boils in the dermal layers, invade and enlarge existing wounds (wound and traumatic myiasis) or form wounds themselves (i.e. penetrate unbroken skin). It may be benign, as when facultative species (those normally free living and unable to initiate myiasis) consume dead tissue, or malignant when obligate species (those dependant on myiasis for survival) destroy living, viable tissue. Of some seven families of Diptera that may cause cutaneous myiasis, two - the Calliphoridae and the Sarcophagidae – are the most important world wide.

Nasopharyngeal myiasis is the invasion of the tissues of the nose, paranasal sinuses and pharynx by dipterous larvae. The family Oestridae is the most important dipterous family causing nasopharyngeal myiasis worldwide.

Myiasis of the eye is referred to as ophthalmomyiasis. External ophthalmomyiasis results from the deposition of larvae on the conjunctiva or eyelids.

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Myiasis is a subject of great veterinary, medical and economic importance, and there is a large body of literature on it, referring to myiasis in both the Old and New World. The definitive treatise of myiasis in the Old World remains that of Zumpt (1965) and much useful information may be gathered from Ferrar (1987) and Smith (1989). It is therefore surprising that the subject has attracted very little attention in Malta. Cilia (1975) reports a case of myiasis in the painted frog, *Discoglossus pictus* (Otth, 1837) and concludes that the agent involved was a species of *Lucilia*, possibly *bufonivora* Moniez, 1876, but this was more likely the common *Lucilia sericata* (Meigen, 1826), since the former was never recorded from Malta (Ebejer, 2007). Ebejer (2007), in a recent review of the Calliphoridae of the Maltese Islands, mentions that the few cases of human and animal myiasis that have been brought to the attention of entomologists involved *Chrysomya albiceps* (Wiedemann, 1819) and *Lucilia sericata* but gives no further details. Savona-Ventura (2007) gives an anecdotal account of fly maggots emerging from the gangrenous foot of an elderly patient in a surgical ward in the late 1970's, but no other information is given. Dr Albert Bezzina (*pers. comm*.) has removed small maggots from the conjunctiva of 5 patients presenting with external ophthalmomyiasis in an ophthalmology clinic over the last 25 years, but no material is available for identification.

It is therefore of interest to report on four cases of myiasis - 1 nasopharyngeal and 3 cutaneous - which have come to the attention of the authors over the last 20 years, and in which the agent of myiasis has been identified. In all but 1 case, the material originated from the veterinary practice of one of us (TZ). The material was identified by the senior author and voucher larval and adult specimens are preserved in his private collection in Malta.

RESULTS

Nasopharyngeal myiasis

Oestrus ovis Linnaeus, 1758

Material examined: MALTA: Luqa, 16.iv.2001, 2 mature, 3rd instar larvae, ex. head of sheep, leg. T. Zammit.

Comments: A total of 6 larvae were retrieved from the refrigerated head of a sheep slaughtered for human consumption. The larvae were collected from the rostrum, frontal sinuses, and between the cranium and the meninges of the animal, and were sluggish, but still alive. An unsuccessful attempt was made to rear the larvae to pupariation. This is the first record of this species from Malta.

Cutaneous myiasis

Lucilia sericata (Meigen, 1826)

Material examined: Case 1: MALTA: Siġġiewi, 20.vi.1993, 6 mature 3rd instar larvae, ex. human leg ulcer, leg. P. Gatt - pupariated 23.vi.1993, 1 ♂ and 1 ♀ emerged 30.vi.1993. **Case 2: MALTA:** Attard, 12.viii.2006, 10 mature 3rd instar larvae, ex. domestic Persian cat, leg. T. Zammit - pupariated 15.viii.2006, 4 ♂♂ and 6 ♀♀ emerged 23.viii.2006. **Case 3: MALTA:** Attard, 13.v.2008, 9 mature 3rd instar larvae, ex. female Persian, domestic short hair cross cat, leg. T. Zammit - pupariated 15.v.2008, 3 ♂♂ and 4 ♀♀ emerged 23.v.2008.

Comments: For Case 1, the larvae were feeding on a necrotic varicose ulcer of a neglected, elderly woman, and dropped to the floor while her dirty bandages, which were seldom changed, were being replaced. For Case 2, the larvae were extracted from the necrotic tissues of the breech of a neglected Persian cat whose fur was matted and soiled with urine and faeces. The ulcer was large and the animal moribund, and had to be euthanized. For Case 3, a cat had a lesion in the femoral region of its right leg probably due to trauma sustained during a fall. The lesion was fresh and clean but covered by a patch of knotted fur. On removing the fur, the lesion was found to be infested by approximately 100 larvae which were feeding subcutaneously and also at various depths inside the exposed muscles of the animal. The wound was very thoroughly cleaned and care was taken to physically remove as many of the larva as possibly. The wound was irrigated with a very mild solution of fipronil after which antibiotics were administered topically and systemically. The animal was revisited the following day and no live larvae were found inside the wound. It recovered fully in 2 weeks time during which the wound healed by secondary intent.

DISCUSSION

The purpose of this article is to review what little has been written on the subject of myiasis in Malta, and to document 4 cases – 1 nasopharyngeal in a sheep caused by *Oestrus ovis* and 3 cutaneous – 1 in a human and 2 in cats, all caused by *Lucilia sericata* - and to provide details of the circumstances in which they occurred. This, and the references provided, will hopefully stimulate further research into this important subject which has hitherto been grossly neglected in Malta.

Animal myiasis has a profound impact on the husbandry, productivity and welfare of livestock. In recent years, there has been concern over the threats of the introduction of alien, exotic species as well as fears of potential changes in arthropod distribution associated with climate change. The most striking example of this was the introduction of the New World screworm fly, *Cochliomyia hominivorax* (Cocquerel, 1858) into Libya in 1988. The subject of livestock ectoparasites in Europe and the Mediterranean, including agents of myiasis, has been recently reviewed by Colebrook & Wall (2004). Traumatic myiasis in humans is much less common than in livestock, but can cause considerable psychological and physical morbidity to those affected by it.

Lucilia sericata is a primary facultative green-bottle blow fly and is the most common and important agent of cutaneous myiasis in most of Northern Europe, particularly in Great Britain (Macleod, 1943). The species is almost cosmopolitan, and is very common in Malta, where it has been reared from human and animal corpses including snails (Ebejer, 2007). It is a species of great hygienic and epidemiological significance (Povolný & Rozsypal, 1968) and its taxonomy and biology have recently been reviewed by Rognes (1991). The larvae are essentially carrion feeders, but can initiate myiasis in living hosts after gravid females lay their eggs on wounds and skin or fur contaminated with faeces or urine. They particularly infest domestic sheep ("sheep strike") and may cause extensive tissue damage. The species has also been reported to cause myiasis in a toad (*Bufo* sp.) (Stewart & Foote, 1974). It is rarely involved in human myiasis and then only in situations of personal neglect (Greenberg, 1984), or in the very young, very old or those unable to maintain good personal hygiene (Hall & Smith, 1993). Larvae usually infest contaminated ulcers of the legs and bed sores (Tikjøb & Haarløv, 1985; Roche *et al*., 1990; Krištofík & Mikulecký, 1991) although other, unusual sites, like the external auditory meatus, have been reported (Meinert, 1888). The ability of the larvae of *Lucilia sericata* and other species to clear necrotic tissue from wounds has been utilised as 'maggot therapy' since antiquity, and the

subject has been recently reviewed by Whitaker *et al.* (2007).

There is little detailed recorded information on animals affected by traumatic myiasis other than humans and sheep, and this should be an area of future study. Hall & Wall (1995) mention *Lucilia sericata* from myiasis infestations of domestic rabbits, dogs, cats and wild hedgehogs and birds. It has also been recorded from geese (Farkas & Szántó, 1998) and horses (Hall & Farkas, 2000). Very few studies have been carried out on the incidence of cutaneous myiasis in pet animals. Anderson & Huitson (2004) report *Lucilia sericata* from myiasis in pet animals in British Columbia. The majority of animals presenting with myiasis were dogs, followed by cats, rabbits and horses, but this may simply reflect the frequency with which each of these animals is kept as a pet. They speculated that a cat's normal scrupulous attention to grooming and personal hygiene protects the animal from infestation. Injured, soiled or long-haired cats were found to be more prone to attack, and this suggested deliberate abuse or neglect. They concluded that the incidence of pet myiasis was probably commoner than that reported, since in cases of abuse or neglect, owners were reluctant to consult a veterinarian for fear of censure. The incidence of cutaneous myiasis in cats in Malta is unknown, but a busy veterinarian would be expected to see about 4 cases a year, based on the clinical experience of one of us (TZ) over the last 20 years.

In the Mediterranean, the obligate myiasis-causing sarcophagid *Wohlfahrtia magnifica* (Schiner, 1862) is a much more important cause of myiasis in sheep, and causes more severe damage, sometimes in the company of *Lucilia sericata*, but this fly has hitherto not been recorded from Malta. It has recently been reported from Crete as a newly introduced species (Sotiraki *et al*., 2003).

Oestrus ovis, the sheep nasal bot fly, is a cosmopolitan species that is found in all sheep raising parts of the world. It is widely distributed in the Mediterranean, and causes nasopharyngeal myiasis (oestrosis) in sheep, and less commonly goats. The highest recorded prevalence from the Mediterranean has been from Sardinia (Scala *et al*., 2001), who reported *Oestrus ovis* larvae in 100% of examined flocks and 91% (514/566) of the sheep heads examined. The mean number of larvae per infested head was 19. Despite the multitude of studies on the prevalence of infestation by *Oestrus ovis*, the economic importance of this parasite remains unclear (Colebrook & Wall, 2004).

The first larval instar of *Oestrus ovis* is also the commonest cause of external ophthalmomyiasis in humans (Krümmel & Brauns, 1956). The larvae never develop beyond the first instar, and cause a catarrhal conjunctivitis which lasts a few days. According to Zumpt (1965) man is affected mainly in regions where the density of sheep and goats is low compared to that of humans, a situation which prevails in Malta. It is therefore reasonable to assume that *Oestrus ovis* was responsible for the ophthalmomyiasis in the patients reported above by Dr Albert Bezzina. This species has been responsible for causing human myiasis on the nearest land mass to Malta, Sicily, for many years (Pampiglione *et al*., 1997).

The single record of *Oestrus ovis* presented here is the first of this species for Malta. The provenance of the infested sheep is unknown, and it could have been imported into the island for slaughter. Though sheep owners have occasionally described clinical signs in their flocks that are highly suggestive of *Oestrus ovis* infestation, mainly sudden onset of sneezing bouts with rubbing of the nostrils against objects and a copious nasal discharge, no data has been published on the status or prevalence of oestrosis in the Maltese Islands.

Collaboration with livestock farmers, abattoir workers and veterinarians, and field work around farm animals is expected to unearth further myiasis-producing agents eg. species of *Sarcophaga* Meigen, 1826 sensu lato, *Hypoderma* Latreille, 1818 and *Gasterophilus* Leach, 1817 and is a potentially fruitful area of research worthy of pursuing.

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Nala lividipes (Dufour, 1828), a new earwig for the Maltese Islands (Dermaptera: Labiduridae)

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ABSTRACT. *Nala lividipes* is recorded for the first time from the Maltese Islands. Distributional, ecological and taxonomic notes are included for this species. New distributional data is provided for other earwig species which were locally known from few or single records.

KEY WORDS. Dermaptera, Malta, *Nala lividipes*, *Anisolabis maritima*, *Labidura riparia*, *Labia minor*.

INTRODUCTION

The Order Dermaptera constitutes a group of primitive insects commonly known as earwigs. This common name derives from a supposed predilection for such insects to entering ears, but this is definitely unsupported. They are distributed worldwide with about 1,900 described species. The greatest species diversity is to be found in the tropical regions (Afrotropical, Neotropical, Oriental and Australian) of the World.

Earwigs are mostly cursorial and nocturnal, with most species rarely flying. Feeding is predominantly on dead and decaying vegetable and animal matter, with some predation and some damage to living vegetation. Some Dermaptera groups are highly specialised. The Arixeniinae are commensals or ectoparasites of bats in Southeast Asia and the Hemimerinae are semi-parasites of South African rodents of the genus *Cricetomys*. Earwigs in both these groups are blind, apterous and with rod-like forceps. The forceps of free-living earwigs, strongly sclerotised and unisegmented in the adults, are used for manipulating prey, for defence and offence and in some species for grasping the partner during copulation.

The earwig fauna of Malta is locally represented by five species (Schembri & Schembri, 1979). *Nala lividipes* (Dufour, 1828) (Labiduridae) was not previously recorded from Malta. The family Labiduridae has a nearly worldwide distribution and is subdivided into three subfamilies with seven genera and approximately 55 species (Kočárek, 2006). The genus *Nala* Zacher, 1910, sole representative of the subfamily Nalinae, accommodates 13 described species distributed throughout the Afrotropical, Oriental, Australian and South Palaearctic faunal regions (Kočárek, 2006).

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Nala lividipes (Dufour, 1828)

Material examined: MALTA: Wied tal-Isqof, 16.vii.2002, 1 ♂ (attracted to UV light traps), leg. D. Mifsud; Bidnija, 26.xi.2006, 1 ♀, leg. D. Magro.

Short description: An immediately distinguishable earwig species due to its length (8.5-11.0 mm), blackish colour and well developed wings. Overall body coloration brown, with dull black abdomen bearing short sparse pale hairs; tegmina and wing scales brown, dull, rugose. Male forceps with branches gently arcuate, with some small teeth at the base and a larger tooth at the apical third; female forceps with slender, almost straight, contiguous branches.

Distinguishing features: The genus *Nala* is represented by only one species in Europe, *N. lividipes*. For this reason, this taxon cannot be confused with other Dermaptera species occurring in Europe. This species superficially resembles *Labia minor* (Linné, 1758) which also occurs in the Maltese Islands, but it is easily distinguished by its larger body dimensions, shape of male forceps and darker body colouration.

Ecology: This species is often accidentally transported into new territories where it becomes established. It can survive in different habitats but it needs humid conditions and relatively high ambient temperatures. The species was locally found in a semi-permanent valley system, surrounded by agricultural fields (Wied tal-Isqof) and in agricultural land bordering some high maquis (Bidnija).

Global distribution: *Nala lividipes* was described from Spain, but this species is most likely of Afrotropical origin. It is widely distributed in the Mediterranean Region from the Canary Islands to Portugal and Spain, to North Africa (Algeria, Tunisia), Sicily, Sardinia and Italian mainland (Vigna Taglianti, 2006); we have examined material from Ethiopia, Uganda, Burkina Faso, Zambia, Mozambique, Madagascar, Bangladesh, Thailand and SW Australia. It is also cited from Afghanistan, India, Ceylon, Java, Sumatra, Sulawesi, China, Formosa, Japan, Philippines, Thailand, Hawaii, and Nearctic and Neotropical regions.

Chorotype: Sub-cosmopolitan.

Additional notes on Maltese Dermaptera

Distributional and other relevant notes are included for three other poorly known earwig species previously recorded from Malta.

Anisolabis maritima (Gené, 1832)

Material examined: MALTA: Mellieħa (Għadira), 27.i.1990, 1 ♂ and 1 ♀, leg. D. Mifsud; Paceville (near Dragonara Hotel), 10.ix.1990, 1 ♀, under stone in coastal sandy area, leg. D. Mifsud; St. Thomas Bay (towards tal-Munxar), 24.ix.2004, 1 ♀, under stone in coastal sandy area, leg. D. Mifsud; Baħar iċ-Ċagħaq (coastal), 20.viii.2006, 1 ♀, leg. D. Magro. **GOZO:** Qbajjar, 15.viii.1989, 3 ♀♀, under stones in coastal area close to man made salt pans, leg. D. Mifsud; Marsalforn Bay, 29.vii.1989, 1 ♀, under stone in coastal sand dune, leg. D. Mifsud.

This species was reported on the basis of a single female from Salina (Schembri & Schembri, 1979) and this was reported as the sole locality for this species (Schembri *et al.*, 1987; Schembri,

1989). The above records widen the distribution range of this species, tied to intertidal rocky or pebbly coasts, but it remains a taxon which should be locally protected as indicated in Schembri (1989).

Labidura riparia (Pallas, 1773)

Material examined: MALTA: Mellieħa Bay, 27.i.1989, 1 ♂, under stone in coastal sand dune, leg. D. Mifsud; Il-Ballut (Marsaxlokk), 22.viii.1989, 3 ♂♂ and 4 ♀♀, under stones in sandy gravel near brackish water, leg. D. Mifsud; Il-Qalliet, 3.ix.1989, 1 ♀, leg. D. Mifsud; St. Thomas Bay, 26.viii.1991, 1 ♂, under stone in sandy coastal area, leg. D. Mifsud; Il-Fossa (near Fort San Luciano), 20.viii. 1991, 1 ♀, leg. D. Mifsud; Birżebbuġa (coastal), 17.ix.2004, 3 ♂♂ and 2 ♀♀, leg. D. Magro; Baħar iċ-Ċagħaq (coastal), 20.viii.2006, 1 ♀, leg. D. Magro. **GOZO:** Qbajjar, 29.x.2002, 2 ♂♂ and 6 ♀♀, under stones in coastal area close to man made salt pans, leg. D. Mifsud.

This species was reported from Għadira, Salina (Schembri & Schembri, 1979) and Ramla in Gozo (Schembri *et al.,* 1987). Locally, *L. riparia* is more common than *A. maritima*, but in view of its habitat preferences, tied to sandy coasts, and therefore more susceptible to damage by human activities, this species should also be locally protected.

Labia minor Linné, 1758

Material examined: MALTA: Żejtun, 24.vii.1989, 1 ♀, on freshwater vegetation in a private garden, leg. D. Mifsud; Chadwick Lakes, 26.ii.1997, 1 ♀, leg. D. Mifsud; Il-Balluta (Marsaxlokk), 4.v.1997, 1 ♀, leg. D. Mifsud; Wied tal-Isqof, 2.viii.2002, 3 ♀♀, leg. D. Mifsud; St. Thomas Bay (towards tal-Munxar), 2.iv.2004, 1 ♂, leg. D. Mifsud; Qrendi, Il-Maqluba, 23.iv.2003, 1 ♀, leg. D. Magro. **GOZO:** Sara Valley, 7.vi.1990, 1 ♂, leg. D. Mifsud.

This species was previously reported from Chadwick Lakes on the basis of a single male and a single female (Schembri & Schembri, 1979). The species is rather scarce locally. Its preferred habitats seem to be valleys where moist conditions prevail all year round.

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The Kateretidae and Nitidulidae of the Maltese Archipelago (Coleoptera)

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ABSTRACT. In the present work, a total of 3 Kateretidae and 26 Nitidulidae are recorded from the Maltese Islands. Of these, 14 Nitidulidae (*Epuraea luteola*, *Epuraea ocularis*, *Carpophilus bifenestratus*, *Carpophilus marginellus*, *Carpophilus quadrisignatus*, *Carpophilus dimidiatus*, *Carpophilus nepos*, *Urophorus humeralis*, *Urophorus rubripennis*, *Nitidula carnaria*, *Omosita discoidea*, *Meligethes rotundicollis*, *Meligethes ruficornis*, *Cybocephalus rufifrons rufifrons*) and 1 Kateretidae (*Brachypterus curtulus*) represents new records for the Maltese Islands. Of these both autochthonous and accidentally introduced but established species are present. The earlier citation of *Cybocephalus politus* may be due to a misidentification. Three further new records of Nitidulidae, *Carpophilus opacus*, *Brachypeplus deyrollei* and *Brachypeplus rubidus* were collected alive on logs originating from Tropical Africa and intended for the timber industry. So far, there were no local records of establishment of any of these three species. All species were assigned to four faunistic groups. These include introduced but non-established species, cosmopolitan species, species with confined distributions and species with small distribution ranges. The complete absence of other species whose host-plants are locally available and which have typical Mediterranean distribution was highlighted. From a zoogeographical perspective the species assemblages of Kateretidae and Nitidulidae of Malta show strong affinities with those present in Italy.

KEY WORDS. Malta, Coleoptera, Kateretidae, Nitidulidae, new records.

INTRODUCTION

The Kateretidae and Nitidulidae are two relatively small families of beetles, with around 100 and 3,700 described species respectively. Kateretids are particularly abundant in warm temperate zones of the world (circum-Mediterranean areas, SW North America, western South America, and Australia) while nitidulids show high species richness especially in tropical, subtropical, and warm temperate regions.

The Kateretidae are characterized by 11-jointed antennae with slender, loose, and mostly three-segmented clubs, tarsal formula 5-5-5, six pairs of abdominal spiracles, maxillary galea strongly developed, larval mandibular prostheca absent, and larval urogomphi absent. All species are phytophagous, mainly being anthophagous or spermophagous, and usually associated with open habitats (meadows, steppic and parasteppic environments, rocky places, edges of bushy areas). Most of the Nitidulidae, excluding the subfamily Cybocephalinae, are characterized by usually

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distinctly 11-jointed antennae with compact, mostly three-segmented club, tarsal formula 5-5-5, six pairs of abdominal spiracles, maxillary galea absent, larval mandibular prostheca usually present. Most species are saprophagous (which is apparently the ancestral way of life), associated with rotting organic matter in forest habitats, others are associated with fresh fungi, but certain subfamilies (e.g. Meligethinae, Mystropinae) are strictly anthophagous, and a few species show peculiar adaptations, being zoosaprophagous, phyllophagous, or myrmecophilous. On the other hand, the Cybocephalinae are very small, sphaeroidal beetles characterized by 11-jointed antennae with compact, three-segmented club, tarsal formula 4-4-4, five pairs of abdominal spiracles, maxillary galea absent, larval mandibular prostheca absent, and larval urogomphi absent. Probably all species are (at both larval and adult stages) somewhat specialized predators of scale insects (Hemiptera: Coccoidea, mainly Diaspididae), especially in thermophilous bushy areas.

The two families belong to the superfamily Cucujoidea and are closely related to each other (Audisio, 1993; Lawrence & Newton, 1995). There is a certain debate about the taxonomic status of the Cybocephalinae, which is considered by most authors as a specialized subfamily within the Nitidulidae (Kirejtshuk, 1992; Lawrence & Newton, 1995; Jelínek & Audisio, 2007), despite showing important diagnostic characters suggesting a family rank for this group (Audisio, 1993). Waiting for more decisive (e.g. molecular) proofs about higher phylogenetic relationships of this specialized group, we use here the most recent position provisionally accepted in Jelínek & Audisio (2007).

To our knowledge, the only references in which records of Kateretidae and Nitidulidae are included from the Maltese Islands are to be found in the following publications. In a list of Coleoptera of the Maltese Islands (Cameron & Caruana Gatto, 1907) eleven names were included under the family heading "Nitidulidae". Of these, eight (of which one was not identified to species level) belong to the family Nitidulidae, two to Kateretidae and one, "*Rhizophagus bipustulatus* F." belongs to the family Monotomidae. In the same work, two names were included under the family heading of "Clambidae" of which one species, "*Cybocephalus politus* Germ." belongs to the subfamily Cybocephalidae within the Nitidulidae. Luigioni (1929), in his work on the Italian Coleoptera, merely repeated these records. Andres (1916) published a list of Lepidoptera, Hemiptera and Coleoptera which he collected from these islands during a period of almost two years that he spent in Malta as a prisoner of war. In this list he included a record of "*Brachypterus glaber* Newm.". Cilia (1989), basing himself on published information, included two taxa in the Red Data Book for the Maltese Islands. These were *Brachypterus* n. sp., which was recorded by Cameron & Caruana Gatto (1907) on the basis of a single specimen and *Pria dulcamarae* (Scopoli, 1763). Most likely, the latter was included in the Red Data Book for the simple reason that Cameron & Caruana Gatto (1907) indicated the status of this species in Malta as "not common". Audisio (1993) included five taxa for which specific mention of the Maltese Islands was included. Of these, one, *Meligethes lindbergi* Rebmann, 1940 was a new record for Malta.

The present work was undertaken so as to provide a detailed account of the species of Kateretidae and Nitidulidae, which occur in the Maltese archipelago. This work forms part of a much larger project, which the first author is coordinating, so as to update the faunistic knowledge of the coleopteran fauna of the Republic of Malta. Such work is taking into account recently collected material but also when available, historical specimens housed in foreign institutions. In part, this historical material formed the basis of the coleoptera list published by Cameron and Caruana Gatto in 1907. Often, the study of this material is crucial for the correct

species identification and interpretation of questionable earlier records. Some beetle families occurring in Malta which were reviewed as outlined above include: Aderidae (Nardi & Mifsud, 2000); Anthicidae (Nardi & Mifsud, 2003); Buprestidae (Mifsud & Bílý, 2002); Cantharidae and Malachidae (Švihla & Mifsud, 2006); Cerambycidae (Mifsud, 2002); Cleridae (Mifsud, 1997); Cryptophagidae (Otero *et al*., 2001); Dermestidae (Háva & Mifsud, 2006); Heteroceridae (Mifsud & Mascagni, 1997); Hydraenidae (Mifsud *et al*., 2004); Languriidae (Mifsud, 2000); Ptinidae (Bellés & Mifsud, 2000); Silvanidae and Laemophloeidae (Halstead & Mifsud, 2003); Tenebrionidae (Mifsud & Scupola, 1998) and the Zopheridae (Schuh & Mifsud, 2000).

MATERIAL AND METHODS

Depositories for material examined include the following institutions and private collections:

BMNH – The Natural History Museum, London, UK;
CMM – private collection, D. Mifsud, Malta;
CAI – private collection, P. Audisio, Italy.

Material of Kateretidae and Nitidulidae was collected from the Maltese Islands between 1989 and 2008. Most of the material was collected from Malta, but additional material was also collected from the nearby island of Gozo. Material was collected by general sweeping, from under bark of trees and in other refugia, leaf litter samples (examined with the Berlese method), and direct examination of rotting vegetation or decaying fruit. Particular attention was devoted to detailed examination of known host plants of species belonging to the genera *Meligethes*, *Meligethinus* and *Xenostrongylus* (Nitidulidae), and *Brachypterolus* (Kateretidae) which are known to have a Mediterranean distribution and whose host plants are known to occur in the Maltese Islands.

Two main collections of historical material of Kateretidae and Nitidulidae were available for study during the present work. One collection was that of Malcolm Cameron which he himself collected either alone or in collaboration with the Maltese naturalist Alfredo Caruana Gatto. Material from this collection is conserved in the BMNH and labeled as "Cameron Coll. B.M. 1936-555". In part, material from this collection included individual label numbers which correspond to numbers in Cameron's private notes and refer to the following information (partially or fully): date of collection, name of the species, name of person who identified this species, locality name and ecological data. In the present work, this information is added in square brackets after the label number. The other collection includes material collected from the Maltese Islands by Commander James John Walker and which is also conserved in the BMNH. This material was collected from the Maltese Islands between 1874-76 almost exclusively between the months of October and March and is labeled as "G.C. Champion Coll. B.M. 1927-409". Except for the name Malta, there is no other data accompanying this material. Both mentioned collections were available when the 1907 coleoptera list of Cameron and Caruana Gatto was published.

Chorological categories follow Vigna Taglianti *et al.* (1993, 1999).

The classification and sequence of species follows that of the recently published Palaearctic Catalogue (Jelínek, 2007; Jelínek & Audisio, 2007), differing slightly from those followed in Angelini *et al.* (1995).

For each species, earlier cited references (except for works which repeat earlier citations e.g.

Luigioni, 1929 and Cilia, 1989), material examined, global distribution, chorological categories and notes with ecological data are included.

CHECKLIST OF MALTESE SPECIES

KATERETIDAE

Brachypterus curtulus Wollaston, 1864
Brachypterus glaber (Newman, 1834)
Kateretes rufilabris (Latreille, 1807)

NITIDULIDAE

Subfamily Epuraeinae

Epuraea (*Haptoncus*) *luteola* Erichson, 1843
Epuraea (*Haptoncus*) *ocularis* Fairmaire, 1849

Subfamily Carpophilinae

Carpophilus (*Carpophilus*) *bifenestratus* Murray, 1864
Carpophilus (*Carpophilus*) *hemipterus* (Linnaeus, 1758)
Carpophilus (*Carpophilus*) *marginellus* Motschulsky, 1858
Carpophilus (*Carpophilus*) *obsoletus* Erichson, 1843
Carpophilus (*Carpophilus*) *opacus* Grouvelle, 1909
Carpophilus (*Carpophilus*) *quadrisignatus* Erichson, 1843
Carpophilus (*Myothorax*) *dimidiatus* (Fabricius, 1792)
Carpophilus (*Myothorax*) *mutilatus* Erichson, 1843
Carpophilus (*Myothorax*) *nepos* Murray, 1864
Urophorus (*Anophorus*) *humeralis* (Fabricius, 1798)
Urophorus (*Urophorus*) *rubripennis* (Heer, 1841)

Subfamily Nitidulinae

Nitidula carnaria (Schaller, 1783)
Nitidula flavomaculata Rossi, 1790
Omosita discoidea (Fabricius, 1775)

Subfamily Cillaeinae

Brachypeplus deyrollei Murray, 1864
Brachypeplus rubidus Murray, 1859

Subfamily Meligethinae

Meligethes lindbergi Rebmann, 1940
Meligethes nigrescens Stephens, 1830
Meligethes rotundicollis C. Brisout de Barneville, 1863
Meligethes ruficornis (Marsham, 1802)
Meligethes submetallicus Sainte-Claire Deville, 1908
Pria dulcamarae (Scopoli, 1763)

Subfamily Cybocephalinae

Cybocephalus politus (Gyllenhal, 1813)
Cybocephalus rufifrons rufifrons Reitter, 1874

ANNOTATED FAUNISTIC LIST

FAMILY KATERETIDAE

Brachypterus curtulus Wollaston, 1864

(?) "*Brachypterus* ? n. sp."; Cameron & Caruana Gatto, 1907: 395.

Material examined: MALTA: Marsa, Għammieri, 4.i.1994, 2 exs., on *Urtica pilulifera* L., leg. D. Mifsud (CMM), same locality and host plant but 15.xi.1995, 1 ex., leg. C. Farrugia (CMM), same locality and host plant but 28.iii.2003, 14 exs., leg. D. Mifsud (CAI, CMM), same locality and host plant, but 11.iv.2003, 3 exs. (CMM), same locality and host plant but 1.iv.2004, 6 exs., leg. P. Audisio & D. Mifsud (CAI); Żejtun, 30.xi.1997, 1 ex., leg. D. Mifsud (CMM).

Distribution: Canary Islands, Morocco, Algeria, central-northern Tunisia, Spain, central-southern Portugal, Balearic Islands, southern Italy (including Sardinia and Sicily) and Malta (Fig. 1).

Chorological category: West Mediterranean.

Notes: *Brachypterus curtulus* represents a new record for the Maltese Islands. Most likely, the record of Cameron & Caruana Gatto (1907) of "*Brachypterus* ? n. sp." is to be attributed to this taxon. Throughout its distribution range, *B. curtulus* represents a rare and localized species, which is strictly associated with *Urtica* spp. (Urticaceae). In southern Italy, larval development takes place mainly in the male inflorescence of *Urtica membranacea* Poiret (Audisio, 1993), however in the Maltese Islands the species was always found on *Urtica pilulifera* L.

Figure 1 – Distribution of *Brachypterus curtulus* in the Maltese Islands.

Brachypterus glaber (Newman, 1834)

"*Brachypterus glaber* Newm."; Cameron & Caruana Gatto, 1907: 395.

Material examined: MALTA: 23 exs., G.C. Champion Coll. B.M. 1927-409 (BMNH, CMM); 5 exs., Cameron Coll. B.M. 1936-555 (BMNH, CMM); Buskett, 31.iii.2004, 5 exs., leg. P. Audisio & D. Mifsud (CMM); Marsa, Għammieri, 28.iii.2003, 10 exs., on *Urtica pilulifera* L., leg. D. Mifsud (CMM); same data but 11.iv.2003, 22 exs. (CMM); Mdina, 2.iv.2004, 1 ex., leg. P. Audisio & D. Mifsud (CMM); Mistra, 4.ii.1996, 1 ex., leg. D. Mifsud (CMM); Mtaħleb, Ta' Baldu, 3.iv.2004, 1 ex., leg. P. Audisio & D. Mifsud (CAI); Qrendi, Maqluba, 1.iv.2004, 1 ex., leg. P. Audisio & D. Mifsud (CMM); Wied Qirda, 28.i.1996, 1 ex., leg. D. Mifsud (CMM); Żejtun, 10.v.1989, 2 exs., leg. D. Mifsud (CMM); Valletta, 4.iv.2004, 1 ex., leg. P. Audisio & D. Mifsud (CMM).

Distribution: Tunisia, Algeria, central-northern Morocco, Azores and almost throughout Europe, from the Iberian Peninsula up to southern Norway, Sweden, Finland and the United Kingdom, eastern up to European Russia and south-eastern up to south-western Turkey.

Chorological category: West Palaearctic.

Notes: This species was previously recorded from the Maltese Islands by Cameron & Caruana Gatto (1907). They indicated the abundance of this species as common during the month of May. *Brachypterus glaber* is a common species throughout its distributional range but is more common in the western Mediterranean basin. In the Mediterranean Region, larval development takes place exclusively in the male inflorescence of *Urtica* spp. (Urticaceae), especially *U. urens* L. and *U. pilulifera* (Audisio, 1993). In part, the above-cited material from Malta (Għammieri in Marsa) was found in association with the male inflorescence of *U. pilulifera*.

Kateretes rufilabris (Latreille, 1807)

"*Cercus rufilabris* Latr."; Cameron & Caruana Gatto, 1907: 395.
Kateretes rufilabris (Latreille); Audisio, 1993: 810.

Material examined: MALTA: 3 exs., Cameron Coll. B.M. 1936-555, 8088 [= May 1903, *Cercus rufilabris*, Ta' Baldu, MC] (BMNH, CMM); Salina, 16.iv.1977, 1 ex., leg. J. L. Schembri (CAI).

Distribution: Tunisia, Algeria, Malta (Fig. 2), northern Morocco and throughout most of Europe; from the Iberian Peninsula to Ukraine, northern up to the United Kingdom, Denmark and southern Sweden and south-easterly up to European Turkey.

Chorological category: European-Mediterranean.

Notes: This species was previously recorded by Cameron & Caruana Gatto (1907) from Ta' Baldu during the month of May and the abundance of this species was indicated as 'common'. Audisio (1993) recorded again the occurrence of this taxon in Malta. Throughout its distribution range, *K. rufilabris* is not a very common species and it is somewhat more frequently found in the western Mediterranean basin (Audisio, 1993). Larval development takes place in the inflorescence of *Juncus* spp. (Juncaceae).

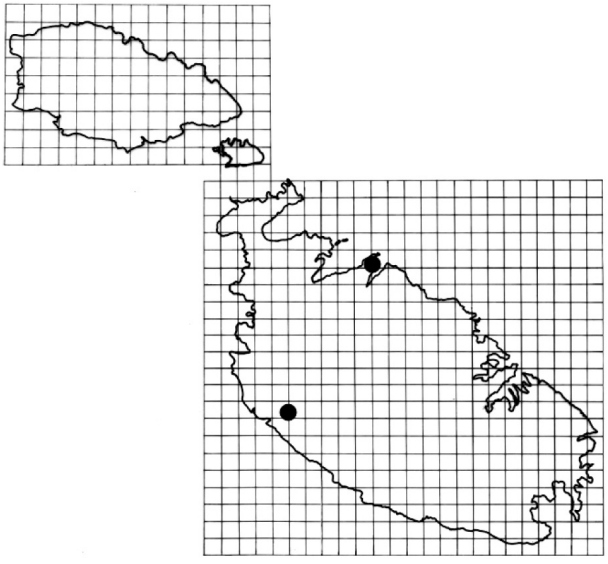

Figure 2 – Distribution of *Kateretes rufilabris* in the Maltese Islands.

FAMILY NITIDULIDAE

Subfamily Epuraeinae

Epuraea (*Haptoncus*) *luteola* Erichson, 1843

Material examined: MALTA: Selmun, 30.iii.1996, 1 ex., leg. D. Mifsud (CMM); Siġġiewi, 5.x.2001, 2 exs., leg. D. Mifsud (CMM); Wied Babu, 30.xi.1995, 3 exs. (in leaf litter under *Ceratonia siliqua* L.), leg. D. Mifsud (CMM); Wied Qirda, 27.iii.1997, 1 ex., leg. D. Mifsud (CMM); Żejtun, 11.xi.1990, 2 exs., leg. D. Mifsud (CMM). **GOZO:** Xagħra, 22.xi.2002, 6 exs. (in rotting fruits), leg. D. Mifsud (CMM).

Distribution: Sub-cosmopolitan species in distribution. This species is of tropical origin but it was introduced and established throughout the intertropical and temperate regions of the world.

Chorological category: Sub-cosmopolitan.

Notes: *Epuraea luteola* represents a new record for the Maltese Islands. It is extremely common throughout its distribution range. This species was established in the Mediterranean Region in the 1970s (Audisio, 1993). It is associated with decaying organic matter especially rotting tropical fruit with high sugar content, where larval development takes place.

Epuraea (*Haptoncus*) *ocularis* Fairmaire, 1849

Material examined: MALTA: near Buskett, 9.x.2006, 2 exs., leg. D. Mifsud (CMM).

Distribution: Sub-cosmopolitan species of pan-tropical origin, phyto-saprophagous and carpophagous. This species was introduced in Southern Europe probably in the late 1990s, first mentioned from Europe and northern Italy only at the beginning of the present century (Audisio, 2002; Busato, 2002; Ratti, 2007), and now common and widespread almost everywhere in central and southern Europe, at low altitudes, both in anthropogenic and natural forest habitats.

Chorological category: Sub-cosmopolitan.

Notes: *Epuraea luteola* represents a new record for the Maltese Islands. The two specimens collected above where found in mature grapes intended for the wine industry.

Subfamily Carpophilinae

Carpophilus (*Carpophilus*) *bifenestratus* Murray, 1864

Material examined: MALTA: Qormi, Ħal-Farrug, 26.ii.2003, 19 exs. (under bark of dead *Ceratonia siliqua* L.), leg. D. Mifsud (CMM).

Distribution: Widespread in the intertropical and temperate regions of Africa, Madagascar and South Africa, and probably the species is of Ethiopian origin. It is widely distributed in the Mediterranean basin and in most of the Macaronesian area (Egypt, Algeria, Tunisia, northern Morocco, Canary Islands, Madeira, southern and eastern Spain, Balearic Islands, southern France including Corsica, Italy including Sardinia and Sicily, Malta, ex-Yugoslavia, Greece, western and southern Turkey, Syria, Palestine and Cyprus).

Chorological category: Afrotropical (subsequently sub-cosmopolitan).

Notes: *Carpophilus bifenestratus* (= *C. tersus* Wollaston, 1865) represents a new record for the Maltese Islands. The species is not commonly found throughout its distribution range. The species is mainly associated with under bark habitats where the species is either mycetophagous or phyto-saprophagous. It is also found associated with decomposing fruits and under rotting cladodes of *Opuntia ficus-indica* (L.) Miller.

Carpophilus (*Carpophilus*) *hemipterus* (Linnaeus, 1758)

"*Carpophilus hemipterus* L."; Cameron & Caruana Gatto, 1907: 395.

Material examined: MALTA: 6 exs., Cameron Coll. B.M. 1936-555, 7477 [= 17 June 1902, *Carpophilus hemipterus*, Bosketto (Buskett)] (BMNH, CMM); Qormi, Ħal-Farrug, 26.ii.2003, 2 exs. (under bark of dead *Ceratonia siliqua* L.), leg. D. Mifsud (CMM); Żejtun, 30.viii.1989, 4 exs. (in decaying grapes), leg. D. Mifsud (CMM), same data but 16.xii.1989, 1 ex. (CMM).

Distribution: Sub-cosmopolitan species in distribution. Probably the species is of Indo-Pakistan

origin but it was introduced and established throughout the intertropical and temperate regions of the world.

Chorological category: Sub-cosmopolitan.

Notes: *Carpophilus hemipterus* was recorded for the Maltese Islands by Cameron & Caruana Gatto (1907) and the abundance of this species was indicated as 'common throughout the year'. The species is very common throughout its distribution range being relatively abundant in coastal regions. The species is mainly associated with decaying fruits where larval development takes place. It is often a serious pest of dried fruit but it can also provoke primary attack on mature fruit still hanging on trees, transmitting fungal and bacterial infections (Hinton, 1945; Williams *et al*., 1983).

Carpophilus (*Carpophilus*) *marginellus* Motschulsky, 1858

Material examined: MALTA: Żebbuġ, 3.v.1978, 1 ex., leg. A. Leo (CAI).

Distribution: Sub-cosmopolitan species in distribution. Probably the species is of Southwestern Asian origin but it was introduced and established throughout the intertropical and temperate regions of the world.

Chorological category: Sub-cosmopolitan.

Notes: *Carpophilus marginellus* represents a new record for the Maltese Islands. The species is relatively frequent throughout its distribution range being sporadic in Sardinia and Corsica possibly due to a relatively recent introduction (Audisio, 1993). The species is mainly associated with decaying fruits where larval development takes place.

Carpophilus (*Carpophilus*) *obsoletus* Erichson, 1843

"*Carpophilus immaculatus* Luc."; Cameron & Caruana Gatto, 1907: 395.
Carpophilus obsoletus Erichson; Audisio, 1993: 254.

Material examined: MALTA: Buskett, 12.ii.2000, 1 ex., leg. D. Mifsud (CMM); Fiddien, 19.v.2003, 1 ex., leg. D. Mifsud (CMM); Qormi, Ħal-Farrug, 5.i.2003, 9 exs. (under bark of dead *Ceratonia siliqua* L.), leg. D. Mifsud (CMM), same data but 26.ii.2003, 15 exs.; Siġġiewi, 29.xii.2003, 2 ex. (at base of beehive boxes), leg. D. Mifsud (CMM); Żejtun, 12.viii.1989, 1 ex., leg. D. Mifsud (CMM).

Distribution: Sub-cosmopolitan in distribution. Probably the species is of Asiatic origin but it was introduced and established throughout the intertropical and temperate regions of the world.

Chorological category: Sub-cosmopolitan.

Notes: This species was recorded from the Maltese Islands by Cameron & Caruana Gatto (1907) on the basis of material collected from Buskett during the month of June. Audisio (1993) recorded the presence of this species also from Malta and indicated its abundance as relatively common in Sicily, Malta, Sardinia and southern Corsica. The species is mainly associated with decaying fruits where larval development takes place; it is also often found under decaying cladodes of

Opuntia ficus-indica (L.) Miller.

Carpophilus (*Carpophilus*) *opacus* Grouvelle, 1909

Material examined: MALTA: Żebbuġ, 3.v.1994, 1 ex., leg. D. Mifsud (CMM).

Distribution: Tropical Africa.

Chorological category: Afrotropical.

Notes: *Carpophilus opacus* represents a new record for the Maltese Islands. A single live specimen was found under bark of tree logs originating from Central Africa and intended for use in the timber industry. There are no records (Jelínek & Audisio, 2007) of stable establishment of this species outside its native range, where it is usually associated with decaying organic material of vegetable origin.

Carpophilus (*Carpophilus*) *quadrisignatus* Erichson, 1843

Material examined: MALTA: Siġġiewi, 29.xii.2003, 1 ex. (at base of beehive box), leg. D. Mifsud (CMM); Żebbuġ, 3.v.1978, 1 ex., leg. A. Leo (CAI).

Distribution: Throughout the Mediterranean basin with dispersal in a number of European localities and diffusing easterly up to Ukraine, Caucasus and northern Iran and southeasterly up to the Arabian Peninsula. Probably only introduced and established in a number of Afrotropical and South African regions and western Asia.

Chorological category: Probably Mediterranean or Afrotropical-Mediterranean; subsequently sub-cosmopolitan.

Notes: *Carpophilus quadrisignatus* represents a new record for the Maltese Islands. This species is relatively common throughout its distribution range but more sporadic in central Europe. The species is mainly associated with decaying and dried fruits where larval development takes place.

Carpophilus (*Myothorax*) *dimidiatus* (Fabricius, 1792)

Material examined: MALTA: Marsaskala, 5.v.1998, 1 ex., leg. D. Mifsud (CMM); Siġġiewi, 29.xii.2003, 1 ex. (at base of beehive box), leg. D. Mifsud (CMM); Żejtun, 2.ix.1989, 1 ex., leg. D. Mifsud (CMM), same data but 5.x.1989, 1 ex., same data but 2.iii.1991, 1 ex., same data but 13.iv.2002, 1 ex. (in leaf litter under *Ceratonia siliqua* L.), (CMM).

Distribution: Sub-cosmopolitan in distribution. Probably the species is of Caribbean or Neotropical origin but it was introduced and established throughout the intertropical and temperate regions of the world.

Chorological category: Sub-cosmopolitan.

Notes: *Carpophilus dimidiatus* represents a new record for the Maltese Islands. The species is extremely common in the tropical regions and somewhat sporadic elsewhere. The species is

mainly associated with decaying fruits where larval development takes place. This species is particularly damaging to dried stored food products (particularly hazelnut in Italy) in warehouses and granaries (Audisio, 1993).

Carpophilus (*Myothorax*) *mutilatus* Erichson, 1843

"*Carpophilus mutilatus* Er."; Cameron & Caruana Gatto, 1907: 395.
Carpophilus mutilatus Erichson; Audisio, 1993: 246.

Material examined: MALTA: 2 exs., Cameron Coll. B.M. 1936-555 (BMNH); 4 exs., Cameron Coll. B.M. 1936-555, 5381 [= 14 August 1901, *Carpophilus mutilatus*, identified by Mr. Caruana Gatto] (BMNH, CMM); Baħrija Valley, 25.viii.1989, 1 ex., leg. D. Mifsud (CMM); Qormi, Ħal-Farrug, 26.ii.2003, 2 exs. (under bark of dead *Ceratonia siliqua* L.), leg. D. Mifsud (CMM); Rabat, Tal-Virtu, 16.xi.1996, 3 exs. (in *Laetiporus sulphureus* (Bull.: Fr.) Murrill, on *Ceratonia siliqua* L.), leg. D. Mifsud (CMM); Siġġiewi, 29.xii.2003, 5 exs. (at base of beehive box), leg. D. Mifsud (CMM); Wied Babu, 12.xi.1995, 1 ex., leg. D. Mifsud (CMM); Żejtun, 7.v.1989, 1 ex., leg. D. Mifsud (CMM), same data but 24.vii.1989, 1 ex., same data but 11.viii.1989, 1 ex., same data but 30.viii.1989, 21 exs., same data but 21.ix.1989. **GOZO:** Xagħra, 22.xi.2002, 1 ex. (in rotting fruits), leg. D. Mifsud (CMM).

Distribution: Sub-cosmopolitan in distribution. Probably the species is of Caribbean origin but it was introduced and established throughout the intertropical and temperate regions of the world.

Chorological category: Sub-cosmopolitan.

Notes: This species was recorded from the Maltese Islands by Cameron & Caruana Gatto (1907) and its abundance was indicated as 'common throughout the year'. Audisio (1993) recorded this taxon as abundant in Sicily, Malta, Sardinia and Corsica, and on many small islands of the Thyrennic coasts. The species is mainly associated with decaying fruits where larval development takes place. This species is of great agricultural importance due to the fact that it can induce primary attack on mature fruit still hanging on trees. The species is known to cause considerable damage to the fruiticulture industry in central and southern Italy, especially on cultivations of pomegranates, figs and peach (Nuzzaci, 1968; Tremblay *et al*., 1984).

Carpophilus (*Myothorax*) *nepos* Murray, 1864

Material examined: MALTA: Żejtun, 30.viii.1989, 3 exs. (in decaying grapes), leg. D. Mifsud (CMM), same locality but 4.xii.1989, 1 ex. (CMM).

Distribution: Sub-cosmopolitan in distribution. Probably the species is of Neotropical origin but it was introduced and established throughout the intertropical and temperate regions of the world.

Chorological category: Sub-cosmopolitan.

Notes: *Carpophilus nepos* (= *C. freemani* Dobson, 1956) represents a new record for the Maltese Islands. It is a very common species throughout its distribution range. The species is mainly associated with decaying fruits where larval development takes place. Contrary to *C. mutilatus*, at least in the Mediterranean Region, this species does not seem to cause strong primary damage to fruit as it often attacks ripe fruit already fallen on the ground (Audisio, 1993).

Urophorus (*Anophorus*) *humeralis* (Fabricius, 1798)

Material examined: MALTA: Siġġiewi, 5.x.2001, 2 exs., leg. D. Mifsud (CMM), same data but 29.xii.2003, 8 exs. (at base of beehive box) (CMM); Wied Qirda, 27.xii.1997, 5 exs., leg. D. Mifsud (CMM); Żejtun, 25.v.-30.viii.1989, 7 exs. (in decaying grapes and vegetables), leg. D. Mifsud (CMM). **GOZO:** Għasri, 11.vii.1993, 1 ex., leg. C. Farrugia (CMM); Xagħra, 22.xi.2002, 14 exs. (in decaying fruits), leg. D. Mifsud (CMM).

Distribution: Sub-cosmopolitan species in distribution. Probably the species is of paleotropic origin but it was introduced and established throughout the intertropical and temperate regions of the world.

Chorological category: Sub-cosmopolitan.

Notes: *Urophorus humeralis* represents a new record for the Maltese Islands. It is a relatively common species throughout its distribution range; sporadic and possibly of recent introduction in Sardinia and Corsica (Audisio, 1993). This species is associated with decaying vegetable refuse and rotting fruit where larval development takes place.

Urophorus (*Urophorus*) *rubripennis* (Heer, 1841)

(Fig. 3)

Material examined: MALTA: Miġra Ferħa, 10.i.2004, 1 ex., leg. D. Mifsud (CMM), same locality but 31.iii.2004, 2 exs. (at base of decaying leaves of *Ferula communis* L.), leg. P. Audisio & D. Mifsud (CAI, CMM); Mtaħleb, near Ta' Baldu, 3.iv.2004, 1 ex., leg. P. Audisio & D. Mifsud (CMM).

Figure 3 – Habitus of *Urophorus rubripennis*.

Distribution: Southwestern Switzerland, central-southern France (including Corsica), southern Spain, Italy (including Sardinia and Sicily), Malta (Fig. 4), ex-Yugoslavia, Albania, Greece, Bulgaria, Romania, Hungary, south-eastern Austria, southern Slovak Republic, Ukraine and Armenia.

Chorological category: South-European.

Notes: *Urophorus rubripennis* represents a new record for the Maltese Islands. The species is relatively rare throughout its distribution range, being more frequent in the southern areas. In natural habitats this species is strictly associated with the rotting basal portions of stems and leaves of large umbellifers, particularly *Ferula* spp. where larval development takes place. In 1988 this species caused severe losses in cultivated carrot plantations in Abruzzo, Italy (Audisio *et al*., 1989).

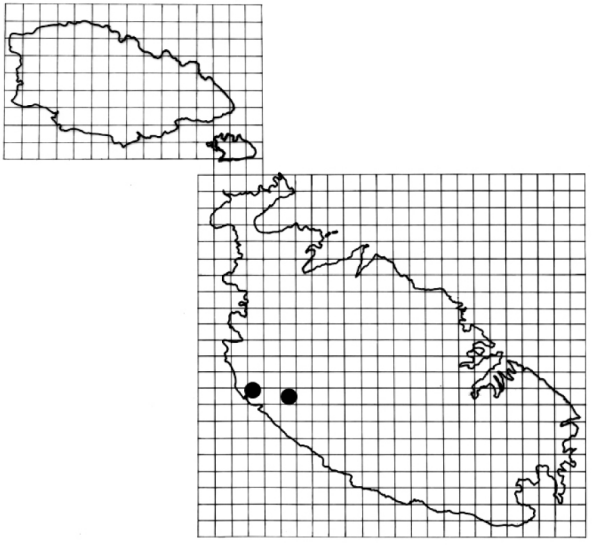

Figure 4 – Distribution of *Urophorus rubripennis* in the Maltese Islands.

Subfamily Nitidulinae

***Nitidula carnaria* (Schaller, 1783)**

Material examined: MALTA: Chadwick Lakes, 19.v.1990, 1 ex., leg. D. Mifsud (CMM); Żejtun, 22.v.1989, 2 exs., leg. D. Mifsud (CMM), same data but 23.vi.1989, 1 ex. (CMM). **GOZO:** Dwejra, 25.iv.2003, 1 ex., leg. D. Mifsud (CMM).

Distribution: Throughout the Palaearctic Region and probably introduced in the United States and Canada.

Chorological category: Holarctic.

Notes: *Nitidula carnaria* represents a new record for the Maltese Islands. It is a very common species almost throughout its distributional range, being more common in the Mediterranean

basin and rare in northern Europe (Audisio, 1993). The species is mainly associated with decaying vertebrates where larval development takes place on semi-dried and partially exposed bones.

Nitidula flavomaculata Rossi, 1790

"*Nitidula flavomaculata* Rossi"; Cameron & Caruana Gatto, 1907: 395.

Material examined: MALTA: 1 ex., G.C. Champion Coll. B.M. 1927-409 (BMNH); Siġġiewi, Wied il-Ħesri, 23.x.1993, 15 exs. (on dog in an advanced stage of decay), leg. D. Mifsud (CMM).

Distribution: Throughout the Mediterranean basin, central-southern Europe (northern limits include France, Belgium and Germany) extending to eastern Turkey and southeasterly up to the Persian Gulf. Introduced in North America and Macaronesia.

Chorological category: Turanic-Mediterranean.

Notes: *Nitidula flavomaculata* was recorded by Cameron & Caruana Gatto (1907) from Marsa (Malta), on the basis of a single specimen collected during the month of October. The species is rare in central Europe but very common throughout the Mediterranean basin. The species is mainly associated with decaying vertebrates where larval development takes place on semi-dried and exposed bones.

Omosita discoidea (Fabricius, 1775)

Material examined: MALTA: Marsa, Għammieri, 29.i.1997, 1 ex., leg. D. Mifsud (CMM).

Distribution: Madeira, Canary Islands, southern Europe up to Japan, extending in northern Europe up to Sweden and southern Norway, southwards up to southern Spain, Balkans, Malta, Israel and in Caucasus. In North America, the species was probably introduced from Europe.

Chorological category: Palaearctic.

Notes: *Omosita discoidea* represents a new record for the Maltese Islands. The species is common throughout its distribution range especially in southern Europe and more sporadic in the North. It is mainly associated with vertebrates in an advanced state of decomposition; larval development takes place on semi-dried and exposed bones. In the Maltese Islands the specimen cited above was collected in a trap baited with dead fish.

Subfamily Cillaeinae

Brachypeplus deyrollei Murray, 1864

Material examined: MALTA: Żebbuġ, 3.v.1994, 2 exs., leg. D. Mifsud (CMM).

Distribution: Tropical Western Africa.

Chorological category: Afrotropical.

Notes: *Brachypeplus deyrollei* represents a new record for the Maltese Islands. The correct identification of this taxon to species level is somewhat problematic due to the fact that the Afrotropical *B. depressus/deyrollei* species group is in need of taxonomic revision. Two specimens were found alive under bark of tree logs originating from Central Africa intended for use in the timber industry. This taxon is frequently found in ports and points of entry in both Europe and North Africa on logs originating from tropical Africa (Audisio, 1993). This species was recently recorded as probably established in southern France (Burle & Lechanteur, 1999), where it was found in rural habitats on decaying fruit and other vegetable material for a consecutive number of years. In its natural habitat, this species is mainly found under bark of trees where it is usually associated with rotting fungi and other decaying organic material.

Brachypeplus rubidus Murray, 1859

Material examined: MALTA: Żebbuġ, 3.v.1994, 1 ex., leg. D. Mifsud (CMM).

Distribution: Tropical Western Africa.

Chorological category: Afrotropical.

Notes: *Brachypeplus rubidus* represents a new record for the Maltese Islands. A single live specimen was found under bark of tree logs originating from Central Africa and intended for use in the timber industry. There are no records of establishment of this species outside its native range (Jelínek & Audisio, 2007), however, it is frequently found in ports and points of entry in both Europe and North Africa on logs originating from tropical Africa (Audisio, 1993). The species is mainly found under bark of trees where it is usually associated with rotting fungi and other organic material.

Subfamily Meligethinae

Meligethes lindbergi Rebmann, 1940

Meligethes lindbergi Rebmann; Audisio, 1993: 686.

Material examined: MALTA: Dingli Cliffs, 31.iii.2002, 2 exs., leg. Schuh & Lang (CMM); Wied Babu, 1.iv.2004, 2 exs., leg. P. Audisio & D. Mifsud (CAI, CMM); Wied id-Dis, 13.vi.2002, 2 exs., leg. D. Mifsud (CMM). **GOZO:** Xlendi, 2.iv.2004, 1 ex., leg. P. Audisio & D. Mifsud (CMM).

Distribution: Tunisia, northern Algeria, southern France, Italy, Malta (Fig. 5), Greece, Croatia, Albania, Slovenia, Serbia and Montenegro.

Chorological category: Mediterranean.

Notes: *Meligethes lindbergi* was previously recorded by Audisio (1993) from Mellieħa Bay and Wied Babu (both localities in Malta). This is a relatively rare species throughout its distribution range with the exception of some areas in central-southern Italy where it is often abundantly found (Audisio, 1993). Larvae of this species are strictly monophagous on *Teucrium flavum* L. (Lamiaceae), whereas adults are usually found also on unrelated yellow flowers, especially in early spring.

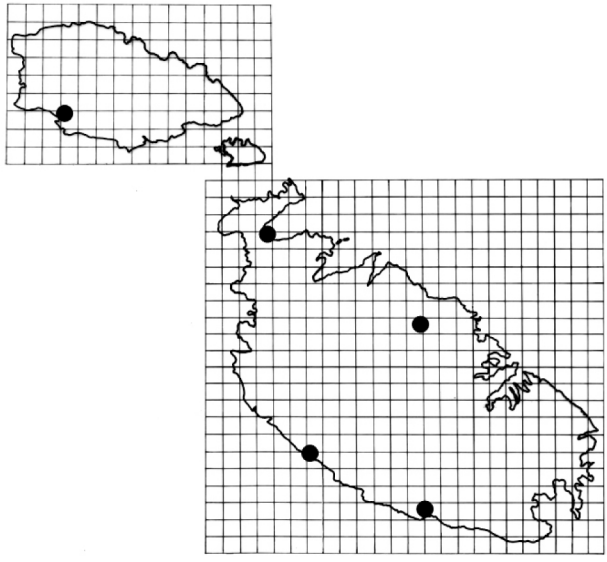

Figure 5 – Distribution of *Meligethes lindbergi* in the Maltese Islands.

Meligethes nigrescens Stephens, 1830

"*Meligethes picipes* Sturm"; Cameron & Caruana Gatto, 1907: 395.

Material examined: MALTA: 22 exs., G.C. Champion Coll. B.M. 1927-409 (BMNH, CMM); 13 exs., Cameron Coll. B.M. 1936-555 (BMNH, CMM); Baħrija, 12.v.1996, 3 exs., leg. D. Mifsud (CMM), same data but 20.iv.2002, 1 ex. (CMM); Buskett, 3.xii.1997, 1 ex., leg. D. Mifsud (CMM); Mtaħleb, 2.v.1997, 1 ex., leg. D. Mifsud (CMM); St. Thomas Bay, Tal-Munxar, 5.i.2003, 1 ex., leg. D. Mifsud (CMM), same data but 24.i.2004, 1 ex. (CMM); Wied Ħas-Sabtan, 14.iv.1990, 1 ex., leg. D. Mifsud (CMM); Żejtun, 13.i.1991, 1 ex., leg. D. Mifsud (CMM), same data but 14.iv.2002, 1 ex. (CMM). **GOZO:** Ramla, 28.i.1997, 7 exs., leg. D. Mifsud (CMM).

Distribution: Throughout Europe and North Africa, Madeira, Middle East, Arabian Peninsula, Iran, central and north-eastern Asia and North America (probably accidentally introduced).

Chorological category: Palaearctic.

Notes: This species was previously recorded by Cameron & Caruana Gatto (1907) from Buskett (Malta). This species is very common throughout its distribution range. Larvae of this species are able to develop on different Fabaceae, particularly *Trifolium* spp., *Vicia* spp., *Medicago* spp. and *Lotus* spp. However, the preferred host plant is *Trifolium repens* L. In North America, this species is particularly damaging in cultivations of medicinal plants.

Meligethes rotundicollis C. Brisout de Barneville, 1863

Material examined: MALTA: Dingli Cliffs, 31.iii.2002, 1 ex., leg. Schuh & Lang (CMM); Ħagar Qim, 4.iv.2004, 34 exs. (on *Sisymbrium officinale* (L.) Scop.), leg. P. Audisio & D. Mifsud (CAI, CMM).

Distribution: Throughout North Africa, Iberian Peninsula, France, Italy, Holland, Belgium, Germany, Switzerland, United Kingdom, Hungary, Romania, ex-Yugoslavia, Albania, Bulgaria, Greece, European Russia, Turkey and the syro-palestinian areas up to northern Iraq.

Chorological category: Mediterranean.

Notes: *Meligethes rotundicollis* represents a new record for the Maltese Islands. This species is relatively common in the Mediterranean area, but rare and sporadic in the northwestern parts of its distribution. Larvae of this species are able to develop on different genera of crucifers (Brassicaceae), such as *Brassica* spp., *Sinapis* spp. and particularly *Sisymbrium* spp. In the Maltese Islands *Meligethes rotundicollis* seems to develop only on its preferred host plant, *Sisymbrium officinale*, since field investigation on other Brassicaceae proved futile.

Meligethes ruficornis (Marsham, 1802)

Material examined: MALTA: Mdina, 2.iv.2004, 32 exs. (on *Ballota nigra* L.), leg. P. Audisio & D. Mifsud (CAI, CMM).

Distribution: Northern Tunisia and northeastern Algeria, throughout Europe, southern Siberia up to the syro-palestinian areas and the Middle East.

Chorological category: West Palaearctic.

Notes: *Meligethes ruficornis* represents a new record for the Maltese Islands. It is a common species in central and southern Europe; more localized and sporadic elsewhere. Larvae of this species in Europe are strictly monophagous on *Ballota nigra* (Lamiaceae), although in syro-palestinian areas and in SE Turkey they develop also on the related *B. saxatilis* Sieber.

Meligethes submetallicus Sainte-Claire Deville, 1908

"*Meligethes lugubris* Sturm"; Cameron & Caruana Gatto, 1907: 395.
Meligethes submetalicus Sainte-Claire Deville; Audisio, 1993: 699.

Material examined: MALTA: 30 exs., Cameron Coll. B.M. 1936-555, 7420 [= June 1902, *Meligethes lugubris*, ER (identified by E. Reitter), Jniena (Ġnejna)] (BMNH, CMM).

Distribution: Southern France, Italy, Malta (Fig. 6), Hungary, Romania, ex-Yugoslavia, Albania, Bulgaria, Greece, north-western Turkey extending in the east up to Central Asia and southern Siberia.

Chorological category: Central-Asiatic-European-Mediterranean.

Notes: This species was recorded by Cameron & Caruana Gatto (1907) from Ġnejna (Malta) during the month of June. It was also recorded by Audisio (1993) as widely distributed in Sicily, Malta, Sardinia, Corsica and the island of Elba. This species is somewhat rare throughout its distribution range. The larvae of this species are strictly monophagous on *Mentha pulegium* L. (Lamiaceae).

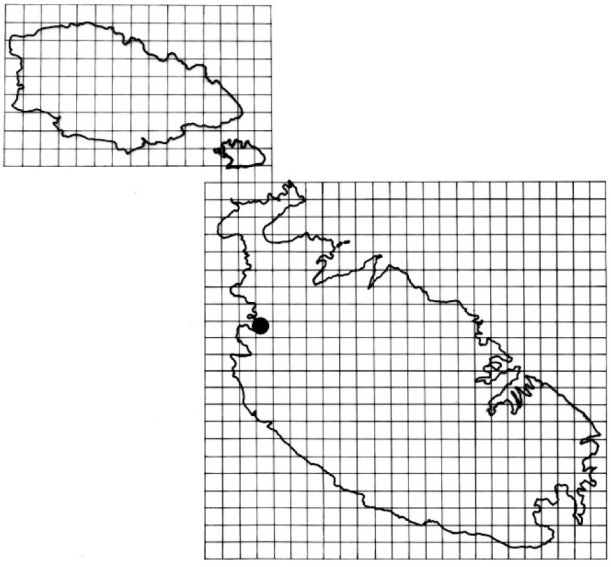

Figure 6 – Distribution of *Meligethes submetallicus* in the Maltese Islands.

Pria dulcamarae (Scopoli, 1763)

"*Pria dulcamarae* Scop."; Cameron & Caruana Gatto, 1907: 395.

Material examined: MALTA: Baħrija, 31.iii.2004, 1 ex., leg. P. Audisio & D. Mifsud (CAI); Chadwick Lakes, 26.ii.1997, 3 exs., leg. D. Mifsud (CMM); Mtaħleb, 7.iv.1996, 2 exs., leg. D. Mifsud (CMM). **GOZO:** Għasri, 1.xii.1994, 1 ex. (in apple blossoms), leg. C. Farrugia (CMM), same data but 3.vii.1995, 1 ex. (on almond tree), (CMM).

Distribution: Palaearctic, from the Canary Islands and Madeira up to Japan, northern up to the United Kingdom, Denmark, southern Norway and Sweden; southerly in the Palestine area, in western North Africa and in northern Egypt.

Chorological category: Palaearctic.

Notes: This species was recorded from Gozo by Cameron & Caruana Gatto (1907) and its abundance was reported as 'not common'. Throughout its distribution range it is a frequently found species. It is associated with flowers of Solanaceae, particularly *Solanum dulcamara* L. (especially in damp places), but also *S. nigrum* L. where larval development takes place. Adults are to be found also on flowers of other unrelated species.

Subfamily Cybocephalinae

Cybocephalus politus (Gyllenhal, 1813)

"*Cybocephalus politus* Germ."; Cameron & Caruana Gatto, 1907: 394.

Material examined: None.

Distribution: Central and southern Europe, southern Sweden, Russia (Central European and North European Territory), Ukraine, Cyprus and Turkey.

Chorological category: European.

Notes: This species was not found during the present study and no historical material was found in the BMNH. It is possible that this record represents a misidentification of *C. rufifrons rufifrons*.

Cybocephalus rufifrons rufifrons Reitter, 1874

Material examined: MALTA: Girgenti, 8.x.1996, 1 ex., leg. D. Mifsud (CMM); St. Thomas Bay (towards tal-Munxar), 20.iv.1996, 1 ex., leg. D. Mifsud, same data but 13.iv.2003, 18 exs., leg. D. Mifsud (CMM); Żejtun, 20.ix.1997, 1 ex., leg. D. Mifsud (CMM); Fgura, 4.xii.1997, 1 ex., leg. C. Farrugia (CMM); Wardija, 23.ii.2000, 1 ex., on *Lycium intricatum* Boiss., leg. D. Mifsud (CMM); Mellieħa Bay, 3.iii.2002, 1 ex., leg. D. Mifsud (CMM); San Gwann, 23.iv.2008, 30 exs., on *Cupressus sempervirens* L. highly infested with *Carulaspis* sp., leg. D. Mifsud (CMM).

Distribution: Central and southern Europe, Caucasus.

Chorological category: European.

Notes: *Cybocephalus rufifrons rufifrons* represents a new record for the Maltese Islands. It is an active predator (Silvestri, 1910) of armoured scale-insects (Coccoidea: Diaspididae) on a large series of shrubs and trees, both in natural and anthropogenic habitats.

DISCUSSION

The present work lists a total of 3 Kateretidae and 26 Nitidulidae collected or cited from the Maltese Islands. Of these, 17 Nitidulidae and 1 Kateretidae represent new records for the Maltese Islands. Four different faunistic groups can be deduced from the recorded species cited in the present work. These include species which are occasionally introduced but there is no evidence of establishment; sub-cosmopolitan species which are mainly allochthonous; species having relatively confined distributions but which are autochthonous and species which are autochthonous but with small distribution ranges (Mediterranean/European). Table 1 provides chorological categories for all species recorded from the Maltese Islands. Three species of Nitidulidae (*Brachypeplus rubidus*, *Brachypeplus deyrollei* and *Carpophilus opacus*) are of Tropical African origin and were accidentally introduced in Malta with logs intended for the timber industry. There is no evidence that any of these three species became established in the Maltese Islands. Only *B. deyrollei* was for a number of consecutive years reported to be established in southern France (Burle & Lechanteur, 1999). Eleven species are sub-cosmopolitan in distribution. Of these 10 represent allochthonous species that were introduced and established. The other species (*Carpophilus quadrisignatus*) is probably of Mediterranean origin but was introduced and established throughout the tropical and intertropical regions of the world. Species with relatively confined distributions and which are autochthonous are represented by 8 taxa. Of these one is Holarctic, one Central-Asiatic-European-Mediterranean, one Turanic-Mediterranean, three Palaearctic, and two West Palaearctic. The Mediterranean/European component is finally represented by 6 species, sub-divided as follows: two Mediterranean, one West Mediterranean, one European-Mediteranean, and one South-European (provisionally excluding the doubtful

Table 1. Kateretidae and Nitidulidae recorded from the Maltese Islands with respective chorological category and codes (after Vigna Taglianti *et al*., 1993, 1999).

	Chorological category	Code
KATERETIDAE		
Brachypterus curtulus	West Mediterranean	WME
Brachypterus glaber	West Palaearctic	WPA
Kateretes rufilabris	European-Mediterranean	EUM
NITIDULIDAE		
Subfamily Epuraeinae		
Epuraea (*Haptoncus*) *luteola*	Sub-cosmopolitan	COS
Epuraea (*Haptoncus*) *ocularis*	Sub-cosmopolitan	COS
Subfamily Carpophilinae		
Carpophilus (*Carpophilus*) *bifenestratus*	Afrotropical	AFT*
Carpophilus (*Carpophilus*) *hemipterus*	Sub-cosmopolitan	COS
Carpophilus (*Carpophilus*) *marginellus*	Sub-cosmopolitan	COS
Carpophilus (*Carpophilus*) *obsoletus*	Sub-cosmopolitan	COS
Carpophilus (*Carpophilus*) *opacus*	Afrotropical	AFT
Carpophilus (*Carpophilus*) *quadrisignatus*	Mediterranean/(?) Afrotropical-Mediterranean	MED*/ AFM*
Carpophilus (*Myothorax*) *dimidiatus*	Sub-cosmopolitan	COS
Carpophilus (*Myothorax*) *mutilatus*	Sub-cosmopolitan	COS
Carpophilus (*Myothorax*) *nepos*	Sub-cosmopolitan	COS
Urophorus (*Anophorus*) *humeralis*	Sub-cosmopolitan	COS
Urophorus (*Urophorus*) *rubripennis*	South-European	SEU
Subfamily Nitidulinae		
Nitidula carnaria	Holarctic	OLA
Nitidula flavomaculata	Turanic-Mediterranean	TUM
Omosita discoidea	Palaearctic	PAL
Subfamily Cillaeinae		
Brachypeplus deyrollei	Afrotropical	AFT
Brachypeplus rubidus	Afrotropical	AFT
Subfamily Meligethinae		
Meligethes lindbergi	Mediterranean	MED
Meligethes nigrescens	Palaearctic	PAL
Meligethes rotundicollis	Mediterranean	MED
Meligethes ruficornis	West Palaearctic	WPA
Meligethes submetallicus	Central-Asiatic-European-Mediterranean	CEM
Pria dulcamarae	Palaearctic	PAL
Subfamily Cybocephalinae		
Cybocephalus politus	European	EUR
Cybocephalus rufifrons rufifrons	European	EUR

* indicates a chorological category which subsequently became sub-cosmopolitan in distribution.

presence of the European *Cybocephalus politus*).

From a zoogeographical point of view, the Kateretidae and Nitidulidae show a strong affinity to the Italian fauna. All species recorded (with the exception of the three Afrotropical accidentally introduced Nitidulidae) are known to occur in Sicily, whereas two species (*Urophorus rubripennis* and *Meligethes submetallicus*) are absent from North Africa. No endemism was found in the two families studied during the present work.

Several other species of phytophagous Kateretidae and Nitidulidae, widespread throughout southern Europe and western North Africa, and whose host-plants are known to occur in the Maltese Islands are not yet recorded from the Maltese archipelago. Such host plants were intensively searched on the field by both authors but without success. Extremely strange, for instance, is the complete absence in the Maltese Islands of the very common and widespread *Meligethes aeneus* (Fabricius, 1775) (Nitidulidae), a pest of cultivated crucifers throughout Europe and North Africa, which has colonized almost all the other large and small Mediterranean islands. A similar situation occurs with the common and widespread *Brachypterolus antirrhini* (Murray, 1864) (Kateretidae), a pest of flowers of wild and ornamental *Antirrhinum* spp. (Scrophulariaceae) and which is found throughout the Mediterranean Region. However, even this species is completely absent from Malta and Gozo despite the local abundance of its host-plants. Another absence which is difficult to explain is that of *Meligethinus pallidulus* (Erichson, 1843) (Nitidulidae), a widespread West Mediterranean species associated with male flowers of the dwarf palm *Chamaerops humilis* (L.) (Arecaceae), almost always introduced everywhere in southern Europe and North Africa with its host plant even in private gardens and in completely artificial habitats. Although the dwarf palm is a widespread re-introduced ornamental plant in towns and villages in Malta and Gozo, no *Meligethinus* are apparently present. Other species of Nitidulidae not found so far, despite their host plants being widespread in the Maltese Islands, are *Meligethes planiusculus* (Heer, 1841) (on *Echium* spp., Boraginaceae), *M. fuscus* (Olivier, 1790) (on *Cistus* spp., Cistaceae), and *Xenostrongylus* spp. (on cultivated Brassicaceae). These absences constitute rather strong evidence of the presence of important barriers to the recent (Pleistocenic) diffusion in the Maltese Islands of widespread phytophagous species characterized by usually high active and passive dispersion rates.

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First record of *Xenopsylla gratiosa* Jordan & Rothschild, 1923 from the Maltese Islands (Siphonaptera: Pulicidae)

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ABSTRACT. *Xenopsylla gratiosa* is reported for the first time from the Maltese Islands. The species was found in an abandoned nest of a Cory's Shearwater, *Calonectris diomedea* on the island of Filfla. Brief notes are included on previous records of fleas from the Maltese Islands and taxonomic, distributional and ecological notes are provided for *Xenopsylla gratiosa*.

KEY WORDS. Malta, Filfla, flea, Siphonaptera, *Xenopsylla*, Cory's Shearwater.

INTRODUCTION

Siphonaptera (fleas) represent an order of insects with some 2,400 described species. They are highly modified, apterous, laterally compressed, holometabolous ectoparasites, with mouth parts modified for piercing and sucking; without true mandibles, with an elongate, serrate lacinial blade within a sheath formed by the maxillary and labial palps; epipharynx forming a long spine; gut with salivary pump to inject saliva into wounds and cibarial and pharyngeal pumps to suck up blood.

Eggs are laid predominantly into the host's habitat, where free-living, worm-like larvae develop on material such as shed skin debris from the host. High temperatures and humidity are required for development by many fleas, including those of domestic animals. The pupa is exarate and adecticous in a loose cocoon. Only few species are restricted to one host, with the majority of taxa being, more or less, polyxenous. Fleas predominantly use mammalian hosts.

The fleas of the Maltese Islands are very poorly known with only 11 recorded species scattered in the entomological literature. Probably the first flea records for Malta were due to Zammit (1918) who recorded the following species: *Pulex irritans* Linnaeus, 1758, *Leptopsylla segnis* (Schönherr, 1811), *Xenopsylla cheopis* (Rothschild, 1903) and *Nosopsyllus fasciatus* (Bosc d'Antic, 1800). Savona-Ventura (2002) reported that fleas were always closely monitored since they were considered as a valuable index in the spread of plague epidemics. Bernard (1937) cited *Xenopsylla cheopis* and *Nosopsyllus fasciatus* for Malta. Both these species are mainly associated with rats and hence their importance in connection with the plague outbreak in Malta at the time when Bernard was reporting. Beaucournu & Launay (1990) questioned the record of *N. fasciatus* for Malta, but a recent record of this species is now known from the island (Beaucournu *in litt*., vii.08), whereas they confirmed the presence of *X. cheopis* with material from Gozo. Traub *et al.* (1983)

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mentioned Malta in the global distribution of *Notopsyllus barbarus* (Jordan & Rothschild, 1912) a flea which is mainly associated with rats and mice. Beaucournu & Launay (1990) in their monograph of the fleas of France and the West Mediterranean Basin cited two additional species. *Echidnophaga murina* (Tiraboschi, 1903), a species which is also mainly associated with rats and mice, and *Archaeopsylla erinacei maura* Jordan & Rothschild, 1912, which is mainly associated with the Algerian hedgehog, *Atelerix algirus* (Lereboullet, 1842), which is locally common. A new subspecies of flea, *Leptopsylla algira vogeli* Beaucournu, 1990, was described from material collected from Gozo on the Sicilian shrew, *Crocidura sicula calypso* Hutterer, 1991 (Beaucournu, 1990). Mifsud (2000) mentioned three cosmopolitan fleas which were all collected from the Maltese Islands. These include the cat flea, *Ctenocephalides felis felis* (Bouché, 1835), the dog flea, *Ctenocephalides canis* (Curtis, 1826) and the human flea, *Pulex irritans*. In a semi-popular article, Mifsud (2007) mentioned two fleas associated with a wild rabbit which was collected from the limits of Mellieħa (25.vi.2007): the rabbit flea, *Spilopsyllus cuniculi* (Dale, 1878) and the cat flea *Ctenocephalides felis felis*.

Recently, flea material collected from the island of Filfla and handed over to the senior author for identification proved to represent a new record for Malta. The island of Filfla is situated about 5 km south of Malta. It has a surface area of about 350 m^2 and its flat-topped plateau is 60 m above sea-level. For over a century the island was used as a target practice for air and naval gunners, but all bombing was stopped in 1971. Filfla holds the largest known colony of Storm petrel, *Hydrobates pelagicus* (Linnaeus, 1758) in the Mediterranean (c.a. 8,000 breeding pairs), some 50-80 pairs of Cory's Shearwater, *Calonectris diomedea* (Scopoli, 1769) and about 150 pairs of Yellow-legged Gulls, *Larus michahellis* Naumann, 1840 (Borg & Sultana, 2002). In view of its ornithological and ecological importance the island was declared a nature reserve.

Xenopsylla gratiosa Jordan & Rothschild, 1923

Material examined: MALTESE ISLANDS: FILFLA: south eastern side, 10.ix.2007, 4 exs., from a recently abandoned nest of a Cory's Shearwater, *Calonectris diomedea* situated under a boulder, leg. J.J.Borg.

Taxonomic notes: The genus *Xenopsylla* Glinkiewicz, 1907 (Pulicidae: Xenopsyllinae) is mainly distributed in the Afrotropical Region with few representatives in the South Palaearctic, Oriental and Australasian Regions. In the Mediterranean Basin, this genus is represented by 11 species and of these only *X. gratiosa* is associated with birds while all the others are associated with mammalian hosts (Beaucournu & Launay, 1990). *X. gratiosa* is readily distinguished from its congeners occurring in the said region by the following morphological characteristics: unique tarsal chaetotaxis, the presence of 4 spines on tarsal segment I (in males), a ventral 'tooth' on femur III and characteristic male and female genitalia (Beaucournu & Launay, 1990).

Global Distribution: Southern France (including Corsica), Portugal, Greece, Canary Islands, Tunisia and Malta.

Ecology: *Xenopsylla gratiosa* is mainly a specific parasite of the Cory's Shearwater. However the species can also be found on the Storm petrel and on the Yelkouan Shearwater, *Puffinus yelkouan* (Acerbi, 1827) and accidentally it can also be found on humans.

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Preliminary notes on the early stages of *Isturgia pulinda* (Walker, 1860) (Lepidoptera: Geometridae)

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ABSTRACT. The early stages, larval hostplant and voltism of *Isturgia pulinda* in the Maltese Islands are documented.

KEY WORDS. Lepidoptera, Geometridae, *Isturgia pulinda*, early stages, biology, Malta.

INTRODUCTION

On August 8, 2007, during one of the activities to identify, document and monitor the lepidopterofauna of the Mellieħa Ridge area as part of an ecological survey for an EU funded project entitled "EU Life Project LIFE06 NAT/MT/000097 SPA Site and Sea Actions Saving *Puffinus yelkouan* in Malta", an unusually large number of both sexes of *Isturgia pulinda* (Walker, 1860) were recorded using mercury vapour lamps. During the same month, the site was revisited three times and each time *Isturgia pulinda* was common. A female was also collected from it-Torri l-Aħmar, also along the Marfa Ridge, on the 20th August. These findings were recently published in Sammut *et al.* (2008). Prior to these findings, this species was known for the Maltese Islands from a single female collected from Rabat on May 3, 1987 but incorrectly recorded as *Idaea manicaria* (Herrich-Schäffer, 1851) (Sammut, 2000), from a male specimen collected from Armier in 2000 and a female specimen collected from Naxxar in 2001 (Sammut *et al.*, 2008).

Isturgia pulinda was originally described from Sri Lanka (Ceylon). It is also known from the Oriental and Afro-tropical Regions, North Africa, Saudi Arabia and Yemen. In Europe it has been recorded from the Canary Islands, mainland Spain and Portugal and the Cape Verde Islands (Hausmann *et al*., 2004). The species probably became established in the Maltese Islands during the late 1970s when extensive afforestation projects using mainly *Acacia* and other exotic trees were underway (Sammut *et al.*, 2008). Very little information is available on the early stages or larval host plant of this species. *Acacia nilotica* (L.) Willd. ex Del., has been recorded as a hostplant and the species is definitely an *Acacia* feeder (Wiltshire, 1990).

MATERIAL AND METHODS

Voucher specimens of this species were deposited in the collections of the authors and the National Museum of Natural History (Mdina) and a few live females were kept for breeding purposes. Following field collection of specimens, each female was placed in a separate plastic container measuring 40 mm x 30 mm and in less than 3 hours these were again separately

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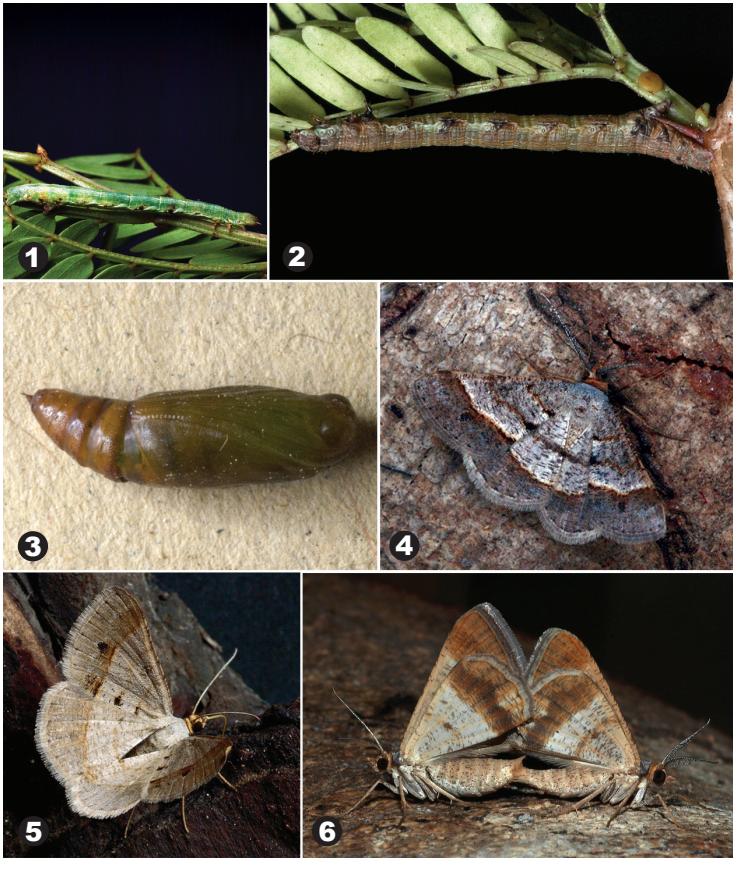
placed in 1 litre plastic containers. Cotton dipped in a weak sugar solution was offered to the moths and was readily accepted. By the following morning some had already laid eggs and egg laying was continued for just over a week. As soon as larvae started to hatch, *Acacia* leaves were provided in the same container. Observations on egg laying, larval hatching and other relevant data were recorded. All observations were carried out in 2007.

OBSERVATIONS

Each female moth laid between 25 and 75 eggs in total. Eggs were either laid on the sides of the plastic container or on leaves of *Acacia karoo* Hayne which were placed in the container. Eggs laid on 20th August hatched after five days. When freshly laid, eggs were greyish green in colour, but just before hatching they turned into an olive green colouration. The young larvae were provided with leaves of both *Acacia cyanophylla* Lindley, the dominant *Acacia* species from where the specimens were collected, and *Acacia karroo*. The larvae ignored *A. cyanophylla* leaves but fed and rapidly grew on those of *A. karroo*, passing through all larval instars in ten days. Larvae were of two colour forms, green with white lateral markings (Fig. 1), or brown with lighter lateral markings (Fig. 2).



Figures 1 – 6: *Isturgia pulinda*. **1 & 2** – larvae; **3** – pupa; **4** – male; **5** – female; **6** – male and female in copulation.

Pupation (Fig. 3) took place loosely on the bottom of the mentioned containers or in a soft cocoon amongst the leaf litter which accumulated during larval feeding. The pupal stage was short, with adults hatching in seven days. Males (Fig. 4) emerged before the females (Fig. 5) and copulation (Fig. 6) could be observed a few hours after hatching. The first pupa formed on the 4th September. Three male specimens emerged on the 11th and four on the 12th of September, while two females emerged on the 13th September and mated with the males on the same night. From a female collected from it-Torri l-Aħmar, also along the Marfa Ridge, on the 20th August three generations were obtained with no diapause in between. In captivity, one complete generation was completed in twenty-two days.

The third generation females laid eggs on the 19th of November but these did not hatch. This may be due to the fact that the species overwinters as an egg which will hatch in favourable warm conditions.

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Luffia lapidella (Goeze, 1783), a new bagworm moth for the Maltese Islands (Lepidoptera: Psychidae)

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ABSTRACT. *Luffia lapidella* is recorded for the first time from the Maltese Islands. Additional notes on the biology and ecology of this species and a list of psychid species known from the Maltese archipelago are included.

KEY WORDS. Lepidoptera, Psychidae, *Luffia lapidella*, Malta, new record.

INTRODUCTION

The genus *Luffia* Tutt, 1899 is represented in Europe by four species. *Luffia lapidella* (Goeze, 1783), the type species, is bisexual and widely distributed in Europe, being found on the Channel Islands, Madeira, Portugal, Spain, France, Corsica, Italy, Sicily, Greece, ex-Yugoslavia and Switzerland (Arnscheid, 2004). The form *ferchaultella* (Stephens, 1850) consisting of only parthenogenetic females is found with the typical form on the Channel Islands, France and Italy. It is also known from the Canary Islands, the Azores, Great Britain and Ireland, Belgium, Germany, Luxemburg and the Netherlands, while the form *maggiella* Chapman, 1901 (only 1 to 5% of the population being males) is known from Switzerland only. The three other described species are endemic to the Canary Islands. *L. rebeli* Walsingham, 1908 is confined to Tenerife, *L. gomerensis* Hendericks, 1996 (Hendericks, 1996) occurs in Gomera and *L. palmensis* Sobczyk, 2001 is known from La Palma (Sobczyk, 2001).

Luffia lapidella (Goeze, 1783)

Material examined: MALTA: Buskett, Wied il-Luq, 5.viii.2006, 1 ♀, reared from pupa; 1 ♀, same data but 8.viii.2006; 1 ♀, same data but 19.viii.2006; 1 ♂, same data but 20.viii.2006; 1 ♂, same data but 22.viii.2006; 1 ♂, same data but 30.viii.2006; 1 ♂, same data but collected from the wild; 16 ♀♀, same data but larvae collected 9.vii.2007, emerged 14-22.ix.2007; 1 ♀, same data but emerged 4.x.2007; 7 ♂♂, same data but 13-30.viii.2007; 7 ♀♀, same data but 20-31.viii.2007; 11 ♀♀, same data but 1-15.ix.2007; Għargħur, Tal-Fanal, 18-30.viii.2007, 3 ♂♂. All material was collected by Sammut and Zerafa.

OBSERVATIONS

In captivity, copulation was noticed to last between 45 to 60 minutes and about 40 minutes after mating, the female locates the opening of the bag and starts laying eggs. Females deposit eggs inside the bag, the latter still having the exuvia inside, and each will lay from 30 - 40 eggs.

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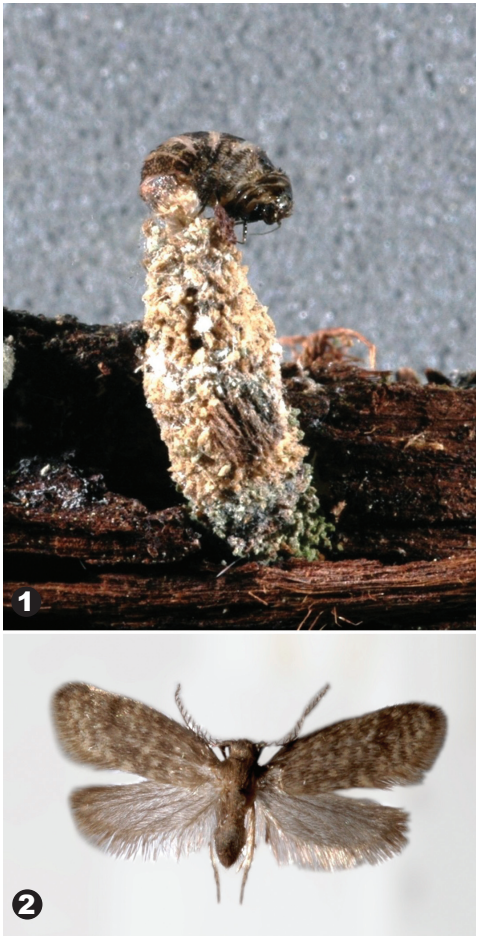
Under artificial conditions eggs hatch in as short as 10 days and as long as 24 days. On hatching the larvae spin a bag with the female's hairs. These hairs are left near the mouth of the bag. Initially the bag is 0.8-1.0 mm long. Afterwards debris and organic matter is added to the bag which grows in the shape of an oblique cone. Larvae are grey with black heads. The duration of the larval stage has not been observed. In Central Europe one generation per year is the norm.

Bag size (Fig. 1): male: 3.8 mm to 5.0 mm long and 1.9 mm wide; female: 5.3 mm to 5.8 mm long and 2.5 mm wide. The male bag is constructed of only fine particles whilst that of the female carries larger plant debris.

Both sexes pupate inside the bag, after attaching it firmly to bark or stone. The pupal stage duration has not been observed but it appears that emergence can be prolonged at will. On hatching, the exuviae of the female remain completely inside the bag and appear to be rigid, filling all the bag. In the male, the empty pupal case emerges half way out of the bag.



Figures 1 – **2**: *Luffia lapidella*. **1** – Female laying inside bag;
2 – Adult male.

DISCUSSION

The bags, containing live larvae or pupae from Wied il-Luq in Buskett, were collected either from the trunks of cypress trees (*Cupressus sempervirens* L.) or from adjacent walls. Both tree trunks and walls were covered with green algae and small lichens. The micro-climate from where the bags were collected can be described as very humid, cool and of low light intensity. The bags from Għargħur were collected from a bare rock face. The micro-climate is warm, with high light intensity. The rock face is in direct sunlight for a couple of hours daily. Similarly algae and lichens were present on parts of the rock.

It appears that the population of Wied il-Luq belongs to the form *ferchaultella*. From the 30 bags collected by one of the authors (PS) on July 9, 2007, 17 females emerged and not a single male. The other bags failed to produce adults. In captivity the bags were kept indoors in clear plastic containers and regularly sprayed with water to increase the humidity and to keep the larvae in a micro-climate more or less similar to that in the wild. From the 44 bags collected by one of us (MZ) on July 9 and 29, 2007, also from Wied il-Luq, 18 females and 7 males emerged. Although these were also raised in captivity, they were not kept indoors and the micro-climate approached more that of Għargħur than that at Wied il-Luq. Additionally, the microclimate at Wied il-Luq is very similar to that described for the form *ferchaultella* from other countries (Bourgogne, 1954; Narbel-Hofstetter, 1964).

From the 3 bags collected from Għargħur on July 22, 2007, only males emerged. It seems that this population belongs to the typical form *lapidella lapidella* due to the different micro-climate conditions. However, for the time being, too few larvae were collected to support this assertion.

CHECK-LIST OF MALTESE PSYCHIDAE

Taleporiinae Tutt, 1900
Sciopetris melitensis Rebel, 1919
Typhoniinae Lederer, 1853
Penestoglossa dardoinella (Millière, 1865)
Psychinae Boisduval, 1829
Luffia lapidella (Goeze, 1783)
Oiketicinae Herrich-Schäffer, 1850
Oiketicoides tedaldii (Heylaerts, 1881)
Pachythelia villosella (Ochsenheimer, 1810)
Phalcropterix apiformis (Rossi, 1790)
Apterona helicinella (Herrich-Schäffer, 1845)

ADDITIONAL NOTES

Sciopteris melitensis was first discovered by Adolf Andres in 1916 (Andres, 1916) and later it was also found by Anthony Valletta (Amsel, 1955). The species has been recently re-discovered and fully described by Hättenschwiler *et al.* (2007). *Pachythelia villosella* has been recorded from Birkirkara by Valletta (1950a, 1950b) who stated it is "not a rare moth at light". However, the species was not listed in Valletta's later work entitled '*The Moths of the Maltese Islands*' (Valletta, 1973). Most probably the author himself was not sure of the correct determination of the species and preferred not to include it. Sammut (2000) included this species on the authority

of Valletta but stated that this record is a misidentification for *Oikecitoides tedaldii*. Numerous males of *Apterona helicinella* have been found dead floating on sea water in salt pans at il-Qbajjar in Marsalforn (Gozo) on May 25, 2006 and on the same day and month of 2007.

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First record of Nepticulidae from the Maltese Islands (Lepidoptera)

Michael ZERAFA[1]

ABSTRACT. *Stigmella aurella* is recorded for the first time from the Maltese Islands. This record is also the first for the family Nepticulidae. Information on the biology and distribution of the species is included.

KEY WORDS. Lepidoptera, Nepticulidae, *Stigmella aurella*, Malta, new record.

INTRODUCTION

The family Nepticulidae includes some of the smallest Lepidoptera known to science, some having a wingspan of less than 3.0 mm. Most species within this family are leaf-miners, although a few species mine seeds or bark of trees. The family Nepticulidae has a worldwide distribution and is represented in Europe by 242 species in 8 genera (Nieukerken, 2004). The genus *Stigmella* Schrank, 1802 has an eastern Palaearctic distribution, with 107 European species (Nieukerken, 2004). The family Nepticulidae is being recorded for the first time from Malta.

Stigmella aurella (Fabricius, 1775)

Material examined: MALTA: Naxxar, 26.ii.2003, 1 ex., bred from larva; Mistra valley, 30.i.2006, 1 ex., bred from larva (on *Rubus ulmifolius* Schott); Mosta, Wied ta' l-Isperanza, 8.iii.-17.iv.2007, 6 exs., bred from larvae (on *Rubus umlifolius* and *Rubus caesius* L.). All material was collected by the author and dates provided indicate emergence of adults.

Short description: Adult male as in Fig. 1. The wing span of the specimens examined varied from 4.5 mm - 5.2 mm. Head rich orange with collar dark bronzy fuscous. Forewings copper purple; a metallic, golden fascia beyond the middle, preceded by a deep purple fascia with violet reflections. Apical area purplish. Cilia purple with a silvery sheen at the tips. Hind wings grey.

Distribution: This moth occurs in all countries bordering the northern Mediterranean. It is found in the larger islands of the Mediterranean Basin, most of central Europe, the Canary Islands and the Azores, Great Britain, Ireland and Northern Ireland, the Ukraine and European Russia (Nieukerken, 2004). It is also known from North Africa.

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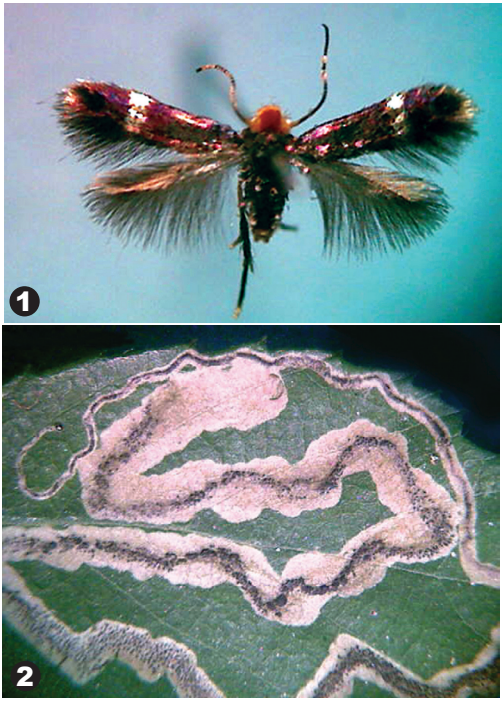

Figures 1 – **2**: *Stigmella aurella*. **1** – adult male; **2** – leaf mine on *Rubus ulmifolius*.

Ecology: The female lays a single egg on or near a lateral vein, on either side of the leaf (Emmet, 1983). The larva exits the egg from the base directly into the leaf and starts the mine, which develops into a long sinuous gallery (Fig. 2). It widens gradually and very rarely crosses itself. The frass is at first compact and linear but later it is dispersed, being absent from the very last part. Up to three mines could be present on one leaf. The larva leaves the mine when ready to pupate and very often drops down to the ground, where it spins a pale ochreous or sometimes greenish cocoon. Pupation lasts between 27-33 days. Throughout most of its distribution range, this species goes through two generations a year, one between late April and May and another during July/August (Emmet, 1983). Locally, larvae were collected between late January and mid-April suggesting that the species flies earlier, either in two successive overlapping generations or in a single extended generation. In Malta, *Stigmella aurella* was observed to mine leaves of *Rubus ulmifolius* and *R. caesius*. Elsewhere, the species was also recorded on *Agrimonia*, *Fragaria* and *Geum* (Parenti, 2000). Haslam *et al*. (1977) listed *Fragaria moscata* Duchesne, as occurring locally and several varieties of strawberries are extensively cultivated in Malta. These could also potentially be used by this species as a host plant. At least two unidentified parasitic wasps were reared from *S. aurella* in Malta. One species emerged from the 3rd or 4th instar larva and pupated inside the mine. The other species remained inside the larva (even after it spinned the pupal cocoon), from where it emerged as an adult.

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I would like to thank Mr Paul Sammut for helping in the identification of *Stigmella aurella* and also for assistance in the preparation of the present work.

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New populations of *Brachytrupes megacephalus* (Lefevre, 1827) on mainland Malta and some notes on its adaptive capacity (Orthoptera: Gryllidae)

Louis F. CASSAR[1*] & Elisabeth CONRAD[1]

ABSTRACT. Until recent years, records of the indigenous gryllid species *Brachytrupes megacephalus* within the Maltese Islands were restricted to Għadira and Armier on Malta, and Ramla l-Ħamra on Gozo. Four newly recorded additional populations are discussed, taking into account the different characteristics of the habitat at the various sites, and associated adaptations of the species in relation to substrate within each site.

KEY WORDS. Malta, Orthoptera, *Brachytrupes megacephalus*.

INTRODUCTION

Research on the subterranean cricket, *Brachytrupes megacephalus* (Lefevre, 1827) in the Maltese Islands has been ongoing since the late 1970s. The first record of this cricket species was that by Guido Lanfranco, in 1955, at Ramla l-Ħamra in Gozo (Lanfranco, 1957). A second specimen, this time from Għadira (Malta), was found in 1977 by one of the authors, in coastal sands (Cassar, 1979). These two isolated occurrences did not, at the time, generate sufficient interest to investigate the status of this species further and existing populations within these localities remained overlooked. When, in 1979, a second specimen was discovered at Għadira, observations carried out systematically at this locality revealed an established population within the Għadira area (Cassar & Bonett, 1985) that has been monitored since. Subsequently, searches at the Ramla l-Ħamra site in 1990 (Cassar, 1990) yielded yet another specimen; further field observations during the following year at this dunal site in Gozo confirmed the presence of a seemingly small established population that extended, sporadically, from the consolidated dune area to the adjoining parcels of agricultural land further inland from the coastal dunes. Moreover, fresh burrow mounds were noted at Armier in 1995 (Cassar, 1996), and the presence of an established population at this third site was confirmed in 1996 (Cassar & Stevens, 2002).

METHODOLOGY

From 1983 onwards, observations of the species in its natural habitat were carried out during its stridulating season, generally between the last week of March and the first week of June. Counts were made of stridulating male specimens, commencing soon after nightfall (when stridulation begins), until the cessation of all stridulating activity. The latter occurs either due to a fall in air temperature and/or due to increases in wind velocity, or when a female of the species is attracted to the male's burrow.

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RESULTS

The presence of established populations at Ramla l-Ħamra in Gozo, and Għadira (Fig. 1, Site 1) and Armier (Fig. 1, Site 5) was re-confirmed. Additional populations were recorded at the following sites within the Marfa promontory (toponymy based on Camilleri (1996) and Camilleri, *pers. comm*., 2008):

- Rdum il-Griewi/Daħlet ix-Xilep (Fig. 1, Site 2);
- L-Aħrax tar-Ramel (Fig. 1, Site 3);
- Tax-Xmajjar (Fig. 1, Site 4);
- Ta' Damma, between Ramla tat-Torri region and the Armier complex (Fig. 1, Site 6).

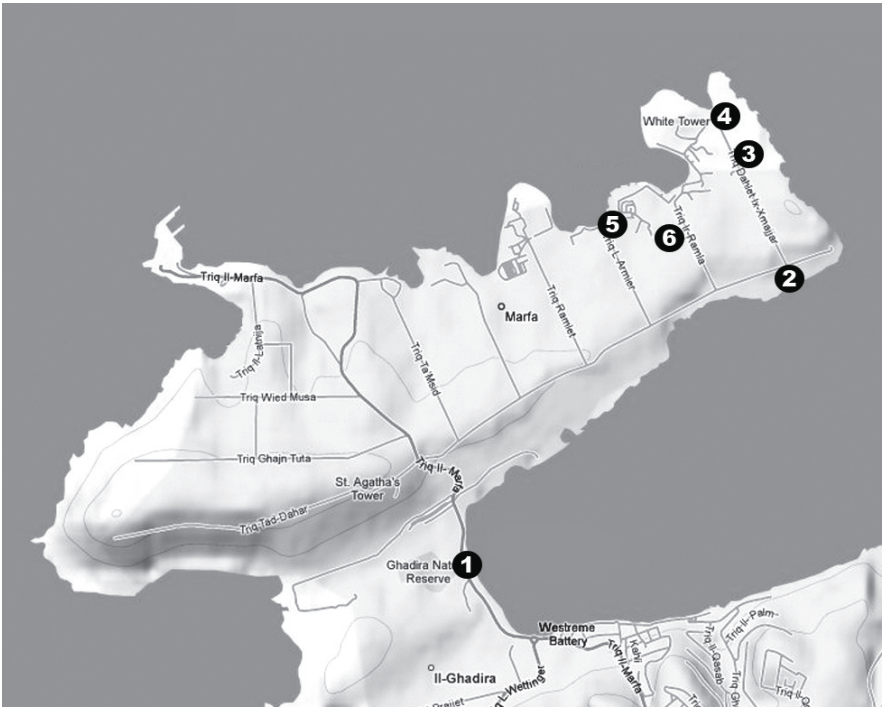

Figure 1 – Recorded populations of *Brachytrupes megacephalus* at Għadira and Marfa Ridge.

DISCUSSION

These newly-discovered populations provide insights into the habitat requirements of the species, which was previously thought to be localized and largely restricted to the complex and geomorphologically dynamic environment of the dune ecosystem (Cassar, 1990), such as occurs at Għadira, Ramla l-Ħamra and Armier. However, the population located within the Rdum il-Griewi and Daħlet ix-Xilep region establishes its burrows within a geological conglomerate (mainly

comprising Upper Coralline Limestone and other deposits resulting from complex processes involving slope failure, scarp fragmentation and colluvial formation), which has been rendered friable through boulder scree dynamics and mass movement, and is intermittently pocketed with Quaternary age and modern soil deposits. Unlike in other locations both in the Maltese Islands and across the Maghreb where the species is traditionally known to colonise sandy areas, both coastal and desert, the population of *B. megacephalus* at Rdum il-Griewi/Daħlet ix-Xilep exhibits an almost tenacious ability to burrow in a considerably harder substrate, in which ground armour and compacted rock materials are a dominant feature, within this sedimentary landscape.

The population at Tax-Xmajjar establishes burrows in a substrate of consolidated sandy soil, representing a complex derived from beach sand, valley sediment and imported soils. The karstic Aħrax tar-Ramel site is bordered by agricultural land, and comprises a naturally-occurring *terra rossa* soil mixed with traces of fine aeolian sand particles. Some specimens of the species at l-Aħrax tar-Ramel were noted on the verges of, and within, cultivated land, indicating that the species can successfully live within intensively used agricultural land. The population at Ta' Damma is in fact established almost entirely on cultivated agricultural land.

It remains to be seen whether the various spatially separated populations within the Marfa promontory and at Għadira function as a metapopulation. Given the proximity of the site at L-Aħrax tar-Ramel to that at Tax-Xmajjar, and on the basis of spatial observations of burrow mounds and stridulating male specimens, it can be reasonably assumed that there is some degree of exchange of individuals between these two populations. Similarly, there is likely to be interaction between the populations at Armier and Ta' Damma. Given the lie of the land between these aforementioned localities and the lack of abrupt topography that may act as a natural barrier to dispersal, it is plausible that the populations at Ta' Damma and L-Aħrax tar-Ramel also interact at some level. The remaining two populations (Għadira and Rdum il-Griewi/Daħlet ix-Xilep), on the other hand, appear, *prima facie*, to exist in isolation, and could possibly be vulnerable to the dynamics of small, isolated populations. Such dynamics include disproportionate exacerbated vulnerability to demographic and environmental stochasticity, and the genetic effects of inbreeding depression (Caughley, 1994). In the case of the Għadira population, apart from its physical distance from the other existing populations at L-Aħrax, a number of natural and anthropic barriers present may hinder the dispersal of crickets and their eventual interaction with neighbouring populations. In the case of the Rdum il-Griewi/Daħlet ix-Xilep population, inter-population migration to neighbouring sites may be physically obstructed by the rugged geomorphology of the scarpline and associated screes.

CONCLUSIONS

Observations on these new populations indicate that *Brachytrupes megacephalus* has behaviourally adapted to survive in environments other than the specialized and spatially restricted habitat of sand dunes, displaying an ability to survive on a variety of substrates and even within an anthropic terrain. This finding provides support and guidance for the establishment of a strategy of wildlife corridors to link the various populations at Marfa ridge and the one at Għadira, which is expected to enhance the long-term viability of these populations and which would provide safeguards for the maintenance of genetic diversity. Moreover, the species' adaptability to survive within coastal hinterland habitats beyond its preferred beach and sand dune environment augurs well in the event of coastal habitat degradation and modification and in the face of predicted threats from sea-level rise.

ACKNOWLEDGEMENTS

The input of Mr Matthew Borg Cardona is gratefully acknowledged, in that he noted burrow mounds on the sandy areas at the Rdum il-Griewi/Daħlet ix-Xilep site prior to any knowledge of a population of the cricket at this site, and passed on this information to the authors; detailed field investigation consequently showed that the species also colonized other areas, as described above, where a sandy substrate was not prevalent. Thanks are also due to Mr Guido Bonett, Mr Alex Casha, Mr Victor and Ms Desiree Falzon, Dott Elena Gagnarli, Mr Guido Lanfranco and Ms Miraine Rizzo, for assisting in field research and/or for passing on relevant information on the species. The authors are indebted to Mr Alex Camilleri for sharing with them his unpublished toponymic information of the Aħrax region.

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Phyllonorycter messaniella (Zeller, 1846), new record for the Maltese Islands (Lepidoptera: Gracillariidae)

Paul SAMMUT[1] & David MIFSUD[2]

ABSTRACT. *Phyllonorycter messaniella* is recorded for the first time from the Maltese Islands. Data about life history, ecology and distribution is included.

KEY WORDS. Lepidoptera, Gracillariidae, *Phyllonorycter messaniella*, new record, Malta.

INTRODUCTION

The family Gracillariidae, world wide, contains 1,809 recognised species in 98 genera (De Prins & De Prins, 2005). In Europe this group is represented by three subfamilies, the Gracillariinae with 91 species in 23 genera, the Lithocolletinae with two European genera, *Phyllonorycter* Hübner, 1822 (with 137 species) and *Cameraria* Chapman, 1902 which contains a single species, the Horse-chestnut leafminer, *Cameraria ohridella* Deschka & Dimic, 1986, and the Phyllocnistinae with 9 species in the genus *Phyllocnistis* Zeller, 1848. In total, the European representatives of this family number 237 species (Buzsko, 2004).

Species belonging to Gracillariidae are generally small to very small moths. The main distinguishing feature is hypermetamorphosis or the successive appearance of two morphologically distinct types of larvae. The first, flattened and apodous form, mines its host plants, whereas the second, which is sub-cylindrical with developed thoracic legs, either continues with its endophytic activity (most of the Lithocollettinae), or emerges and either continues to feed, or becomes an aphagous stage preceding pupation (Phyllocnistinae). The transition from one form of larva to the other also involves changes in the head capsule and all of the mouth parts (Parenti, 2000).

In the Maltese Islands, this family has been poorly studied and only three species have been recorded: *Dialectica scalariella* (Zeller, 1850) a fairly common species in Malta feeding on *Echium vulgare* L., *Caloptilia coruscans* (Walsingham, 1907) known only from a single specimen collected from Pembroke in 1992 (Sammut, 2000) and *Phyllonocnistis citrella* (Stainton, 1856) an established alien species since the 1990s with *Citrus* spp. as host plants (Mifsud, 1997).

Phyllonorycter messaniella (Zeller, 1846)

Material examined: MALTA: Lija, near cemetery, 6 exs., larvae collected on 18.x.2005 from *Quercus robur* L., leaves and adults emerged in late December, leg. D. Mifsud & A. Porta-Puglia; same locality, 30 exs., bred from larvae collected from 20-30.iv.2007, leg. A. Seguna.

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Short description: Adult (Fig. 1) with a wing-span of 8-10 mm. Face white, head and thorax yellow. Forewings light golden ochreous; basal streak narrow, well defined pale, dark-edged above and reaching almost to the middle. Strigulae on forewings pale but well defined. Costal strigulae 4; first reaching the dorsal one at an acute angle. Dorsal strigulae 4. Forewings without transverse pale fasciae. Hindwing cilia fuscous.

Figure 1 – *Phyllonorycter messaniella* adult.

Distribution: The species is very common in most of central and southern Europe. It is known from Great Britain and Ireland, the Channel Islands, the Canary Islands, Madeira, the Azores, Spain, the Balearic Is., Portugal, France, Belgium, Austria, Switzerland, Italy, Corsica, Sicily, Bulgaria, Croatia, Germany, Hungary, Greece, Crete, Macedonia, Ukraine, Moldova and S. Russia (Buzsko, 2004). Outside Europe it is also recorded from Morocco, Australia, New Zealand and Hawaii (New, 1981).

Ecology: Locally this species was only found on *Quercus robur* L. However, elsewhere the larvae are also known to feed on *Quercus ilex* L., *Castanea*, *Carpinea*, *Tilia* and *Fagus* (Emmet, 1979). Given the fact that most of the known host plants of this species are not present in Malta and locally, the species was always found (often large numbers of leaf mines present) on *Quercus robur* which is exotic, it is most likely that *P. messaniella* is a well established alien species in Malta. The species is known to be trivoltine but locally only two broods have been observed, although it is very probable that another brood occurs between the two recorded ones. The larva mines the underside of the leaf eating away the tissue leaving only the transparent cuticle, while the upper-side leaf tissue is left intact. The mine is in the form of an oval or circular blotch about a centimetre in diameter. A leaf may carry more than one mine. The larvae pupate inside the mine, usually surrounded by the black frass. Before hatching the pupa pushes itself half way out of the mine and the empty pupal case remains attached to the mine when the moth flies away.

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species and Dr Angelo Porta-Pulgia of Rome, Italy who was the first to observe the damage caused by this species in Malta. Thanks are also due to Mr Robert Edmunds for permission to use image of *P. messaniella*.

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An annotated catalogue of the Lepidoptera collection of Guido Lanfranco at the National Museum of Natural History in Malta

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ABSTRACT. An annotated list of the lepidoptera in the Lanfranco collection donated to the National Museum of Natural History of Mdina in Malta is included. Where relevant, comments on particular species or specimens are provided.

KEY WORDS. Lepidoptera collection, Guido Lanfranco, National Museum of Natural History, Malta.

PREAMBLE

The entomological collection of Mr Guido Lanfranco was acquired by the National Museum of Natural History as a bequest by Mr G. Lanfranco himself. Most of the insect orders occurring in Malta are represented in the Lanfranco collection. Initially Mr Lanfranco had donated the entomological collection to Dr Louis Cassar who, on acquiring the material contacted the senior author who, in turn, suggested that such a collection should be deposited in an appropriate institution instead of it being dismembered amongst a number of private collections. The formal presentation of the collection to the museum was carried out on April 3, 2006, in the presence of Mr and Ms G. Lanfranco, Dr Mario Tabone, Ms Cecilia Xuereb, Dr L. Cassar and the authors.

INTRODUCTION

In Guido Lanfranco's collection, the Lepidoptera are represented by 716 specimens belonging to 99 different species. Except for one species of Geometridae, one of Papilionidae and seven of Saturniidae (in all 13 specimens), all the other material has been ascertained by the collector to be of local origin. Unfortunately, 255 specimens (just over 35.6%) have no data label and in this category, a specimen of *Euchloe ausonia* (Hübner, 1804), a species possibly new to the lepidopterofauna of Malta is present. Another 43 specimens have only a number on the data label. This brings the number of specimens without data to 298 (just over 41.6%). However, unless otherwise stated by the present authors, much of the material is of local origin (Lanfranco, G. *pers. comm.*).

THE COLLECTION

The collection is very rich in the butterfly species. All the indigenous and migratory species are well represented. None of the erratic migratory species are represented. The larger moths, such as Sphingidae, Lasiocampidae and Arctiidae are also well represented.

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Geometridae are poorly represented by only six species. The collection is very poor as regards the microlepidoptera. There is only one specimen of each from Tineidae, Depressariidae, Oecophoridae and Sesiidae. From the Pyralidae (*sensu lato*) there are only 23 specimens belonging to 8 species.

The collection may have little aesthetic value but its scientific value is important. Of the butterflies, *Maniola jurtina hyperhispulla* (Thomson, 1972), *Aricia agestis* (Denis & Schiffermüller, 1775) and *Lycaena phlaeas* (Linnaeus, 1758) and of the moths, *Brythis crini* (Fabricius, 1775) appear to have been common during the time the collection was assembled. The four specimens of *Celastrina argiolus* (Linnaeus, 1758), dated 1962 are amongst the earliest known from the Maltese Islands. Areas which appear to have harboured a rich entomofauna, such as Wied il-Kbir and Wied Mejxu both in St. Julian's area have completely disappeared and even the locality names are no longer traceable on modern maps.

Most of the material in this collection has been assembled during the years 1951 to 1953 and again from 1964 to 1966. The oldest specimen is a Meadow Brown (*Maniola jurtina hyperhispulla*) collected in June of 1949 while the most recent is a Large White (*Pieris brassicae* Linnaeus, 1758) collected from Ta' Ġiorni on July 15, 1969. A bred specimen of a hybrid between two papilionid species bears a later date, July 9, 1976. The original entomological collection was housed in 19 wooden boxes of different sizes and specimens pinned on both sides of the boxes on polystyrene. Boxes housing the lepidoptera contained also specimens from the others orders of insects. In at least one of the boxes a setting board was present. This entomological collection is now housed at the National Museum of Natural History in Malta in a separate cabinet labelled as 'Lanfranco Collection'.

Very few specimens carry identification labels. From the material which was attributed to local origin, whether with data or without (700 specimens), only 37 specimens are determined. Of the determined specimens only a specimen of *Dysgonia torrida* (Guenée, 1852) was incorrectly determined as *Ophiusa algira* (Linnaeus, 1767). Another species, identified as *Crino solieri* (Boisduval, 1829) (a correct name for the taxon at that time) is currently known as *Mniotype deluccai* (Berio, 1976).

The country name Malta appears on the data label of only one specimen, an *Aricia agestis* (Denis & Schiffermüller, 1775) taken from San Anton Gardens. On the majority of the data labels, it is clear that the country name (Malta) is intended but not written. The locality name appears on most of the labels, sometimes in the old orthography such as Kaliet (Qaliet) and Wied il-Luk (Luq). This is followed by the date, the month represented in arabic numbers, and the year abbreviated to the last two of the four digit figure. If the specimen has been bred, terms like "ex-larva", "bred" or "reared" have been included on the data label. None of the data labels bears the collector's name.

A variety of media has been used to write the data labels. All data labels of the material which we deem are of local origin are all in manuscript by Mr Lanfranco himself (Lanfranco, G., *pers. comm.*). Labels are written in black, violet or blue ink, black, blue, red and green biro ink and in graphite pencil. Very ordinary paper was used for labels and very rarely was the label trimmed and squared. Labels on which just a number appear are slightly thicker. These are circular and according to Mr Lanfranco these have been cut out by a puncher. These numbers correspond to an entry in a notebook, which however, to date could not be traced. Such data labels and numbers

are not confined only to Lepidoptera and are found on specimens from other orders of insects. The non-Maltese geometrid species carry a part printed and part manuscript data label while the data label on the foreign Saturniids is typewritten in blue or black ink.

Most of the specimens have been mounted on Continental 35mm black-coated brass pins. Some were mounted on ordinary "Lill' pins. Micropins used to mount microlepidoptera were used on only a handful of specimens.

INTERVENTION ON THE COLLECTION

It was decided that where it was possible and without risking damaging the specimen, that the original pin will be removed and substituted by a standard entomological, 40mm steel pin. A small numbers of specimens where placed in a relaxing box for over 24 hours after which, if the pin was loose on the specimen, this was removed. If the pin was not loose enough it was returned to the relaxing box for a further 24 hours. The new pin was introduced in the hole left by the old one. In a number of instances where the specimen was too loose on the new pin, a drop of fast drying, acetone-based glue was applied from the underside to fix the pin. Where removal of the pin was not possible and it was considered too unsightly, it was cut down to as near the thorax as possible from the dorsal and ventral side. A new, size 0 pin was then introduced as near to the original pin as possible. In other instances, after trimming down the pin, the specimen was staged on plastozote strip. Some specimens were deliberately left on their original pin, either because of the importance of the specimen or because removal of the pin would have caused damage to the specimens. During this intervention no specimens were damaged or lost, although a few legs got detached and lost in the process. No resetting was attempted. All original data labels, even blank labels were returned on the respective specimen. It was thought fit to scissor-trim the roughly hand-cut data labels.

Finally, to each specimen two new labels were added, one, with the following information "G. Lanfranco Bequest – 2005", and a determination label. The latter including the taxon name, the authority and publication date along with the person who identified the species. These two labels were printed in black, ink-jet ink on glossy paper, font size 6 and font type New Times Roman.

ANNOTATED CATALOGUE

In the annotated list which follows, species sequence follows that of Sammut (2000), except for the Noctuoidea for which the recent work of Fibiger & Hacker (2004) was followed and the Saturniidae where Heppner (1991) was followed in the arrangement of the subfamilies. All identifications were carried out by the senior author. After each species entry, any details on the data label are included. Text in square brackets '[]' does not appear on the original data labels. Where a question mark is included, this denotes an illegible writing on the original label. Collection dates are transcribed as on the original labels. In cases where neither a data label nor a number is present with the specimen, this is specifically noted as '[no data label]'. In cases where two labels are present on the same insect (or series of insects pinned together) this is denoted by the slash symbol '/'. The semicolon ';' denotes a new entry of a specimen or series of specimens having the same data.

TINEOIDEA
TINEIDAE

***Trichophaga tapetzella* (Linnaeus, 1758)** [MALTA], Sliema, 10.11.68, 1 ex.

GELECHIOIDEA
DEPRESSARIIDAE

***Agonopterix thapsiella* (Zeller, 1847)** [MALTA], 27.4.53, 1 ex., reared.
Remarks: This specimen carries an identification label reading *Agonopteryx thapsella* [*sic*].

OECOPHORIDAE

***Esperia sulphurella* (Fabricius, 1775)** [MALTA], W[ied] Encita, 26.5.53, 1 ex.

SESIOIDEA
SESIIDAE

***Synanthedon myopaeformis cruentata* (Mann, 1859)** [MALTA], Sliema, 12.6.63, 1 ex.
Remarks: This specimen is labelled *Sesia cruentata*. The taxon *cruentata* has now been lowered to subspecies rank and associated with the species *myopaeformis* (Borkhausen, 1789).

PYRALOIDEA
PYRALIDAE

***Lamoria anella* (Denis & Schiffermüller, 1775)** [MALTA], 3.7.52, 4 exs., reared; 1 ex. [no data label].

***Pyralis farinalis* (Linnaeus, 1758)** [MALTA], Sliema, 3.6.61, 1 ex.; 3 exs. [no data label].
Remarks: The specimen from Sliema carries a determination label reading *Pyralis farinalis*.

***Aglossa caprealis* (Hübner, 1809)** [MALTA], Sliema, 26.4.52, 1 ex.; 1 ex. [No.] 31; 1 ex. [no data label].

***Euchromius ocellea* (Haworth, 1811)** [MALTA], 1 ex. [no data label].

***Evergestis isatidalis* (Duponchel, 1833)** [MALTA], 2 exs. [no data label].

***Pleuropyta ruralis* (Scopoli, 1768)** [MALTA], Sliema, 29.2.64, 2 exs., ex-larva on *Stapelia minima*.

***Duponchelia fovealis* (Zeller, 1847)** [MALTA], 20.9.51, 1 ex. / [No.] 267.

***Nomophila noctuella* (Denis & Schiffermüller, 1775)** [MALTA], Sliema, 30.10.65, 1 ex., resting; W[ied] Mexju, 6.10.51, 1 ex. / [No.] 289; 3 exs. [no data label].
Remarks: The specimen from Wied Mejxu bears a determination label reading *Nomophyla noctuella* [*sic*].

LASIOCAMPOIDEA
LASIOCAMPIDAE

***Lasiocampa trifolii* (Denis & Schiffermüller, 1775)** [MALTA], Sliema, 4.10.64, 1 ex., ex-larva; 2 exs. [no data label].
Remarks: The specimen from Sliema carries a determination label reading *Lasiocampa trifolii.*

***Gastropacha quercifolia* (Linnaeus, 1758)** [MALTA], 19.11.52, 1 ex.; 9.[??].52, 1 ex., ex-larva; 3.11.53, 2 exs., ex-larva; 3.11.53, 1 ex. / [No.] 5; 7.11.53, 2 exs., ex-larva; 9.11.53, 2 exs., ex-larva; 12.11.53, 1 ex., ex-larva; 16.11.53, 2 exs., ex-larva; 25.11.53, 1 ex., ex-larva; 28.11.53, 1 ex., ex-larva; 1.12.53, 1 ex., ex-larva; 1 ex. [No.] 2; 4 exs. [no data label].
Remarks: The two ex-larva specimens dated 3.xi.1953 also bear data labels indicating that they have mated together.

BOMBYCOIDEA
BOMBYCIDAE

***Bombyx mori* (Linnaeus, 1758)** 1 ex. [no data label].
Remarks: This species, the silk-worm moth, does not occur in the wild in Malta and represents breeding experiments. The specimen is in a very poor state. There are also two empty silk cocoons, also without data.

SATURNIIDAE

***Automeris io* (Fabricius, 1775)** AMERICA, 1 ex.
Remarks: The data label bears also the vernacular name "Bull's Eyes" and the female symbol.

***Aglia japonica* Leech, [1889]** 1 ex. [no data label].
Remarks: This species is endemic to Japan.

***Actias luna* (Linnaeus, 1758)** AMERICA, 1 ex.
Remarks: The specimen bears a determination label: *A*[*ctias*] *luna*, and the vernacular name "Moon moth".

***Antheraea paphia* (Linnaeus, 1758)** INDIA, 1 ex.
Remarks: The specimen bears a determination label: *A*. *mylitta,* and the vernacular name "Tussor silk-moth".

***Antheraea pernyi* Guérin-Menéville, 1855** 1 ex. [no data label].
Remarks: The specimen bears a determination label: *A*. *pernyi*. The species originates from China.

***Antheraea polyphemus* (Cramer, [1775])** AMERICA, 1 ex.
Remarks: The specimen bears a determination label: *T. polyphemus*, and the vernacular name "Oak Silk Moth".

***Attacus atlas* (Linnaeus, 1758)** 1 ex. [no data label].
Remarks: The specimen bears a determination label: *A*[*ttacus*] *atlas*. Atlas moths are found only in Southeast Asia.

***Callosamia promothea* (Drury, 1773)** AMERICA, 1 ex.; 1 ex. [no data label].
Remarks: The specimen labelled "America" also bears the male symbol.

***Samia cynthia* (Drury, [1773])** U.S.A., 1 ex.
Remarks: The vernacular name "Ailanthus moths" is also included on the data label.

SPHINGOIDEA
SPHINGIDAE

***Agrius convolvuli* (Linnaeus, 1758)** [MALTA], [?]Buħarrat, 7.10.52, 1 ex.; Għadira, 19.9.65, 1 ex., resting on *Pancratium*; 2 exs. [no data label].

***Acherontia atropos* (Linnaeus, 1758)** [MALTA], Sliema, May 52, 1 ex. / [No.] 438; 5 exs. [no data label].

***Macroglossum stellatarum* (Linnaeus, 1758)** [MALTA], W[ied] Encita, 10.10.[??], 1 ex.; 3 exs. [no data label].

***Hyles sammuti* Eitschberger, Danner & Surholt, 1998** [MALTA], W[ied] [il-]Kbir, 1.11.64, 1 ex.; W[ied] [il-]Kbir, 3.11.64, 1 ex., ex-larva; 10.10.53, 1 ex., ex-larva; 26.6.54, 2 exs., ex-larva; 14.7.54, 1 ex., ex-larva; 7.8.54, 1 ex., ex-larva; 9.[??].54, 1 ex., ex-larva; 2.9.54, 1 ex., ex-larva; 4.9.54, 2 exs., ex-larva; 6.9.54, 1 ex., ex-larva; 11.9.54, 1 ex.; 26.4.5[?], 1 ex.; 2 exs. [data label undecipherable]; 4 exs. [no data label].
Remarks: At the time that the collection was assembled, the Maltese population of this taxon was known as *Hyles euphorbiae* (Linnaeus, 1758).

***Hyles livornica* (Esper, 1779)** [MALTA], Sliema, 10.4.64, 1 ex.

***Hippotion celerio* (Linnaeus, 1758)** [MALTA], 26.2.53, 1 ex., reared emerged; [place name undecipherable], 8.11.66, 1 ex.; 1 ex. [No.] 346; 2 exs. [no data label].
Remarks: The specimen collected on 8.xi.1966 bears a determination label reading *Deilephila celerio*.

HESPERIOIDEA
HESPERIIDAE

***Gegenes pumilio* (Hoffmannsegg, 1804)** [MALTA], W[ied] Encita, 10.10.53, 4 exs.; W[ied] Encita, 24.9.65, 2 exs.; 1 ex. [No.] 379; 1 ex. [No.] 413; 1 ex. [data label undecipherable].

PAPILIONOIDEA
PAPILIONIDAE

***Papilio machaon melitensis* Eller, 1936** [MALTA], Floriana, 1.10.53, 1 ex.; Floriana, 2.10.53, 1 ex.; 9.9.52, 1 ex., reared; W[ied] Encita, 4.10.53, 1 ex.; 16.10.59, 1 ex., ex-larva; Żabbar, 23.5.76, 1 ex.; 29.9.52, 1 ex., reared; [?]24.9.52, 1 ex., reared; 3 exs. [no data label].
Remarks: There are also two dry pupae and one dry larva, all without data.

Papilio polyxenes asterius* (Stoll, 1782) x *Papilio machaon [MALTA], Żabbar, 9.7.76, 1 ex.
Remarks: This specimen represents a hybrid between the North American *Papilio polyxenes asterius* and a subspecies of the European *Papilio machaon* (Linnaeus, 1758), very probably our *melitensis*. This breeding experiment has been carried out by Mr Noel Camilleri. The information

on the data label of this specimen probably refers to where breeding and eclosion of the adult took place.

PIERIDAE

***Euchloe ausonia* (Hübner, 1804)** 1 ex. [no data label].
Remarks: There is a possibility that this specimen is of local origin. However since it bears no data whatsoever it is considered inappropriate to add this species to the list of Maltese lepidopterofauna. In Lanfranco's collection this specimen was placed with the series of *Pontia daplidice* (Linnaeus, 1758). *Euchloe ausonia* was also reported by Valletta (1974a, 1974b) as having been collected by Flt. Lt. Harrison during his three day stay in Malta in July of 1953. However, this species, together with three others, the pierid, *Catopsilia florella* Fabricius, 1775, and two lycaenids, *Tarucus theophrastus* Fabricus, 1793 and *Pseudophilotes baton* Bergstrasser, 1779, all reported by Valletta (1974a, 1974b) as new records for Malta, were actually collected by Harrison in Cyprus, and not Malta (Harrison, *pers. comm.*). This error was communicated by Harrison to Valletta soon after the latter's publication appeared in *'The Entomologist'*, but has to date not been rectified.

***Pieris brassicae* (Linnaeus, 1758)** [MALTA], Kaliet, 13.3.56, 1 ex.; Ta Ġiorni, 15.7.69, 1 ex.; W[ied] Encita, 3.4.53, 2 exs.; 3.11.53, 2 exs., ex-larva; 4.11.53, 1 ex., ex-larva; 1 ex. [No.] 148; 7 exs. [no data label].
Remarks: There is also a dry pupa without data.

***Pieris rapae* (Linnaeus, 1758)** [MALTA], Sliema, 31.7.53, 1 ex.; W[ied] Encita, 3.4.53, 1 ex.; 26.3.64, 1 ex., ex-larva; 2 exs. [No.] 146; 1 ex. [no data label].

***Pontia daplidice* (Linnaeus, 1758)** [MALTA], Floriana, 2.5.52, 1 ex.; Floriana, 3.5.52, 1 ex.; Floriana, 29.4.52, 1 ex.; W[ied] [il-] Kbir, 10.10.64, 5 exs.; W[ied] [il-] Kbir, 2.11.64, 3 exs.; 1 ex. [No.] 122; 1 ex. [No.] 228; 2 exs. [no data label].

***Colias croceus* (Fourcroy, 1785)** [MALTA], Floriana, 3.4.54, 1 ex.; Kaliet, 30.3.52, 1 ex.; W[ied] Encita, 3.10.53, 1 ex.; W[ied] Encita, 4.10.53, 1 ex.; W[ied] Encita, 10.10.53, 4 exs.; W[ied] Encita, 3.4.54, 1 ex.; W[ied] Mejxu, 13.3.52, 1 ex.; W[ied] Mejxu, 27.4.52, 1 ex.; W[ied] Mejxu, 10.6.52, 1 ex.; W[ied] [is-] Sewda, 16.4.51, 1 ex.; W[ied] [is-] Sewda, 10.4.52, 1 ex.; W[ied] [is-] Sewda, 16.4.52, 1 ex.; [locality name undecipherable], 10.10.64, 1 ex.; 1 ex. [No.] 140; 1 ex. [No.] 142; 1 ex. [No.] 144; 1 ex. [No.] 145; 4 exs. [no data label].
Remarks: Six specimens from the above cited material belong to the form *helice* Hübner, 1803.

***Gonepteryx cleopatra* (Linnaeus, 1767)** [MALTA], [Balzan] S[an] Anton [Gardens], 4.6.52, 1 ex.; [Floriana], Argotti Gardens, 7.10.53, 1 ex.; Kaliet, 11.5.52, 1 ex.; Vittoriosa, 5.10.64, 1 ex.; W[ied] Encita, 24.5.52, 4 exs.; W[ied] Encita, 10.6.54, 2 exs.; 4 exs. [no data label].

LYCAENOIDEA
LYCAENIDAE

***Lycaena phlaeas* (Linnaeus, 1758)** [MALTA], [Balzan], S[an] Anton [Gardens], 24.9.65, 1 ex.; Boskett, 17.10.51, 1 ex.; Buskett, 14.6.52, 2 exs.; Buskett, 2.7.52, 2 exs.; W[ied] Babu, 21.4.52, 1 ex.; W[ied] Encita, 18.5.52, 1 ex.; W[ied] Encita, 21.3.53, 1 ex.; W[ied] Encita, 2.3.54, 1 ex.; W[ied] Encita, 24.9.65, 2 exs.; W[ied] Mejxu, 9.4.52, 1 ex.; W[ied] Mejxu, 27.4.52, 1 ex.; W[ied] Mejxu, 8.8.52, 1 ex.; W[ied] Mejxu, 12.4.53, 1 ex.; 1 ex. [No.] 51; 1 ex. [No.] 53; 1 ex. [No.] 54; 6 exs. [no data label].

***Lampides boeticus* (Linnaeus, 1758)** [MALTA], [Balzan], S[an] Anton [Gardens], 24.9.65, 2 exs.; Kaliet, 12.6.52, 1 ex.; W[ied] Encita, 10.10.52, 1 ex.; W[ied] Mejxu, 10.6.52, 1 ex.; W[ied] Mejxu, 12.6.52, 2 exs.; 1 ex. [No.] 57.

***Leptotes pirithous* (Linnaeus, 1758)** [MALTA], Sliema, 26.6.52, 1 ex.; W[ied] Encita, 24.9.65, 6 exs.; W[ied] [il-] Kbir, 10.10.64, 1 ex.; 1 ex. [No.] 58; 1 ex. [No.] 59; 1 ex. [No.] 60; 1 ex. [No.] 278; 1 ex. [No.] 333; 4 exs. [no data label].

***Celastrina argiolus* (Linnaeus, 1758)** [MALTA], 2.4.62, 4 exs.; 1 ex. [no data label].
Remarks: The four specimens collected on 2.iv.1962 had only one data label and one determination label between them. These were placed on one of the specimens and to the other three we have added an additional black, ink-jet printed data label bearing: 2.4.62, Lanfranco Coll. At least the four specimens bearing the date of collection are important because they represent very early records for this species. The first records for this species from Malta are those of Valletta (1961a, 1961b) from two male specimens collected from Buskett on March 23, 1961.

***Aricia agestis* (Denis & Schiffermüller, 1775)** MALTA, [Balzan], San Anton [Gardens], 23.9.65, 1 ex.; [Balzan], S[an] Anton [Gardens], 24.9.65, 1 ex.; Gnejna, 15.5.52, 1 ex.; W[ied] Babu, 21.4.52, 1 ex.; W[ied] Encita, 4.10.53, 2 exs.; W[ied] [il-] Kbir, 10.10.64, 2 exs.; W[ied] Mejxu, 27.4.52, 2 exs.; W[ied] [is-]Sewda, 18.5.52, 1 ex.; W[ied] [is-]Sewda, 19.9.52, 1 ex.; 1 ex. [No.] 42; 1 ex. [No.] 45; 1 ex. [No.] 46; 1 ex. [data label blank]; 4 exs. [no data label].
Remarks: In recent times this species has become quite rare.

***Polyommatus icarus* (Rottemburg, 1775)** [MALTA], Buskett, 14.6.52, 3 exs.; Għajn Tuffieħa, 14.4.52, 1 ex.; W[ied] Babu, 21.4.52, 1 ex.; W[ied] Encita, 12.4.52, 1 ex.; W[ied] Encita, 16.4.52, 2 exs.; W[ied] Encita, 4.10.53, 4 exs.; W[ied] Encita, 19.9.54, 3 exs.; W[ied] Encita, 24.9.65, 1 ex.; W[ied] Mejxu, 13.3.52, 2 exs.; W[ied] Mejxu, 15.3.52, 3 exs.; W[ied] Mejxu, 9.4.52, 1 ex.; W[ied] Mejxu, 27.4.52, 2 exs.; W[ied] Mejxu, 11.5.52, 1 ex.; W[ied] Mejxu, 12.4.53, 1 ex.; 1 ex. [No.] 63; 1 ex. [No.] 64; 1 ex. [No.] 66; 1 ex. [data label blank]; 6 exs. [no data label].

NYMPHALOIDEA
NYMPHALIDAE

***Vanessa atalanta* (Linnaeus, 1758)** [MALTA], Floriana, 3.4.52, 1 ex.; Kaliet, 14.3.54, 1 ex.; W[ied] Mejxu, 30.3.52, 1 ex.; 1 ex. [No.] 387; 3 exs. [no data label].

***Vanessa cardui* (Linnaeus, 1758)** [MALTA], Sliema, 28.9.64, 2 exs., ex-larva; Sliema, 1.10.64, 1 ex., ex-larva; St. George's [Bay], 15.3.54, 1 ex.; W[ied] Encita, 10.10.53, 2 exs., ex-larva; W[ied] [is-] Sewda, 10.4.52, 1 ex.; W[ied] [is-] Sewda, 16.4.52, 1 ex.; W[ied] [is-] Sewda, [date undecipherable], 1 ex.; 21.9.64, 2 exs., ex-larva; 29.9.64, 1 ex., ex-larva; 30.9.64, 6 exs., ex-larva; 1.10.64, 1 ex., ex-larva; 1 ex. [no data label].
Remarks: On the verso of the data label of the specimen collected from Wied is-Sewda and in which the date is undecipherable, we have written in ms. Blue ink – "Wied is-Sewda – P. Sammut".

***Lasiommata megera* (Linnaeus, 1767)** [MALTA], Kaliet, 14.3.54, 1 ex.; W[ied] Encita, 3.10.53, 1 ex.; W[ied] Encita, 2.3.54, 1 ex.; W[ied] Mejxu, 15.3.52, 1 ex.; 3 exs. [no data label].

***Pararge aegeria* (Linnaeus, 1758)** [MALTA], W[ied] Encita, 27.2.54, 1 ex.; W[ied] [is-] Sewda, [date undeciperable], 1 ex.; W[ied] [ta' l-] Isperanza, 19.3.52, 1 ex.; 1 ex. [No.] 332; 8 exs. [no data label].

***Coenonympha pamphilus* (Linnaeus, 1758)** [MALTA], Buskett, 14.6.52, 1 ex.; W[ied] Mejxu, 13.3.52, 1 ex.; 1 ex. [no data label].

***Maniola jurtina hyperhispulla* Thomson, 1972** [MALTA], Buskett, 14.6.52, 3 exs.; Buskett, 17.5.52, 4 exs.; Kaliet, 6.5.52, 1 ex.; Kaliet, 11.5.52, 1 ex.; Kaliet, 12.5.52, 1 ex.; Floriana, 29.4.52, 1 ex.; Floriana, 1.10.53, 1

ex.; St.George's [Bay], 11.5.52, 1 ex.; W[ied] Encita, 25.5.52, 1 ex.; W[ied] Encita, 27.5.52, 2 exs.; W[ied] Encita, 13.6.53, 1 ex.; W[ied] Encita, 4.10.53, 1 ex.; W[ied] Encita, 10.6.54, 2 exs.; W[ied] Encita, 2.3.57, 1 ex.; W[ied] Encita, 24.9.65, 1 ex.; W[ied] [il-] Kbir, 20.5.54, 2 exs.; W[ied] [il-] Kbir, 24.5.54, 2 exs.; W[ied] Mejxu, 6.5.52, 2 exs.; W[ied] Mejxu, 8.5.52, 1 ex.; W[ied] Mejxu, 11.5.52, 5 exs.; W[ied] Mejxu, 12.6.52, 1 ex.; W[ied] Mejxu, 18.6.52, 2 exs.; W[ied] Mejxu, 29.6.52, 2 exs.; W[ied] Mejxu, 14.5.53, 1 ex.; W[ied] Mejxu, 27.5.54, 2 exs.; W[ied] [is-] Sewda, 18.5.52, 4 exs.; Jun[e] 49, 1 ex.; Jul[y] 51, 1 ex.; 1 ex. [No.] 125; 1 ex. [No.] 128.

Remarks: This formerly very common species is now rare, having almost completely disappeared from Malta but still existing in small populations on the island of Gozo.

GEOMETROIDEA
GEOMETRIDAE

***Scopula imitaria* (Hübner, [1799])** [MALTA], 4 exs. [no data label].

***Rhodometra sacraria* (Linnaeus, 1767)** [MALTA], 3 exs. [no data label].

***Xanthorrhoe disjunctaria* (La Harpe, 1860)** [MALTA], 1 ex. [no data label].

***Larentia clavaria* (Haworth, 1809)** [MALTA], 8 exs. [no data label].

***Larentia malvata* (Rambur, 1832)** [MALTA], Blata l-Bajda, School, 1.12.65, 1 ex.; 2 exs. [no data label].

***Anaitis efformata* (Guenée, 1857)** [MALTA], Buskett, 10.11.51, 1 ex.; 1 ex. [no data label].

***Spargania luctuata* (Denis & Schiffermüller, 1775)** [GERMANY], Frank[fur]t [-a-] Main, [?] Solochberg, 15.6.50, leg. Wunderlich.

Remarks: The specimen bears a partly printed and partly manuscript label.

NOCTUOIDEA
ARCTIIDAE

***Phragmatobia fuliginosa melitensis* (O.Bang-Haas, 1927)** [MALTA], 2 exs. [no data label].

***Cymbalophora pudica* (Esper, [1785])** [MALTA], Floriana, 27.10.53, 3 exs.; 1 ex. [No.] 353; 8 exs. [no data label].

Remarks: One of the Floriana specimens bears a determination label reading *Euprepia pudica*.

***Utetheisa pulchella* (Linnaeus, 1758)** [MALTA], [Birżebbuġia], Għar Dalam, 13.10.64, 2 exs.; Kaliet, 17.10.53, 1 ex.; Vittoriosa, 11.10.64, 1 ex.; W[ied] Encita, 10.10.53, 1 ex.; W[ied] [il-] Kbir, 10.10.64, 2 exs.; W[ied] [il-] Kbir, 28.10.64, 2 exs., ex-larva; W[ied] [il-] Kbir, 29.10.64, 1 ex., ex-larva; W[ied] [il-] Kbir, 31.10.64, 5 exs., ex-larva; W[ied] [il-] Kbir, 1.11.64, 1 ex., ex-larva; W[ied] [il-] Kbir, 2.11.64, 2 exs.; W[ied] [il-] Kbir, 3.11.64, 2 exs., ex-larva; W[ied] [il-] Kbir, 4.11.64, 1 ex., ex-larva; W[ied] [il-] Kbir, 5.11.64, 2 exs., ex-larva; W[ied] [il-] Kbir, 7.11.64, 1 ex., ex-larva; W[ied] [il-] Kbir, 12.11.64, 1 ex., ex-larva; 1 ex. [No.] 359; 4 exs. [no data label].

Remarks: With this series there is an additional data label to cover material collected from Wied il-Kbir, and reads "*U. pulchella* dated Oct. & Nov. 1964 were all collected from W. Kbir during exc[ursion] of NHSM [Natural History Society of Malta] of Oct. 1964" Additionally the two specimens collected from Wied il-Kbir on 3.xi.1964 have the word "Sliema" next to the words, "ex-larva".

EREBIDAE

***Eublemma ostrina* (Hübner, [1808])** [MALTA], W[ied] [il-] Għasel, 16.10.65, 1 ex., by beating; W[ied] Mejxu, 12.4.53, 1 ex.

***Nodaria nodosalis* (Herrich-Schäffer, [1851])** [MALTA], W[ied] Encita, 18.5.52, 1 ex. / [No.] 419; W[ied] [is-] Sewda, 19.4.52, 1 ex.; 1 ex. [No.] 8; 3 exs. [no data label].
Remarks: The specimen from Wied Encita carry a determination label, *Metaporia nodosalis*. Specimen with data label [No.] 8 is determined as *Herminia nodosalis*.

***Hypena lividalis* (Hübner, 1796)** [MALTA], Sliema, 28.7.53, 1 ex.; Sliema, 21.9. 53, 1 ex.; Sliema, 18.8.[??], 1 ex.; 1 ex. [no data label].

***Clytie illunaris* (Hübner, [1813])** [MALTA], Sliema, 5.9.55, 1 ex.; 3 exs. [no data label].

***Dysgonia torrida* (Guenée, 1852)** [MALTA], [No.] 284; 1 ex. [no data label].
Remarks: The specimen numbered 284 bears an incorrect determination label reading *Ophiusa algira*.

***Dysgonia algira* (Linnaeus, 1767)** [MALTA], 1 ex. [no data label].

***Cataocala elocata* (Esper, 1787)** [MALTA], Buskett, Wied [il-] Luk, 1.8.60, 1 ex.; 2 exs. [no data label].

NOCTUIDAE

***Abrostola triplasia* (Linnaeus, 1758)** [MALTA], [??].[??].57, 1 ex.

***Trichoplusia ni* (Hübner, [1803])** [MALTA], Vittoriosa, 27.9.64, 1 ex., at light; Vitt[oriosa], 10.11.64, 1 ex.; 5 exs. [no data label].

***Thysanoplusia orichalcea* (Fabricius, 1775)** [MALTA], W[ied] Encita, 24.11.51, 1 ex. / [No.] 366.
Remarks: This specimen carries two determination labels reading *Plusia oricalcea* [*sic*].

***Chrysodeixis chalcites* (Esper, 1789)** [MALTA], Buskett, 24.11.51, 1 ex.; Sliema, 10.9.53, 1 ex., ex-larva on Capsicum; Sliema, 1.10.64, 1 ex.; [data label undecipherable], 1 ex.; 1 ex. [No.] 358; 1 ex. [no data label].
Remarks: The specimen from Buskett bears a determination label reading: *Plusia chalcites.*

***Autographa gamma* (Linnaeus, 1758)** [MALTA], [?] Buskett, 17.8.52, 1 ex.; Vittoriosa, 27.9.64, 1 ex.; W[ied] Encita, 10.10.52, 1 ex.; W[ied] Mejxu, 13.3.52, 1 ex.; W[ied] Mejxu, 1.4.53, 1 ex.; 13.3.51, 1 ex.; 1 ex. [No.] 318; 7 exs. [no data label].

***Emmelia trabealis* (Scopoli, 1763)** [MALTA], 1 ex. [no data label].

***Diloba caeruleocephala* (Linnaeus, 1758)** [MALTA], St. George[es] [Bay], Nov. 51, 1 ex.; 11.11.52, 1 ex.; 16.11.52, 1 ex.; 11.11.53, 1 ex.; 15.11.53, 1 ex.; 1 ex. [No.] 357.
Remarks: The specimen collected from St. George's bay bears a determination label reading *Episima caeruleocephala* [*sic*].

***Synthymia fixa* (Fabricius, 1787)** [MALTA], W[ied] Mejxu, 9.4.52, 1 ex. / [No.] 427.
Remarks: This specimens carries a determination label reading: *Monogramma fixa*, and an additional data label reading 9. April 1952.

***Tyta luctuosa* (Denis & Schiffermüller, 1775)** [MALTA], St. George's B[ay], 6.5.51, 1 ex. / [No.] 5; W[ied] Mejxu, 29.7.52, 1 ex.; W[ied] Mejxu, 27.9.52, 1 ex.; [data undecipherable], 2 exs.; 1 ex. [no data label].
Remarks: The specimen from St. George's Bay bears also a determination label reading: *A. luctuosa*. The specimen collected from Wied Mejxu on 29.vii.1952 bears a determination label reading: *Acontia luctuosa*.

***Cucullia* (*Cucullia*) *calendulae* (Treitschke, 1833)** [MALTA], Sliema, 21.1.66, 1 ex.

***Cucullia* (*Shargacucullia*) *verbasci* (Linnaeus, 1758)** [MALTA], 5.5.64, 2 exs., ex-larva.
Remarks: Both specimens carry a determination label reading *Cucullia verbasci*.

***Heliothis peltigera* (Denis & Schiffermüller, 1775)** [MALTA], Kaliet, 12.6.52, 3 exs.; Vittoriosa, 27.9.64, 1 ex., at light; W[ied] Mejxu, 12.6.52, 2 exs.; 14.7.52, 1 ex., reared; 4 exs. [no data label].

***Helicoverpa armigera* (Hübner, [1808])** [MALTA], 23.5.52, 1 ex., reared / [No.] 431.
Remarks: The specimen carries two determination labels, reading *Cloride armigera* [*sic*].

***Spodoptera exigua* (Hübner, [1808])** [MALTA], Vittoriosa, 27.9.64, 2 exs.; Vittoriosa, 8.11.64, 3 exs., at light; Vittoriosa, 10.11.64, 1 ex.; W[ied] [il-] Kbir, 10.10.64, 1 ex.; 1 ex. [No.] 365; 8 exs. [no data label].

***Spodoptera littoralis* (Boisduval, 1833)** [MALTA], Sliema, 4.10.64, 1 ex., at rest; Vittoriosa, 8.11.64, 2 exs.; Vittoriosa, 10.11.64, 1 ex.; Vittoriosa, 19.11.64, 1 ex.; W[ied] [il-] Kbir, 10.10.64, 1 ex.; 18.11.67, 1 ex., on *Alisma*.

***Phlogophora meticulosa* (Linnaeus, 1758)** [MALTA], 1 ex. [No.] 10; 1 ex. [no data label].

***Agrochola lychnidis* (Denis & Schiffermüller, 1775)** [MALTA], Ta' Ġiorni, Nov. 66, 1 ex.; 1 ex. [No.] 352; 19 exs. [no data label].
Remarks: One of the specimens without data label carries a determination label reading: *Orthosia pistacina* ?. The taxon *pistacina* Denis & Schiffermüller, 1775 is only a colour morph and is a synonym of *lychnidis*.

***Xylena exsoleta* (Linnaeus, 1758)** [MALTA], Floriana, 13.12.51, 1 ex.; 1 ex. [No.] 382.
Remarks: The population from Malta of this species is today referred to as ssp. *maltensis* Fibiger *et al*., 2006 (Fibiger *et al.*, 2006).

***Aporophila nigra* (Haworth, [1809])** [MALTA], 1 ex. [No.] 376; 2 exs. [no data label].

***Aporophila canescens* (Duponchel, 1826)** [MALTA], 24.11.51, 2 exs.; 9.10.53, 1 ex., 3x-larva; 13.10.53, 1 ex., ex-larva; 17.10.53, 1 ex., ex-larva; 21.10.53, 1 ex., ex-larva; 24.10.53, 2 exs., ex-larva; 27.10.53, 1 ex., ex-larva; 29.10.53, 1 ex., ex-larva; 2.11.53, 1 ex., ex-larva; 7.11.53, 1 ex., ex-larva; 2 exs. [no data label].
Remarks: The specimens dated 24.xi.1951 each bear a determination label reading *Polia canescens* and an additional data label, on one reading [No.] 362 and on the other reading [No.] 364.

***Mniotype deluccai* (Berio, 1976)** [MALTA], Buskett, Nov[ember], 51, 1 ex.; Sliema, 3.11.52, 1 ex.; Vittoriosa, 26.10.64, 1 ex.; 1 ex. [No.] 356; 1 ex. [No.] 442; 28 exs. [no data label].
Remarks: The specimen from Buskett and the one numbered 356, each bear a determination label reading *Crino solieri.*

***Anarta* (*Calocestra*) *trifolii* (Hufnagel, 1766)** [MALTA], 1 ex. [no data label].

***Mythimna unipuncta* (Haworth, 1809)** [MALTA], Floriana, 24.3.53, 1 ex.

***Brithys crini* (Fabricius, 1775)** [MALTA], Mellieħa, 8.10.65, 5 exs., on *Pancratium*; 9.10.65, 10 exs.; 22.2.65, 1 ex.
Remarks: The full data with specimens collected from Mellieħa on 8.x.1965 reads: "larva 20.9.65 imago 8.10.65" and the verso, "on *Pancratium*, Mellieħa Malta". The full data on the specimens bearing date 9.x.1965 reads "larva 22.9.65 imago 9.10.65".

***Peridroma saucia* (Hübner, [1808])** [MALTA], Floriana, 30.5.52, 1 ex. / [No.] 452; 3 exs. [no data label].

***Agrotis lata* (Treitschke, 1835)** [MALTA], Vittoriosa, 27.9.64, 1 ex., at light; 2 exs. [no data label].

***Agrotis puta* (Hübner, [1803])** [MALTA], 12 exs. [no data label].

***Agrotis trux* (Hübner, [1824])** [MALTA], Floriana, 6.10.53, 1 ex.; 4 exs. [no data label].

***Agrotis ipsilon* (Hufnagel, 1766)** [MALTA], Floriana, 1.9.53, 1 ex.; Vittoriosa, 24.10.64, 1 ex., at light; Zurrieq, Blue Grotto, 28.9.69, 1 ex.; 1 ex. [No.] 354; 1 ex. [No.] 385.
Remarks: The specimen numbered 354 carries a determination label reading *Apamea ypsilon* [*sic*] while that from Floriana carries a determination label reading *Agrotis ypsilon* [*sic*].

***Noctua pronuba* (Linnaeus, 1758)** [MALTA], 3 exs. [no data label].

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Stenonemobius gracilis (Jakovleff, 1871): an addition to the orthopteran fauna of the Maltese Islands (Orthoptera: Gryllidae)

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ABSTRACT. *Stenonemobius gracilis* is recorded for the first time from the Maltese Islands on the basis of two specimens taken at light in 1993 at Mellieħa Bay, and subsequent records of specimens, collected between 1999 and 2004, from various sites located on the 'northwest' region of Malta and one site on Gozo. It is suggested that this species may well have been overlooked previously due to its diminutive size and nocturnal habits.

KEY WORDS. Malta, Orthoptera, Gryllidae, *Stenonemobius gracilis*.

INTRODUCTION

During the last seven decades or so, the list of Maltese Orthoptera has been periodically reviewed and up-dated, mostly but not exclusively by Maltese authors (Borg, 1939; Valletta, 1954, 1955; Lanfranco, 1955, 1957; Baccetti, 1973; Cilia, 1975; Schembri & Ebejer, 1983, 1984; Schembri, 1984; Cassar, 1990). The present report adds another species to the orthopteran fauna of the Maltese Islands.

Stenonemobius gracilis (Jakovleff, 1871) belongs to the Subfamily Nemobiinae and Tribe Pteronemobiini. In the West Palaearctic Region, this genus is represented by two species, of which *Stenonemobius gracilis* (Jakovleff) is fairly widespread within the Mediterranean Basin, while *Stenonemobius bicolor* (Saussure, 1877) is restricted to the northern Black Sea region.

Stenonemobius gracilis is a small light-coloured nocturnal gryllid, with an overall length that does not exceed 6.5 mm. It is noted to be quite common in *oued* systems across the Maghreb and is readily attracted to artificial lights (Chopard, 1943; Harz, 1969; Fontana *et al*., 2002).

MATERIAL AND METHODS

The records on which this contribution is based are the result of general light trap sampling. The light trapping in which the first recorded specimens were collected was conducted on 4th August 1993 within the remnant coastal sand dune area at Għadira within the precincts of the Għadira Nature Reserve. Two large white sheets were utilized, one held vertically by poles and the other laid over the sand in a clearing within an otherwise heavily afforested dunal area. A 160 W Mercury Vapour lamp powered by a portable generator was used. The light trap was set up at around 20h30 and dismantled at 23h30, during which time a constant vigil was kept for any

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insects landing on the sheets. A similar set-up was also used at Għar Barka in July of 1999 and Wied il-Baħrija in August of 2003, while an actinic moth trap was used during the Ramla and Binġemma sessions, respectively, in June of 2001 and June of 2004. The light trapping session at Wied l-Isqof during which the 2002 specimen was taken, was conducted on August 2nd on a rural road immediately adjacent to the valley bed, using an ultra-violet light source.

Stenonemobius gracilis (Jakovleff, 1871)

Material examined: MALTA: Mellieħa Bay, Għadira Nature Reserve, 4.viii.1993, 1 ♂ & 1 ♀, leg. L.F. Cassar; Rabat, Għar Barka, 20.vii.1999, 1 ♀, leg. P.M. Sammut; Rabat, Wied l-Isqof, 2.viii.2002, 1 ♂, leg. D. Mifsud; Rabat, Wied il-Baħrija, 6.viii.2003, 1 ♀, leg. A. Seguna; Mgarr, Binġemma, 28.vi.2004, 1 ♀, leg. A. Seguna. GOZO: Xagħra, Ramla, 16.vi.2001, 1 ♀, leg. A. Seguna. All specimens were collected at light.

Distribution: *Stenonemobius gracilis* has a relatively widespread distribution, ranging from the western Mediterranean (including Spain and the Maghreb) (Harz, 1969), Malta (Fig. 1), Sicily, central and northern Italy (Fontana *et al*., 2002; Fontana *et al*., 2005) and Macedonia (Harz, 1969), to the eastern Mediterranean and the Near East (Egypt and Palestine) and to Asia Minor and beyond (Mesopotamia, Turkestan, the Caspian Sea region), as well as eastern Africa (northern Sudan) (Chopard, 1943; Harz, 1969).

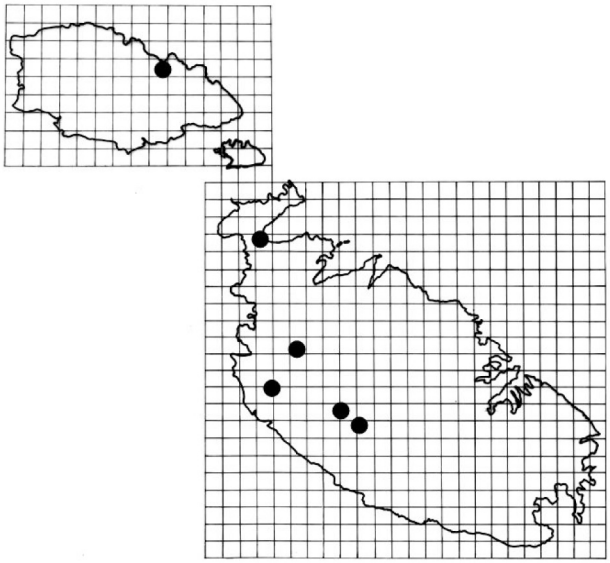

Figure 1 – Distribution of *Stenonemobius gracilis* in the Maltese Islands.

DISCUSSION

Notes on habitat: The Għadira specimens were taken on the remnant coastal sand dune, which, in recent decades, was subject to considerable modification through heavy planting of an assortment of trees, both indigenous and alien, that consequently created a dense canopy over a habitat typical of open coastal landscapes. At the time of capture, the Għadira dune comprised isolated

patches of relatively consolidated sand, colonized by a remnant dune flora that characterised the entire dune prior to afforestation, together with a host of planted trees, ranging from *Tamarix* and *Pinus* species to *Eucalyptus* and *Acacia* species, among others. The precise area on which the light trap was set-up consisted of a parcel of bare sand with patches of *Lotus cytisoides* L., *Pancratium maritimum* L., and *Juncus acutus* L.

The Għar Barka specimen was taken within the urban-rural fringe of the town of Rabat, where fairly extensive cultivation is still practised. Crop types in this area comprise those often encountered on more arid farmlands, such as onions and cereals in the main, since groundwater is apparently not as plentiful within this part of Għar Barka as in other localities nearby (Sammut, P.M., *pers. comm*., 2008). Some small-scale orchards, largely stone-fruit, also occur. There are no natural or semi-natural assemblages other than the ubiquitous suite of ruderal species often encountered along field margins.

The Ramla (Gozo) specimen was taken on the coastal sand dune, a habitat which, although still geomorphologically active, is relatively quite small compared to other similar biotopes in the Mediterranean. The Ramla dunes, which support a reasonably well developed dune flora, are located between the beach and encroaching agricultural parcels inland. A seasonal watercourse forms in this locality during the wet season, cutting through beach sands to form a temporary, small estuarine environment.

The Wied l-Isqof specimen was taken on the rural secondary road that lies close and immediately adjacent to the valley bed. This seasonal watercourse, which functions as a freshwater run-off conduit, is mainly colonized by *Arundo donax* L. and is almost entirely surrounded by farmland. In general, the landscape within this region consists of a mosaic characterized by extensive cultivation and parcels of semi-natural and natural vegetation.

The Wied il-Baħrija specimen was taken on the adjacent banks of the valley proper. The Baħrija watercourse supports a perennial source of freshwater which maintains fairly high levels of humidity all year round, as a consequence of which, dense riparian vegetation colonises the valley-bed and its immediate surroundings.

The Binġemma specimen was taken on an elevated parcel of land, largely karstic, with an adjacent valley system nearby, which in-part is heavily cultivated. The original biotope, remnants of which still persist, was based on thickets of *Rubus ulmifolius* Schott together with a variety of garrigue and steppic assemblages on the upper, more exposed reaches of the area.

As indicated above, all the specimens recorded herein were taken at light, using Mercury Vapour, UV or actinic light sources. The species was encountered between the latter part of June and early August. Overall, every locality lies within a rural setting in which aquatic habitats and/or humid environments, natural or man-made (valleys, marshland, artificial pools and reservoirs), ranging from fresh to brackish waters, occur within or in close proximity to the record sites. Moreover, the one common factor for all the sites in which *S. gracilis* was taken is agriculture within perched aquifer zones; each locality (Għadira, Għar Barka, Ramla, Wied l-Isqof, Wied il-Baħrija and Binġemma) harbours actively cultivated farmland that lies, in every instance, on the younger stratigraphic layers that comprise exposures of the Upper Coralline Limestone and Blue Clay, the latter of which is characteristic of high water retention capabilities.

Stenonemobius gracilis is widely distributed across the Mediterranean basin and, as a result, it would be reasonable to assume that the species has been overlooked locally. In particular, its small size and slender form, as well as its nocturnal habits, render the species relatively inconspicuous. Species with similar physical characteristics and habit generally only attract attention when they are associated with agriculture and economic implications. Thus, the fact that *S. gracilis* is not noticeably associated with farmland or cultivation and is not a conspicuous pest, may be the reason why this species has gone unnoticed for so long, including by country folk from whom, typically, vernacular names and indigenous rural knowledge most often originate. There is no doubt that only through thorough searches for the species in appropriate habitats could the actual status of *Stenonemobius gracilis* in the Maltese Islands be ascertained; indeed, it is likely that this species is commoner than immediately evident.

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An annotated catalogue of the Odonata collection of Guido Lanfranco at the National Museum of Natural History in Malta

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ABSTRACT. An annotated list of the Odonata collection of Guido Lanfranco, is provided. The specimens were captured between 1952 and 1971, and may be the oldest surviving specimens caught and still available in local collections from Malta. Almost all locally occurring species are represented, with some specimens collected in sites and habitats that have since been destroyed by urban development. A portion of the specimens bear no data labels and do not contribute to the knowledge of the distribution of the species. During the cataloguing process, specimens in poor condition were restored.

KEY WORDS. Odonata collection, Guido Lanfranco, National Museum of Natural History, Malta.

INTRODUCTION

The Odonata collection of Guido Lanfranco, now housed at the National Museum of Natural History at Mdina, illustrate the diversity of Odonata present on the Maltese Islands at the time the collection was assembled. This is consistent with the scant documentation of Odonata by contemporary entomologists. Cowley (1940) mentioned *Ischnura genei* (Rambur, 1842), *Sympetrum striolatum* (Charpentier, 1840), and *Crocothemis erythraea* (Brullé, 1832) as being common species present on the Maltese Islands, whereas Valletta (1949, 1957) recorded ten species of anisopterans, nine of which are represented in the Lanfranco collection, namely: *Anax ephippiger* (Burmeister 1839), *A. imperator* (Sèlys, 1839), *A. parthenope* (Sèlys, 1839), *Orthetrum brunneum* (Fonscolombe, 1837), *O. cancellatum* (Linnaeus, 1758), *O. coerulescens anceps* (= *O. ramburi*) (Selys, 1841), *S. fonscolombii* (Selys, 1840), *S. striolatum* (Charpentier, 1840), *and C. erythraea* (Brullé, 1832). Valletta (1947, 1952) reported *A. ephippiger* (Burmeister, 1839) as a species that migrates to the Maltese Islands in rather large numbers from time to time. He also describes *Selysiothemis nigra* (Van Der Linden, 1825) as being a rare migrant. No other records of this species exist since the time of the assembly of the Lanfranco collection. Cilia (1972) mentioned the same species as recorded by Valletta. It is to be noted that some of the localities from where specimens were captured have been subjected to urban development and the natural habitat occurring in these locations was destroyed. One such location includes Wied Mejxu in Swieqi.

During this study the Odonata in the Lanfranco collection and the private collection of Dr Cassar were studied. The latter collection was studied since the Lanfranco collection was originally donated to Dr Cassar.

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THE COLLECTION

The collection contains representatives of all the indigenous and migratory Odonata, with the exception of *Selysiothemis nigra*. The only locally occurring species of coenagronid, together with all aeshnids and most libellulids are represented. In all, the collection contains 40 specimens represented by nine species, while a specimen representing a tenth species, *Orthetrum corulescens anceps* (Selys, 1841), is found amongst the specimens that were retained by Dr Cassar.

The original entomological collection of Guido Lanfranco was housed in 19 wooden boxes of different sizes, with specimens pinned on both sides of the boxes on polystyrene sheets. The collection was allocated a separate cabinet at the National Museum of Natural History. The Odonata had been moved prior to the current cataloguing by the author into two drawers, one housing all anisopteran species while the other drawer containing the specimens of *Ischnura genei*, together with some Dichtyoptera (mantids) and Neuroptera (lacewings and antlions).

Most of the material in this collection was assembled between 1952 and 1971 with the oldest record being a male specimen of S*ympetrum striolatum* from Buskett dated 14.6.1952, while the most recent is a female specimen of *Anax parthenope* from Salina dated 29.9.1971. The records show that some specimens, particularly the ones collected during the 1950's, may be the oldest surviving Odonata collected from the Maltese Islands.

Of the 40 specimens in the collection housed in the National Museum of Natural History, 14 specimens (35 %) bear no data label. Three of the seven other specimens currently found in the collection of Dr Cassar, also bear no data label. Unfortunately, one of the unlabelled specimens happens to be a specimen of *Orthetrum brunneum*, a species which has always been considered to be rare and localized on the Maltese Islands, with records being mostly confined only to the Rabat, Mtaħleb and Baħrija areas. This species was taken by the author at Baħrija Valley in 2001 and other records pertain to a freshwater spring in Rabat (Degabriele, 1992). Another two specimens of this species, also without data labels, originally belonging to the Lanfranco collection, are found in the private collection of Dr Cassar.

Another 12 specimens in the collection only bear a catalogue number as their data label. These numbers corresponded to an entry in a notebook compiled by Mr Lanfranco, which, to date has not been traced. The total number of Odonata specimens without scientific data therefore amounts to 26, or around 65%. However, Lanfranco (*pers. comm.*) confirmed that most of the material in question is of local origin.

Only three specimens have a species name on their data label. In most cases, the species name was included in the box as a separate label with a number of specimens assembled in rows behind or in front of this label. Since the author did not have access to the collection before the specimens were relocated to their current cabinet, it was not possible to confirm that the specimens were placed in the original sequence. It has nonetheless been confirmed that the relocation was done in such a way as to keep the specimens in the original order (Borg, J., *pers. comm*.). The author has rearranged a few of the specimens, particularly those in the drawer containing anisopteran specimens in the order as they appear in the records inventory present in this paper.

Of the determined specimens, only one specimen of *Anax parthenope* had been incorrectly determined as *Anax imperator*.

The locality name appears on many of the labels followed by the date with the year abbreviated to the last two of the four digit figure. The name of the collector however, does not appear on any of the data labels. The country name (Malta) is intended, but not written on any of the labels.

A variety of media was used to write the data labels. All data labels attached to the specimens are handwritten by Mr Lanfranco himself. They were written in black or blue fountain pen ink, black or blue ball pen ink and in graphite pencil. Ordinary paper was used for labels and often the label was not trimmed and squared. The labels where the catalogue numbers were written are of a slightly thicker, better quality paper. These are circular in shape and were cut out by means of a puncher. In some cases, the location and date of capture was also written on this label, while in a few others, a separate untrimmed label bore the data for the specimen.

Most of the specimens were mounted using ordinary, non-entomological pins and for some of the larger specimens, even small nails were used.

During the original setting of some of the specimens, the abdomen was opened ventrally in order to remove the internal organs. While this practice tends to preserve the body colour, which would otherwise turn black as the internal organs decomposed, it can unfortunately destroy the secondary genitalia in males of some species. This can make species identification more difficult, particularly in some teneral male libellulids. However, this was not a serious problem in the specimens in question. In other specimens, a toothpick was inserted inside the abdomen to keep it in place. This eventually caused some damage to the specimens.

It was decided that none of the original pins would be replaced, as they showed no signs of tarnishing or corrosion, which would have resulted in the deterioration of the specimens. Since the pins used in many cases were large and thick, clipping the pins and replacing them could have damaged the specimens. The decision to retain the original pins was also taken in view of the importance of the specimens, with some records being more than fifty years old.

Many specimens were in a poor state of preservation. Some specimens might also have been damaged during the relocation process. However, in almost all cases, the broken pieces from the specimens could be found in the respective drawers. These were reassembled by the author using small quantities of a clear, fast drying, acetone based adhesive. During this intervention none of the specimens were damaged or lost. No resetting was attempted, as this would not have enhanced the value of the collection in any way.

ANNOTATED INVENTORY

The classification of Odonata follows Dijkstra & Lewington (2006). All identifications were carried out by the author. After each species entry, any details on the data label are included. Text in square brackets '[]' does not appear on the original data labels. Where a question mark is included, this denotes an illegible writing on the original label. Collection dates are transcribed as on the original labels. In cases where neither a data label nor a number is present with the specimen, this is specifically noted as '[no data label]'. The semicolon ';' denotes a new entry of a specimen or series of specimens having the same data. In cases where two labels are present on the same insect (or series of insects pinned together) this is denoted by the slash symbol '/'. In case where material is housed in another collection, this information is included in brackets '()'.

ZYGOPTERA
COENAGRIONIDAE

***Ischnura genei* (Rambur, 1842)** [MALTA], Salina, 29.9.71, 1 ♂; 1 ♂, 1 ex. [No.] 71; 1 ♂ [no data label]; 1 ♂ [no data label], [laterally mounted]; 1 ♀ [?] 9.71; 1 ♀ [No.] 68; 1 ♀ [No.] 260; 1 ♀ [no data label].
Remarks: Specimen numbered 71 has a very prominent black/bicoloured pterostigma. The female specimen dated 9.71 could have possibly been caught with the other male specimen bearing the same date and could also have been collected from Salina. Specimen numbered 260 and one female specimen with no data are rather battered and both are missing their abdomen. One male specimen with no data carries a determination label reading "*I. genei*".

ANISOPTERA
AESHNIDAE

***Anax* sp.** Exuviae [no data label].

***Anax imperator* (Leach, 1815)** [MALTA], Salina, 29.9.63, 1 ♂; 2.7.52, 1 ♂; 3 ♂♂ [no data label]; 2 ♀♀ [no data label].

***Anax parthenope* (Sèlys, 1839)** [MALTA], Salina, 29.9.71, 1 ♀; 1 ♀ [no data label].
Remarks: The female specimen recorded from Salina carries an incorrect determination label reading "*A. imperator"*.

***Anax ephippiger* (Burmeister 1839)** [MALTA], 1 ♂ [No.] 393; Attard, Wied Enċita, 21.3.53, 1 ♀; Sliema, Summer, 1953, 1 ♀ (L. Cassar coll.).
Remarks: The specimen labelled "Wied Enċita" is missing half its abdomen.

LIBELLULIDAE

***Orthetrum cancellatum* (Linnè, 1758)** [MALTA], 1 ♀ [No.] 70; 1 ♀, [No.] 257.
Remarks: The specimen numbered 70 is missing its abdomen.

***Orthetrum brunneum* (Fonscolombe, 1837)** [MALTA], 1 ♂ [no data label]; 2 ♂♂ [no data label] (L. Cassar coll.).

***Orthetrum coerulescens anceps* (Selys, 1841)** 1 ♂ [no data label] (L. Cassar coll.).

***Sympetrum fonscolombii* (Selys, 1840)** [MALTA], 1 ♂ [No.] 18; Buskett, 17.8.52, 1 ♀; 1 ♂ [No.] 77; 29.8.64, 1 ♂; 1 ♂ [no data label]; Swieqi, Wied Mejxu, 8.8.52, 1 ♀ / [No.] 258; 1 ♀ [No.] 78; 1 ex. [no data label]; 1 ♀ [No.] 254 (L. Cassar coll.).
Remarks: The male specimen numbered 77 bears a label reading "*Sympetrum fonscolombi*". The male specimen dated 29.8.64 is annotated as "Red Dragonfly" and has an illegible annotation which could allude to its location of capture. The specimen with no data is very battered and with a missing head and abdomen. The female specimen numbered as 254 in the Cassar collection is also in poor condition.

***Sympetrum striolatum* (Charpentier, 1840)** [MALTA], Buskett, 14.6.52, 1 ♂; 29.8.64, 1 ♀; Buskett, 14.6.52, 1 ♀; 1 ♀ [no data label]; Buskett, 17.viii.1952, 1 ♀ (L. Cassar coll.); Swieqi, Wied id-Dis, 09.vi.1952, 1 ♀ (L. Cassar coll.).

Remarks: The specimen with no data is in poor condition and is missing the head and forewings.

***Crocothemis erythraea* (Brullé, 1832)** [MALTA], Swieqi, Wied Mejxu, 27.9.52, 1 ♂; Mellieħa, Għadira, 23.09.65, 1 ♂; 1 ♂ [No.] 209; 1 ♂ [No.] 209a; 1 ♂ [no data label]; 1 ♀ [No.] 74.

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The distribution of *Orthetrum trinacria* Selys, 1841 and *Trithemis annulata* Palisot de Beauvois, 1807 in the Maltese Islands (Odonata: Libellulidae)

Mario V. BALZAN[1]

ABSTRACT. Two recently recorded dragonfly species, *Orthetrum trinacria* and *Trithemis annulata*, were observed over several bodies of water in Gozo. The distribution of these species is documented. Moreover, it is suggested that the introduction of these species could have been favoured by changes in the climate, in the light of similar observations made throughout Southern Europe.

KEYWORDS. Odonata, Malta, distribution, *Orthetrum trinacria*, *Trithemis annulata*.

INTRODUCTION

The origins of dragonflies (Order Odonata) go back to the Upper Carboniferous period when giant Protodonata, roamed the Carboniferous forests (Tillyard, 1917; Corbet 1962, 1999). The group is divided into three suborders: Zygoptera, Anisozygoptera and Anisoptera. All members of the order Odonata are hemimetabolous and amphibiotic insects, inhabiting all kinds of freshwater habitats, whether permanent or temporary. In the Maltese Islands inland surface waters provide highly restricted spatiotemporal habitats and only a few permanent water bodies persist. Consequently, it is not expected to find a large number of dragonfly species on the Islands, as argued by Valletta (1949). Indeed, despite the fact that odonates are large, conspicuous, day-flying, easily handled, easily observed organisms (Conrad *et al*., 1999) the number of recorded species is small and few studies have been conducted locally on this order. The first publication to mention three Maltese Odonata was that of McLachlan (1899) which included: *Ischnura genei* (Rambur, 1842), *Crocothemis erythraea* (Brullé, 1832) and *Sympetrum striolatum* (Charpentier, 1840). The same species were included within Cowley's list of Odonata of the eastern Mediterranean area (Cowley, 1940). Valletta (1949, 1957) published two papers with lists of species that occurred locally. The first article lists nine species: *Ischnura genei*, *Anax imperator* (Leach, 1815), *Anax parthenope* (Selys, 1839), *Crocothemis erythraea*, *Orthetrum cancellatum* (Linnaeus, 1758), *Orthetrum brunneum* (Fonscolombe, 1837), *Sympetrum striolatum*, *Sympetrum fonscolombii* (Selys, 1840) and *Selysiothemis nigra* (Vander Linden, 1825). In his second contribution, Valletta (1957) lists two additional species: *Anax ephippiger* (Burmeister, 1839) and *Orthetrum coerulescens anceps* (Fabricius, 1798), formerly identified as *Orthetrum ramburi* (Selys, 1848). A recent work on Maltese Odonata is that of Degabriele (1992) where the distribution of dragonflies and damselflies in freshwater habitats in mainland Malta was investigated. The most recent publication on the Odonata fauna of Malta is the annotated checklist published by Ebejer *et al*. (2008).

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During the past months the author monitored adult dragonfly populations in freshwater habitats within agricultural landscapes. During this study two species of dragonflies, *Trithemis annulata* (Palisot de Beauvois, 1807) and *Orthetrum trinacria* (Selys, 1841) were monitored. After being recorded in semi-popular articles in local newspapers (e.g. Sciberras *et al.*, 2007), the occurrence of these two species was formally recorded by Ebejer *et al.*, (2008).

METHODOLOGY

Observations were made during an ongoing survey which started in April 2008. Standardised survey methodology for adult Odonata involved weekly direct 30 minute timed counts of adults over the water body. Adult Odonata are large, conspicuous and day-flying, making them highly visible and relatively easy to identify in the field (Moore, 1997; Conrad *et al.,* 1999; Plant *et al*., 2005). Despite a reservoir of individual Odonata dispersed throughout agricultural landscapes and the various microhabitats required throughout their lifecycle (Corbet, 1999), Odonata density within breeding microhabitats, has been shown to remain fairly constant due to territorial behaviour. Thus direct counts over water bodies are considered a conservative measurement of odonate abundance (Moore, 1953; Conrad *et al*., 1999). Similar timed counts were conducted over farmland and semi-natural water bodies within the Maltese agricultural landscapes. Where necessary, a hand-net was used to catch adult Odonata that were later identified to species level and released. However two specimens of *Trithemis annulata* and *Orthetrum trinacria* were taken for record. Askew (2004) was used for the identification of Odonata to species level.

Timed counts of these two species have been carried out in four localities:

1. The Qattara pool in Gozo. This is a deep freshwater pool which lies at the foot of the southernmost cliffs at il-Qawra in Dwejra. The Qattara pool receives water which comes from Wied il-Kbir as well as water all the year round from seepage through the overhanging rock face, thus making it a permanent pool. The banks of the pool are colonised by *Cyperus longus* L., *Rumex bucephalophorus* L., *Mentha pulegium* L. and also *Tamarix africana* Poir and *Vitex agnus-castus* L.

2. The permanent freshwater pool at Ta' Sarraflu in Gozo. This large pool is dominated by *Tamarix* spp. Other species commonly recorded from the banks of the pool including *Foeniculum vulgare* L., *Diplotaxis tenuifolia* L., *Inula crithmoides* L. and *Nerium oleander* L. Emergent aquatic vegetation includes *Typha* sp. Two recently introduced species now common in this freshwater pool include the exotic fish, *Gambusia* sp. and the Bedriaga's frog, *Rana bedriagae* Camerano, 1882 (Sciberras & Schembri, 2006).

3. Tal-Grazzja valley in Rabat, Gozo. This system has been extensively modified in the past, most probably in the 1950s, in order to ensure that it retains a water supply to be used for agricultural practices throughout the year. The valley is dominated by *Cyperus longus* L., but other common vegetation includes *Galactites tomentosa* Moench, *Avena sterilis* L., *Emex spinosa* L., *Foeniculum vulgare* L., *Opuntia ficus-indica* L. and *Ricinus communis* L.

4. The watercourse in Wied il-Lunzjata. This system is directly dependent on springs flowing from the Victoria-Kerċem groundwater body. The dominant vegetation on the sides of the valley investigated include *Arundo donax* L. and *Acanthus mollis* L.

RESULTS

Two Anisopteran species of the family Libellulidae were studied in the water bodies mentioned above.

Orthetrum trinacria Selys, 1841

Short description: *Orthetrum trinacria* is a large and elongate species. Total body length is about 60 mm, making it the largest European species of *Orthetrum*. In both sexes the abdomen is narrow and almost cylindrical but basally swollen at S1-2. The species is characterised by a large yellowish brown pterostigma about 4mm long and a yellowish or olivaceous ground colour in females and immature males. Mature males and old females are darker and covered basally by bluish pruinescence.

Global distribution: This species is widespread in Africa and common in the north extending east to Sudan, Egypt and the Middle East (Palestine and Iraq). In Europe, the species is known from Sicily and recently recorded in Sardinia and Spain (Belle, 1984; Askew, 2004).

Local distribution: The species was recorded from Wied Żnuber, Baħrija, Wied il-Għasel, in Malta and from Marsalforn and Kerċem (Għadira ta' Sarraflu) in Gozo between 2003 and 2004 and has since been sighted or taken in various localities across the Islands (Ebejer *et al*., 2008). During this study, the first observations of *Orthetrum trinacria* were made on the 25th of May, 2008. On this day, three male individuals were observed for the first time at Ta' Sarraflu. A male individual was recorded at Qattara on the 1st of June, 2008. Following these initial recordings, individuals of this species were recorded weekly at Ta' Sarraflu but were only recorded on two sampling occasions at the Qattara freshwater pool, these being the 1st and 11th of June, 2008. *Orthetrum trinacria* individuals were observed in tandem and engaging in reproductive behaviour on the 11th of June sampling visit to the Ta' Sarraflu freshwater pool. Adult individuals were also recorded during a visit to Wied tal-Grazzja, on the 11th, 15th and 21st of June, 2008. The first record of individuals of this species over agricultural water reservoirs was made on the 21st of June 2008. During a visit to an agricultural water reservoir near the Ta' Sarraflu area an adult male individual was observed engaging in territorial behaviour with *Anax imperator* and *Crocothemis erythraea* individuals. A male individual was also observed by the author in mainland Malta at a remnant freshwater pool at the Fiddien valley on the 29th of June and the 24th of July 2008.

Trithemis annulata Palisot de Beauvois, 1807

Short description: Total body length ranges from 32-38 mm. Mature males of this species posses a broad body with a distinctive, vivid violet coloration. The thorax is reddish-brown, frons and vertex have a metallic purple colour. Females are yellow-brown with a narrow mid-dorsal black abdominal band on S8-10. Forewing has 9½ to 10½ transverse antenodals and a reddish pterostigma enclosed by black veins. The hindwing is characterised by a basal orange mark which extends as far as the discoidal cell.

Global distribution: *Trithemis annulata* is common all over Africa, and found in the Middle East, Arabia, western Asia and the extreme south of Europe. However, this species is a generalist which develops in static and slow moving waters with low oxygen concentrations and neutral or slightly alkaline pH, a biotope which is very common in the Mediterranean Region (Bonet Betoret, 2000). The species was recently recorded from south-western Iberia, north as far as central Portugal, Sardinia, Sicily, coastal parts of Italy as far north as Tuscany and from southern Greece

(Askew, 2004). It has been suggested that this species has undergone a geographic expansion in the countries of southern Europe (Belle, 1984; Bonet Betoret, 2000; Dijkstra, 2006).

Local distribution: First recorded from Wied il-Qlejgħa and Santa Lucia (Malta), the species has since been observed in increasing numbers in different localities such as at Mistra and Ċirkewwa (Ebejer *et al*., 2008). During the present study four individuals of this species were first observed on the wing on the 25th of May, 2008 at the Qattara freshwater pool and two males were observed at the freshwater pool at Ta' Sarraflu. Following these initial recordings, the species was recorded weekly at the Qattara freshwater pool. However, no recordings have been made during the following two sampling visits at Ta' Sarraflu on the 7th and 11th of June, 2008. Male individuals were observed in subsequent sampling occasions in the mentioned site on the 15th and 2nd of June. Individuals of this species were also observed at the Lunzjata Valley in Kerċem. The first recordings at the Lunzjata valley were made on the 1st of June when individuals were observed engaged in territorial and also in mating behaviour over an agricultural water reservoir. Individuals were also observed on subsequent sampling occasions, often engaged in territorial behaviour with *Crocothemis erythraea* individuals, over the same agricultural reservoir. Male individuals were also observed engaged in territorial behaviour, with *Crocothemis erythraea*, *Anax imperator* and *Orthetrum coerulescens anceps* over the Lunzjata valley watercourse and regularly using reeds (*Arundo donax* L.) at the sides, as perching sites. *Trithemis annulata* individuals were also observed at the Lunzjata Valley during subsequent weekly visits. Adult individuals were also observed during visits to Wied tal-Grazzja, on the 11th, 15th and 21st of June, 2008.

DISCUSSION

The recent geographic expansion of these two species into Southern Europe could be attributed to the changing climate of the region, which has been marked by a slow ascent of average temperatures together with a diminution of the rainfall, therefore resulting in a greater similarity of the climatic conditions in the south of Europe to those in the area of original distribution of the species. Statistical analysis of past meteorological data indicates a slight increase in the mean annual air temperature within the Maltese Islands (Sammut & Micallef, 2004).

The males of both species are rather territorial and often attack other males, of similar or different species. This aggressiveness is a factor that favours the colonisation of new areas. Bonet Betoret (2000) has observed that initially abundant *Crocothemis erythraea* disappeared after the colonisation of the water body by *Trithemis annulata* individuals.

The hypothesis that African species increased their range recently throughout Southern Europe is supported by the data of the present study. Furthermore, individuals of both species have been observed over farmland reservoirs near semi-natural water bodies colonised by members of the same species. Several agricultural water reservoirs throughout the Maltese Islands which have been monitored for the past months have been observed to provide an adequate habitat for *Crocothemis erythraea* and *Anax* species. The colonisation of agricultural reservoirs may suggest a current expansion in the distribution of *Trithemis annulata* and *Orthetrum trinacria* within the agricultural landscapes of the Maltese Islands. However, further monitoring of Odonata populations is required in order to investigate the local distribution of both species and the ecological consequences of their expansion.

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