

The Scarabaeoidea of the Maltese Islands (Central Mediterranean) (Coleoptera)

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ABSTRACT. The Scarabaeoidea of the families Trogidae, Geotrupidae, Hybosoridae and Scarabaeidae from the Maltese islands are reviewed. A total of 54 species are included of which the following eight species represent new records for this archipelago: *Trox fabricii* and *T. scaber* in Trogidae; *Aphodius beduinus*, *A. algiricus*, *Amphimallon* (?) *scutellare*, *Aplidia hirticollis*, *Protaetia opaca* and *Lasiotrichius succinctus* in Scarabaeidae. Of these, the record of *Aplidia hirticollis*, previously endemic to southern Italy, extends its distributional range further south and that of *Lasiotrichius succinctus* is based on intercepted material and its local establishment is not confirmed. A number of species are based on old records and were not collected again recently pointing out to the possible extinction of these species from Malta. The almost complete absence of grazing animals in Malta may have contributed substantially for the disappearance of species associated with animal dung. Thirteen previously recorded species of Scarabaeoidea from Malta are being excluded from the Maltese fauna.

KEY WORDS. Trogidae, Geotrupidae, Hybosoridae, Scarabaeidae, Malta, new records.

INTRODUCTION

The Scarabaeoidea constitutes a diverse group of beetles distributed throughout the World with more than 30,000 described species. Ecological requirements are very varied. Certain groups dig deep burrows in the soil which they stock with organic material like fungi, rooting vegetation, dung and carrion as food for their larvae; others feed on dried carrion; others are specialised in recycling mammalian dung, especially that of the larger herbivores; other species are root feeders as larvae and pollen/nectar feeders as adults (MARTÍN PIERA & LÓPEZ-COLÓN, 2000; KRAJCIK, 2006). According to LAWRENCE & NEWTON (1995) the Superfamily Scarabaeoidea currently accommodates 13 families. This classification will be the one followed in the present work. Of these, only four families (Trogidae, Geotrupidae, Hybosoridae and Scarabaeidae) are represented in the Maltese islands.

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Table 1. Species of Scarabaeoidea recorded from Malta in three main works.

	CAMERON & CARUANA GATTO (1907)	CATALOGUE OF PALAEARCTIC COLEOPTERA	FAUNA EUROPAEA
TROGIDAE			
<i>Trox hispidus</i>			✓
<i>Trox litoralis</i>	✓ ¹	✓	✓
GEOTRUPIDAE			
<i>Geotrupes douei</i>	✓	✓	✓
<i>Sericotrupes niger</i>			✓
<i>Thorectes laevigatus</i>	✓		
HYBOSORIDAE			
<i>Hybosorus illigeri</i>			✓
SCARABAEIDAE			
Aphodiinae			
<i>Aphodius constans</i>		✓	✓
<i>Aphodius hydrochaeris</i>	✓	✓	✓
<i>Aphodius castaneus</i>		✓	✓
<i>Aphodius fimetarius</i>	✓	✓	✓
<i>Aphodius ictericus ghardimaouensis</i>	✓ ²	✓	✓
<i>Aphodius longispina</i>	✓	✓	✓
<i>Aphodius lugens</i>		✓	✓
<i>Aphodius granarius</i>	✓	✓	✓
<i>Aphodius mayeri</i>		✓	✓
<i>Aphodius unicolor</i>	✓	✓	✓
<i>Aphodius lineolatus</i>	✓	✓	✓
<i>Aphodius quadriguttatus</i>	✓	✓	✓
<i>Aphodius tersus</i>	✓	✓	✓
<i>Aphodius lividus</i>	✓	✓	✓
<i>Aphodius plagiatus</i>		✓	✓
<i>Aphodius consputus</i>	✓	✓	✓
<i>Aphodius obliteratus</i>		✓	✓
<i>Aphodius sturmi</i>		✓	✓
<i>Brindalus porcicollis</i>	✓ ³		
<i>Diastictus vulneratus</i>	✓		
<i>Euheptaulacus carinatus</i>		✓	✓
<i>Pleurophorus caesus</i>	✓	✓	✓
<i>Psammodius asper</i>	✓ ⁴	✓	
<i>Rhyssemus plicatus</i>	✓ ⁵		

¹recorded as *Trox hispidus* Pont. v. *asiaticus* Fald. [sic.]²recorded as *Aphodius nitidulus* F.³recorded as *Psammodius porcicollis* Ill.⁴recorded as *Psammodius sulcicollis* Ill.⁵recorded as *Rhyssemus arenarius* Costa

	CAMERON & CARUANA GATTO (1907)	CATALOGUE OF PALAEARCTIC COLEOPTERA	FAUNA EUROPAEA
Scarabaeinae			
<i>Copris hispanus cavolinii</i>	✓		
<i>Euoniticellus fulvus</i>	✓		✓
<i>Bubas bison</i>	✓		
<i>Bubas bubalus</i>	✓		
<i>Cheironitis ungaricus irroratus</i>	✓ ⁶		
<i>Onthophagus taurus</i>	✓		
<i>Onthophagus andalusicus</i>	✓	✓	
<i>Onthophagus opacicollis</i>			✓
<i>Onthophagus vacca</i>			✓
<i>Scarabaeus semipunctatus</i>	✓	✓	
<i>Scarabaeus variolosus</i>	✓	✓	✓
Dynastinae			
<i>Oryctes nasicornis grypus</i>	✓	✓	✓
<i>Pentodon bidens punctatus</i>	✓ ⁷	✓	✓
<i>Phyllognathus excavatus</i>	✓	✓	✓
Cetoniinae			
<i>Aethiessa floralis</i>	✓	✓	✓
<i>Cetonia aurata pisana</i>			✓
<i>Protaetia angustata</i>	✓		
<i>Protaetia incerta</i>	✓ ⁸		✓
<i>Protaetia mayeti</i>		✓	
<i>Tropinota squalida</i>	✓	✓	✓
<i>Oxythyrea funesta</i>	✓ ⁹	✓	✓

The literature on Scarabaeoidea of Malta is rather limited with some local publications which are often inaccessible to the international scientific community. GULIA (1858) was probably the first to mention some beetles of this group in Malta. However, in general, the works of Gulia contain species lists which, to say the least, are difficult to sustain from a scientific point of view. For example he mentioned *Lucanus cervus* (Linnaeus, 1758) and *Polyphylla fullo* (Linnaeus, 1758), both species which cannot be confused with no other beetles. The former, he cites as one of the rare indigenous insects present in Malta and the latter he quotes as the only Maltese species of this group. On the other hand, Gulia was present on these islands in a period where the natural habitats were still in good condition and it is thus possible that some of the insects which he mentioned may have really existed at that time. However, since most of his records were never sustained by others (e.g. CAMERON & CARUANA GATTO, 1907), they will be excluded from the present work. BAUDI (1891) in his *Catalogus Coleopterorum Europae* mentioned the following four species for Malta: *Aphodius (Agrilinus) constans*, *Aphodius (Alocoderus) hydrochaeris*, *Aphodius (Bodilus) lugens*

⁶recorded as *Chironitis hungaricus* Hbst. [sic.]

⁷recorded as *Phyllognathus silenus* F.

⁸recorded as *Potosia metallica* v. *cuprea* Gory

⁹recorded as *Leucocelis funesta* Poda

and *Aphodius (Calamosternus) granarius*. CARUANA GATTO (1893) in an account on the common beetles of the Maltese islands also mentioned some species belonging to this group, both those associated with dung and those associated with flowers. LE COMTE (1906) described from Malta *Cetonia mayeti*. The first and only comprehensive account of this group of beetles is to be found in CAMERON & CARUANA GATTO (1907) which provided a list of 36 species (Table 1) subdivided as follows: Trogidae - 1; Geotrupidae - 2 and Scarabaeidae - 33. ANDRES (1916) published a list of Lepidoptera, Hemiptera and Coleoptera which he collected from these islands during a period of almost two years spent in Malta as a prisoner of war. In this list, he included 9 species under Scarabaeidae and of these, one species, *Aphodius (Bodilopsis) rufus* represented a new record for Malta. SCHATZMAYR (1946) mentioned two dung beetles for Malta: *Platytomus laevistriatus* and *P. tibialis*, both never previously reported from Malta. SALIBA (1963) in an account on insect pests, included six species of this group for Malta. This work however lacks a taxonomic base for most species mentioned therein and many records are incorrect, being based on information available mainly from continental Europe. BONETT & SCHEMBRI (1976) recorded *Anoxia matutinalis* as a first record for Malta and three years later, VALLETTA (1979) gave a list of insect pollinators on *Cynara cardunculus* which he observed in June 1977 in the Wardija (Malta) area and which included three scarab beetles. CILIA (1989) included 15 species of Scarabaeoidea in the Red Data Book for Malta basing most of his records on previously published material. SABATINELLI & SCHEMBRI (1990) provided a comprehensive revision on the flower scarab beetles of Malta and included detailed information for nine species, of which one, *Cetonia aurata pisana*, represented a new record. Table 1 also includes information on Scarabaeoidea included in the Fauna Europaea database (ALONSO-ZARAZAGA, 2004) and in the Catalogue of Palaearctic Coleoptera (LÖBL & SMETANA, 2006) for species reported from Malta.

The aim of the present work is to provide a detailed account of the local species of Scarabaeoidea, thus updating the faunistic knowledge of the coleoptera fauna of Malta.

MATERIAL AND METHODS

Recently collected material of Scarabaeoidea was mainly gathered during the last thirty years, and mostly from the main island of Malta, but additional material was also obtained from the nearby islands of Gozo and Comino. Material was collected by general sweeping, from under bark of trees, by rearing of some larval material, by light traps, by sifting leaf litter and sandy habitats and by pit fall traps were fresh dung was used on a regular basis.

Some historical material collected at the beginning of the twentieth century was also available for this study. Most of this material formed the basis of the coleoptera list published by Cameron and Caruana Gatto in 1907. In total, more than 900 specimens were available for the present study. The consideration and examination whenever possible of historical material, often housed in foreign institutions was often crucial for the correct species interpretation and verification of earlier doubtful records. Two main collections of old material of Scarabaeoidea were available, the first of which is that of Malcolm Cameron. This material was either collected by Mr Cameron alone or most probably in collaboration with the Maltese naturalist Count Alfredo Caruana Gatto, with whom he later co-authored a list of coleoptera of the Maltese islands (CAMERON & CARUANA GATTO, 1907). Specimens of this collection are conserved in the BMNH where they can be recognised by the label "Cameron Coll., B.M. 1936-55". In part, material from this collection includes individual label numbers, the same as those found on Cameron's private notes, and may contain information on date of collection, name of the species, name of the person who identified the material, locality

and ecological data: this data is provided in square brackets after the mentioned label number. The other collection includes specimens collected from the Maltese islands by Commander James John Walker, which is also conserved in the BMNH. This material was collected over a two year span (1874-1876) almost exclusively during the months of October and March (CAMERON & CARUANA GATTO, 1907), and is labelled as “G.C. Champion Coll., B.M. 1927-409”. Except for the name “Malta” (very often abbreviated to just a typical handwritten M underneath the mounted insect specimen card), there is no other information accompanying this material. Probably, both these collections formed the basis of the coleoptera list of CAMERON & CARUANA GATTO (1907).

Where relevant, for each species in the following annotated faunistic list of the Scarabaeoidea, we provide (i) the cited reference(s) when Maltese material is mentioned (except for works which repeat earlier citations, e.g. LUIGIONI (1929), PORTA (1932) and most of CILIA’S (1989) records), together with the species name provided therein, if it differs from its current accepted name or if we are sure that a misidentification was reported, (ii) material examined, (iii) global distribution, (iv) ecology and (v) notes. We also provide a short diagnosis to differentiate each species from the other Maltese Scarabaeoidea; this, together with the relevant figure, should aid in species identification. Photos of species of Scarabaeoidea were taken from dry material using a Canon MP-E65mm f/2.8 Macro Lens and from BALLERIO *et al.* (2010). For the Aphodiinae, which represent a very homogenous group of species and there is often some difficulty to distinguish closely related species, a dichotomous key is instead provided. The terminology used to describe the morpho-anatomical features follows that of DELLACASA *et al.* (2001). The sequence of families and species within each family follow (LÖBL & SMETANA, 2006). Appendix I includes a check-list of the Scarabaeoidea of Malta.

Unless otherwise stated all material is deposited in the private collection of one of the authors (DM). Other depositories include the Natural History Museum, London (BMNH) and the National Museum of Natural History, Malta (MNHM). Collectors are abbreviated as follows: AS - Anthony Seguna; CD - Carmelo Delucca; CF - Charles Farrugia; Dennis Magro - DO; DM - David Mifsud; GL - Guido Lanfranco; HBB - Henry Borg Bathet; IP - Igor Pivotti; JAM - John Attard-Montalto; JB - John Borg; JC - John Caruana; LC - Loui Cassar; MJE - Martin J. Ebejer; MZ - Mario Zammit; PS - Paul Sammut; RS - Rudolf Schuh.

ANNOTATED SPECIES LIST

TROGIDAE MacLeay, 1819

**Trox fabricii* Reiche, 1853

Diagnosis. Length 8-10 mm. External morphology rather similar to the following species from which it is possible to distinguish because of the larger punctuation on pronotum having always an umbilical shape (Fig. 1).

Material examined. MALTA: Żejtun, 18/26.ix.1989, 2 exs., DM; Żejtun, 20.ix.1997, 24 exs., DM; Il-Marnisi, 24.ix.1989, 2 exs., DM. GOZO: Ghasri, 15.x.1994, 1 ex., CF.

Adults of *T. fabricii* are commonly found in the Maltese islands after the first rains generally between September and October. The species is known from the southern Iberian Peninsula, Sicily, Malta and North Africa (Morocco, Algeria and Tunisia). The species is known to feed on dried hair of dead mammals (mainly canines and ovines). A case of carrion-feeding is also known for this species (RUIZ, 1995; LÓPEZ-COLÓN, 2000).

Trox litoralis Pittino, 1991

Diagnosis. Length 8-9 mm. Similar to preceding species, but with smaller punctuation on pronotum and normally not of an umbilical shape (Fig. 2).

Material examined. MALTA: 1 ex., G.C. Champion Coll., B.M. 1927-409 (BMNH); Żejtun, 22.i.1989, 1 ex., DM; Żejtun, 20.viii.2001, 1 ex., DM; Wied Qannotta, 11.xi.1985, 1 ex., AS.

GOZO: Ramla, 21.ii.2000, 1 ex., DM; Dwejra, San Lawrenz, 5.xi.2004, 1 ex., AS.

T. litoralis, a carrion-feeder, is known from Albania, Bosnia Herzegovina, Croatia, Serbia, Montenegro, Greece, Italy, Malta, Algeria and Turkey. It was previously reported from Malta by CAMERON & CARUANA GATTO (1907) as *Trox hispidus* var. *asiaticus*, a taxon which was then revised by PITTINO (1991).

**Trox scaber* (Linnaeus, 1767)

Diagnosis. Length 5-7 mm. Readily distinguished from the other congeners due to its narrower body form and smaller size (Fig. 3).

Material examined. MALTA: Rabat, 27.vi.2001, 1 ex., PS; Rabat, 14.vi-23.vi.2002, 5 exs., PS (MNHM); Rabat, 19.v-31.v.2003, 7 exs., PS; Wied tal-Isqof, 28.vi.2002, 1 ex., PS (MNHM); Mosta, 29.viii.2003, 1 ex., JC (MNHM); Mellieħa, Körtin, 28.iv-29.v.2005, 12 exs. HBB (10 exs. in MNHM); Mellieħa, Körtin, 9/10.vi.2009, 3 exs., HBB; Buskett, 24.vi.2003, 1 ex., DM; Dingli Cliffs, 9.v.2003, 1 ex., AS; Naxxar, Tas-Sgħajtar, 26.v.2006, 2 exs., AS.

The above cited material of *T. scaber* was entirely collected by light traps where the species is relatively common between May and June. The species is known from Europe, Australia, North America, Chile, and North Africa. The species is a carrion-feeder where development takes place in decomposing animals preferably in dry hairs and feathers.

GEOTRUPIDAE Latreille, 1802

Geotrupes douei Gory, 1841

Diagnosis. Length 20-23 mm. Readily distinguished from all other species of Scarabaeoidea except from *Thorectes intermedius* because of its robust roundish shape and blackish colour (Fig. 4). It is distinguished from *T. intermedius*, because of the longer elytra in relation to pronotal length and the coarse surface of *G. douei* when compared to that of *T. intermedius*.

Material examined. MALTA: vi/x.1901/2, 9 exs., M.C., Cameron Coll., B.M. 1936-555 (BMNH).

G. douei is known from Sicily, Malta and North Africa (Algeria, Morocco and Tunisia). The systematics of this taxon follows ZUNINO (1984). Wherever recorded this species seems to be very localized. It is mainly associated with equine and bovine dung. CAMERON & CARUANA GATTO (1907) reported the distribution of this species in Malta as "general".

Thorectes intermedius (O. G. Costa, 1839)

Diagnosis. Length 11-20 mm. *T. intermedius* (Fig. 5) is distinguished from *Geotrupes douei* because of its somewhat smaller size and subequal lengths of pronotum and elytra. Elytral surface shiny.

Material examined. MALTA: 1 ex., G.C. Champion Coll., B.M. 1927-409 (BMNH); St. Thomas Bay, 23.iii.1989, 1 ex., DM; Marsa, Ghammieri, 2.x.1996, 1 ex., DM; Dingli Cliffs, 31.iii.2002, 1 ex., RS; Mellieha, Armier, 21.ix.2003, 1 ex., AS; Ramla tat-Torri, 7.xi.2002, 1 ex., DM; Mellieha, Kortin, 18.x.2003, 10 exs., HBB (MNHM); Gharghur, 25.ii/14.xi.1968, 2 exs., CD (MNHM); Naxxar, 25.xi.1970, 8 exs., CD (MNHM); Rabat, 16.x.1989, 7 exs., PS (MNHM); Mdina, 24.x.2007, 4 exs., IP; Roman Baths, 19.x.2007, 5 exs., IP; Qormi, 22.x.2007, 2 exs., IP; Mnajdra temples, 3.iii.2008, 1 ex., IP.

T. intermedius is known to occur in Croatia, France, Italy, Spain, Malta and in Algeria and Tunisia in North Africa. According to CROVETTI *et al.* (1985) its distribution corresponds to that of Mediterranean type climates, from temperate to subtropical types. Adults usually feed, both above or beneath the ground, on portions of material taken by them from the main dung which is not rolled or modeled, and are not exclusively coprophagous but usually euryphagous (CROVETTI *et al.*, 1985). However they use only vertebrates dung as food for their larvae (PALESTRINI & ZUNINO, 1985). This common species was previously reported for Malta as *Geotrupes laevigatus* by CAMERON & CARUANA GATTO (1907) and ANDRES (1916) but this should refer to the above species.

HYBOSORIDAE Erichson, 1847

Hybosorus illigeri Reiche, 1853

Diagnosis. Length 7-8 mm. Convex body with an overall dark brown to black shining coloration (Fig. 6). Punctuation on head strong and dense, sparse and fine on pronotum. *H. illigeri* cannot be confused with any other Scarabaeoidea occurring in Malta.

Material examined. MALTA: Rabat, 31.v.2003, 1 ex., PS; Rabat, Ta' Koronja, 14/21.vi.2002, 2 exs., PS; Naxxar, Tas-Sghajtar, 28.vi.2004, 1 ex., AS.

H. illigeri is known from most of continental Africa, Cape Verde Islands, Madagascar, Comoros, Mauritius and Réunion. In the Palearctic Region the species is known from southern Europe and Morocco and in the warmer parts of central and India, E Asia to China and Vietnam. The species was introduced in the Americas (from USA to Venezuela, Greater Antilles and Bahamas). This species is a scavenger and predatory on other insects (OCAMPO, 2002). In Mexico it is a frequent predator in the nests of an introduced coprophagous scarab beetle, *Digitonthophagus gazella* (Zunino, *pers. observations*). The above cited material of *Hybosorus illigeri* from Malta, was entirely collected by light traps. The species was previously recorded from Malta in the database of Fauna Europaea but we were unable to trace the original reference for such an inclusion.

SCARABAEIDAE Latreille, 1802

Aphodiinae Leach, 1815

Key to Maltese tribes of Aphodiinae

1. Elytra not bordered at base; pronotum without both keels and transversal grooves and without median longitudinal groove, at most with trace of median longitudinal groove and with more or less distinct lateral depressions. Middle and hind tibiae usually with strong and complete transverse carinae at outer face; head almost situated at the same level of pronotum and with the eyes usually well visible **Aphodiini**
- Elytra usually bordered at base; pronotum usually with median longitudinal groove and with transverse grooves and keels very distinct, rarely reduced to trace or nearly obsolete. Middle and hind tibiae without transverse carinae at outer face or with weak and incomplete carinae; head strongly declivious as to pronotum and with the eyes usually nearly concealed **Psammodiini**

Aphodiini Leach, 1815

Key to the Maltese subgenera of *Aphodius*

1. Pronotum distinctly bordered at front margin 2
- Pronotum not bordered at front margin 3
2. Frontal suture not tuberculate **A. (*Anomius*)**
 Only one species from Malta. Length 5.0-7.0 mm. Species more or less dark brownish **A. *castaneus***
- Frontal suture trituberculate or, at least, with a median tubercle **A. (*Alocoderus*)**
 Only one species from Malta. Length 5.0-12 mm. Species testaceous, pronotum disc usually with cordiform brownish spot **A. *hydrochaeris***
3. Scutellum pentagonal or cordiform, with sides parallel or convergent toward base 4
- Scutellum triangular equilateral or isosceles, widely or narrowly ogival, with sides straight or curved..... 8
4. Hind tibiae apically fimbriate with short and equal spinules 5
- Hind tibiae apically fimbriate with unequal spinules irregularly, alternately or progressively elongate 7
5. Frontal suture not tuberculate, sometimes obsolete **A. (*Liothorax*)**
 Only one species from Malta. Length 4.0-6.0 mm. Blackish species, rarely with oblique reddish stripe on elytra **A. *plagiatus***
- Frontal suture distinctly tuberculate 6

6. Basal margin of pronotum bordered; clypeus regularly sinuate at middle; epistoma rugosely punctured. Blackish; sometimes elytra and pronotum more or less diffusely reddish *A. (Calamosternus)*
- Basal margin of pronotum not bordered. Head and pronotal disc more or less strongly darkened; elytra yellowish, usually with discal spot more or less distinct *A. (Labarrus)*
 Only one species from Malta. Length 3.0-7.0 mm *A. lividus*
7. Basal margin of pronotum distinctly bordered. Blackish; elytra black or light yellow or black with reddish spots, rarely entirely reddish *A. (Euorodalus)*
 Only one species from Malta. Length 4.0-5.0 mm *A. tersus*
- Basal margin of pronotum not bordered. Brown reddish or testaceous *A. (Subrinus)*
 Only one species from Malta. Length 3.0-4.0 mm *A. sturmi*
8. Hind tibiae apically fimbriate with more or less elongate and irregularly, progressively or alternately unequal spinules 9
- Hind tibiae apically fimbriate with short and equal spinules 13
9. Elytra yellowish with several small blackish spots or with blackish longitudinal strip 10
- Elytra differently coloured 11
10. Pronotum with hind angles widely rounded and indistinct; epistoma anteriorly and laterally with more or less straight setae; elytra glabrous or pubescent; frontal suture usually mutic. Head and pronotum black with metallic shines; elytra yellowish with cloudy blackish spots *A. (Nimbus)*
 Only one species from Malta. Length 4.0-8.0 mm *A. obliteratus*
- Pronotum with hind angles obtuse, rarely rounded; epistoma and elytra glabrous; latter sometimes finely pubescent toward apex only; frontal suture trituberculate. Black or brownish; pronotum often yellowish at sides; elytra yellowish or testaceous with several small blackish spots *A. (Chilothorax)*
 Only one species from Malta. Length 3.0-6.0 mm *A. lineolatus*
11. Aedeagus digitiform; genae obtusely angulate, distinctly protruding more than eyes; in males apical spur of fore tibiae inserted at inner margin at level of second outer distal tooth. Reddish-testaceous; sides of pronotum and elytra yellowish, sometimes with large cloudy discal spot brownish *A. (Bodilus)*
- Aedeagus differently shaped 12
12. Elytra quite glabrous; clypeal margin glabrous; fore tibial apical spur, in males, claviform. Head and pronotum black; fore angles of pronotum reddish; elytra blackish with wide, rounded bright orange spots *A. (Eudolus)*
 Only one species from Malta. Length 3.0-5.0 mm *A. quadriguttatus*
- Elytra more or less diffusely pubescent, at least toward apex distinctly even if shortly pubescent. Elytra yellowish, usually with wide cloudy brownish discal spot; striae wide and distinctly crenulate. Black; sometimes clypeal margin and pronotal sides yellowish *A. (Melinopterus)*
 Only one species from Malta. Length 4.0-8.0 mm *A. consputus*

13. Hind angles of pronotum obliquely truncate and inward sinuate; frontal suture distinctly trituberculate; front margin of pronotum, in males, foveolate at middle. Black; elytra reddish or yellowish, often with bands or spots brownish; seldom quite blackish *A. (Aphodius)*
 Only one species from Malta. Length 5.0-10.0 mm *A. fimetarius*
- Hind angles of pronotum not obliquely truncate 14
14. Clypeal margin quite bristled; aedeagus digitiform *A. (Bodiloides)*
 Only one species from Malta. Length 5.0-12.0 mm. Testaceous; sides of pronotum reddish; elytra with brownish suture *A. ictericus ghardimaouensis*
- Clypeal margin glabrous; aedeagus differently shaped 15
15. Epistoma anteriorly with distinct transverse carina. Species blackish or piceous; sometimes elytra reddish *A. (Agrilinus)*
 Only one species from Malta. Length 4.0-6.0 mm *A. constans*
- Epistoma without anterior transverse carina. Species testaceous or entirely piceous; elytra sometimes brownish spotted, rarely entirely blackish *A. (Bodilopsis)*
 Only one species from Malta. Length 5.5-8.0 mm *A. rufus*

***Aphodius (Agrilinus) constans* Duftschmid, 1805**

(Fig. 7)

A. constans is recorded throughout most of Europe, Canary islands, Lebanon, Syria, Turkmenistan and Turkey. It has a specialized ecology being coprophagous and associated with most dung (mainly ovine and bovine) with a preference for open pastures. This species was recorded from Malta by BAUDI (1891) and since then the species was never found again.

***Aphodius (Alocoderus) hydrochaeris* (Fabricius, 1798)**

(Fig. 8)

Material examined. MALTA: 5 exs., G.C. Champion Coll., B.M. 1927-409 (BMNH).

A. hydrochaeris is recorded from central and southern Europe, Asia Minor, Syria, Lebanon, Palestine, central and north-eastern Asia, and North Africa from Morocco up to Egypt. It has a specialized ecological requirements, preferring open and dry land, and is associated with most types of dung but more frequently found in ovine dung. This species was originally recorded from Malta by BAUDI (1891) and then by CAMERON & CARUANA GATTO (1907) with material collected from Marsa.

***Aphodius (Anomius) castaneus* Illiger, 1803**

(Fig. 9)

Material examined. MALTA: Paradise Bay, 11.x.2002, 1 ex., DM; Mosta, 30.ix.2003, 1 ex., UV light trap, JC; Mellieha, Kortin, 7.x/30.ix.2004, 2 exs., UV light trap, HBB.

A. castaneus is recorded from southern France, Spain, Portugal, Morocco, Algeria, Tunisia, Sicily, Sardinia and Malta. This species prefers open spaces where it is normally found in association with very fresh ovine and bovine dung.

CAMERON & CARUANA GATTO (1907) recorded *Aphodius unicolor* Ol. [sic.] from material collected in Marsa (Malta). *A. unicolor* Olivier, 1789 is a species present in southern France, Iberian Peninsula, Morocco, Algeria, Tunisia, Senegal, Ethiopia (?), Arabian Peninsula and Iran, a distribution range which could well include Malta. However, due to the fact that *A. unicolor* was not found in Malta and its presence was never confirmed neither in Italy, we are attributing such a record to *A. castaneus*. In fact, *A. unicolor* Olivier *sensu* Reitter, 1892 is identical to *A. castaneus*, a record which was reported as such by LUIGIONI (1929) and PORTA (1932) for Malta following only Cameron and Caruana Gatto's work since they never examined Maltese material.

***Aphodius (Aphodius) fimetarius* (Linnaeus, 1758)**

(Fig. 10)

A. fimetarius is regarded as sub-cosmopolitan in distribution being present in Europe, central and southern Asia, North Africa, North America, Mexico and Australia. This species is associated with all type of dung and decomposing material. It is also saprophagous on potato (LANDIN, 1961) and other vegetables (LUMARET, 1990) and it was also reported to be mycetophagous (JANSSENS, 1960). The species was recorded from Malta by CAMERON & CARUANA GATTO (1907) from material collected in Attard and Gnejna.

***Aphodius (Bodiloides) ictericus ghardimaouensis* Balthasar, 1929**

(Fig. 11)

Material examined. GOZO: Iċ-Ċnus, 8.v.1977, 1 ex., LC.

A. ictericus ghardimaouensis is widely distributed in the Mediterranean basin, Asia Minor, Middle East, western and central Asia upto Kazakhstan. This species has a tendency to colonize open spaces and is associated with all types of dung but with a preference for bovine dung. CAMERON & CARUANA GATTO (1907) recorded this species as *Aphodius nitidulus* Fabricius, 1792 from Gnejna and Żebbieh (Malta).

***Aphodius (Bodilopsis) rufus* (Moll, 1782)**

(Fig. 12)

A. rufus is recorded throughout most of Europe, penetrating in the eastern regions with records from Israel, China, eastern and western Siberia, Kazakhstan and Nepal. Euryphagous and coprophagous species associated with all type of dung. This species was recorded from Malta by ANDRES (1916) on the basis of a single specimen collected in October and since then this species was not found again.

Key to the Maltese species of *Aphodius* subgenus *Bodilus*

1. First elytral stria, on preapical declivity, neither strongly sunk nor very close to suture; interstiae glabrous, flat, shiny and sparsely superficially punctured; juxtasutural one not preapically sunk. Reddish-testaceous, head and pronotum entirely brownish-red. Length 7.0-10.0 mm ***A. lugens***
- First elytral stria, on preapical declivity, strongly sunk and very close to suture; interstices toward apex shortly but distinctly pubescent; juxtasutural one narrow and strongly sunk preapically. Pale testaceous or yellowish; sides and base of pronotum widely yellowish **2**

2. Elytra strongly convex, subparallel-sided; interstices feebly but distinctly convex, finely sparsely punctured; pronotum very sparsely and finely punctured on disc; hind tibiae, at inner margin, fimbriate with spinulae neither particularly dense nor particularly elongate. Elytra yellowish. Length 7.0-8.0 mm *A. beduinus*
- Elytra moderately convex, regularly oval; interstices flat, serially punctured near lateral margins; pronotum almost coarsely and densely punctured on disc; hind tibiae at inner margin with setae dense and elongate. Elytra reddish-testaceous. Length 7.0-8.0 mm
..... *A. longispina*

****Aphodius (Bodilus) beduinus* Reitter, 1892**

(Fig. 13)

Material examined. MALTA: 1 ex., G.C. Champion Coll., B.M. 1927-409 (BMNH); Buskett, 24.vi.2003, 1 ex., DM; Pembroke, 6.x.2003/29.ix.2004, 9 exs., PS; St. Thomas Bay, Tal-Munxar, 29.ix.2010, 29 exs., with dog's dung, DM; Qrendi, 29.ix.2003, 5 exs., DM; Mosta, 22.ix.2003, 1 ex., JC (MNHM); Naxxar, Tas-Saghjtar, 2.ix.2001/21-24.ix.2003/30.ix.2004, 7 exs., AS; Wied Qirda, 2.iii.1986, 1 ex., AS. GOZO: Xaghra, x.1989, 1 ex., LC.

A. beduinus is distributed in North Africa (Morocco, Algeria, Tunisia and Libya), Puglia, Basilicata, Calabria, Sicily, Sardinia and Malta. It is mainly found in open spaces and is mainly associated with equine dung.

***Aphodius (Bodilus) longispina* Küster, 1854**

(Fig. 14)

A. longispina is recorded from Spain, Italy, Malta, Israel and North Africa (Algeria and Tunisia). From Italy, the species was recorded from Sicily (LUIGIONI, 1929) and Sardinia (BARGAGLI, 1872) and it was never collected again recently. The species is to be found in open pastures and is mainly associated with bovine, equine and ovine dung. The species was reported from Malta (CAMERON & CARUANA GATTO, 1907) from Marsa and Gnejna.

***Aphodius (Bodilus) lugens* Creutzer, 1799**

(Fig. 15)

A. lugens is a widespread species throughout most of Europe, in North Africa with records from Morocco and Algeria and eastwards in Asia upto Kazakhstan. This coprophagous species, mainly associated with bovine and equine dung, is exclusively found in open pastures on dry ground. This species was recorded from Malta by BAUDI (1891) and since then the species was never found again.

Key to the Maltese species of *Aphodius* subgenus *Calamosternus*

1. Hind tibiae stout, distinctly widened apically; first segment of hind tarsi plump, distinctly shorter than superior apical spur of tibiae; latter stout, lanceolate; clypeus sinuate at middle, subangulate at sides, front margin upturned; pronotum densely, coarsely, irregularly punctured; median tubercle of frontal suture distinct in both sexes. Black, sometimes elytra reddish. Length 4.0-5.0 mm *A. mayeri*

- Hind tibiae relatively more slender, feebly widened apically; first segment of hind tarsi subcylindrical and as long as superior apical spur of tibiae; latter elongate, subconical; clypeus sinuate at middle and widely rounded at sides; females with frontal suture nearly not tuberculate 2

- 2. Scutellum basally with one depression, distinctly microreticulate so rather dull; pronotum rather regularly, densely and doubly punctured; elytral interstices convex on disc, irregularly, almost sparsely but distinctly punctured; third segment of hind tarsi distinctly shorter than second. Piceous; elytra often brownish; legs brown; under side brown-yellowish. Length 4.5-6.0 mm *A. algiricus*

- Scutellum quite flat, superficially microreticulate so rather shiny; pronotum with double, irregular and sparse punctation, large punctures lacking on disc; elytral interstices flat on disc, very sparsely and finely punctured; third segment of hind tarsi as long as second. Black; elytra sometimes more or less diffusedly reddish, rarely quite reddish; legs blackish; under side blackish. Length 4.0-6.0 mm *A. granarius*

****Aphodius (Calamosternus) algiricus* Mariani & Pittino, 1983**

(Fig. 16)

Material examined. MALTA: Mosta valley, 26.xii.1993, 1 ex., DM; Mellieha, Kortin, 11.x.2003, 1 ex., HBB; Żejtun, 4-9.x.1989, 6 exs., DM; Żejtun, 20.ix.1997/20.i.2003, 2 exs., DM. **GOZO:** Ghasri, 12.i.1995, 1 ex., CF.

A. algiricus is known from Italy, Malta, Corsica, Portugal, Spain and from all over North Africa (Morocco up to Egypt). This species is polyphagous and can be found in association of dung and decaying vegetation.

***Aphodius (Calamosternus) granarius* (Linnaeus, 1767)**

(Fig. 17)

Material examined. MALTA: 42 exs., G.C. Champion Coll., B.M. 1927-409 (BMNH); Rabat (Santa Caterina), 3.iii.2008, 1 ex., IP.

A. granarius is regarded as a cosmopolitan species which is found in all types of dung, decaying vegetation and similar commodities rich in humus. Originally recorded from Malta by BAUDI (1891), and then by CAMERON & CARUANA GATTO (1907) the latter stating that it is a common species.

***Aphodius (Calamosternus) mayeri* Pilleri, 1953**

(Fig. 18)

A. mayeri is recorded from Croatia, Italy, Corsica, Greece, Malta, Spain, Portugal and North Africa (Morocco upto Lybia). This coprophagous species is exclusively found in open pastures and is mainly associated with ovine dung. This species was included in both the Fauna Europaea database as well as in the recently published Catalogue of Palaearctic coleoptera. These records were based on historical material labelled Malta and conserved at the BMNH (Dellacasa, G., *pers. comm.*, 2011).

***Aphodius (Chilothorax) lineolatus* Illiger, 1803**

(Fig. 19)

Material examined. MALTA: 11 exs., G.C. Champion Coll., B.M. 1927-409 (BMNH).

A. lineolatus is widely distributed in the Mediterranean basin, with the easternmost records coming from Kazakhstan. The species prevails in specialized ecological requirements, preferring open pastures and is mainly associated with ovine dung. This species was recorded from Malta by CAMERON & CARUANA GATTO (1907) from Marsa and Kordin and SCHATZMAYR (1946) indicate that they observed the species in Malta.

***Aphodius (Eudolus) quadriguttatus* (Herbst, 1783)**

(Fig. 20)

A. quadriguttatus is widely distributed in Europe, throughout North Africa (from Morocco upto Libya) and eastwards up to eastern Siberia. The species prevails in specialized ecological requirements, preferring open pastures with well drained surfaces. It is associated with various types of semi-dried dung but mainly in ovine, caprine and occasionally in that of bovines, equines, pigs and humans. The species was recorded from Malta by CAMERON & CARUANA GATTO (1907) on the basis of material collected by Commander James John Walker in 1874-6 and since then the species was never found again in the Maltese islands.

***Aphodius (Euorodalus) tersus* Erichson, 1848**

(Fig. 21)

A. tersus is known from southern Europe (Italy, Malta, Spain, Portugal and Slovakia) and North Africa (Morocco, Algeria, Tunisia and Libya). This species is exclusively found in open pastures preferably on sandy ground and is mainly associated with fresh ovine dung. The species was recorded from Marsa (Malta) by CAMERON & CARUANA GATTO (1907).

***Aphodius (Labarrus) lividus* (A. G. Olivier, 1789)**

(Fig. 22)

Material examined. MALTA: Marsa, Ghammieri, 1.v.1998, 1 ex., DM; Rabat, 4.vi.1999/1.vii.2002, 2 exs., PS; Żejtun, 4.x.1989/26.iii.1990/30.iii.2001, 3 exs., DM.

A. lividus is a sub-cosmopolitan species with a habitat preference for open pastures. It is found in associated with all types of dung, especially that of equines and is also found in decaying vegetation. The species was previously reported from Mdina (Malta) by CAMERON & CARUANA GATTO (1907).

***Aphodius (Liothorax) plagiatus* (Linnaeus, 1767)**

(Fig. 23)

A. plagiatus is widely distributed in Europe, recorded only from Tunisia in northern Africa, and widely distributed in Asia with the most eastern records pertaining to eastern Siberia. In its southernmost distribution range, this species is exclusively found in littoral marshlands and saltmarshes being principally phytophagous but occasionally coprophagous in bovine, equine and ovine dung. This species was included in both the Fauna Europaea database as well as in the recently

published Catalogue of Palaearctic coleoptera. These records were based on historical material labelled Malta and conserved at the BMNH (Dellacasa, G., *pers. comm.*, 2011).

***Aphodius (Melinopterus) consputus* Creutzer, 1799**

(Fig. 24)

A. consputus is widely distributed in Europe, North Africa (Morocco, Algeria and Tunisia) and known also from Iran, Syria and Turkey. The species is associated with most types of animal dung. The species was recorded from Malta by CAMERON & CARUANA GATTO (1907) on the basis of material collected by Commander James John Walker in 1874-6 and since then the species was never found again in the Maltese islands.

***Aphodius (Nimbus) obliterated* Panzer, 1823**

(Fig. 25)

A. obliterated is widely distributed in Europe and is also recorded from Israel and Turkey. This coprophagous species is mainly found in open pastures on well drained sandy ground. It is associated with all type of animal dung, and sometimes it is also saprophagous in decomposing organic matter. This species was included in both the Fauna Europaea database as well as in the recently published Catalogue of Palaearctic coleoptera. These records were based on historical material labelled Malta and conserved at the BMNH (Dellacasa, G., *pers. comm.*, 2011).

***Aphodius (Subrinus) sturmi* Harold, 1870**

(Fig. 26)

A. sturmi is widely distributed in Europe and Asia with Japan being its easternmost record. This coprophagous species mainly found in bovine and ovine dung, is exclusively found on arid and open clayey pastures. This species was included in both the Fauna Europaea database as well as in the recently published Catalogue of Palaearctic coleoptera. These records were based on historical material labelled Malta and conserved at the BMNH (Dellacasa, G., *pers. comm.*, 2011).

Psammodiini Mulsant, 1842

Key to the Maltese species of Psammodiini

1. First segment of hind tarsi strongly plumped and shortened, subconical, asymmetrically widened toward apex; fore femora usually not widened and very slender **2**
- First segment of hind tarsi elongated, subcylindrical, feebly and almost symmetrically widened toward apex; fore femora strongly widened and very stout **3**

2. Elytral suture fused: micropterous species; pronotum with transverse ridges usually smooth and with bristles of lateral margins short, apically widened; elytra with interstices quite, or at least toward apex, granulated; hind tibial apical spurs apically acuminate. Length 3.0-5.0 mm ***Brindalus porricollis***
- Elytral suture not fused: macropterous species; pronotum with bristles of lateral margins piliform; elytra with interstices smooth; hind tibial apical spurs spatulate. Length 3.0-5.0 mm ***Psammodius pierottii***

3. Middle and hind tarsi distinctly shorter than tibiae; tarsal segments shortened and more or less distinctly widened apically; hind tibial superior apical spur at least as long as first two tarsal segments combined; pronotum with median longitudinal groove and with two lateral foveolae; lateral margins and base bordered, almost glabrous; elytral interstices not granulated. Shape shortened, more or less distinctly widened backwards 4
- Middle and hind tarsi as long as or longer than tibiae; tarsal segments slender and more or less elongated, cylindrical; hind tibial superior apical spur usually shorter than first tarsal segment 5
4. Pygidium apically with six or eight straight elongate bristles; great punctures of pronotum relatively greater and denser; elytra oval with striae wide, deep, strongly punctured, crenulated. Length 3.0-4.0 mm *Platytomus tibialis*
- Pygidium apically with only two straight bristles; great punctures of pronotum relatively smaller and more scattered; elytra subcylindrical with striae fine, superficial, rather finely punctured, subcrenulated. Length 3.0-4.5 mm *Platytomus laevistriatus*
5. Elytral interstices not granulated; pronotum with traces of median longitudinal groove and traces of transverse grooves; ridges absolutely lacking. Length 2.0-4.0 mm *Pleurophorus caesus*
- Elytral interstices granulated; pronotum with median longitudinal groove and with transverse ridges and grooves; elytra glabrous. Length 2.5-4.5 mm *Rhyssemus plicatus*

***Brindalus porcicollis* (Illiger, 1803)**

(Fig. 27)

Material examined. GOZO: Ramla, 15.iv.1994, 3 exs., in coastal sand dunes, DM; 31 exs., same data but 1.x.1995, 23.x.1996, 3.v.1997, 23.viii.1997, 18.i.1999, 29.xii.2002.

B. porcicollis is known from the Azores, Canary islands, Iberian Peninsula, Austria, France, Great Britain, Greece, Italy, Malta, North Africa (from Morocco upto Egypt), Israel, Lebanon, Saudi Arabia, Syria and Turkey. The record from Austria is probably incorrect and should refer to Croatia. This saprophagous species is exclusively found in the littoral regions of coastal sandy beaches where it is generally associated with plant roots. The species was recorded from Mellieha in Malta by CAMERON & CARUANA GATTO (1907) but all recent material comes from the coastal sand dune of Ramla in Gozo.

***Platytomus laevistriatus* (Perris, 1870)**

(Fig. 28)

P. laevistriatus is recorded from France, Spain, Sardinia, Sicily, Malta, Algeria and Tunisia. The species is exclusively found in coastal habitats and in sandy biotopes. This species was reported for Malta by SCHATZMAYR (1946).

***Platytomus tibialis* (Fabricius, 1798)**

(Fig. 29)

P. tibialis is a sub-cosmopolitan species. It is exclusively found in dunes and in coastal areas where it is associated with decaying vegetation but also under dried dung. This species was reported for Malta by SCHATZMAYR (1946) and more recently by PITTINO & MARIANI (1986) from Attard (Malta).

***Pleurophorus caesus* (Panzer, 1796)**

(Fig. 30)

Material examined. MALTA: 97 exs., G.C. Champion Coll., B.M. 1927-409 (BMNH); x/xi.1901, 4 exs., M.C., Cameron Coll., B.M. 1936-555 (BMNH); Ballut, limits of Wardija/San Pawl il-Baħar, 1.iv.2002, 1 ex., DM; Buskett, 24.vi.2003, 4 exs., DM; Dahlet il-Fekruna, 11.iii.1990, 1 ex., DM; Ghadira, 23.v.1990, 1 ex., DM; Ghajn Rihana, 3.iii.1990, 1 ex., DM; Ghajn Tuffieħa Bay, 1.iv.2002, 1 ex., RS; Mellieħa, Kortin, 23.v/5.vi.2009, 2 exs., HBB; Mellieħa Bay, 3.iii.2002, 1 ex., DM; St. Thomas Bay, Tal-Munxar, 23.v.1998, 16.iii/13.iv.2003, 4 exs., DM; Wied Babu, 3.vii.2002, 1 ex., DM; Wied tal-Isqof, 16.vii.2002, 21 exs., DM; Żejtun, 7.v/6.x/5.xii.1989, 3 exs., DM; Żejtun, 30.xi.1997, 3 exs., DM; Żejtun, 20.iii/5.v.1998, 9 exs., DM; Żejtun, 24.xi.2001, 4 exs., DM. **GOZO:** Ghasri, 30.x.1994, 1 ex., CF; Marsalforn Valley, 20.iv.1990, 1 ex., DM.

P. caesus is considered as a sub-cosmopolitan species. The species is exclusively found in exposed areas associated with decaying vegetation, roots of coastal sand dunes and also on all type of dung. The species is locally common and it was previously recorded from Malta by CAMERON & CARUANA GATTO (1907), ANDRES (1916) and PITTINO & MARIANI (1986).

***Psammodyus pierottii* Pittino, 1979**

(Fig. 31)

P. pierottii is a south European species extending eastwards to Iran. As such, CAMERON & CARUANA GATTO (1907) recorded from Malta (Fort Manuel) *P. sulcicollis* (Illiger, 1802) which is a synonym of *P. asper* (Fabricius, 1775). However, PITTINO (1979) regarded *P. asper* as belong to two closely related species, *P. asper*, a more central-northern occurring species and *P. pierottii*, a more southern occurring species. Even though no material of this species was available for study we are of the opinion that the Maltese records should refer to *P. pierottii*.

***Rhyssemus plicatus* (Germar, 1817)**

(Fig. 32)

Material examined. MALTA: 59 exs., G.C. Champion Coll., B.M. 1927-409 (BMNH); Buskett, 13.i.1999, 2 exs., DM; Delimara, St. Peter's Pool, 16.v.1990, 1 ex., DM; Fomm ir-Riħ, 26.iii.1995, 1 ex., DM; Marfa, 17.ix.1995, 1 ex., DM; Migra Ferħa, 26.xii.1994, 20.xii.1996, 5 exs., DM; Mosta, 21.xi.1989, 1 ex., DM; St. Thomas Bay, 11.xi.1996, 1 ex., DM. **GOZO:** Dwejra, 10.v.1996, 1 ex., DM; Ta' Kantra, limits of Munxar, 28.xii.2002, 1 ex., DM; Xlendi, 15.i.1995, 1 ex., CF.

R. plicatus is recorded from Spain, Croatia, southern France, Italy, Sardinia, Sicily, Malta and North Africa (from Morocco upto Tunisia). The species prefers sandy habitats and is often found associated with roots of plants. The species was previously recorded from Malta by CAMERON & CARUANA GATTO (1907) and ANDRES (1916).

Scarabaeinae Latreille, 1802

Copris (Copris) hispanus cavolinii (V. Petagna, 1792)

Diagnosis. Length 15-30 mm. Colour black and shining, with an elongated horn in males (Fig. 33), but shorter in females (Fig. 34). Elytra with nine striae, with convex interstriae. This taxon cannot be confused with any other scarab beetle present in Malta.

Material examined. MALTA: Wied Incita, 1952, 1 ex., GL; Dingli, 17/28.iii.1981, 2 exs., MZ (MNHM); Dingli, 27.iii.1991, 1 ex., MZ (MNHM); Wied il-Kbir, 12.iii.1990, 1 ex., AS.

According to the most recent published works (e.g. ARNONE *et al.* 1995; DELLACASA, 2004; LOBO & MARTÍN PIERA, 1993) the nominal subspecies is distributed in the western part of the Mediterranean basin, from southern France to North Africa, Balearic islands, Corsica, Sardinia, Lampedusa and Pantelleria, whereas the spp. *cavolinii* is present in Sicily, Malta and continue its distribution into the eastern part of the Mediterranean Region up to Asia. However, according to KABAKOV (2006) transitional forms of *C. h. hispanus* and *C. h. cavolinii* are present in central Asia, Iran and Afghanistan and the separation of the two subspecies is unjustified. It has a specialised ecology having a preference to open spaces and exhibits a high degree of parental care. This species seems to have a very restricted distribution in the Maltese islands.

Euoniticellus fulvus (Goeze, 1777)

Diagnosis. Length 7-11 mm. Elongated species with lateral sides of body parallel to each other, convex on prothorax. Overall body coloration, yellowish-brown with lighter coloured elytra (Fig. 35).

E. fulvus is known from Southern and Central Europe (except British Isles), Maghreb, Near East up to Caucasus, North Africa, Asia Minor, Iran, Iraq, Transcaspian Region and Turkmenistan (SIMONIS, 1984). The species was recorded by CAMERON & CARUANA GATTO (1907) as “not uncommon” from Gnejna in Malta.

Bubas bison (Linnaeus, 1767)

Diagnosis. Length 12-22 mm. Overall body coloration black and shining. Males with two pointed but short tubercles on head and pronotum pointed anteriorly on median line (Fig. 36). Females without pointed tubercles on head and anterior part of pronotum not pointed (Fig. 37).

Material examined. MALTA: 1 ♂ & 1 ♀, G.C. Champion Coll., B.M. 1927-409 (BMNH); x.1901, M.C., 1 ♂ & 1 ♀, Cameron Coll., B.M. 1936-555 (BMNH); Marsa, Ghammieri, 24.xii.2001/10.i.2002, 2 ♂♂, DM; Wied Qirda, 13.xii.1989/18.ii.1990, 1 ♂ & 1 ♀, AS; Mistra, 8.xii.2002, 1 ♂ & 1 ♀, DM; St. Thomas Bay, 7.vii.1989, 1 ♂, DM; Chadwick Lakes, 20.i.2002, 1 ♂, DM; B’Kara, 30.xii.1995, 1 ♀, DM; Msida, Tal-Qroqq, 28.x.1995, 1 ♂, CF; Chadwick Lakes, 3.iii.2008, 2 ♀♀, IP.

B. bison is known from the Iberian Peninsula, France, Corsica, Italy, Malta, Bosnia Herzegovina, Croatia, Serbia and Montenegro, Albania, Greece, Bulgaria and northern Maghreb (in southern Morocco, Algeria and Tunisia, *B. bison* is replaced by *B. bubaloides* (ZUNINO, 1974). The species is mainly associated with dung of big herbivores, ovines, equines, bovines and sometimes canines

and man. CAMERON & CARUANA GATTO (1907) recorded this species from the following locations in Malta: Marsa, Gġirgenti and Mellieħa. This is a relatively frequent species in Malta.

***Cheironitis ungaricus irroratus* (P. Rossi, 1790)**

Diagnosis. Length 14-20 mm. Body coloration brown to dark brown (Fig. 38), with dark yellowish infusion especially on elytra. Margin of pronotum serrated. Protibiae of males elongated, and highly curved inwards; simple in females.

Material examined. MALTA: 3 exs., G.C. Champion Coll., B.M. 1927-409 (BMNH).

C. ungaricus irroratus is known from central and southern Sicily, Sardinia, France, Spain, Malta, Cyprus, North Africa (from Morocco up to Egypt) and the Near East (Israel, Syria and Turkey) (MARTÍN PIERA & LÓPEZ COLÓN, 2000). The species was recorded from Malta by CAMERON & CARUANA GATTO (1907) precisely from Kordin and Chadwick Lakes during the months of June and August.

***Onthophagus (Onthophagus) taurus* (Schreber, 1759)**

Diagnosis. Length 6-11.5 mm. Overall body coloration shining black, sometimes with metallic reflections. Males with two curved fine horns on lateral side of head directed posteriorly (Fig. 39); females lack such structures (Fig. 40). This species can only be confused with *O. andalusicus*, but coloration of elytra and the shape of the head's horns should discriminate both species easily.

Material examined. MALTA: x/xi.1901, 7 ♀♀, M.C., Cameron Coll., B.M. 1936-555 (BMNH); Bahrija valley, 27.vi.1993, 3 ♂♂ & 1 ♀, associated with rabbit dung, DM; Buskett, 3.vii.1994, 1 ♀, DM; Chadwick Lakes, 19.v.1990, 1 ♀, DM; Ghadira, 21.ix.1993, 3 ♀♀, DM; Żejtun, 8.vi.1995, 1 ♀, DM; Marsa, Għammieri, 5.x.1997, 1 ♀, DM; Mellieħa, Kordin, 15.v.2004, 3 ♀♀, HBB (MNHM); Selmun, 10.iv.2002, 1 ♂, HBB (MNHM); Rabat, 14/16. iv.2007, 4 ♂♂ & 4 ♀♀, in pit fall traps using bovine dung, IP; Rabat, 20/22.vii.2007, 3 ♂♂ & 16 ♀♀, in pit fall traps using bovine dung, IP; Chadwick Lakes, 17-20.iv.2007, 2 ♂♂ & 13 ♀♀, in pit fall traps using bovine dung, IP; Chadwick Lakes, 17-24.vii.2007, 5 ♂♂ & 40 ♀♀, in pit fall traps using bovine dung, IP; Buskett, 20.x.2007, 1 ♀, in pit fall traps using bovine dung, IP; Dingli, Villa Oriana, 19.iv.2007, 1 ♀, in pit fall traps using bovine dung, IP; Mgarr, Roman Baths, 16.iv/22vii.2007, 1 ♂ & 2 ♀♀, in pit fall traps using bovine dung, IP; Qormi, 22.x.2007, 7 ♀♀, in pit fall traps using bovine dung, IP.

O. taurus is present throughout southern and central Europe, western Russia, Armenia, Transcaucasus, Morocco, Algeria and Tunisia. Introduced in Australia and North America. The species was previously reported from Malta by CAMERON & CARUANA GATTO (1907). It represents a common species associated with various type of animal dung in the Maltese islands.

***Onthophagus (Palaeonthophagus) andalusicus* Waltl, 1835**

Diagnosis. Length 6-12 mm. Similar to previous species but easily recognised because of the yellowish-orange elytra with irregular black markings. Males having only one medial short horn directed posteriorly (Fig. 41) and females without such a horn (Fig. 42)

Material examined. MALTA: 5 ♀♀, G.C. Champion Coll., B.M. 1927-409 (BMNH); Żejtun, 3.iii.1991, 1 ♀, DM; Bahrija Valley, 27.vi.1993, 1 ♀, DM; Mellieħa, Kordin, 26.vii.2004, 1

♀, HBB; Naxxar, 25.ii.1970, 1 ♀, CD (MNHM); Ghallis, 25.ii.1968, 5 ♀♀ [no collector], (MNHM); Xemxija, 3.iii.2008, 1 ♂, IP; Mgarr, Roman baths, 16.iv.2007, 1 ♀, IP; Rabat, 16.iv.2007, 1 ♂ & 1 ♀, IP.

O. andalusicus is recorded from Italy, Malta, Portugal, and Spain and from the following North African countries: Algeria, Morocco and Tunisia. MARTÍN PIERA & ZUNINO (1981) consider *andalusicus* as subspecies of *O. marginalis* and distinguished four infrasubspecific groups within *O. m. andalusicus*. This species was recorded from Gnejna by CAMERON & CARUANA GATTO (1907) who described the distribution of the species in Malta as “not uncommon”. This species is less common than *O. taurus* in the Maltese islands, but it is still a frequently encountered species associated with animal dung.

Scarabaeus (Ateuchetus) semipunctatus Fabricius, 1792

Diagnosis. Length 15-23 mm. Overall body coloration black. Pronotum convex, with large and deep punctuation. Punctuation of elytral striae very fine, with flat interstriae (Fig. 43).

This species is known from the following countries in Europe: Albania, Croatia, France, Hungary, Italy, Malta, Portugal, Spain, Serbia and Montenegro; North Africa (Algeria, Egypt, Libya, Morocco and Tunisia) and Palestine. It was locally recorded by CAMERON & CARUANA GATTO (1907) from Mellieha and by CILIA (1989) from a single specimen collected from Ramla l-Hamra in Gozo on 3.ix.1975. The species is strictly associated with coastal sand dune habitats and may well represent an already extinct species locally.

Scarabaeus (Ateuchetus) variolosus Fabricius, 1787

Diagnosis. Length 15-25 mm. Large blackish species (Fig. 44). Can only be confused with previous species from which it can be separated by its very strong elytral punctuation.

Material examined. MALTA: 1 ex., G.C. Champion Coll., B.M. 1927-409 (BMNH); x.1901, 2 exs., M.C., Cameron Coll., B.M. 1936-555 (BMNH); Gharghur, 3.xi.1957, 1 ex., [no collector] (MNHM); Naxxar, 25.ii.1970, 4 exs., CD (MNHM); Wied Qirda, 15.iii.1990, 1 ex., AS; Mellieha, Kortin, 27.v.2004, 1 ex., HBB; Qrendi, Maqluba, 8.iii.2003, 1 ex., DO; Armier, 1.iv.1988, 1 ex., AS; Birzebbuga, Wied Dalam, 12.x.2005, 1 ex., AS; Hal Ginwi, 1.v.1989, 1 ex., DM; Mnajdra Temples, 3.iii.2008, 1 ex., in bovine dung, IP; Bahrija, 31.iii.1989, 1 ex., DM; Wied Has-Sabtan, 3.ii.1996, 1 ex., DM; Wied il-Ghasel, 18.iii.1990, 1 ex., DM; Wardija, 11.ii.1990, 1 ex., DM.

S. variolosus is recorded from the following European countries: Albania, Bosnia Herzegovina, Bulgaria, Croatia, Greece, Italy, Malta, Serbia and Montenegro, North Africa (Algeria, Morocco and Tunisia) and Turkey. The species was recorded by CAMERON & CARUANA GATTO (1907) and ANDRES (1916). It is a common species in Malta often seen modelling dung in small round balls.

Melolonthinae Samouelle, 1819

Anoxia (Mesanoxia) matutinalis matutinalis Laporte, 1832

Diagnosis. Length 19-26 mm. Very distinct large and elongated species (Fig. 45), with a brownish overall coloration. Elytra having distinct banded striae. Pelosity yellowish and particularly prominent on anterior half of ventre.

Material examined. MALTA: Mellieha, 12.iii.1962, 1 ex. [collector unknown] (MNHM); Ghadira, 12.vi.1976, 2 exs., at 8:30pm, MZ (MNHM); Ghadira, vi.1986, LC; Armier, 18.vi.1989, 1 ex., DM; Ghadira, 23.v.1990, 1 ex., DM; Mellieha, around Ghadira nature reserve, 2.vi.2002, 1 ex., DM; Mellieha Bay, Gerbulin Beach, 29.v.2004, 1 ex., HBB.

A. matutinalis matutinalis is known from Albania, Croatia, Italy and Slovenia. Four other subspecies are known from Corsica, Sardinia, Vulcan island in Italy and Greece. This species seems to be restricted to North-western Malta where it seems to be frequent. It was first recorded from Malta by BONETT & SCHEMBRI (1976). CILIA (1989) recorded this species as *Anoxia australis* Herbst with a record from Mellieha taken on 28.v.1970 stating that the species might be a recent introduction associated with vines.

****Amphimallon* (?) *scutellare* (P. H. Lucas, 1846)**

Diagnosis. Length 12 mm. Yellow-orange elongated species (Fig. 46) with darker head and thorax. Ventre entirely orange in colour. This species cannot be confused with other Scarabaeoidea occurring in Malta.

Material examined. GOZO: Xlendi, pupa found in soil (garigue habitat) on 13.ix.1995 and adult emerged on 13.x.1995, CF.

The identity of this species is problematic as the above specimen represents a female and males are often required for correct species identification in *Amphimallon*. Our tentative identification suggests that it is close to *A. scutellare*, a species which is only known from North Africa (Algeria, Morocco and Tunisia). Species of this genus, generally feed on roots of small plants.

****Aplidia hirticollis* Burmeister, 1855**

Diagnosis. Length 14-19 mm. Distinct elongated species (Fig. 47), widest at basal fifth. General body coloration light to dark brown with fine yellow pubescence on dorsum getting more distinct on ventral surface.

Material examined. MALTA: Balzan, 12.vi.1996, 1 ex., MJE; Lija, Mosta road, 3.vi.2005, 2 exs., HBB; Mosta, 30.v.2003, 1 ex., JC (MNHM); Naxxar, 5.vi.1999, 1 ex., AS; Naxxar, 5/14.vi.2002, 4 exs., AS; Naxxar, 30.v.2003, 17 exs., AS (in part MNMH); Naxxar, 8.vi.2003, 1 ex., AS; Naxxar, Tas-Saghjtjar, 6/26.vi.2004, 9 exs., AS (in part MNHM); Naxxar, Tas-Saghjtjar, 4.vii.2004, 1 ex., AS; Naxxar, Tas-Saghjtjar, 23/24/31.v.2005, 16 exs., AS (in part MNHM); Naxxar, Tas-Saghjtjar, 2/5.vi.2005, 10 exs., AS (in part MNHM); Naxxar, Tas-Saghjtjar, 21.v.2006, 1 ex., AS.

Aplidia hirticollis was known only from Italy (Calabria, Sicily and Sardinia) but in the present study has been found in large numbers in central-northern Malta. The species seems to have a very restricted distribution in Malta and it is worth mentioning that all of the above material was collected using Actinic light traps.

Dynastinae MacLeay, 1819

Oryctes (Oryctes) nasicornis grypus (Illiger, 1803)

Diagnosis. Length 28-40 mm. The largest Scarabaeoidea occurring in Malta with a shiny dark brown colour all over its body. Males (Fig. 48) with a distinct curved horn on head, which in females (Fig. 49) is almost completely absent.

Material examined. MALTA: Żejtun, 7.v.1990, 1 ♂, DM; St. Andrews, 10.v.2003, 1 ♂, DM; Msida, 17.vii.2003, 1 ♂, DM; Wied tal-Isqof, 16.vii.2002, 2 ♀♀, DM; Ta' Qali, 12.vi.2002, 1 ♀, DM; Lija, 1.vii.2003, 1 ♀, DM; Lija, 10.vi.2004, 1 ♂, DM; Mellieħa, Kortin, 8.vii.2004, 1 ♀, HBB; Rabat, Ta' Koronja, 14/21.vi.2002, 1 ♂ and 2 ♀♀, PS (MNHM); Sliema, 4.viii.2005, 1 ♂, JAM (MNHM); Mellieħa, 1.vi.2002, 1 ♂, HBB (MNHM); Mtarfa, 1.vii.2002, 1 ♀, PS (MNHM); Wied tal-Isqof, 28.vi.2002, 1 ♀, PS (MNHM); B'Kara, 20.vi.1974, 1 ♀, M. Berry coll. (MNHM); Mellieħa, Kortin, 5.vii.2004/3.vi.2005, 2 ♀♀, HBB (MNHM); Marsa, Għammieri, 25.v.1996, 1 ♀, CF.

O. nasicornis grypus is known from Europe (France, Italy, Malta, Portugal, Spain and Switzerland) and North Africa (Algeria, Morocco and Tunisia). The species develops in humus deposits and in cavities of large trunks. The species seems to be on the decline in Malta as very few records were observed in recent years.

Pentodon bidens punctatus (Villers, 1789)

Diagnosis. Length 15-25 mm. Large black elongated species widest at basal third (Fig. 50). This species can only be confused with females of *Phyllognathus excavatus* from which it can be separated by the darker colour and presence of front angles on pronotum.

Material examined. MALTA: x/xi.1901, 5 exs., M.C., Cameron Coll., B.M. 1936-555 (BMNH); Kappara, 11.v.2004, 1 ex., HBB; Wied Qannotta, 23.vi.1989/17.ii.1990, 2 exs., DM; Żejtun, 22.v.1989/19.ii.1995/14.iv.2002, 3 exs., DM; St. Thomas Bay, 22.x.1996, 1 ex., DM; Wied il-Kbir, 31.i.1988, 1 ex., AS; Marsaxlokk, 18.iv.2007, 1 ex., IP; Rabat, 17.iv.2007, 2 exs., IP; Rabat, Dwejra, 30.iv.2006, 1 ex., PS (MNHM); Rabat, 14.vi.2002/15.ix.2003/22.vii.2004, 3 exs., PS (MNHM); Buskett, 24.vi.2003/27.iv.2006, 2 exs., PS (MNHM); St. Julians, 3.xii.2004, 1 ex., HBB (MNHM); Lija, 16.v.2005, 1 ex., HBB (MNHM); Mellieħa, Kortin, 22.v.2004/8.iv.2005, 3 exs., HBB (MNHM). **COMINO:** 4.v.2006, 1 ex., JB (MNHM); Santa Marija Bay, 5.iv.2003, 1 ex., DM.

P. bidens punctatus is widely distributed in Southern Europe and is also known from North Africa (Algeria and Morocco). The species is very common in the Maltese islands and was previously recorded by CAMERON & CARUANA GATTO (1907) and ANDRES (1916).

Phyllognathus excavatus (Forster, 1771)

Diagnosis. Length 18-28 mm. Large species with overall body coloration dark brown. Males (Fig. 51) with distinct horn on head and an excavated wide median sulcus on pronotum, whereas females (Fig. 52) lack such characteristics.

Material examined. MALTA: Rabat, 5.viii.2003/12.ix.2004, 2 ♂♂ and 1 ♀, PS (MNHM); Marsa, 26.ix.1989, 1 ♂ and 1 ♀, DM; Marsa, Għammieri, 30.x.1994/28.x.1995, 2 ♂♂, CF; Marsa, Għammieri, 3/10.ix/3/8.x/20.xi.2001/26.viii.2002, 6 ♂♂ and 1 ♀, DM; Għaxaq,

5.ix.2002, 1 ♂, DM; Żejtun, 1.x.2001, 1 ♂, DM; Żurrieq, Wied Babu, 4.x.2002, 1 ♂, DM;
GOZO: Ramla, 9.viii.2002, 1 ♂, DM.

P. excavatus is a widespread and common species throughout its distribution range. It is known from all over Europe, North Africa and Asia. In Malta the species is very common with large numbers observed towards the end of summer time. It was previously recorded from Malta by CAMERON & CARUANA GATTO (1907) and ANDRES (1916) as *Phyllognathus silenus* (Fabricius, 1775).

Cetoniinae Leach, 1815

Aethiessa floralis (Fabricius, 1787)

Diagnosis. Length 13-21 mm. *A. floralis* (Fig. 53) is a very distinct species, somewhat similar to *Protaetia opaca* but of smaller body dimensions and having a more slender shape.

Material examined. MALTA: Żejtun, 22.vi/31.v.1989, 2 exs., DM; St. Thomas Bay, Tal-Munxar, 1.vi.1990, 1 ex., DM; St. Thomas Bay, 8.vi.1989, 1 ex., DM; Rabat, 21.vi.2002, 1 ex., PS (MNHM); Rabat, 10.vi.2003, 1 ex., PS; Rabat, Ta' Koronja, 14.vi.2002, 4 exs., AS & PS (MNHM); Naxxar, 3.vi.2001, 1 ex., AS; Mellicha, Kortin, 2/17/20.vi.2005, 4 exs., HBB (MNHM).

Until recently, *A. floralis* was known from Spain, Italy (Calabria and Sicily), Malta, Algeria, Egypt, Libya, Morocco, Tunisia and Israel however, SPARACIO (2009) assigned the Italian population of this taxon to a distinct species, *A. squamosa* (Gory & Percheron, 1833). The species was previously recorded from Malta by CAMERON & CARUANA GATTO (1907), ANDRES (1916) and SABATINELLI & SCHEMBRI (1990) and represent a frequent taxon locally.

Cetonia (Cetonia) aurata pisana Heer, 1841

Diagnosis. Length 17-22 mm. Superficially similar to *Protaetia incerta* from which it is readily distinguished by the smaller body size and overall body coloration which is more of a greenish metallic contrast (Fig. 54).

C. aurata pisana is known from France, Greece, Italy, Malta, Portugal, Spain and Switzerland. This flower associated species was recorded from Malta (SABATINELLI & SCHEMBRI, 1990) on the basis of a single specimen found on *Vitis* sp. and captured on May 1973 from Birkirkara. This species may have been accidentally introduced in Malta in recent times (SABATINELLI & SCHEMBRI, 1990).

Protaetia (Potosia) incerta (A. Costa, 1852)

Diagnosis. Length 22-28 mm. Large species (Fig. 55) with shining dorsum often of a bronze-maroon metallic coloration, but sometimes also somewhat greenish or bluish. Ventrals of a metallic dark violet coloration.

Material examined. MALTA: Gżira, 14.iv.1973, 1 ex., M. Berry coll. (MNHM); Żejtun, 11.ix.1993, 1 ex., DM; Hemsija (limits of Rabat), 20.vi.2002, 1 ex., DM; Rabat, Ta' Kurunja, 6.vi.2002, 1 ex., PS (MNHM); Mtarfa, 1.vii.2002, 1 ex., PS (MNHM); Buskett, 20.ii.1991, 1 ex., AS; Siggiewi, 20.vi.1993, 1 ex., DM; Dingli, 13.vi.1994, 1 ex., DM; Mellicha, Kortin, 15.v.2004/8.v.2006, 2 exs., HBB (MNHM); Bur Marrad, Wied l-Arkata, 24.v.2003, 4 exs., DM & PS.

P. incerta is only known from Southern Italy (Calabria, Sicily) and Malta however this taxon together with other closely related species (e.g. *P. cuprea* (s. str.)) and its subspecies are in need of taxonomic re-evaluation possibly using not only morphological characters but also molecular analysis. SPARACIO (2009) provided information on the synonymy associated with this taxon and he referred to the above mentioned species as *Potosia cuprea hypocrita* Ragusa, 1905. The species was previously reported from Malta by CAMERON & CARUANA GATTO (1907) and SABATINELLI & SCHEMBRI (1990).

***Protaetia (Potosia) mayeti* (Le Comte, 1906)**

This species was described on the basis of a single male specimen (LE COMTE, 1906) but the type locality was uncertain and was given as either Malta or Benghazi (Libya). SABATINELLI & SCHEMBRI (1990) considered this taxon as a variety of *Protaetia incerta* but the recent catalogue of Palaearctic Coleoptera (LÖBL & SMETANA, 2006) consider this taxon as a distinct species described from Malta. According to the original description, this specimen is of a metallic green colour, with a length of 17-18 mm. Elytra with numerous transverse white markings with a deep sutural depression. Abdomen with white lateral markings. Yellowish pubescence ventrally. These characters should discriminate this species from *P. incerta*.

****Protaetia (Potosia) opaca* (Fabricius, 1787)**

Diagnosis. Length 16-27 mm. This species (Fig. 56) is of the same body dimension and shape as *Protaetia incerta* but is readily distinguished from this species because of its dull blackish colouration.

Material examined. MALTA: Mellieħa, 10.x.2006, 7 exs., found alive in a honeybee colony, DM; Mosta, Burmarrad, 25.vii.2007, 2 exs., found as cocoons in dead palm trees, AS; Wardija, 6.x.2004, 1 ex., found alive in a honeybee colony, DM; Marsa, 20.viii.2004, 1 ex., DM; Valletta, 3.ix.2001, 1 ex., DM; Siggiewi, 1.v.2006, 1 ex., DM; Żejtun, 2.ix.2009, 1 ex., DM.

This species is known from Europe (France, Italy, Malta, Portugal, Spain and the Canary Islands) and from North Africa (Algeria, Morocco and Tunisia). Most of the above cited material from Malta was found in honeybee colonies, where presumably the species forms a relationship with honeybees.

***Tropinota (Tropinota) squalida squalida* (Scopoli, 1763)**

Diagnosis. Length 9-14 mm. Body entirely brown to dark grey with dense long yellowish pubescence (Fig. 57). No markings present on ventral surface of abdomen.

Material examined. MALTA: St. Thomas Bay, 23.iii.1989, 1 ex., DM; Buskett, 27.ii.2000, 1 ex., AS; Rabat, Ta' Koronja, 14.vi.2002, 1 ex., AS; Ras il-Bajjada, 3.iii.2008, 3 exs., IP; Mellieħa, Kortin, 14.iv.2005, 4 exs., HBB (MNHM); Mellieħa Bay, 25.iii.2005, 3 exs., HBB (MNHM).

T. squalida is known from most European countries (Albania, Bosnia Herzegovina, Bulgaria, Croatia, France, Greece, Italy, Malta, Macedonia, Portugal, Slovenia, Spain, Switzerland, Serbia and Montenegro) and Turkey. Other subspecies are confined to Asia and North Africa. The species was previously reported from Malta by CAMERON & CARUANA GATTO (1907), ANDRES (1916) and

SABATINELLI & SCHEMBRI (1990). It represents a very common species in the Maltese islands where adults are often found damaging different flowers.

***Oxythyrea funesta* (Poda von Neuhaus, 1761)**

Diagnosis. Length 9-14 mm. Similar to preceding species but with whitish pubescence (Fig. 58) and four median spots arranged longitudinally on the ventral surface of the abdomen.

Material examined. MALTA: Rabat, 12.iii.1989, 1 ex., DM; St. Thomas Bay, 23.iii.1989, 1 ex., DM; Wied il-Kbir, 13.i.1990, AS; Rabat, Ta' Koronja, 3.vi.2002, 5 exs., PS (MNHM); Mellieha, Kortin, 30.iii.2002, 3 exs., HBB (MNHM); Mellieha hill, 3.iv.2004, 1 ex., HBB (MNHM); Mellieha, Gnien Ingraw, 1.v.2004, 1 ex., HBB (MNHM).

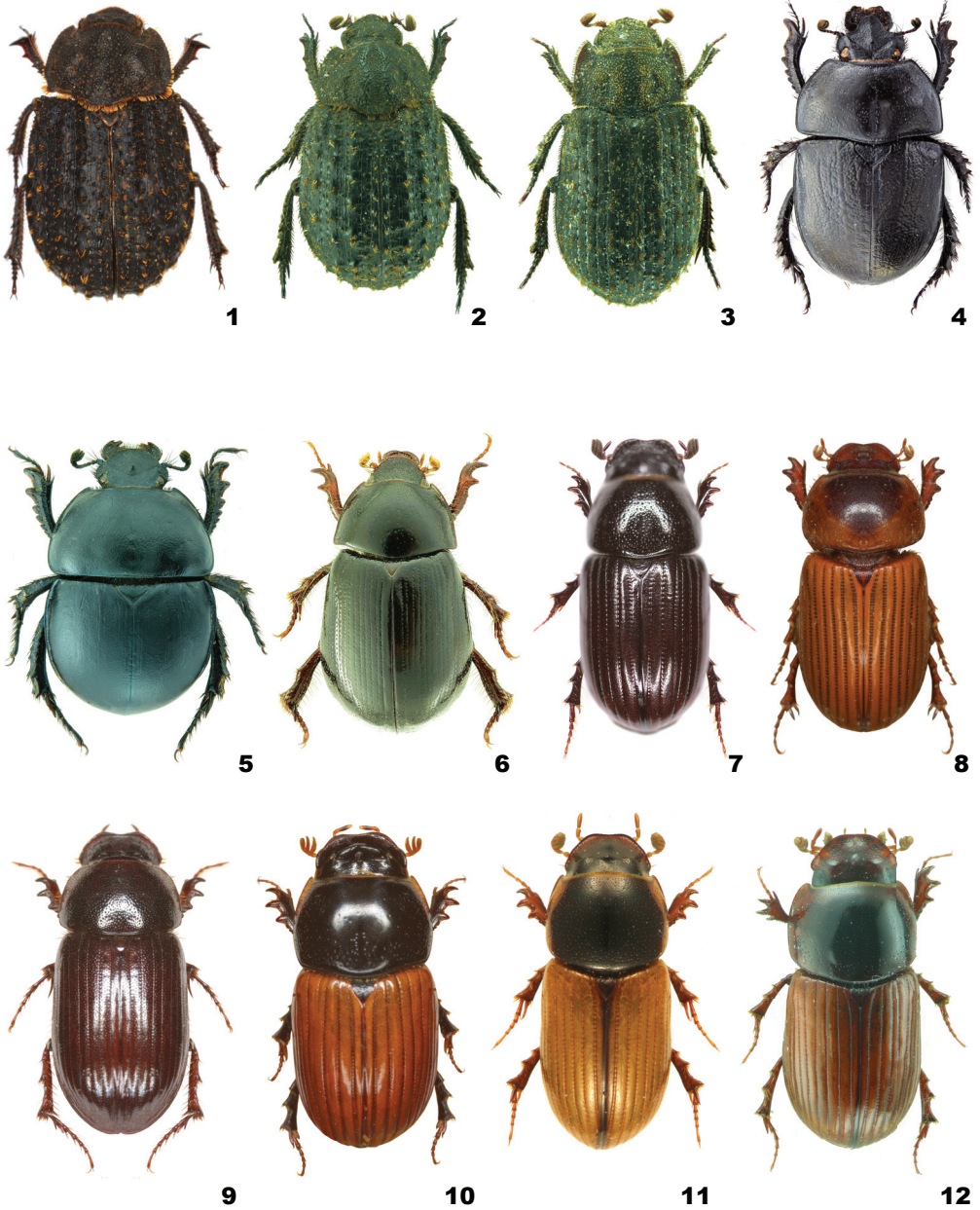
O. funesta is widely distributed in Europe, North Africa (Algeria, Libya, Morocco and Tunisia) and the Near East (Iran and Turkey). This species was reported from Malta by CAMERON & CARUANA GATTO (1907) and SABATINELLI & SCHEMBRI (1990). It represents a very common species found on different flowers in Malta.

****Lasioirichius succinctus* (Pallas, 1782)**

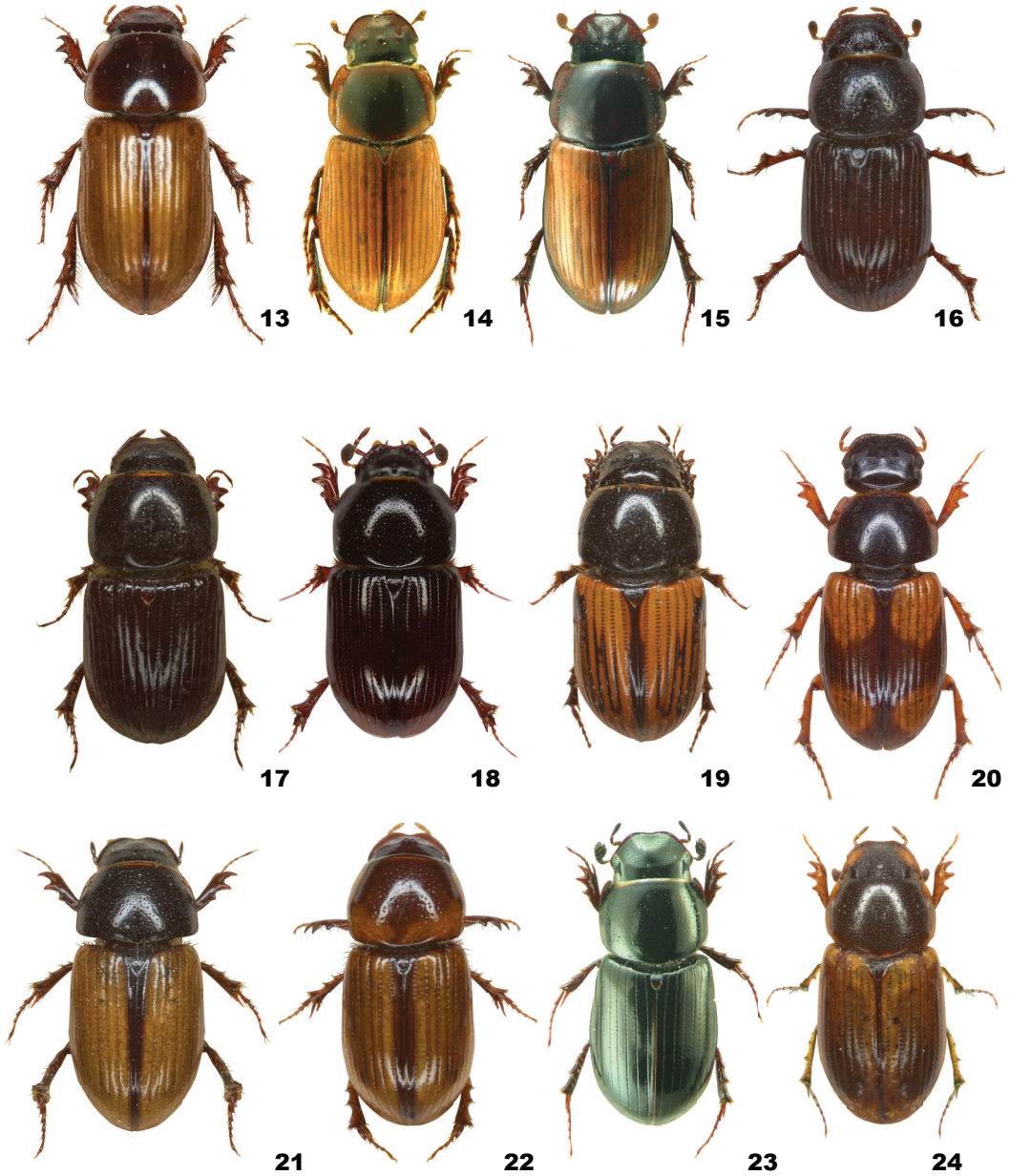
Diagnosis. Length 11-13 mm. Superficially resembling the two preceding species from which it is easily distinguished because of the banded pattern on elytra (Fig. 59).

Material examined. MALTA: Larvae collected on 16.xi.2005 in wood of pellets holding cars originating from Japan, and 4 exs. emerged on 10.iv.2006, DM.

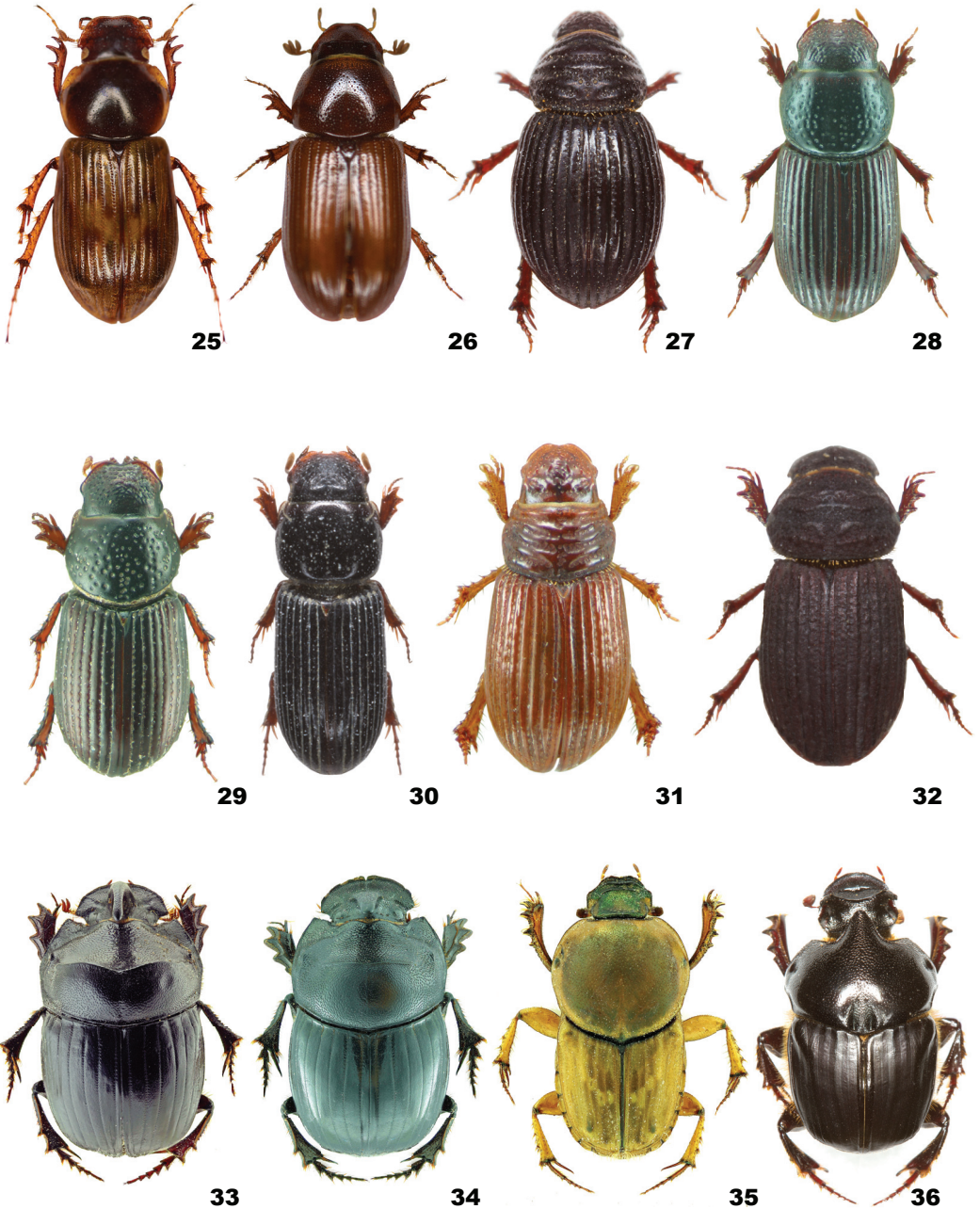
The establishment of this Asian species in Malta is not confirmed as it was never collected in the wild.



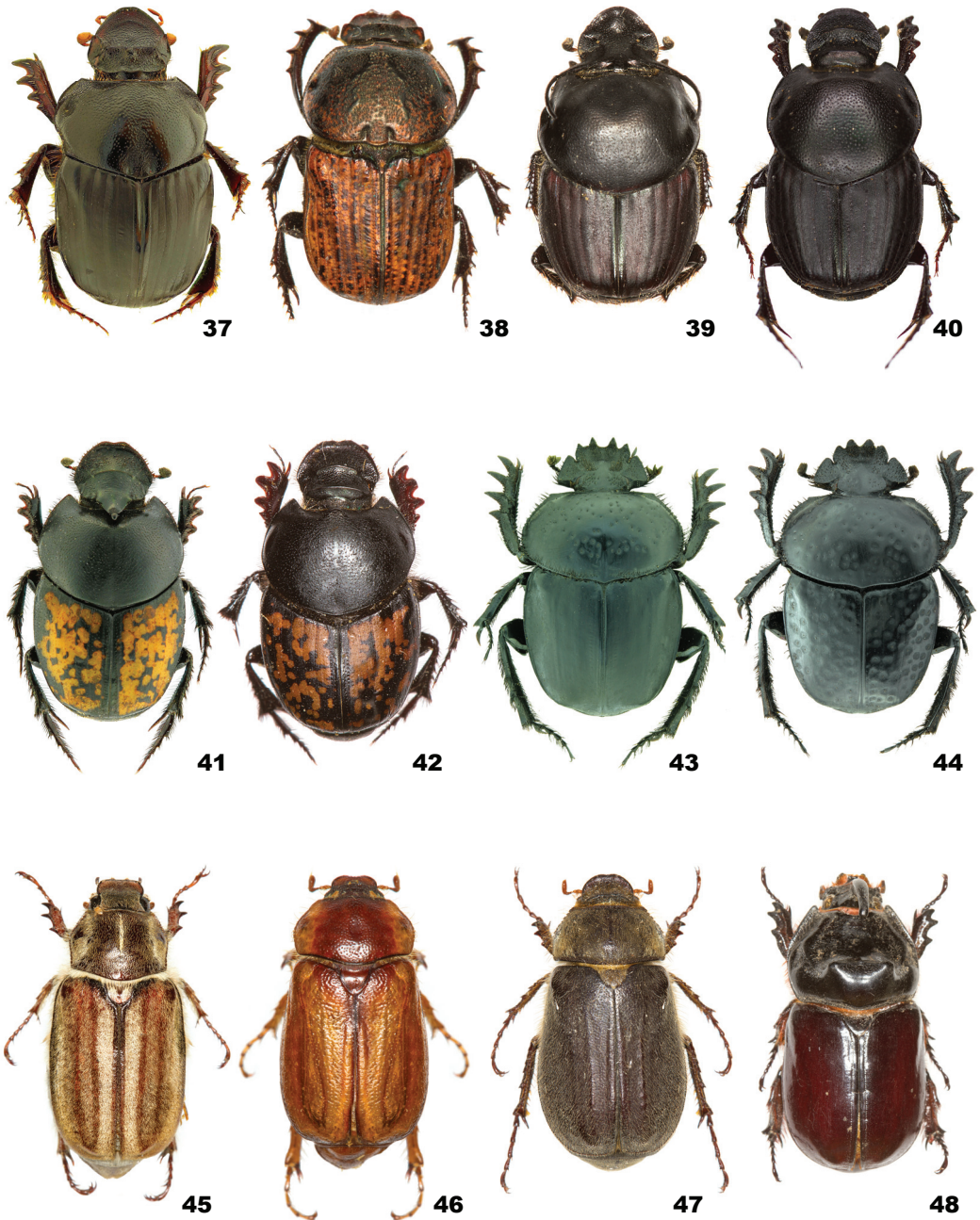
Figures 1-3: TROGIDAE. 1: *Trox fabricii*; 2: *T. litoralis*; 3: *T. scaber*. **Figures 4-5: GEOTRUPIDAE.** 4: *Geotrupes douei*; 5: *Thorectes intermedius*. **Figure 6: HYBOSORIDAE:** *Hybosorus illigeri*. **Figures 7-12: SCARABAEIDAE.** 7: *Aphodius constans*; 8: *A. hydrochaeris*; 9: *A. castaneus*; 10: *A. fimetarius*; 11: *A. ictericus ghardimaouensis*; 12: *A. rufus*.



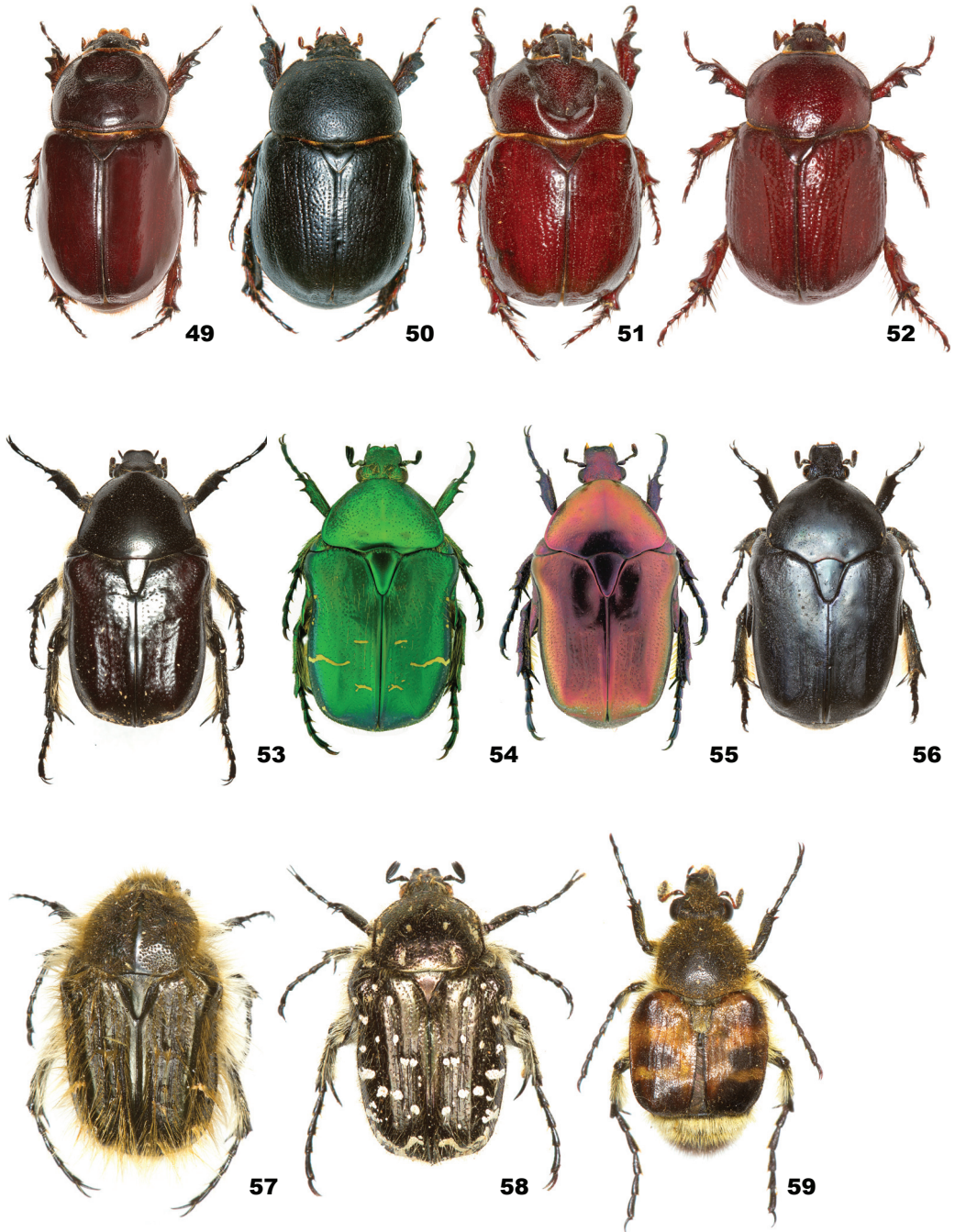
Figures 13-24: SCARABAEIDAE. 13: *Aphodius beduinus*; 14: *A. longispina*; 15: *A. lugens*; 16: *A. algiricus*; 17: *A. granarius*; 18: *A. mayeri*; 19: *A. lineolatus*; 20: *A. quadriguttatus*; 21: *A. tersus*; 22: *A. lividus*; 23: *A. plagiatus*; 24: *A. consputus*.



Figures 25-36: SCARABAEIDAE. 25: *Aphodius obliteratus*; 26: *A. sturmi*; 27: *Brindalus porcicollis*; 28: *Platytomus laevistriatus*; 29: *P. tibialis*; 30: *Pleurophorus caesus*; 31: *Psammodius pierottii*; 32: *Rhyssemus plicatus*; 33-34: *Copris hispanus cavolinii*; 33: male; 34: female; 35: *Euoniticellus fulvus*; 36: *Bubas bison*, male.



Figures 37-48: SCARABAEIDAE. 37: *Bubas bison*, female; 38: *Cheironitis ungaricus irroratus*; 39-40: *Onthophagus taurus*; 39: male; 40: female; 41-42: *Onthophagus andalusicus*; 41: male; 42: female; 43: *Scarabaeus semipunctatus*; 44: *S. variolosus*; 45: *Anoxia matutinalis*; 46: *Amphimallon* (?) *scutellare*; 47: *Aplidia hirticollis*; 48: *Oryctes nasicornis grypus*, male.



Figures 49-59: SCARABAEIDAE. 49: *Oryctes nasicornis grypus*, female; 50: *Pentodon bidens punctatus*; 51-52: *Phyllognathus excavatus*; 51: male; 52: female; 53: *Aethiessa floralis*; 54: *Cetonia aurata pisana*; 55: *Protaetia incerta*; 56: *P. opaca*; 57: *Tropinota squalida*; 58: *Oxythyrea funesta*; 59: *Lasiotrichius succinctus*.

SPECIES INCORRECTLY RECORDED FOR THE MALTESE FAUNA

***Trox hispidus* Pontoppidan, 1763**

This taxon was revised by PITTINO (1991) and material from Malta proved to belong to *T. litoralis*. The record of this taxon in the database of the Fauna Europaea is unjustified.

***Sericotrupes niger* (Marshall, 1802)**

This species is included in the database of the Fauna Europaea but we were not able to trace the original data/reference of such a record. Even though the distribution of this species may very well include Malta, past and present data indicates that this is not the case. For the above mentioned reasons, this species is being excluded from the Scarabaeoidea of Malta.

***Thorectes laevigatus* (Fabricius, 1798)**

Recorded by CAMERON & CARUANA GATTO (1907) as having a general distribution in Malta and by ANDRES (1916). All recent and historic material of *Thorectes* available for the present study proved to belong to *T. intermedius*.

***Bubas bubalus* (A. G. Olivier, 1811)**

Recorded by CAMERON & CARUANA GATTO (1907) on the basis of material collected by Comm. James John Walker between 1874-6. This species has a very restricted distribution in the western Mediterranean Region. It is known from Southern France, Spain and Portugal. The record from Malta must be due to either a mistaken locality datum or at most it could be attributed to *Bubas bubaloides* Janssens, 1938 widely distributed in North Africa, eastern Mediterranean and the Near East.

***Onthophagus (Palaeonthophagus) opacicollis* Reitter, 1892**

Same situation as for *Sericotrupes niger*.

***Onthophagus (Palaeonthophagus) vacca* (Linnaeus, 1767)**

Same situation as for *Sericotrupes niger*.

***Aphodius (Calamosternus) unicolor* (A. G. Olivier, 1789)**

Refer to note following *A. castaneus*.

***Euheptaulacus carinatus carinatus* (Germar, 1824)**

This species is widely distributed in Europe and Asia. It was included in both the Fauna Europaea database as well as in the recently published Catalogue of Palaearctic coleoptera. These records were based on historical material labelled Malta and conserved at the BMNH (Dellacasa, G., *pers. comm.*, 2011). We are of the opinion however that this material represents an incorrect locality datum as the species is mainly found in high altitudes and prefers mountain habitats, a habitat type completely lacking in Malta.

***Diastictus vulneratus* (Sturm, 1805)**

The species was recorded from Malta by CAMERON & CARUANA GATTO (1907) on the basis of material collected by Commander James John Walker in 1874-6. This is a central-European species

and the Maltese record must definitely derive from a mistaken locality label datum which was available to M. Cameron and A. Caruana Gatto when they were writing the Coleoptera list for Malta.

Melolontha (Melolontha) melolontha (Linnaeus, 1758)

Recorded by SALIBA (1963) as very common on potato, tomato and globe artichokes. This record is definitely incorrect as other species given in Saliba's list of insect pests of crop plants in Malta, which study was not based on a critical examination and study of such pests.

Protaetia (Liocola) marmorata marmorata (Fabricius, 1792)

This species was recorded by VALLETTA (1979) as *Cetonia lugubris* Herbst, 1786. He recorded the species as one of the many pollinators he observed on *Cynara cardunculus* in early June of 1977 in Wardija (Malta). We agree with SABATINELLI & SCHEMBRI (1990) who state that the record should probably refer to *Protaetia incerta*.

Protaetia (Potosia) angustata angustata (Germar, 1817)

This species was recorded by CAMERON & CARUANA GATTO (1907) as rare on flowers of *Cynara horrida*. SABATINELLI & SCHEMBRI (1990) argued that the record of this species from Malta is outside its distributional range and most likely it is the result of a misidentification. Most likely this record should refer to *Protaetia incerta* given its great variability.

Tropinota (Epicometis) hirta hirta (Poda von Neuhaus, 1761)

Recorded by SALIBA (1963) as fairly common on peach. This record is definitely incorrect for the same reasons given in *Melolontha melolontha* above.

DISCUSSION

As a result of this present work, the Scarabaeoidea of Malta numbers a total of 54 species, namely: 3 - Trogidae, 2 - Geotrupidae, 1 - Hybosoridae and 48 - Scarabaeidae. Thirteen previously recorded species were excluded from the Maltese fauna for a number of valid reasons as documented above.

The Republic of Malta with a total surface area of 316 square kilometers, constitutes one of the most densely populated countries in the world, with over 1,100 inhabitants per square kilometer. With this figure, one have to add at least one million tourists who visit these islands every year. All this, coupled with agriculture practice and the very often unsustainable development exert a high negative pressure on the few natural habitats which still exist in this archipelago. Moreover, since the islands are of low lying level (the highest elevation being that of about 250 m), the presence of several taxa usually associated with the upper level of hills or mountains are completely lacking.

Several species of Scarabaeoidea which are mainly associated with dung (e.g. *Aphodius hydrochaeris*, *A. lineolatus*, *Cheironitis ungaricus irroratus*) are only known from historical material. It is possible that some of these taxa are no longer present on these islands due to the fact that grazing of domestic animals is nowadays almost completely abolished. Thus, if such a microenvironment, that is, dung of different animals, is lacking for a prolonged period of time from the natural environment, many species may disappear altogether from the territory in question. It is also possible that some old records especially within the Aphodiinae were incorrectly determined or are nowadays assigned to newly described species which were previously unrecognised.

Table 2. 1st order chorotypes of Maltese Scarabaeoidea following STOCH & VIGNA TAGLIANTI (2005). In some cases, new chorotypes were established on the same criteria following the mentioned work.

Species	Chorological category	Code
<i>Trox fabricii</i>	SW Mediterranean	SWMED
<i>Trox litoralis</i>	SE Mediterranean	SEMED
<i>Trox scaber</i>	Holarctic	OLA
<i>Geotrupes douei</i>	SW Mediterranean	SWMED
<i>Thorectes intermedius</i>	W Mediterranean	WMED
<i>Hybosorus illigeri</i>	Indoafrikan-Oriental-SW Palaearctic	INDOAFR-OR-SWPAL
<i>Aphodius constans</i>	European	EUR
<i>Aphodius hydrochaeris</i>	Turanic-Mediterranean	TUM
<i>Aphodius castaneus</i>	W Mediterranean	WMED
<i>Aphodius fimetarius</i>	Asiatic-European	ASE
<i>Aphodius ictericus ghardimaouensis</i>	Mediterranean	MED
<i>Aphodius rufus</i>	Palaearctic	PAL
<i>Aphodius beduinus</i>	Central-SW Mediterranean	CSWMED
<i>Aphodius longispina</i>	Betic-Maghrebine	BET-MAGR
<i>Aphodius lugens</i>	Turanic-Mediterranean	TUM
<i>Aphodius algiricus</i>	Central-W Mediterranean	CWMED
<i>Aphodius granarius</i>	Cosmopolitan	COSMO
<i>Aphodius mayeri</i>	Mediterranean	MED
<i>Aphodius lineolatus</i>	Mediterranean	MED
<i>Aphodius quadriguttatus</i>	Turanic-European-Mediterranean	TEM
<i>Aphodius tersus</i>	Central-W Mediterranean	CWMED
<i>Aphodius lividus</i>	Mediterranean	MED
<i>Aphodius plagiatus</i>	Asiatic-European	ASI-EUR
<i>Aphodius consputus</i>	European-Mediterranean	EUM
<i>Aphodius obliterated</i>	European	EUR
<i>Aphodius sturmi</i>	C Asiatic-European-Mediterranean	CEM
<i>Brindalus porcicollis</i>	Mediterranean	MED
<i>Platytomus laevistriatus</i>	W Mediterranean	WMED
<i>Platytomus tibialis</i>	Subcosmopolitan	SUBCOSMO
<i>Pleurophorus caesus</i>	Subcosmopolitan	SUBCOSMO
<i>Psammodytes pierottii</i>	S European-Mediterranean-Iranian	SEUR-MED-IRA
<i>Rhyssemus plicatus</i>	Mediterranean	MED
<i>Copris hispanus cavolinii</i>	C Asiatic-Mediterranean	CAM
<i>Euoniticellus fulvus</i>	Turanic-European-Mediterranean	TEM
<i>Bubas bison</i>	W Mediterranean	WMED

Table 2. 1st order chorotypes of Maltese Scarabaeoidea (cont.).

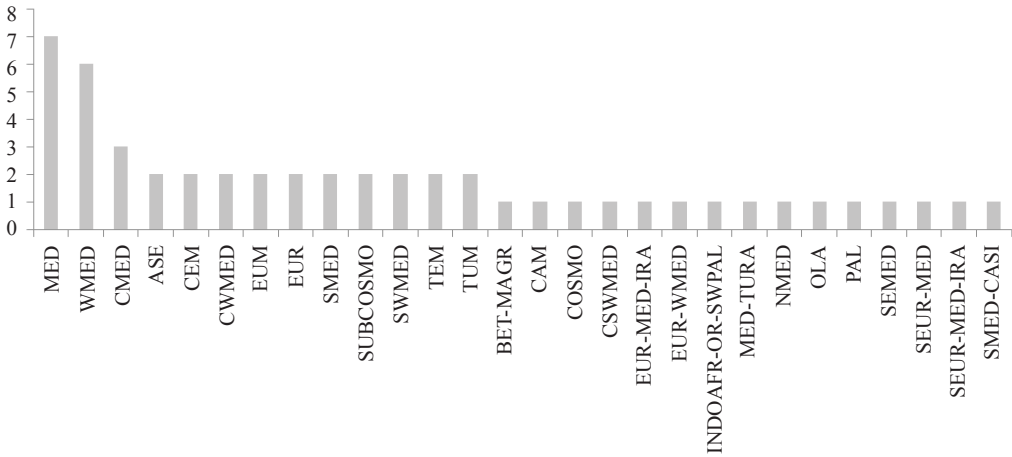
Species	Chorological category	Code
<i>Cheironitis ungaricus irroratus</i>	S Mediterranean	SMED
<i>Onthophagus taurus</i>	C Asiatic-European-Mediterranean	CEM
<i>Onthophagus andalusicus</i>	S Mediterranean-Central Asiatic	SMED-CASI
<i>Scarabaeus semipunctatus</i>	W Mediterranean	WMED
<i>Scarabaeus variolosus</i>	Mediterranean	MED
<i>Anoxia matutinalis matutinalis</i>	N Mediterranean	NMED
<i>Aplidia hirticollis</i>	Central Mediterranean	CMED
<i>Oryctes nasicornis grypus</i>	European-W Mediterranean	EUR-WMED
<i>Pentodon bidens punctatus</i>	S European-Mediterranean	SEUR-MED
<i>Phyllognathus excavatus</i>	Mediterranean-Turanic	MED-TURA
<i>Aethiessa floralis</i>	S Mediterranean	SMED
<i>Cetonia aurata pisana</i>	Central Mediterranean	CMED
<i>Protaetia incerta</i>	Central Mediterranean	CMED
<i>Protaetia opaca</i>	W Mediterranean	WMED
<i>Tropinota squalida squalida</i>	European-Mediterranean	EUM
<i>Oxythyrea funesta</i>	European-Mediterranean-Iranian	EUR-MED-IRA

Table 3. Number of species of Maltese Scarabaeoidea present in each chorotype.

Chorological code	No. of species
MED	7
WMED	6
CMED	3
ASE	2
CEM	2
CWMED	2
EUM	2
EUR	2
SMED	2
SUBCOSMO	2
SWMED	2
TEM	2
TUM	2
BET-MAGR	1

CAM	1
COSMO	1
CSWMED	1
EUR-MED-IRA	1
EUR-WMED	1
INDOAFR-OR-SWPAL	1
MED-TURA	1
NMED	1
OLA	1
PAL	1
SEMED	1
SEUR-MED	1
SEUR-MED-IRA	1
SMED-CASI	1

Figure 60: Number of species of Maltese Scarabaeoidea representing the different recognized chorotypes.



Out of the 54 Maltese Scarabaeoidea, the following three species were excluded from the biogeographical analysis which follows. These include: *Protaetia mayeti*, since we do not know neither its validity nor its distribution; *Amphimallon (?) scutellare* since currently we are not sure of its specific identity, and *Lasiotrichius succinctus* as it represents an introduced taxon whose establishment was not documented. On the remaining Scarabaeoidea species, the biogeographical analysis is limited to the study of chorotypes of first order (cfr. ZUNINO, 2005; BELLUCCI *et al.*, 2007; AGOGLITTA & ZUNINO, in press), since chorotypes of second order are based on monophyletic species groups. As clearly indicated in Tables 2 and 3 and in Fig. 60, the Mediterranean component (including its subdivisions: SW Mediterranean, SE Mediterranean, W Mediterranean, CSW Mediterranean, CW Mediterranean, S Mediterranean, N Mediterranean, C Mediterranean, Betic-Maghrebine) is represented by almost half (20) of the species. Within this chorological framework, 12 species represent a typical western distribution, whereas only one, *Trox litoralis*, corresponds to a model having an east-centred gravitation. Three species, *Aplidia hirticollis*, *Cetonia aurata pisana* and *Protaetia incerta* correspond to a central Mediterranean chorotype with a very limited distributional range. Fifteen species represent chorotypes which include an extended Mediterranean distribution (Turanic-Mediterranean, Turanic-European-Mediterranean, European-Mediterranean, C Asiatic-European-Mediterranean, S European-Mediterranean-Iranian, C Asiatic-Mediterranean, S Mediterranean - C Asiatic, European-W Mediterranean, Mediterranean-Turanic, S European-Mediterranean, European-Mediterranean-Iranian). However within this broad category, most species (11) show geographical extensions in the turanic and centralasiatic regions, whereas the rest of the species (4) show geographical extensions in the European parts of the western Palaearctic. The other chorotypes correspond to much larger geographical distributions with very limited value from a biogeographical perspective. In fact, three species are regarded as having a cosmopolitan or sub-cosmopolitan distribution, whereas the only exception in this respect is represented by an indoafrikan-oriental-SW Palaearctic species, *Hybosorus illigeri*.

The above chorological traits of the Maltese Scarabaeoidea fauna describe its current biogeographical relationships. Concerning historical biogeography, no hypotheses can be formulated until at least the implied chorotypes of second order are available.

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Appendix 1. Checklist of the Scarabaeoidea of the Maltese Islands

(* represent new records for the present work)

TROGIDAE MacLeay, 1819

- **Trox fabricii* Reiche, 1853
- Trox litoralis* Pittino, 1991
- **Trox scaber* (Linnaeus, 1767)

GEOTRUPIDAE Latreille, 1802

- Geotrupes douei* Gory, 1841
- Thorectes intermedius* (O. G. Costa, 1839)

HYBOSORIDAE Erichson, 1847

- Hybosorus illigeri* Reiche, 1853

SCARABAEIDAE Latreille, 1802**Aphodiinae Leach, 1815**

- Aphodius (Agrilinus) constans* Duftschmid, 1805
- Aphodius (Alocoderus) hydrochaeris* (Fabricius, 1798)
- Aphodius (Anomius) castaneus* Illiger, 1803
- Aphodius (Aphodius) fimetarius* (Linnaeus, 1758)
- Aphodius (Bodiloides) ictericus ghardimaouensis* Balthasar, 1929
- Aphodius (Bodilopsis) rufus* (Moll, 1782)
- **Aphodius (Bodilus) beduinus* Reitter, 1892
- Aphodius (Bodilus) longispina* Küster, 1854
- Aphodius (Bodilus) lugens* Creutzer, 1799
- **Aphodius (Calamosternus) algiricus* Mariani & Pittino, 1983
- Aphodius (Calamosternus) granarius* (Linnaeus, 1767)
- Aphodius (Calamosternus) mayeri* Pilleri, 1953
- Aphodius (Chilothorax) lineolatus* Illiger, 1803
- Aphodius (Eudolus) quadriguttatus* (Herbst, 1783)
- Aphodius (Euorodalus) tersus* Erichson, 1848
- Aphodius (Labarrus) lividus* (A. G. Olivier, 1789)
- Aphodius (Liothorax) plagiatus* (Linnaeus, 1767)
- Aphodius (Melinopterus) consputus* Creutzer, 1799
- Aphodius (Nimbus) obliteratedus* Panzer, 1823
- Aphodius (Subrinus) sturmi* Harold, 1870
- Brindalus porcicollis* (Illiger, 1803)
- Platytomus laevistriatus* (Perris, 1870)
- Platytomus tibialis* (Fabricius, 1798)
- Pleurophorus caesus* (Panzer, 1796)
- Psammodius pierottii* Pittino, 1979
- Rhyssemus plicatus* (Germar, 1817)

Scarabaeinae Latreille, 1802

- Copris hispanus cavolinii* (V. Petagna, 1792)
- Euoniticellus fulvus* (Goeze, 1777)

Bubas bison (Linnaeus, 1767)
Cheironitis ungaricus irroratus (P. Rossi, 1790)
Onthophagus (Onthophagus) taurus (Schreber, 1759)
Onthophagus (Palaeonthophagus) andalusicus Waltl, 1835
Scarabaeus (Ateuchetus) semipunctatus Fabricius, 1792
Scarabaeus (Ateuchetus) variolosus Fabricius, 1787

Melolonthinae Samouelle, 1819

Anoxia (Mesanoxia) matutinalis matutinalis Laporte, 1832
 **Amphimallon (?) scutellare* (P. H. Lucas, 1846)
 **Aplidia hirticollis* Burmeister, 1855

Dynastinae MacLeay, 1819

Oryctes (Oryctes) nasicornis grypus (Illiger, 1803)
Pentodon bidens punctatus (Villers, 1789)
Phyllognathus excavatus (Forster, 1771)

Cetoniinae Leach, 1815

Aethiessa floralis (Fabricius, 1787)
Cetonia (Cetonia) aurata pisana Heer, 1841
Protaetia (Potosia) incerta (A. Costa, 1852)
Protaetia (Potosia) mayeti (Le Comte, 1906)
 **Protaetia (Potosia) opaca* (Fabricius, 1787)
Tropinota (Tropinota) squalida squalida (Scopoli, 1763)
Oxythyrea funesta (Poda von Neuhaus, 1761)
 **Lasiotrichius succinctus* (Pallas, 1781)¹

¹introduced and intercepted species in Malta whose establishment is not confirmed