An identification and informative guide to the Tenebrionidae of Malta (Coleoptera)

Martin LILLIG[1], Henry BORG BARTHET[2] & David MIFSUD[3]

ABSTRACT. A simplified dichotomous key for the identification of the 61 species of Maltese Tenebrionidae is provided. In order to aid further identification, colour photographs of most species are included and for each species ecological and other relevant notes are provided. Distribution maps of 57 species are presented.

KEY WORDS. Dichotomous key, Maltese Islands, Mediterranean.

INTRODUCTION

The Tenebrionidae, often commonly referred to as darkling beetles, is a family of beetles with some 20,000 described species worldwide. Of these, around 8,000 species are found in the Palaearctic Region (Löbl & Smetana, 2008); the European fauna is represented by almost 1,800 species. They are extremely variable in shape, size and ecological requirements.

Tenebrionids generally feed on material of plant origin including decaying matter, wood, leaf litter, pollen, as well as fungal and algal matter. Some are also scavengers while very few species are predatory especially of wood boring beetles. A small number of species are myrmecophilous. Some tenebrionids have become associated with stored grain products and are now considered as cosmopolitan pests of such commodities.

In the Maltese Islands, this group of insects is perhaps one of the best known, since so much work of a mainly taxonomic nature, has been published about it. Küster (1849) was probably the first author to mention and describe a new species from Malta, *Opatrum melitense*, which material was probably collected by Dr Leach in 1833. Gulia (1858) mentioned four common tenebrionid species that occur in Malta in a series of lectures he presented at the Palace in San Antonio Gardens. Baudi di Selve (1875; 1876; 1877) described three endemic taxa, *Tentyria laevigata leachii* (under the name *Tentyria leachii*), *Allophylax picipes melitensis* (under the name *Phylax melitensis*) and *Omophlus melitensis*, based on Maltese material conserved at the Natural History Museums of Genova and Torino in Italy. *Omophlus melitensis* was described again by Reitter (1891) under a different name, *Omophlus championi*, but was subsequently synonymised by the same author. A new species of *Blaps*, *B. foveicollis*, was described from Malta by Allard (1880) but this species was later synonymised with *B. mucronata* by Mifsud & Scupola (1998). Based on material collected in Malta by Count Alfredo Caruana Gatto and Dr Malcom Cameron, five endemic tenebrionids were described by the German coleopterist Edmund Reitter. These include *Alphasida grossa melitana*

[1] Department of Environmental Sciences, University of Basel, Biogeography Research Group, St. Johanns-Vorstadt 10, CH-4056 Basel, Switzerland / Krämersweg 55, 66123 Saarbrücken, Germany. E-mail: martin.lillig@t-online.de
[2] 12, Majestic Court East, Cross Street, Mellieħa. E-mail: henry@borgbarthet.com
[3] Department of Biology, University of Malta, Junior College, Msida MSD 1252, Malta. E-mail: david.a.mifsud@um.edu.mt

(under the name *Asida melitana*), *Stenosis melitana*, *Pseudoseriscius cameroni* (under the name *Crypticus cameroni*), *Erodius siculus melitensis* and *Pimelia rugulosa melitana* (Reitter, 1894; 1902; 1914; 1915). In a semi-popular paper entitled "*Common beetles of the Maltese Islands*", Caruana Gatto (1893) mentioned 14 species of Maltese tenebrionids and thirteen years later he co-authored a list of coleoptera from the Maltese Islands (Cameron & Caruana Gatto, 1907) in which 41 species of Tenebrionidae were included. This list was based on material which the authors collected from the Maltese Islands between the 1890's and early 1900's and a historical collection of beetles collected by Commander James John Walker between 1874 and 1876. Andres (1916) in a list of Lepidoptera, Hemiptera and Coleoptera which he collected from Malta (at the Verdala Barracks in Cospiqua) during his almost two year stay in Malta as a prisoner of war, recorded the presence of eight tenebrionids. Lanfranco (1964) listed three species of Tenebrionidae from the offshore islet of Filfla. Focarile (1969), recorded a total of 33 darkling beetles from Malta, based on previous literature and material housed at the Natural History Museum of Milan in Italy. Marcuzzi (1970) in a work on the Sicilian tenebrionids, mentioned five species as occurring in Malta and Canzoneri (1979) listed nine species of which, one, *Stenosis schembrii* was described as new. An important faunistic work on this beetle family was that by Grimm (1986) in which 31 species were reported as occurring in Malta, of which, four represented new records. Mifsud & Scupola (1998) provided information on 56 species of Maltese Tenebrionidae of which a further eight species were new records for this territory. Mifsud (1999) gave information of 11 tenebrionids associated with coastal sand-dunes in Malta, two of which were previously unrecorded. Ecological and other related studies on coastal sand-dune inhabiting organisms were carried out by Alan Deidun and his co-workers (e.g. Deidun *et al*., 2003; Borg *et al*., 2004; Gauci *et al*., 2005; Deidun, 2007; Deidun *et al*., 2010) and data on Maltese tenebrionids occurring in this type of habitat were included. Scupola & Mifsud (2002) described a new subspecies of *Heliopathes avarus* based on material collected from Dwejra in Gozo. Finally, Lillig *et al*. (2012) provided some faunistic and taxonomic updates of Maltese Tenebrionidae and included a check-list for 61 species.

The Italian tenebrionid fauna is composed of some 320 different species, of which approximately half are present in Sicily (Aliquò & Soldati, 2010). Given that the Maltese Islands comprise a considerably much smaller land area (less than 320 km^2) in comparison to Sicily (more than 25,000 km^2), and, as a consequence, lack the topographic diversity that occurs on the latter, larger landmass, the habitat gradient within the Maltese Islands is likewise limited. In fact, as a result of the low-lying nature of the Maltese island group, the vegetation type which occurs throughout the islands consists solely of those assemblages largely characteristic of the Thermo-Mediterranean zone. Yet another limitation, with respect to the Maltese Islands' flora, is the geology, which has a bearing on soil development. Since the Islands comprise a relatively homogenous stratigraphy, made up of calcareous rocks, the floral composition is, by and large, typical of calcicolous environments. As a result, the vegetation is represented by less than a third of the species that occur in Sicily. Notwithstanding all this, the 61 tenebrionid species reported for Malta, compare relatively well with those present in Sicily. Human influence is a key factor for the Maltese Islands' ecology. The population density is significant and one of the highest on a world-wide basis, with some 1,300 inhabitants per km^2. In these last 40 years there has been extensive anthropogenic influence on the Maltese natural environment with several habitats being completely destroyed or much reduced in size through fragmentation. Agricultural activity is another factor which, generally, accelerates degradation of natural habitats and the destruction of biota, through direct competition via land-take or consequent to the excessive use of pesticides and fertilizers. The tourist industry is yet another contributing element where habitat loss is concerned, with more than a million visitors to the Islands annually; the constant up-grading of infrastructure has had an overall negative impact on biological

Figure 1: Coastal garrigue, a common type of habitat in the Maltese Islands; **Figure 2**: coastal sand-dune habitat (Ramla, Gozo); **Figure 3**: Blue clay taluses in north-western Malta - typical habitat for *Centorus elongatus ecalcaratus* and *Cossyphus moniliferus moniliferus*; **Figure 4**: Woodland habitat (Buskett, Malta).

diversity. Despite their restricted size and the threats outlined above, however, the Maltese Islands still harbour a diverse array of different habitat types. One of the more common vegetation-types, which provides a habitat to a host of species, is the garrigue, which comprises a suite of assemblages including a number that are typical of coastal areas (Fig. 1). This aerohaline assemblage, or maritime garrigue, is known to provide a habitat to a significant number of tenebrionid species. Coastal sand-dunes, a biotope that is both rare and restricted in extent (due to the limited number of pocket beaches spared from unplanned coastal and leisure-related development), are also known to support

an interesting biota. Notwithstanding the pressures, the dunal area at Ramla (Fig. 2), in Gozo, which is still geomorphologically active in terms of aeolian and sediment dynamics, is habitat to several stenoecious tenebrionid species, exclusive to this locality. Some of the north-western coasts of Malta are bound by clay slopes - Blue Clay taluses - (Fig. 3) in which other specialised tenebrionid species occur. Another important coastal habitat-type, which provides refuge to tenebrionid beetles is the salt marsh. Although salt marshes are generally quite degraded, the ones that occur at Salina, Marsaxlokk and Marsaskala still harbour some interesting tenebrionids. Mature woodland habitats, with well-developed forest ecosystems, are restricted to four localities, where remnant sclerophyllous assemblages still persist. The only one of modest extent exists at Buskett (Fig. 4), where a mosaic comprising a *Quercus ilex*-dominated woodland, archaeophytes and cultivated varieties tends to merge, to form a continuous canopy. A number of tenebrionid beetles associated with woodland habitats can be found within the Buskett area. Other habitat-types within which tenebrionids occur, include the diverse landforms that make up the slopes and banks of valley systems and within archaeophytic and natural maquis assemblages.

The aim of the present work is to provide some general information on all the 61 species of tenebrionids recorded from the Maltese Islands. Besides, a simplified dichotomous key for their identification is included with drawings of certain morphological features to facilitate their interpretation. Coloured photographs of most species are also included.

MATERIAL AND METHODS

The dichotomous key for the 61 tenebrionid species recorded from Malta included several line drawings to facilitate the interpretation of morphological characters used within couplets. Characters for *Opatrum melitense* were taken from its original description. Moreover, figure 5 provides the basic morphological terminology of a generalised beetle. The photographs comprising figures 40-92 were taken using a Canon EOS 7D digital camera. For beetles smaller than 6/7mm, a Canon MP-E 65mm f/2.8 1-5X lens was attached, whereas for larger beetles, a Canon 100mm f/2.8 Macro lens was used. For some beetles, several photographs of the same specimen were taken and merged together using Photoshop to obtain a fully focused image. Appendix I provides the distribution of tenebrionid species in the Maltese Islands for which locality data from published sources only were taken. Tenebrionid names in Appendix I are arranged alphabetically; otherwise the sequence of species follows that of Löbl & Smetana (2008).

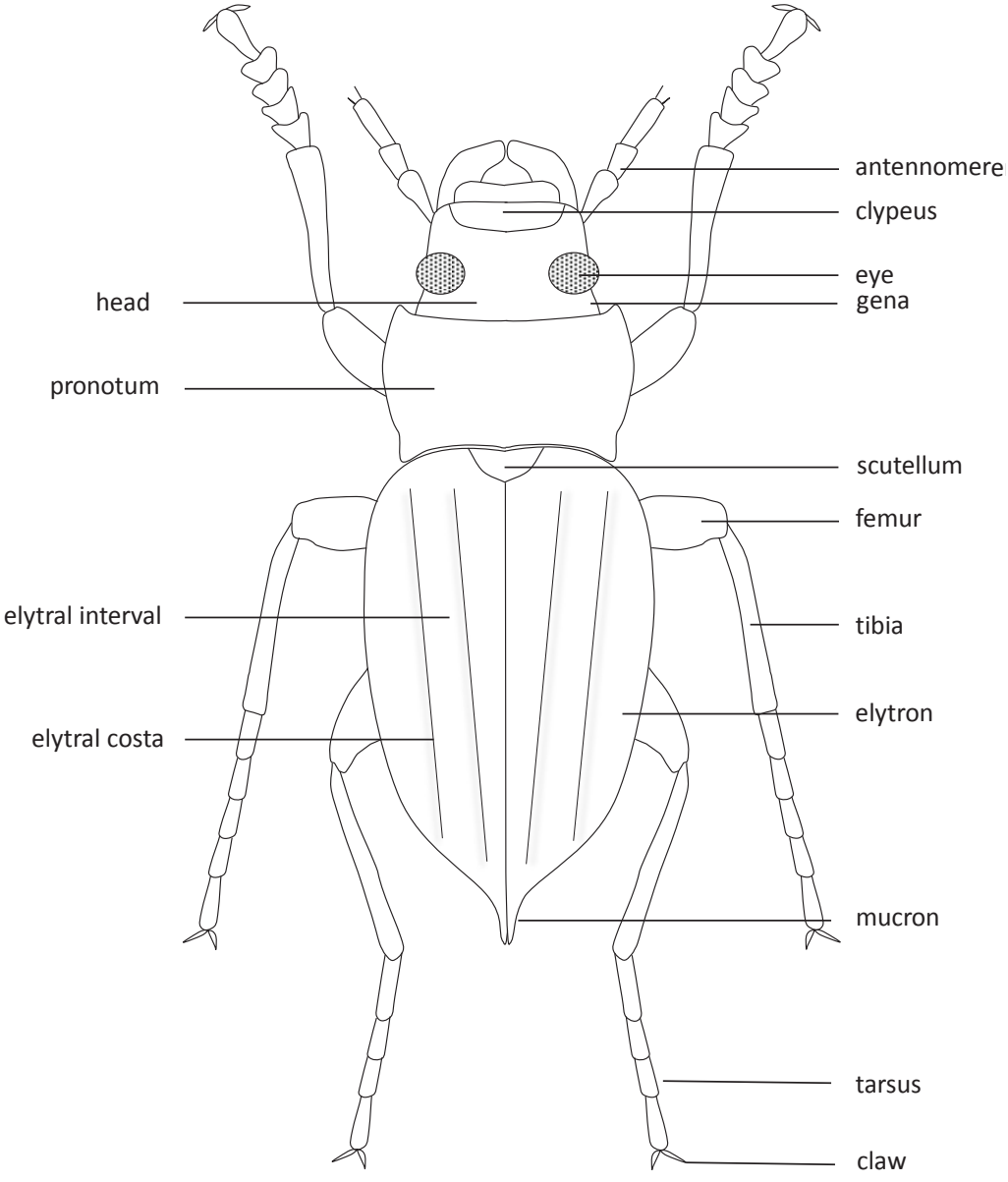


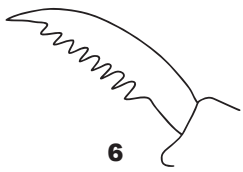
Figure 5: Diagrammatic representation of a generalised tenebrionid beetle (dorsal) with morphological terminology used in the dichotomous key.

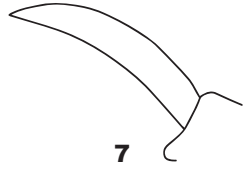
KEY TO THE MALTESE TENEBRIONIDAE

The key is only valid for Tenebrionidae occurring in the Maltese Islands. It is a simplified key and therefore it does not consider any phylogenetic relationships.

1. Claws of all tarsi pectinate (Fig. 6) ……..……..…… **2**

– Claws simple, not pectinate (Fig. 7) ……..…….....…….. **3**


6


7

2. Eyes not emarginated on the insertion of the antennae; bicoloured: head, pronotum, scutellum and ventral side black, elytra yellow; 9-10 mm .... ***Omophlus melitensis*** (Fig. 92)

– Eyes emarginated near insertion of the antennae; entirely brown; 6.2-7.3 mm …… ……..……..…… ***Isomira melanophthalma*** (Fig. 91)

3. Head not visible in dorsal view; pronotum and elytra flattened, seed-like; light brown; 5.2-5.5 mm ……..…….....……..… ***Cossyphus moniliferus moniliferus*** (Fig. 41)

– Head visible in dorsal view and shape different from the one described above …..... **4**

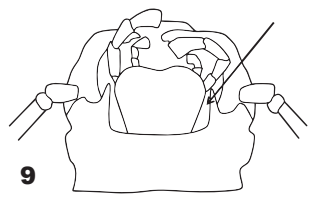
4. Elongated and slender shape; brown; elytra about 2.2 times as long as wide; last tarsal joint longer than the other joints together; antennae slender, eyes reniform; pronotum flat; elytra with 10 strongly punctured rows, 1st row not reaching base; scutellum wider than long; 7-10 mm ..... ***Centorus elongatus ecalcaratus*** (Fig. 40)

– Combination of the above mentioned characters different ….....…. **5**

5. Mentum large, without cleft between mentum and buccal fissure lobe (Fig. 8); black species ……..……..... **6**

– Mentum smaller, with cleft between mentum and buccal fissure lobe (Fig. 9); black or brown species ……..…….....……..…… **9**


8

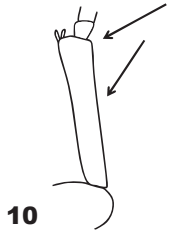

9

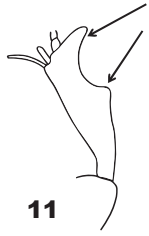
6. Dorsally completely covered with small light bristles; black; pronotum densely punctured, deeply emarginated anteriorly, hind margin bisinuate; shoulders elevated, fore tibiae apically widened, without tooth in the middle of the tibiae; 12-16 mm long …… …..……..…….....……..…… ***Alphasida grossa melitana*** (Fig. 43)

– Dorsally without bristles; shoulders not elevated ……..……..…….. **7**

7. Shiny; foretibia slender without tooth in the middle (Fig. 10); sides of pronotum narrowed posteriorly, base of pronotum much narrower than elytra in the middle; elytra without costae ……..……..……..…… **8**

– Dull; foretibia provided with a tooth in the middle and strongly dilated apically (Fig. 11); base of pronotum almost as broad as middle of elytra, sides not narrowed posteriorly; elytra with 3 costae, 1st costa weaker than the others; 10-11 mm …… ……..……..……..……..…… ***Erodius siculus melitensis*** (Fig. 46)

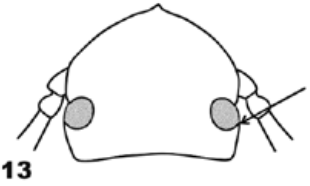

10


11

8. Eyes protruding beyond margin of head (Fig. 12); pronotum deeply punctured, sides of pronotum regularly rounded, hind margin bisinuate ……. ***Tentyria grossa grossa*** (Fig. 53)

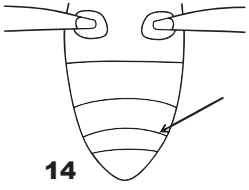
– Eyes flat, rounded with the genae (Fig. 13); pronotum weakly punctured, sides of pronotum apically less narrowed than towards the base, hind margin not bisinuate ……..……..…… ***Tentyria laevigata leachii***

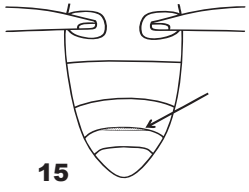

12


13

9. Membrane between 3rd and 4th abdominal ventrite not visible (Fig. 14) ……..…. **10**

– Membrane between 3rd and 4th abdominal ventrite visible (Fig. 15) ……..…….. **17**


14


15

10. Small species, length less than 6 mm …..……..……..……. **11**

– Larger species, length more than 12 mm ……..…..……..…… **15**

11. Small, less than 3 mm in length; fore tibiae broadened apically; eyes convex, protruding beyond genae; antennae 10-segmented, last 3 antennomeres round, much larger than antennomeres 2 to 7; pronotum widened apically; 2.5-3 mm .... ***Cnemeplatia atropos*** (Fig. 44)

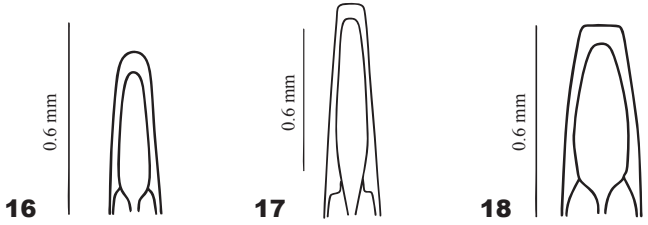
– Large, more than 3 mm in length; fore tibiae slender; eyes not convex; antennae 11-segmented **12**

12. Antennae slender, all antennomeres having about the same width; punctures on head and pronotum clearly visible; elytra without rows of punctures; longer than 4 mm ……..... **13**

– Antennae thick, middle antennomeres much broader than remaining ones; punctures of head and pronotum weak; elytral rows 1-3 with very large punctures; 2.8-3.1 mm ….…..... ..... ***Dichillus pertusus*** (Fig. 50)

13. Apical portion of aedeagus rounded; 4.5-5 mm (Fig. 16) ..... ***Stenosis melitana***

– Apical portion of aedeagus truncate (Figs. 17 & 18) …….....…….. **14**



14. Aedeagus long and slender, about 1.5 mm in length (Fig. 17); 5-6.5 mm ….....……. …… ***Stenosis freyi*** (Fig. 51)

– Aedeagus stout, about 1 mm in length (Fig. 18); c. 5 mm ..... ***Stenosis schembrii*** (Fig. 52)

15. Black; glabrous, without bulged pronotum; scutellum visible, elytra without spines …… ……..…….....……..……. **16**

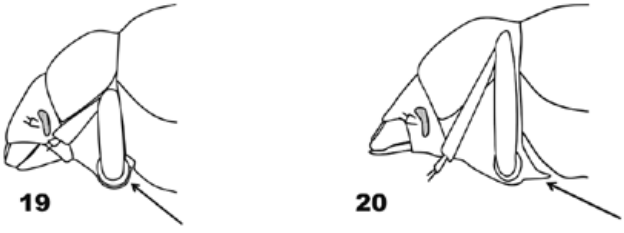
– Almost completely covered with light setae and scales, pronotum bulged, scutellum invisible, elytra with several spines ..... ***Sepidium tricuspidatum tomentosum*** (Fig. 49)

16. Pronotum flat, laterally bent up, hind corners protruding beyond base, almost as wide as elytra combined; 17-21 mm …….....…….....…….....…….. ***Akis subterranea*** (Fig. 42)

– Pronotum sphaerical, much narrower than elytra combined; 15-21 mm …..……..…… ……..…….....…….....…….. ***Leptoderis collaris*** (Fig. 45)

17. Hind tibiae flattened posteriorly, not round or oval; prosternal apophysis completely bent (Fig. 19); pronotum more than twice as wide as long; 15-17 mm …… …… ……..…….....…….....…….. ***Pimelia rugulosa melitana*** (Fig. 47)

– Hind tibiae round or oval; prosternal apophysis bent (Fig. 19) or horizontally projecting (Fig. 20); form of pronotum variable …….....…… **18**

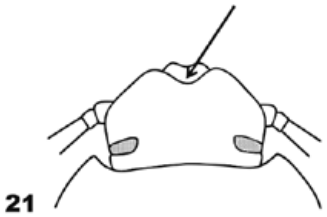


18. Dorsally covered with light erect setae; prosternal apophysis horizontally projecting (Fig. 20); black; more than 20 mm ..... ***Trachyderma lima*** (Fig. 48)

– Dorsally glabrous or covered with scales or short bristles **19**

19. Clypeus emarginated (Fig. 21); smaller than 15 mm **20**

– Clypeus not emarginated (Fig. 22); if male's clypeus is emarginated, larger than 20 mm ... **31**


21


22

20. Anterior tibiae strongly dilated; brown or reddish, not black; less than 8 mm **21**

– Anterior tibiae slender or if weakly dilated, black; 8 mm or longer **23**

21. Anterior tibiae dentate in the middle; elytra irregularly punctured; less than 5 mm **22**

– Anterior tibiae not dentate in the middle; elytra with rows of punctures; 6-7 mm ..... ***Sclerum multistriatum*** (Fig. 71)

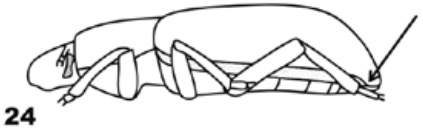
22. Elytra oval; pronotum less than twice as wide as long; middle and hind tibiae not dentate; 2.5-3.8 mm ..... ***Ammobius rufus*** (Fig. 65)

– Anterior part of the elytra parallel; pronotum twice as wide as long; middle and hind tibiae dentate; 3-4 mm ..... ***Cheirodes brevicollis*** (Fig. 64)

23. Pseudepipleura reaching apex of the elytra (Fig. 23) **24**

– Pseudepipleura shortened, not reaching apex of the elytra (Fig. 24) **26**


23

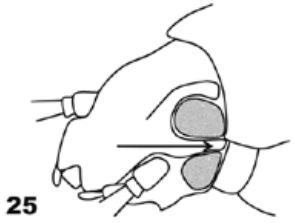

24

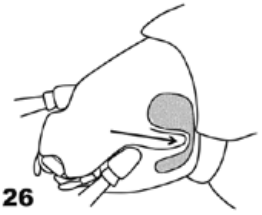
24. Sides of pronotum and posterior angles regularly rounded; shoulders rounded; eyes completely divided by genae; 9.4-11.4 mm ..... ***Heliopathes avarus dwejrensis*** (Fig. 74)

– Posterior angles of pronotum strongly directed backwards; shoulders well marked; eyes sometimes divided by genae or sometimes not **25**

25. Eyes completely divided (Fig. 25); antennae not reaching base of pronotum; 7 mm …. ……..…. ***Allophylax picipes melitensis*** (Fig. 75)

– Eyes not completely divided (Fig. 26); antennae protruding beyond base of pronotum; 10-16 mm ..…….....……..…. ***Dendarus lugens*** (Fig. 73)


25

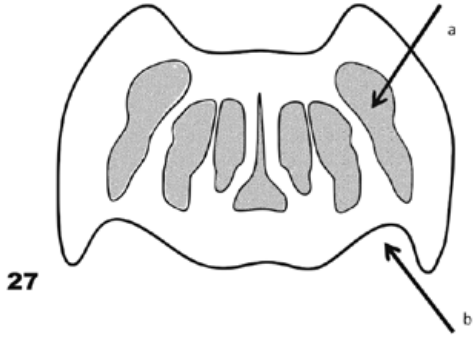

26

26. Elytra tuberculate; pronotum punctured or granulate, with or without a pattern; base of pronotum deeply or weakly emarginated …….....…… **27**

– Elytra not tuberculate; pronotum punctured or granulate, but pattern always absent; base of pronotum not emarginated …….…….....…… **28**

27. Pronotum irregularly sculptured with a pattern (Fig. 27a), base deeply emarginated near posterior corner (Fig. 27b); 10 mm .....….. ***Opatrum emarginatum*** (Fig. 70)

– Pronotum regularly granulate, not sculptured with a pattern, base weakly emarginated near posterior corner; 8.5-10mm …….....……...… ***Opatrum melitense***



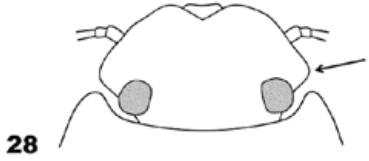
27

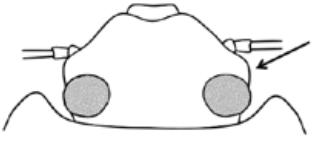
28. Eyes completely divided by the genae (Fig. 25); 6-9.5 mm ……..... ……..… ***Opatroides punctulatus punctulatus*** (Fig. 69)

– Eyes not completely divided by the genae (Fig. 26) ……..……...…….. **29**

29. Genae protruding beyond eyes (Fig. 28); pronotum granular ……....……...…. **30**

– Genae not protruding beyond eyes (Fig. 29); pronotum punctate, somewhat convex; 5-6 mm ……..……..…..... ***Clitobius ovatus*** (Fig. 66)


28


29

30. Elytral intervals with 3 rows of hairs; 8-11 mm …..... ***Gonocephalum rusticum*** (Fig. 67)

– Elytral intervals with 1 row of hairs; 4.3-5.5 mm ……..…… ……..……..…….. ***Gonocephalum setulosum setulosum*** (Fig. 68)

31. Large, more than 15 mm in length; not metallic ……....…… **32**

– Smaller species, less than 10 mm in length, if larger, metallic blue ……..…..... **39**

32. Terminal antennomere longer than antennomere 9 and 10 together and pointed apically .. **33**

– Terminal antennomere much shorter than antennomere 9 and 10 together ……...…… **35**

33. First elytral costa reaching base; 18-22.5 mm ……....…. ***Scaurus striatus*** (Fig. 76)

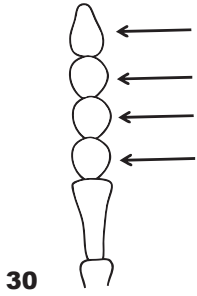
– First elytral costa not reaching base ……..……..…….. **34**

34. Disc of pronotum densly, coarsely punctured; 18-20 mm ……..…... ***Scaurus tristis***

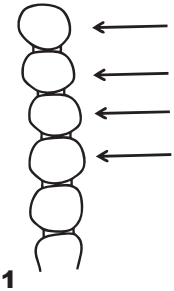
– Disc of the pronotum sparsely, finely punctured; 20-22 mm ……..…... ***Scaurus aegyptiacus***

35. Antennae protruding beyond base of pronotum; antennomeres 8 to 10 spherical, antennomere 11 pointed (Fig. 30); large species ……..…….. **36**

– Antennae not protruding beyond base of pronotum; antennomeres 8 to 10 wider than long (Fig. 31) ……..……..…….. **37**



30



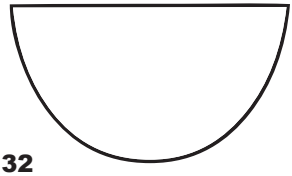
31

36. Pronotum and elytra convex; apex of elytra with a long mucron in males (2.4 - 4.0 mm); larger and more slender species, 32-38 mm ..... ***Blaps gigas*** (Fig. 55)

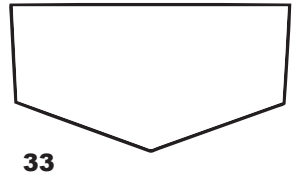
– Pronotum and elytra dorsally flattened, apex of elytra with very short mucron in both sexes (1-1.5 mm); smaller and wider species, 20-24 mm ….....…..….. ***Blaps mucronata*** (Fig. 56)

37. Scutellum semicircular (Fig. 32); pronotum with just a few punctures along the middle; clypeus deeply emarginated in males; large: c. 20 mm ..... ***Zophobas opacus*** (Fig. 78)

– Scutellum pentagonal (Fig. 33); pronotum densely punctured; clypeus never emarginated; less than 20 mm ……..……..…….. **38**



32



33

38. Antennomere 11 wider than long; dorsal side matt, 12-19 mm . ***Tenebrio obscurus*** (Fig. 77)

– Antennomere 11 as wide as long; dorsal side shiny, 12-18 mm ……. ***Tenebrio molitor***

39. Tarsal formula 4-4-4; very small, about 2 mm, brown, antennae and legs lighter; c. 2 mm ……. ***Myrmechixenus picinus*** (Fig. 87)

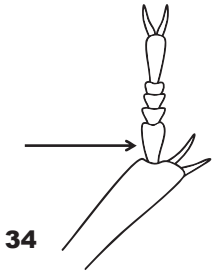
– Tarsal formula 5-5-4; larger, more than 2 mm; if about 2 mm, antennae and legs not distinctively lighter than dorsal side ……. **40**

40. Penultimate antennomere at least as long as wide, usually longer than wide; antennae never clubbed ……. **41**

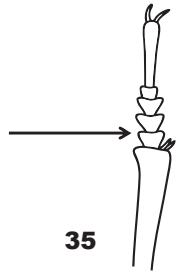
– Penultimate antennomere not prolonged, wider than long; antennae usually clubbed **48**

41. Joint 1 of the anterior tarsi longer than joint 2 and 3 together (Fig. 34) ……. **42**

– Joint 1 of the anterior tarsi shorter than joint 2 and 3 together (Fig. 35) ……. **43**



34



35

42. Light brown; dorsal side covered by white slender elongate scales; 4.5 mm ……. ***Pseudoseriscius cameroni*** (Fig. 82)

– Black; dorsal side covered by inconspicuous hair; 6.5-8.5 mm ... ***Crypticus gibbulus*** (Fig. 81)

43. Metallic blue; large; pronotum densely punctured; 13-20 mm ..... ***Helops rossii*** (Fig. 63)

– Not metallic but dark brown, black or yellow; much smaller than 13 mm **44**

44. Yellow; 6-10 mm ……. ***Xanthomus pallidus*** (Fig. 60)

– Brown or black ……. **45**

45. Eyes small, round or almost round; 4.8-5.5 mm ……. ***Gunarus parvulus*** (Fig. 62)

– Eyes reniform; usually more than 6 mm ……. **46**

46. Posterior and anterior corners of pronotum rounded; pronotum roughly punctured, some punctures elongate; 4-9 mm ……. ***Catomus rotundicollis*** (Fig. 61)

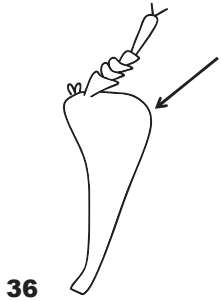
– Posterior corners of pronotum prominent; pronotum weakly punctured or with laterally wrinkled punctuation ……. **47**

47. Elytra bearing some small tubercles apically; anterior tibiae of males with a tubercle; 8-9 mm ……. ***Odocnemis* sp.** (Fig. 59)

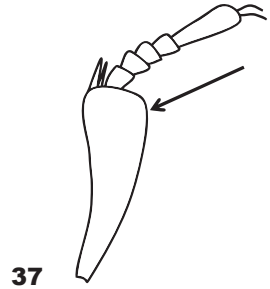
– Elytra and male tibiae without tubercles; 5-6 mm ……. ***Nalassus aemulus aemulus*** (Fig. 58)

48. At least protibiae distinctly dilated apically (Fig. 36) ……..……..……..…….. **49**

– Protibiae normal, not or just slightly dilated apically (Fig. 37) ……..……. **52**



36



37

49. Black; less than 5 mm …….....…….....……. **50**

– Yellow-red; more than 5 mm ….…….....…….....……. **51**

50. Smaller, body convex; edge of the body with long bristles; corners of the unpunctured pronotum rounded; 3-4 mm ……..... ***Trachyscelis aphodioides*** (Fig. 90)

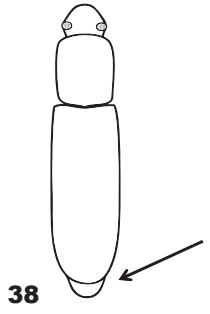
– Larger, body plain, elongate; without long bristles; corners of the punctured pronotum angled; c. 5 mm ……..…….…..…….....…. ***Phtora crenata*** (Fig. 89)

51. Elytral intervals apically convex; 7-8 mm ……...…..... ***Phaleria bimaculata bimaculata***

– Elytral intervals apically plane; 5.5-7.5 mm …..... ***Phaleria acuminata acuminata*** (Fig. 88)

52. Last abdominal tergite visible in dorsal view (Fig. 38) …...……..……..…….. **53**

– Last abdominal tergite covered by the elytra ...……...……..…….. **54**



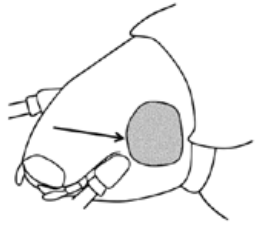
38

53. Dorsal side uniformly dark brown; 5-7 mm ……...……..…… ***Corticeus unicolor*** (Fig. 86)

– Elytra bicoloured: apically dark brown, distally much lighter; 3.5-4 mm …….……. ……. ***Corticeus bicolor*** (Fig. 85)

54. Eyes round, not even partly divided by genae (Fig. 39) ……..……. **55**

– Eyes more or less reform, at least partly divided by genae (Fig. 26) ……..……..…. **56**



39

55. Elongate, elytra about 1.8 times longer than wide; brown; elytra with regular punctuated rows, clypeus elevated; 2.5-3 mm ……..…..…… ***Palorus subdepressus*** (Fig. 72)

– Oval, elytra about 1.4 times as long as wide; brown; elytra without any punctuated rows; clypeus not elevated; 1.5-2 mm …..…….....…….. ***Pentaphyllus testaceus*** (Fig. 84)

56. Lateral margins of pronotum notched; last 3 antennomeres forming an oval club; dark brown; 2.2-2.5 mm ……..……..… ***Eledona agricola*** (Fig. 57)

– Lateral margins of pronotum entire ……..……..……..……. **57**

57. Dark brown or black; more than 4.5 mm ……..……..…… **58**

– Brown; less than 4.5 mm ……..……..……..……. **59**

58. Margins of pronotum regulary rounded; 4.5-5 mm ..……..…. ***Alphitobius laevigatus***

– Pronotum widest at base, lateral margins are almost parallel at basal two thirds; 5.5-6 mm ……..…… ***Alphitobius diaperinus*** (Fig. 54)

59. Antennae not clubbed; in males frons with 2 short horns and very long mandibles bent upward; 3.5-4.5 mm ……..……..… ***Gnatocerus cornutus*** (Fig. 83)

– Last 3 or 4 antennomeres forming a club; males and females without horns; mandibles in both sexes normal ……..……..… **60**

60. Antennal club formed by 3 antennomeres; pronotum wider than long; 3-3.5 mm ……... ***Tribolium castaneum*** (Fig. 80)

– Antennal club formed by 4 antennomeres; pronotum as wide as long; 5-6 mm …….. ……..……..…. ***Lyphia tetraphylla*** (Fig. 79)

INFORMATION FOR MALTESE TENEBRIONIDAE

Family TENEBRIONIDAE Latreille, 1802
Subfamily LAGRIINAE Latreille, 1825

***Centorus elongatus ecalcaratus* (Seidlitz, 1896)**
(Fig. 40)

Centorus elongatus ecalcaratus is distributed from Algeria to Cyprus, whereas *C. elongatus elongatus* (Herbst, 1797) is known from France and Tunisia up to the Canary Islands. In the Maltese Islands this species has a restricted distribution being mainly confined to clay slopes on the north-western coasts of Malta (e.g. Għajn Tuffieħa, Pellegrin) and Ramla in Gozo.

***Cossyphus moniliferus moniliferus* Chevrolat, 1833**
(Fig. 41)

Cossyphus moniliferus moniliferus is found in the Afrotropical Region and the Mediterranean basin. *C. moniliferus decellei* Scupola, 2000 is known from central Africa. This species, has also a restricted distribution in Malta being mainly confined to clay slopes on the north-western coasts.

Subfamily PIMELIINAE Latreille, 1802

***Akis subterranea Solier*, 1837**
(Fig. 42)

Akis subterranea is endemic to southern Italy (Calabria and Sicily) and the Maltese Islands. It represents a relatively rare species where it is often found singly in anthropogenic habitats such as close to old farm houses.

***Alphasida grossa melitana* (Reitter, 1894)**
(Fig. 43)

Alphasida grossa melitana is endemic the Maltese Islands. Two additional subspecies occur in southern Italy. It is a very common taxon generally found in diverse habitat types, even in rubble walls around agricultural fields.

***Cnemeplatia atropos* A. Costa, 1847**
(Fig. 44)

Cnemeplatia atropos is a Mediterranean species but occurs also in Asia. It is a rare species in the Maltese Islands where it was once collected from under bark of *Eucalyptus* and on another occasion it was collected from leaf litter under a carob tree (*Ceratonia siliqua*).

***Leptoderis collaris* (Linnaeus, 1767)**
(Fig. 45)

Leptoderis collaris is confined to the western Mediterranean basin. This species was once common throughout its distribution range but has steadily declined in numbers in recent years. In Malta, it is only found in anthropogenic habitats such as in old buildings and inside bastion walls.

***Erodius siculus melitensis* Reitter, 1914**
(Fig. 46)

Erodius siculus melitensis is endemic to the Maltese Islands. It is confined to coastal sand-dunes in both Malta and Gozo where it is relatively common. Two additional subspecies occur in Italy and the Balkans.

***Pimelia rugulosa melitana* Reitter, 1915**
(Fig. 47)

Pimelia rugulosa melitana is endemic to the Maltese Islands. It is commonly found in diverse habitat types including agricultural fields. Four other subspecies occur in Italy and Greece.

***Trachyderma lima* (L. Petagna, 1819)**
(Fig. 48)

Trachyderma lima is a typical Mediterranean species and relatively rare throughout its distribution range. It is a noctural species and apparently anthropophilic. In Malta it was always found near old abandoned houses and close to old farmsteads.

***Sepidium tricuspidatum tomentosum* Erichson, 1841**
(Fig. 49)

Sepidium tricuspidatum tomentosum is known from Egypt and Tunisia. In 1980 it was also reported to occur in Malta on the basis of five specimens conserved at the Natural History Museum of Berlin in Germany. The presence of this species in Malta requires validation. In Sicily this genus is represented by an endemic species, *S. siculum* Solier, 1844.

***Dichillus pertusus* (Kiesenwetter, 1861)**
(Fig. 50)

Dichillus pertusus, a myrmecophilous species, is distributed in the eastern Mediterranean and is rare throughout its distribution range. It was recorded from Malta in the early 1900's from "Porto Reale" and since then it was never found again.

***Stenosis freyi* Koch, 1940**
(Fig. 51)

Stenosis freyi is endemic to southern Italy (Sicily) and Malta. It seems to be a rare species in both Sicily and Malta, where it is known to occur near coastal areas. In Malta this species was collected only once at Golden Bay and not at Migra Ferħa as reported in Grimm (1986) (R. Grimm, *personal communication*).

***Stenosis melitana* Reitter, 1894**

Stenosis melitana is endemic to southern Italy (Sicily) and Malta. This species is very common in Malta and is found in diverse habitat types such as abandoned agricultural fields, coastal areas, garrigue etc. In winter time, adults are often found under bark of trees or woody shrubs.

***Stenosis schembrii* Canzoneri, 1979**
(Fig. 52)

Stenosis schembrii is endemic to Malta. This species is frequently found in Malta in diverse habitat types but is not at all common. It is closely related to *S. intermedia* (Solier, 1838) being distinguished from this species by subtle morphological differences.

***Tentyria grossa grossa* Besser, 1832**
(Fig. 53)

Tentyria grossa grossa is a typical Mediterranean subspecies and not very common in the Maltese Islands. It is often found under stones in garrigue habitats. Four other subspecies occur in Italy and Spain.

***Tentyria laevigata leachii* Baudi di Selve, 1875**

Tentyria laevigata leachii is endemic to the Maltese Islands. It represents a very common species and is often found under stones in garrigue habitats and under the bark of different trees. *Tentyria laevigata laevigata* Steven, 1829 is endemic to southern Italy.

Subfamily TENEBRIONINAE Latreille, 1825

***Alphitobius diaperinus* (Panzer, 1796)**
(Fig. 54)

Alphitobius diaperinus is an established alien in Europe, now having a sub-cosmopolitian distribution. It lives on stored grain products, rarely in tree cavities or under bark. It is a common species in Malta.

***Alphitobius laevigatus* (Fabricius, 1781)**

Alphitobius laevigatus is sub-cosmopolitan in distribution, and can also be considered as an established alien tenebrionid in Europe. It is often found in association with stored grain products and is a common species in Malta.

***Blaps gigas* (Linnaeus, 1767)**
(Fig. 55)

Blaps gigas represents a Turanic-Mediterranean species. In Malta this species is very common being found in both anthropogenic and natural habitats such as garrigue and steppe.

***Blaps mucronata* Latreille, 1804**
(Fig. 56)

Blaps mucronata represents a Euromediterranean species which was also introduced to North America. In Malta it is less common than *B. gigas* and is generally found in anthropogenic habitats.

***Eledona agricola* (Herbst, 1783)**
(Fig. 57)

Eledona agricola represents a Turanic-Mediterranean species. It is found in bracket fungi where large numbers are often encountered. In Malta, this species was always found in association with the bracket fungus, *Laeteporus sulphureus* var. *ceratoniae* which is common on carob trees.

***Nalassus aemulus aemulus* (Küster, 1850)**
(Fig. 58)

Nalassus aemulus aemulus represents a typical western Mediterranean species. It is confined to coastal sand-dunes and in the Maltese Islands it was only found in small numbers at Ramla in Gozo. *Nalassus aemulus calaritanus* Leo, 1985 is endemic to Sardinia.

***Odocnemis* sp.**
(Fig. 59)

This apparently nocturnal species was collected only once in Malta from Wied Babu in Zurrieq. It is closely related to *O. clypeatus* (Küster, 1851), a species which is endemic to Sicily. In order to verify whether this taxon represents a new species to science, more material is required for study.

***Xanthomus pallidus* (Curtis, 1830)**
(Fig. 60)

Xanthomus pallidus is a typical Euromediterranean species. It is confined to coastal sand-dunes and in the Maltese Islands it was only found at Ramla in Gozo.

***Catomus rotundicollis* (Guérin-Méneville, 1825)**
(Fig. 61)

Catomus rotundicollis is distributed in the western Mediterranean basin where it is commonly found in diverse habitat types. In Malta, this species is very common, often found in large numbers under the bark of different trees.

***Gunarus parvulus* (Lucas, 1846)**
(Fig. 62)

Gunarus parvulus represents a typical Mediterranean species which is mostly associated with the roots of sand-dune plants. The species was reported only once in Malta from Mellieħa Bay where a single specimen was found under bark of an *Acacia* tree. Repeated searches proved futile and the presence of this species in Malta still require validation.

***Helops rossii* Germar, 1817**
(Fig. 63)

Helops rossii represents an eastern Mediterranean species which is associated with trees and seems to be rare and with a restricted distribution in the Maltese Islands. Recorded by single captures at Chadwick Lakes and Ħas-Sabtan Valley in Birzebbugia but several specimens were once collected from Marsaxlokk under a cloth resting on the main trunk of a *Eucalyptus* tree.

***Cheirodes brevicollis* Wollaston, 1864**
(Fig. 64)

Cheirodes brevicollis represents a central Asiatic-Mediterranean species mostly found in sub-desert conditions. It was first reported from Malta on the basis of a single specimen in 1986 from Armier Bay but recently more material was collected using UV light traps from Naxxar and Mellieħa.

***Ammobius rufus* (Lucas, 1846)**
(Fig. 65)

Ammobius rufus is mainly confined to the Mediterranean basin with extensions up to Caucasus. It is found associated with roots of coastal sand-dune plants and in the Maltese Islands it is found on most sandy beaches.

***Clitobius ovatus* (Erichson, 1843)**
(Fig. 66)

Clitobius ovatus is found in the Afrotropical and Mediterranean Regions. In the Maltese Islands this uncommon species has a restricted distribution and is generally found under stones close to salt marshes and coastal habitats having fine dust alluvial deposits.

***Gonocephalum rusticum* (A.G. Olivier, 1811)**
(Fig. 67)

Gonocephalum rusticum represents a Turanic-Mediterranean species. It is generally found under stones in coastal arid areas. Apart from this habitat type, this species was also found under bark of *Eucalyptus* trees and rarely along the sides of fresh water valleys in Malta.

***Gonocephalum setulosum setulosum* (Faldermann, 1837)**
(Fig. 68)

Gonocephalum setulosum setulosum is a Turanic-Mediterranean species extending its distribution southwards to the Saharan deserts. In Malta it is generally found under stones in costal xeric environments. Another two subspecies occur in North Africa and Asia.

***Opatroides punctulatus punctulatus* Brullé, 1832**
(Fig. 69)

Opatroides punctulatus punctulatus is a Mediterranean subspecies commonly found under stones in xeric habitats. Another subspecies is known to occur from Asia Minor to central Asia, and a further one, is known from Mauritania to Sudan.

***Opatrum emarginatum* Lucas, 1846**
(Fig. 70)

Opatrum emarginatum is confined to North Africa, Italy and Malta. It is a relatively common species in Malta mainly confined to the north-western parts where it is generally found in abandoned agricultural fields and arid places.

***Opatrum melitense* Küster, 1849**

Opatrum melitense is a presumably endemic species but since its original description it was never found again in Malta.

***Sclerum multistriatum* (Forskål, 1775)**
(Fig. 71)

Sclerum multistriatum is confined to the Turanic-Mediterranean Region. It is a species which is mainly found under bark of trees and under stones. In Malta this species was reported in the early 1900's and it was never collected again since then.

***Palorus subdepressus* (Wollaston, 1864)**
(Fig. 72)

Palorus subdepressus is a cosmopolitan species probably of Afrotropical origins. It is found associated with stored products, mainly cereals, and is a common species in Malta where it is generally found in stored commodities but also under the bark of trees.

***Dendarus lugens* (Mulsant & Rey, 1854)**
(Fig. 73)

Dendarus lugens is confined to Italy and Malta. It is a termophilous and xerophytic species often found singly under stones. In Malta this species is not common but widely distributed.

***Heliopathes avarus dwejrensis* Scupola & Mifsud, 2001**
(Fig. 74)

This taxon is endemic to Gozo where it was only found on a very localised coastal area in Dwejra. Despite repeated investigations in similar habitats across the Maltese Islands, this species was not found elsewhere and it may well represent a relict species confined to Gozo. Recent developments and habitat degradation in the area may have been detrimental to this species as it was not found again. Two additional subspecies occur in Italy and Algeria.

***Allophylax picipes melitensis* (Baudi di Selve, 1876)**
(Fig. 75)

Allophylax picipes melitensis is endemic to the Maltese Islands where it is commonly found in different habitat types such as under stones in garrigue and steppe and coastal sandy beaches. *Allophylax picipes picipes* (A.G. Olivier, 1811) occurs from Algeria to Croatia.

***Scaurus aegyptiacus* Solier, 1838**

Scaurus aegyptiacus is a typical Mediterranean species. This species was found only once from Sara valley in Gozo, where the specimen was collected under a large stone embedded in dry sediment.

***Scaurus striatus* Fabricius, 1792**
(Fig. 76)

Scaurus striatus is widely distributed in southern Europe. This is a very common species in the Maltese Islands where it is often found under stones in garrigue and arid coastal habitats.

***Scaurus tristis* A.G. Olivier, 1795**

Scaurus tristis is a typical Mediterranean species. In Malta this species is much less common than *S. striatus* and is generally found under stones on disturbed ground and in anthropogenic environments.

***Tenebrio molitor* Linnaeus, 1758**

Tenebrio molitor may have originated from central Europe, but it is now cosmopolitan in distribution. In Europe, this species is mostly found in buildings, sometimes in cavities of old trees or under bark. Larvae are used as food for reptile and amphibian pets. In Malta this species is often encountered in anthropogenic environments.

***Tenebrio obscurus* Fabricius, 1792**
(Fig. 77)

Tenebrio obscurus is also cosmopolitan in distribution. In Malta, this species was found only once in a garden in Zejtun near pigeon lofts, but the species is probably more widespread. In France it is known from foodstuffs, henhouses, attics and silos.

***Zophobas opacus* (Sahlberg, 1823)**
(Fig. 78)

Originally, this species occurred from the United States to Argentine. As it is easily bred in captivity, larvae of *Z. opacus* are nowadays sold as food for reptiles and fish in pet shops in many countries throughout the world. Although found in Malta, it does not seem to be established in the wild.

***Lyphia tetraphylla* (Fairmaire, 1856)**
(Fig. 79)

Lyphia tetraphylla has a patchy distribution from Spain up to Israel and is also mentioned from North America and central Europe. It is predatory on Bostrichidae and is found in dead wood of oaks, vine shoots and other woody trees. In Malta it was collected twice using UV light traps.

***Tribolium castaneum* (Herbst, 1797)**
(Fig. 80)

Tribolium castaneum is sub-cosmopolitan is distribution and probably originated in the Indian subcontinent. It is known as a pest of stored products all over the world and sometimes it can be found in rotten wood. In Malta it is generally found where grains are stored.

Subfamily DIAPERINAE Latreille, 1802

***Crypticus gibbulus* (Quensel, 1806)**
(Fig. 81)

Crypticus gibbulus is a typical Mediterranean species. It is generally found under stones in arid places. Despite the fact that so far this species was only found in one locality in Malta (Gudja), it is probably more widespread and common.

***Pseudoseriscius cameroni* (Reitter, 1902)**
(Fig. 82)

Pseudoseriscius cameroni is confined to coastal sand-dunes and is endemic to the Maltese Islands. This species was reported from Mellieħa bay in the early 1900's but now seems to be extinct from there. However, in the 1990's the species was rediscovered in Ramla in Gozo and more recently it was also found at White Tower Bay and Armier Bay.

***Gnatocerus cornutus* (Fabricius, 1798)**
(Fig. 83)

Gnatocerus cornutus is a cosmopolitan species in distribution being found in stored foodstuffs. It is an established alien species and is commonly encountered in diverse commodities in Malta.

***Pentaphyllus testaceus* (Hellwig, 1792)**
(Fig. 84)

Pentaphyllus testaceus is widely distributed in Europe and the Mediterranean basin and also mentioned from Tajikistan. As *Eledona agricola*, this species is also found in bracket fungi where large numbers are often encountered. In Malta, this species was found in association with *Laeteporus sulphureus* var. *ceratoniae*.

***Corticeus bicolor* (A.G. Olivier, 1790)**
(Fig. 85)

Corticeus bicolor, a typical Euro-Mediterranean species with extensions in Far Eastern Russia and western Siberia, was reported from Malta in the early 1900's but since then the species was never found again. The species is mainly found in forest habitats where it occurs in wood of different trees predatory of bark beetles (Scolytidae).

***Corticeus unicolor* Piller & Mitterpacher, 1783**
(Fig. 86)

Corticeus unicolor, a typical European species with extensions in the near East, was reported from Malta in the early 1900's but since then the species was never found again. As the previous species, it is mainly confined to forest habitats where it occurs in wood of different trees predatory on bark beetles (Scolytidae). In contrast to other *Corticeus* spp., it probably feeds also on fungi.

***Myrmechixenus picinus* (Aubé, 1850)**
(Fig. 87)

Myrmechixenus picinus is mainly confined to the Mediterranean basin with extensions up to Madeira. It is probably a nocturnal species with most Maltese records being collected from afforested areas using UV light traps.

***Phaleria acuminata acuminata* Küster, 1852**
(Fig. 88)

Phaleria acuminata acuminata is widely distributed in the Mediterranean basin. It lives in coastal sand-dunes and in the Maltese Islands it is not a common species being reported from a few sandy coasts. Another two subspecies are confined to the eastern Mediterranean.

***Phaleria bimaculata bimaculata* (Linnaeus, 1767)**

Phaleria bimaculata bimaculata is also widely distributed throughout the Mediterranean basin. It is found in coastal sand-dunes and in the Maltese Islands this species is commonly found on most sandy beaches. There are three more subspecies in the Mediterranean Region.

***Phtora crenata* Germar, 1836**
(Fig. 89)

Phtora crenata is confined to the western Mediterranean basin. In the Maltese Islands this uncommon species is confined to salt marshes and brackish water pools, where it is often found under stones.

***Trachyscelis aphodioides* Latreille, 1809**
(Fig. 90)

Trachyscelis aphodioides is almost sub-cosmopolitan in distribution (European but introduced to North, Central and South America). In the Maltese Islands this coastal sand-dune species is commonly found on the main sandy beaches of Malta and Gozo.

Subfamily ALLECULINAE Laporte, 1840

***Isomira melanophthalma* (Lucas, 1846)**
(Fig. 91)

Isomira melanophthalma is confined to the western Mediterranean basin. It is commonly found on flowers between April and May in diverse habitat types in both Malta and Gozo.

***Omophlus melitensis* Baudi di Selve, 1877**
(Fig. 92)

Omophlus melitensis is endemic to the Maltese Islands. As the previous species, it is commonly found on flowers between April and May in diverse habitat types in both Malta and Gozo.

DISCUSSION

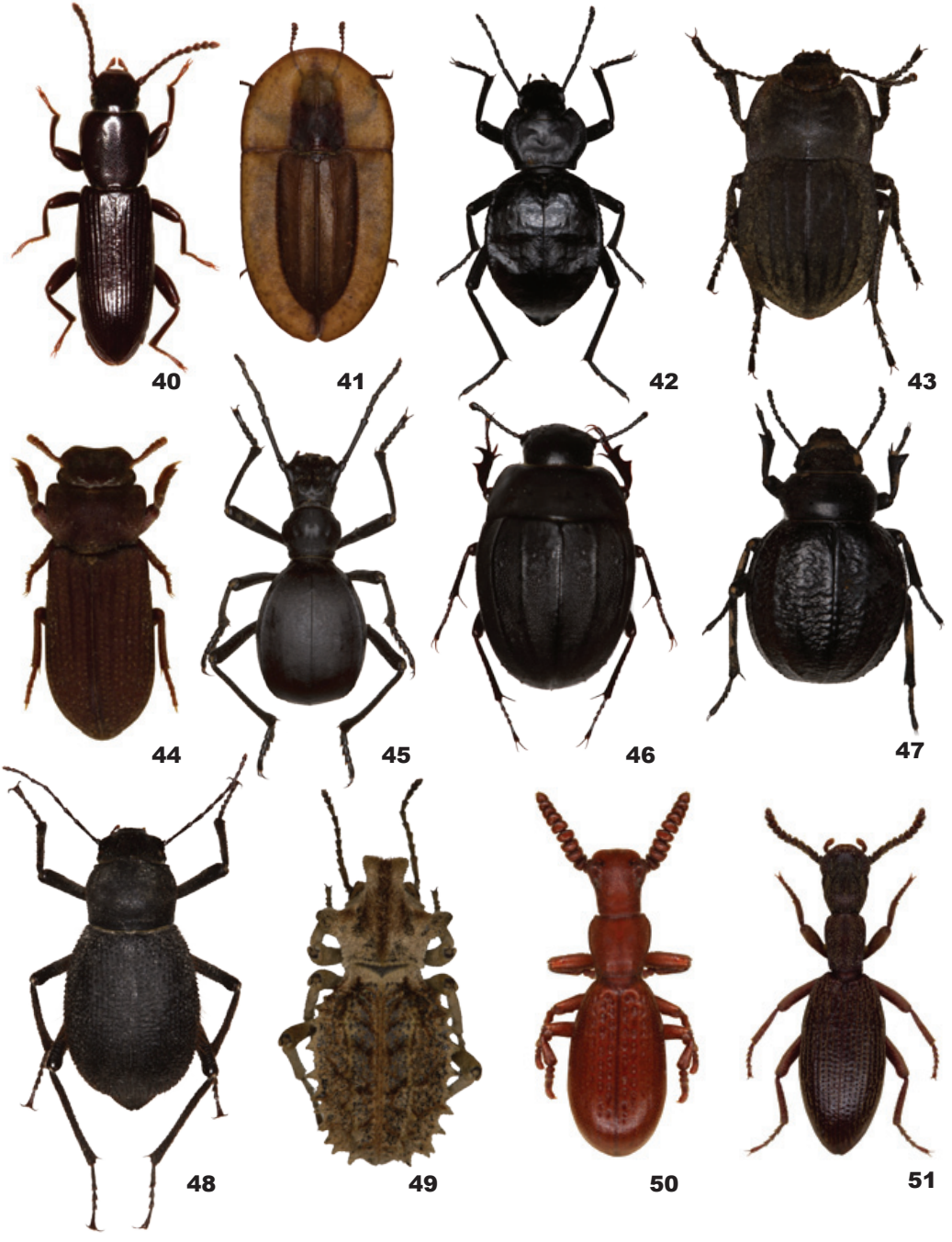
The Maltese tenebrionids can be grouped in ten different distribution categories. Three species, namely *Gunarus parvulus*, *Opatrum melitense*, and *Sepidium tricuspidatum tomentosum*, are being removed from this analysis since their presence in Malta requires validation. Widespread species are represented by 10 sub-cosmopolitan and cosmopolitan ones, and probably all were introduced by men. Ten species occur in the Mediterranean Region with extensions in the Near East and Asia (Turanic-Mediterranean - 17.2%) and two species are Afrotropical. Another ten species/subspecies occur throughout the Mediterranean basin (Holomediterranean - 17.2%), whereas five are confined to the western Mediterranean (W-Mediterranean - 8.6%) and three are confined to the eastern side (E-Mediterranean - 5.2%). Three species occur in both Europe and the Mediterranean basin (Euromediterranean - 5.2%) whereas a single species is confined to southern Europe. The most interesting taxa with very confined distributions are represented by four species (*Akis subterranea*, *Dendarus lugens*, *Stenosis freyi*, and *Stenosis melitana*) which occur in Italy and Malta and are often referred to as sub-endemic, whereas a further ten (Endemic - 17.2%) are presumably endemic to the Maltese Islands. The ratio of endemic tenebrionid taxa for the Maltese Islands is similar to that of the endemic tenebrionids of Sicily, represented by 13% (Aliquo & Soldati, 2007). The endemic Tenebrionidae of Malta consists of four species (most probably *Odocnemis* sp., *Omophlus melitensis*, *Pseudoseriscius cameroni*, and *Stenosis schembrii*) and five subspecies (*Allophylax picipes melitensis*, *Erodius siculus melitensis*, *Heliopates avarus dwejrensis*, *Pimelia rugulosa melitana*, and *Tentyria laevigata leachii*). The faunal relationships of the Maltese Islands to Italy are much closer than those to North Africa. Of the Maltese tenebrionids, 29 (excluding the sub-cosmopolitan/cosmopolitan species) occur in both North Africa and Italy. Nine species that do not occur in North Africa, are however present in Italy; and there are no North African species that are found in Malta, but not in Italy.

Pseudoseriscius cameroni is an endemic species restricted in distribution to few coastal sand-dune habitats of the Maltese Islands, and is listed in both Annex II and IV of the Habitats Directive. Other tenebrionids should require conservation and protection measures at national level. In this respect, all endemic taxa are already protected through local legislation. Sand-dune inhabiting species such as *Cheirodes brevicollis*, *Nalassus aemulus aemulus*, and *Xanthomus pallidus* would require some form of conservation strategy in Malta, since this habitat type is not only limited in space but is under high recreational pressure. Furthermore, the latter two species are only known from one locality in Gozo. *Helops rossii*, a species associated with old trees should also require conservation measures. Some species of tenebrionids may already be extinct from Malta. Thus, *Corticeus bicolor*, *Corticeus unicolor*, *Dichillus pertusus*, and *Sclerum multistriatum*, recorded from Malta in the early 1900's were never found again. This may well reflect a true decline in species diversity following extensive anthropogenic influence on the Maltese environment especially in the last 40 years.

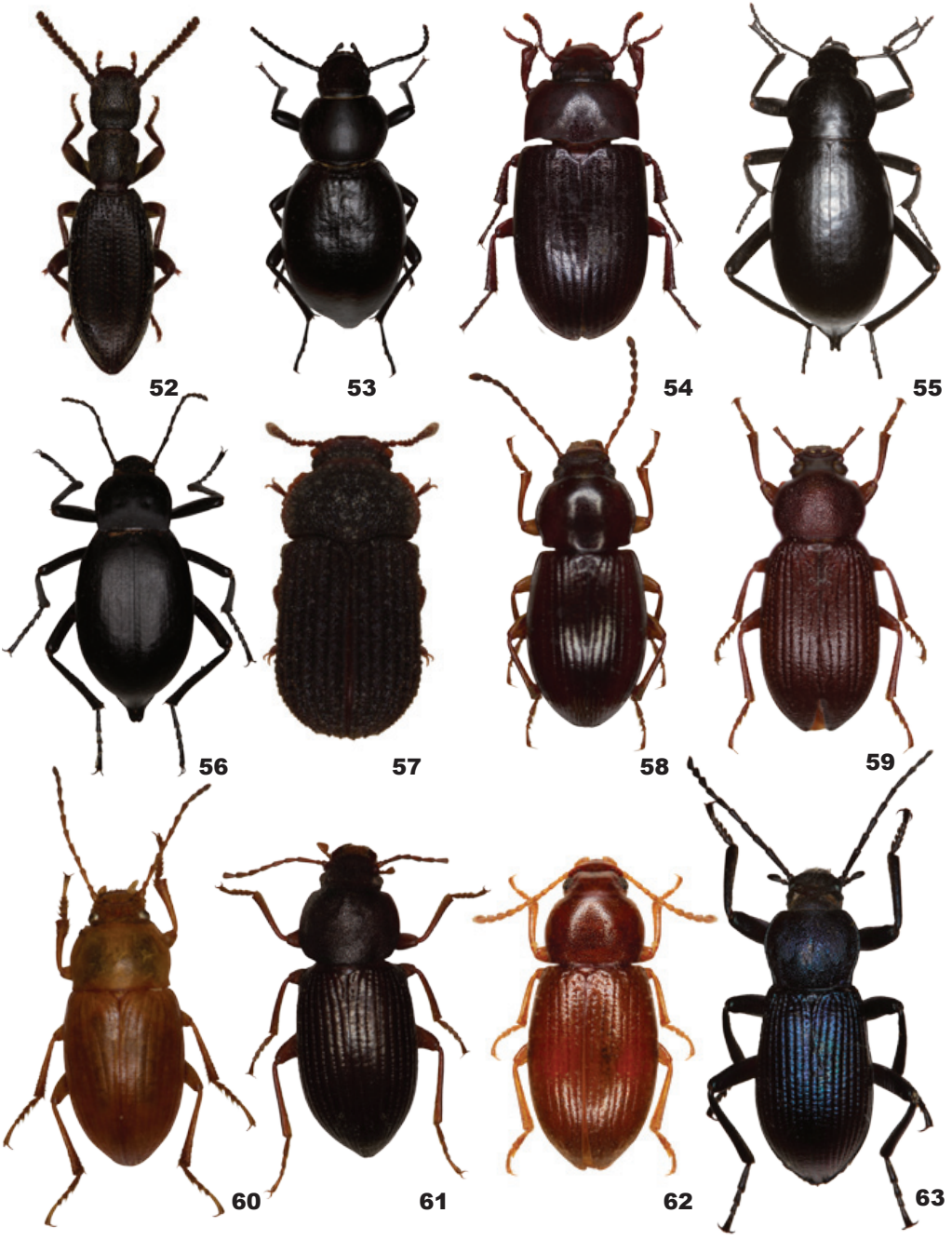
The 61 tenebrionids recorded from the Maltese Islands, even though not definite, should represent most of the species actually living (or which used to live) in this archipelago. From a faunistic point of view, we hope that a generally good overview was provided in this work and we hope that this will stimulate the interest of younger scientists to carry out further research work on these beetles.

ACKNOWLEDGEMENTS

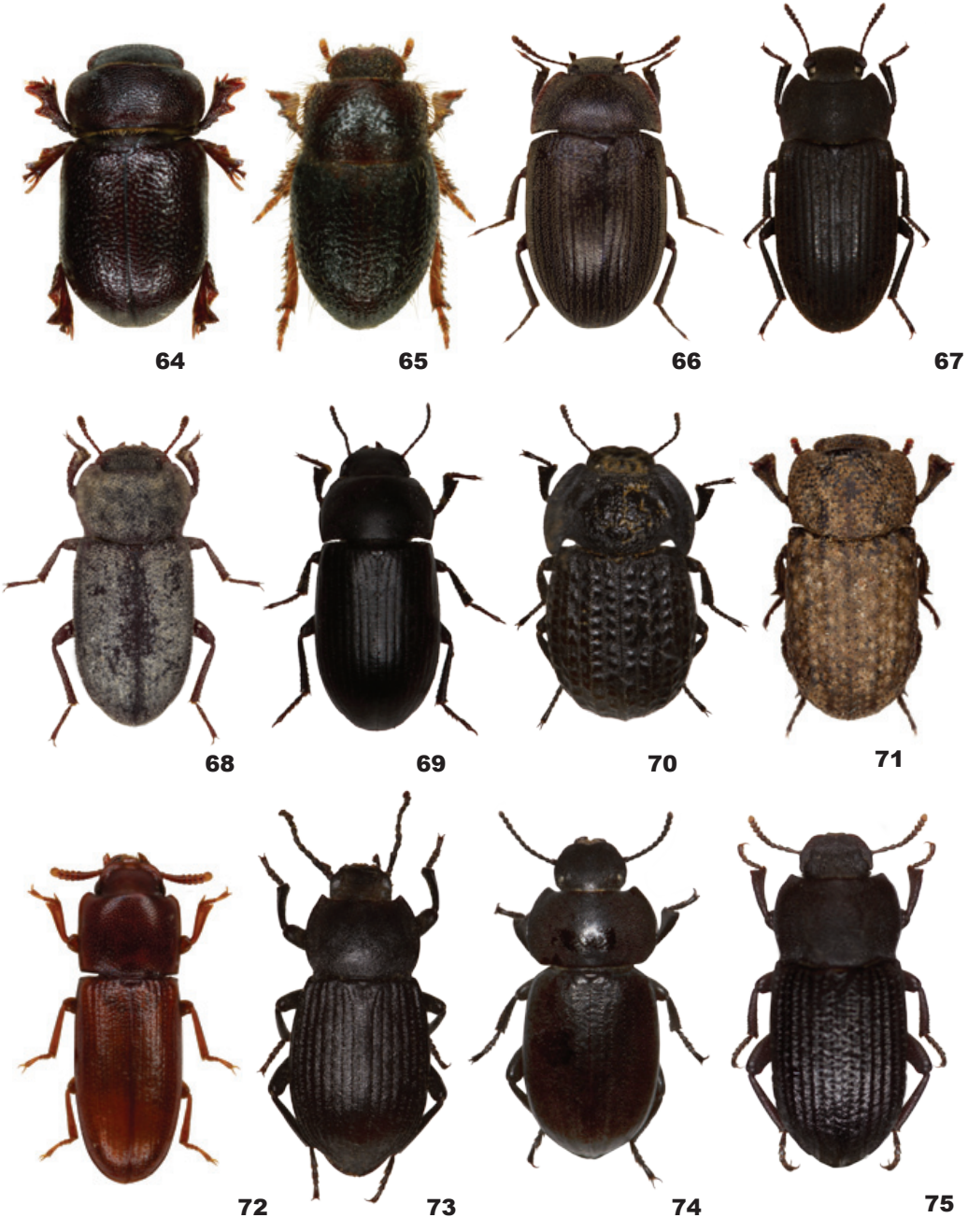
A special thanks goes to Guido Bonett for taking all photographs of Maltese Tenebrionidae (Figs. 40-92) and to Daniel Spagnol for elaborating these photos with Photoshop. We also thank Roland Grimm for allowing us to use Figs. 16-18 previously published in Grimm (1986). We also thank Dr Loui Cassar and two anonymous reviewers for their constructive comments.



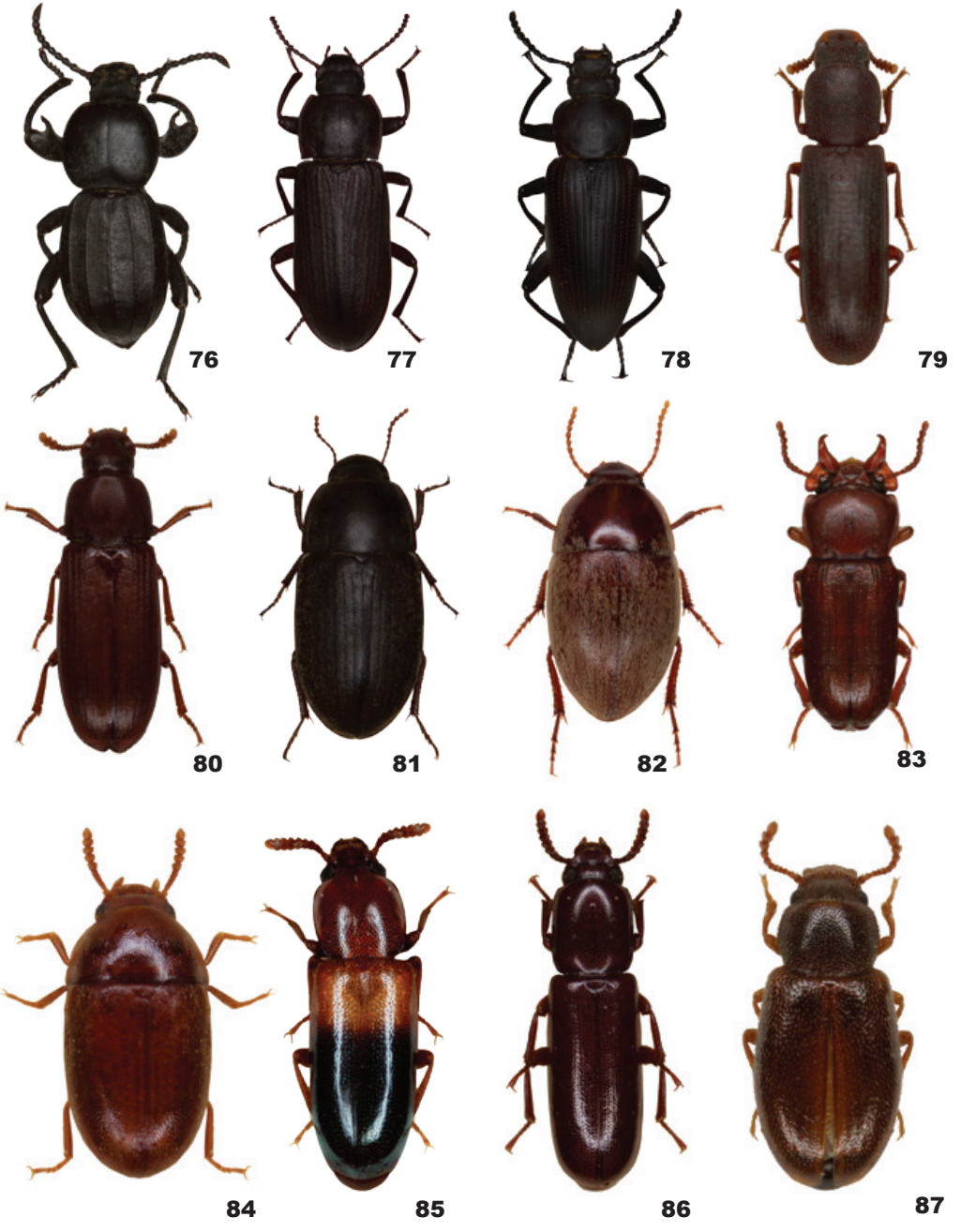
Figures 40-92: **TENEBRIONIDAE**. **40**: *Centorus elongatus ecalcaratus*; **41**: *Cossyphus moniliferus moniliferus*; **42**: *Akis subterranea*; **43**: *Alphasida grossa melitana*; **44**: *Cnemeplatia atropos*; **45**: *Leptoderis collaris*; **46**: *Erodius siculus melitensis*; **47**: *Pimelia rugulosa melitana*; **48**: *Trachyderma lima*; **49**: *Sepidium tricuspidatum tomentosum*; **50**: *Dichillus pertusus*; **51**: *Stenosis freyi*.



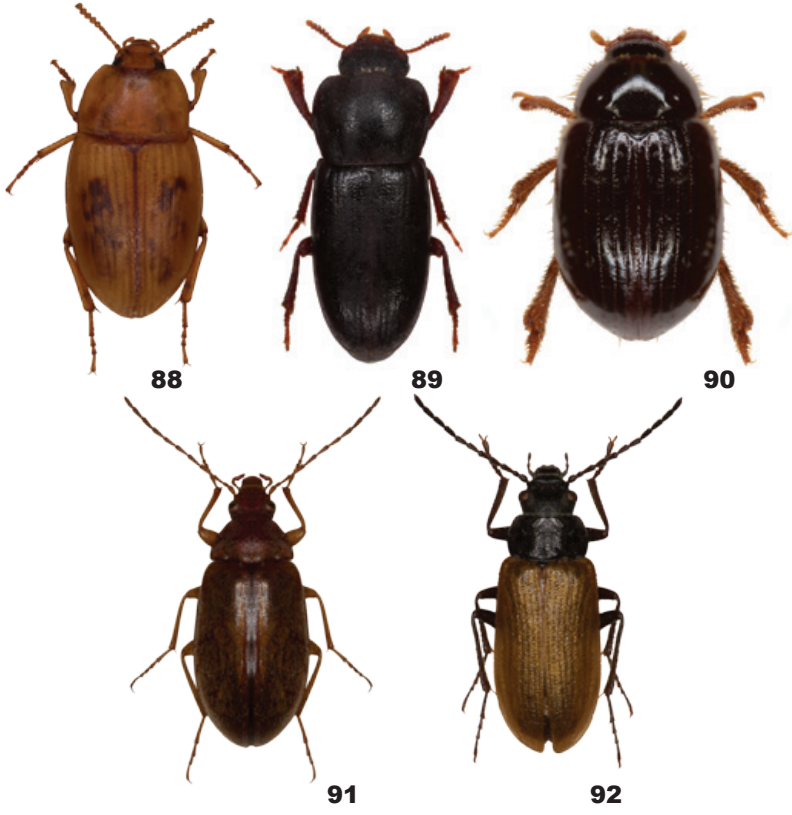
52: *Stenosis schembrii*; **53**: *Tentyria grossa grossa*; **54**: *Alphitobius diaperinus*; **55**: *Blaps gigas*; **56**: *Blaps mucronata*; **57**: *Eledona agricola*; **58**: *Nalassus aemulus aemulus*; **59**: *Odocnemis* sp.; **60**: *Xanthomus pallidus*; **61**: *Catomus rotundicollis*; **62**: *Gunarus parvulus*; **63**: *Helops rossii*.



64: *Cheirodes brevicollis*; **65**: *Ammobius rufus*; **66**: *Clitobius ovatus*; **67**: *Gonocephalum rusticum*; **68**: *Gonocephalum setulosum setulosum*; **69**: *Opatroides punctulatus punctulatus*; **70**: *Opatrum emarginatum*; **71**: *Sclerum multistriatum*; **72**: *Palorus subdepressus*; **73**: *Dendarus lugens*; **74**: *Heliopathes avarus dwejrensis*; **75**: *Allophylax picipes melitensis*.



76: *Scaurus striatus*; **77**: *Tenebrio obscurus*; **78**: *Zophobas opacus*; **79**: *Lyphia tetraphylla*; **80**: *Tribolium castaneum*; **81**: *Crypticus gibbulus*; **82**: *Pseudoseriscius cameroni*; **83**: *Gnatocerus cornutus*; **84**: *Pentaphyllus testaceus*; **85**: *Corticeus bicolor*; **86**: *Corticeus unicolor*; **87**: *Myrmechixenus picinus*.



88: *Phaleria acuminata acuminata*; **89**: *Phtora crenata*; **90**: *Trachyscelis aphodioides*; **91**: *Isomira melanophthalma*; **92**: *Omophlus melitensis*.

REFERENCES

Aliquò, V. & Soldati, F. (2010) *Coleotteri Tenebrionidi di Sicilia (Insecta: Coleoptera, Tenebrionidae)*. Monografie Naturalistiche, 1. Edizioni Danaus, Palermo, Italy. 176 pp.

Allard, E. (1880) Essai de classification des Blapsides de l'ancien monde. 1e partie. *Annales de la Société Entomologique de France*, (5) **10**: 269-320.

Andres, A. (1916) Verzeichnis der während meiner Kriegsgefangenschaft von mir auf Malta gesammelten Lepidoptera, Hemiptera und Coleoptera. *Entomologische Rundschau*, **33** (12): 57-59.

Baudi di Selve, F. (1875) Europae et circummediterraneae faunae Tenebrionidum specierum, quae Comes Dejean in suo Catalogo, edition 3ª, consignavit, ex ejusdem collectione in R. Taurinensi Musaeo asservata, cum auctorum hodierne denominatione collation. Pars quarta. *Deutsche Entomologische Zeitschrift*, **19**: 17-119.

Baudi di Selve, F. (1876) Europae et circummediterraneae faunae Tenebrionidum specierum, quae Comes Dejean in suo Catalogo, edition 3ª, consignavit, ex ejusdem collectione in R. Taurinensi Musaeo asservata, cum auctorum hodierne denominatione collation. Pars altera. *Deutsche Entomologische Zeitschrift*, **20**: 1-74.

Baudi di Selve, F. (1877) Europae et circummediterraneae faunae Heteromerum specierum, quae Comes Dejean in suo Catalogo, edition 3ª, consignavit, ex ejusdem collectione in R. Taurinensi Musaeo asservata, cum auctorum hodierne denominatione collation. Pars quarta. *Deutsche Entomologische Zeitschrift*, **21**: 385-416.

Borg, J., Deidun, A. & Schembri, P.J. (2004) Population ecology of *Phaleria acuminata* (Coleoptera: Tenebrionidae) from sandy beaches in the Maltese Islands. *Rapp. Comm. Int. Mer. Medit*., **37**: 496.

Canzoneri, S. (1979) Primi appunti sui Tenebrionidi dell'Archipelago Maltese (XXXII Contributo allo studio dei Tenebrionidi). *Lavori della Società veneziana di scienze naturali*, **4**: 20-22.

Cameron, M. & Caruana Gatto, A. (1907) A list of the Coleoptera of the Maltese Islands. *Transactions of the Entomological Society of London*, **59** (3): 383-403.

Caruana Gatto, A. (1893) Common beetles of the Maltese Islands. *The Mediterranean Naturalist - A review of natural science*, **3**(27): 447-451.

Deidun, A. (2007) *Notes on the ecological importance of the beach macrofaunal assemblages at Xatt L-Ahmar, Gozo. The Central Mediterranean Naturalist*, **4**(3): 191-194.

Deidun, A., Azzopardi, M., Saliba, S. & Schembri, P.J. (2003) Low faunal diversity on Maltese sandy beaches: fact or artefact? *Estuarine, Coastal and Shelf Science*, **58S**: 83-89.

Deidun, A., Pawley, A. & Schembri, P.J. (2010) Distribution and biology of two sympatric *Phaleria* species (Coleoptera: Tenebrionidae) on Maltese sandy beaches. Proceedings of the 39*th CIESM Congress,* Venice, Italy. 373.

Focarile, A. (1969) Sintesi preliminare sulle attuali conoscenze sui Coleotteri Tenebrionidi delle piccolo isole circum-siciliane (Col. Tenebrionidae). *Memorie della Società entomologica italiana*, **48**: 402-416.

Gauci, M., Deidun, A. & Schembri, P.J. (2005) Faunistic diversity of Maltese pocket sandy and shingle beaches: are these of conservation value? *Oceanologia*, **47**(2): 219-241.

Grimm, R. (1986) Tenebrionidae vom Maltesischen Archipel (Insecta: Coleoptera). *Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie)*, **392**: 1-17.

Gulia, G. (1858) *Corso elementare di Entomologia Maltese*. Palazzo di San Antonio, Malta. 82 pp.

Küster, H.C. (1849) *Die Käfer Europa's. Nach der Natur beschrieben*. Nürnberg: Bauer & Raspe. Heft 16: [4] + 100 sheets, 3 pls.

Lanfranco, G. (1964) Coleoptera from Filfla islet. *The Maltese Naturalist*, **1**: 1.

Lillig, M., Mifsud, D. & Grimm, R. (2012) Faunistic and taxonomic updates on the Tenebrionidae of Malta (Coleoptera). *Bulletin of the Entomological Society of Malta*, **5**: 111-119.

Löbl, I. & Smetana, A. [eds.] (2008) *Catalogue of Palaearctic Coleoptera*, Vol. 5. Tenebrionoidea. Stenstrup: Apollo Books, 670 pp.

Marcuzzi, G. (1970) Ricerche sulla fauna e sulla zoogeografia della Sicilia. XVLII Contributo alla conoscenza dei Coleotteri di Sicilia. *Bolletino dell'Accademia Gioenia di scienze naturali* (ser. 4), **10**: 406-428.

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

Mifsud, D. & Scupola, A. (1998) The Tenebrionidae (Coleoptera) of the Maltese Islands (Central Mediterranean). *Annali del Museo Civico di Storia Naturale "Giacomo Doria"*, **XCII**: 191-229.

Reitter, E. (1891) Zweiter Beitrag zur Coleopteren-Fauna von Europa und den angrenzenden Ländern. *Wiener Entomologische Zeitung*, **10**: 259-262.

Reitter, E. (1894) Einige neue Coleopteren von der Insel Malta. *Wiener Entomologische Zeitung*, **13**: 81-83.

Reitter, E. (1902) Fünfzehnter Beitrag zur Coleopteren-Fauna von Europa und den angrenzenden Ländern. *Wiener Entomologische Zeitung*, **21**: 191-196.

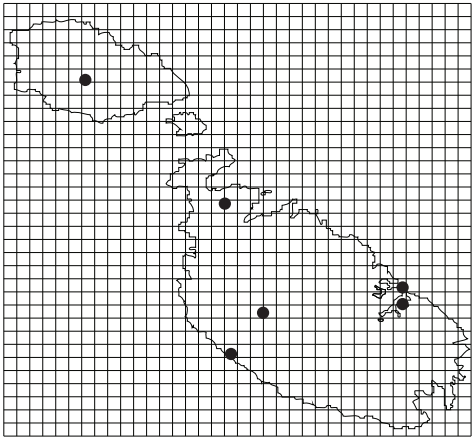
Reitter, E. (1914) Bestimmungs-Tabelle für die Unterfamilie: Erodini der Tenebrionidae aus Europa und den angrenzenden Länder. *Deutsche Entomologische Zeitschrift*, **1914**: 43-85.

Reitter, E. (1915) Bestimmungs-Tabelle der echten Pimeliiden aus der paläarktischen Fauna. *Wiener Entomologische Zeitung*, **34**: 1-63.

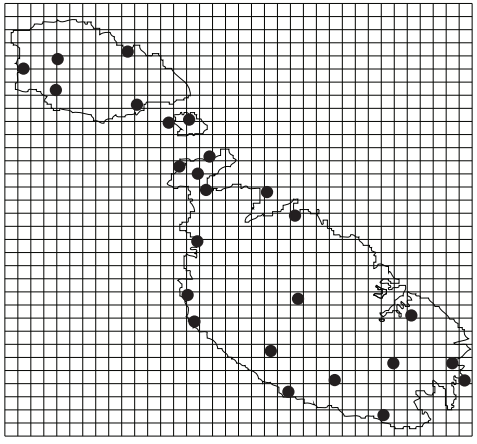
Scupola, A. & Mifsud, D. (2002) Descrizione di una nuova sottospecie di *Heliopathes avarus* Mulsant & Rey, 1854 del isola di Gozo (Archipelago Maltese) (Coleoptera, Tenebrionidae). *Doriana*, **7** (324): 1-7.

Appendix I: Distribution of tenebrionids in the Maltese Islands with species arranged alphabetically.

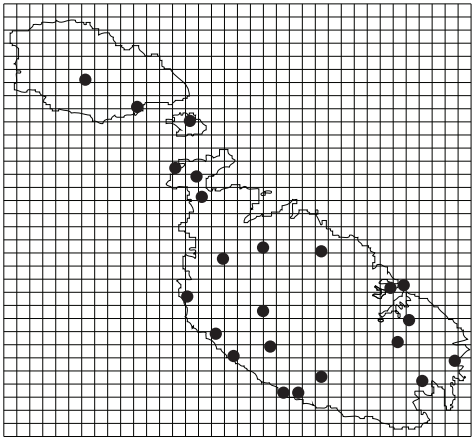
Locality details were taken from the following publications: Cameron & Caruana Gatto (1907); Andres (1916); Lanfranco (1964); Canzoneri (1979); Grimm (1986); Mifsud & Scupola (1998); Mifsud (1999); Scupola & Mifsud (2002) and Lillig *et al*. (2012). *Corticeus bicolor*, *C. unicolor*, *Opatrum melitense*, *Sclerum multistriatum* and *Sepidium tricuspidatum tomentosum* are not included as they were recorded from Malta without locality details.



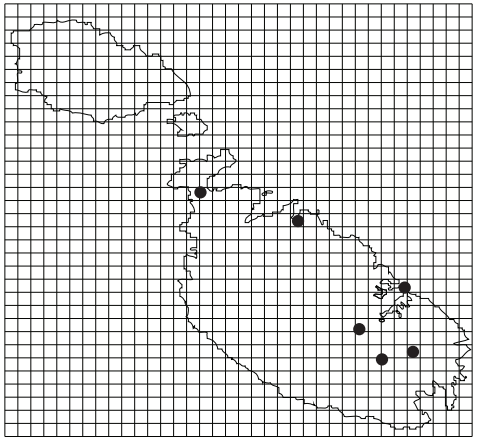
Akis subterranea (recorded also from Filfla)



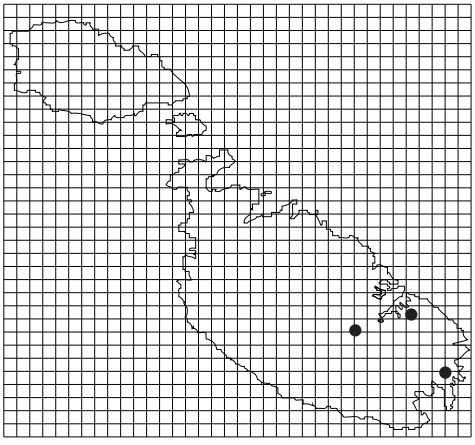
Allophylax picipes melitensis



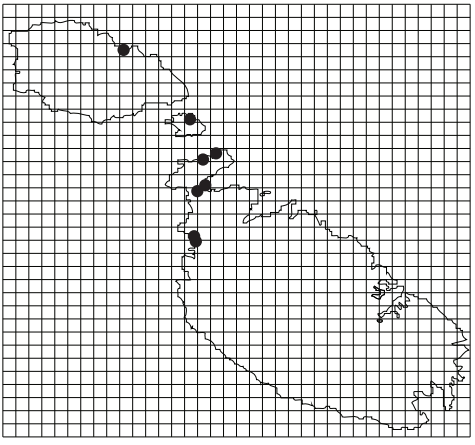
Alphasida grossa melitana (recorded also from Filfla)



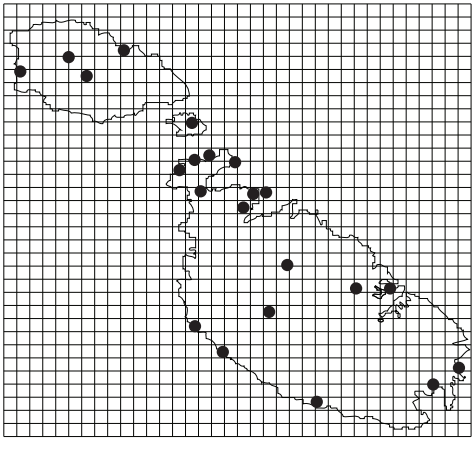
Alphitobius diaperinus



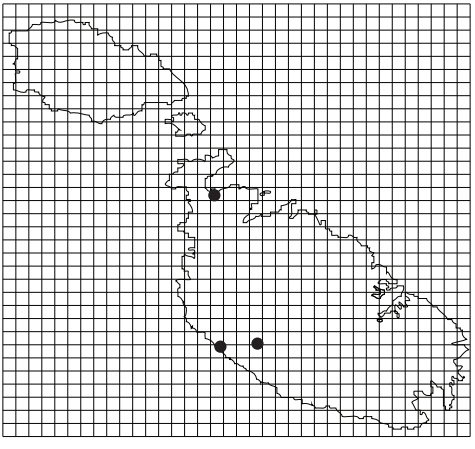
Alphitobius laevigatus



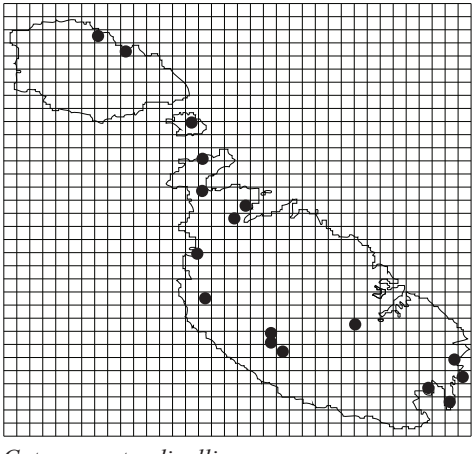
Ammobius rufus



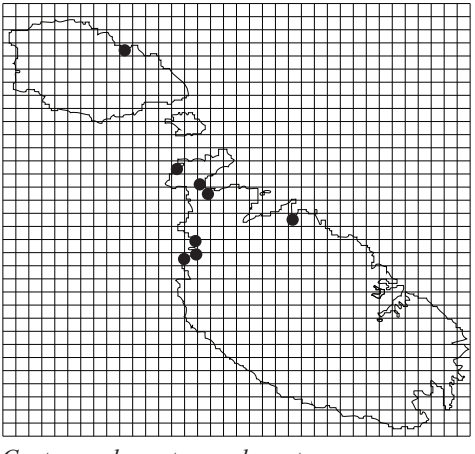
Blaps gigas



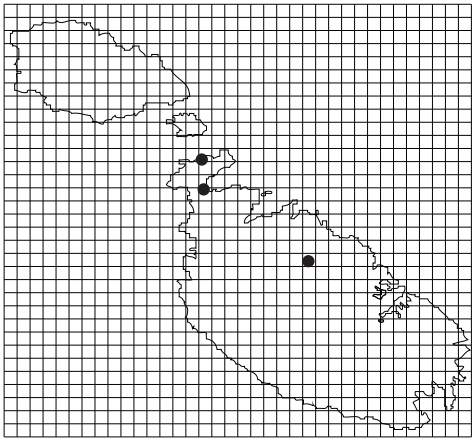
Blaps mucronata



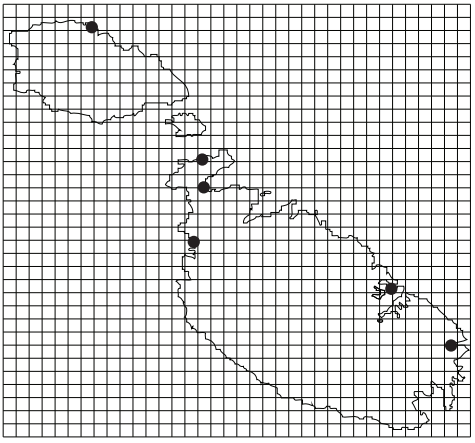
Catomus rotundicollis



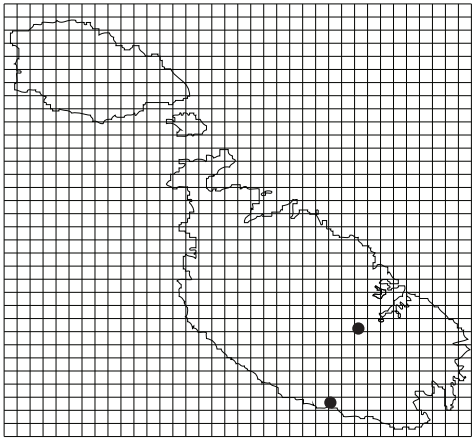
Centorus elongatus ecalcaratus



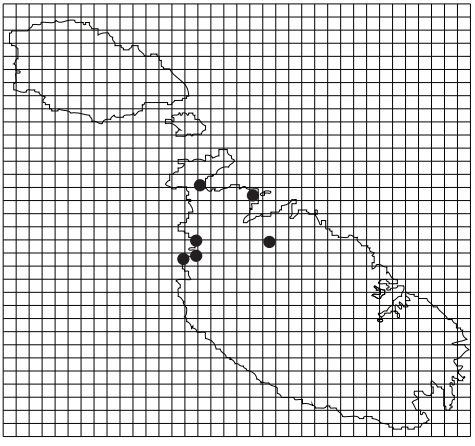
Cheirodes brevicollis



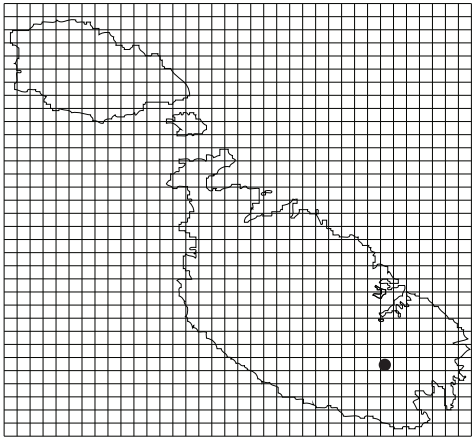
Clitobius ovatus



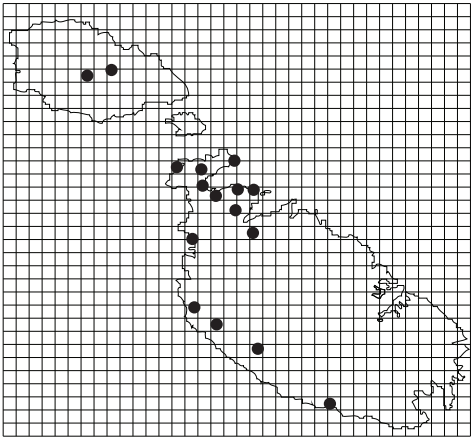
Cnemeplatia atropos



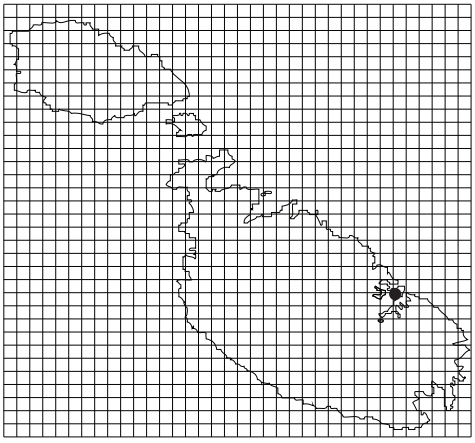
Cossyphus moniliferus moniliferus



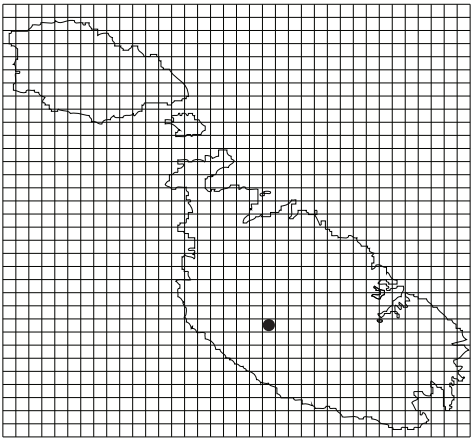
Crypticus gibbulus



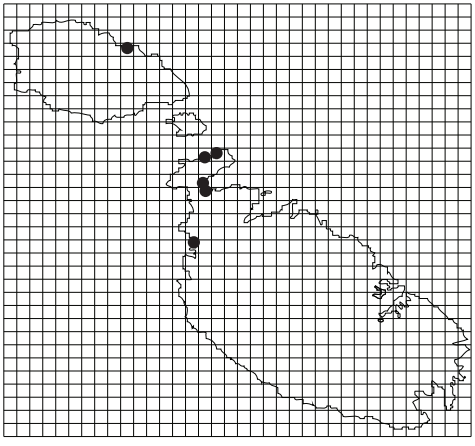
Dendarus lugens



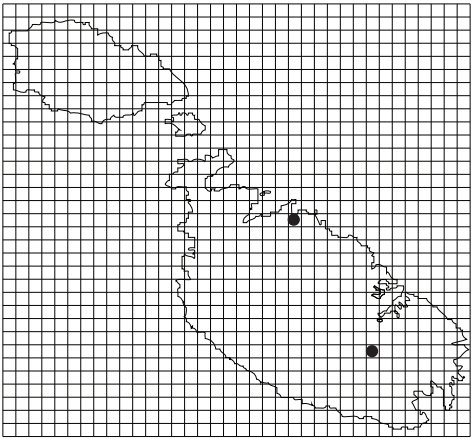
Dichillus pertusus



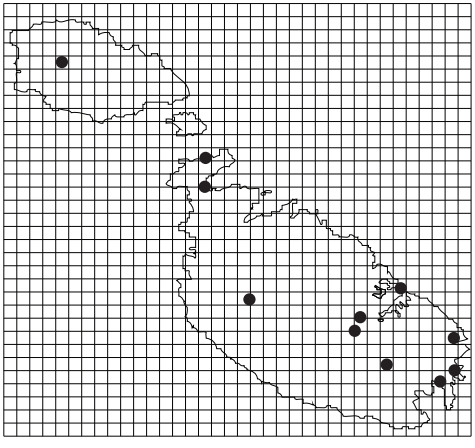
Eledona agricola



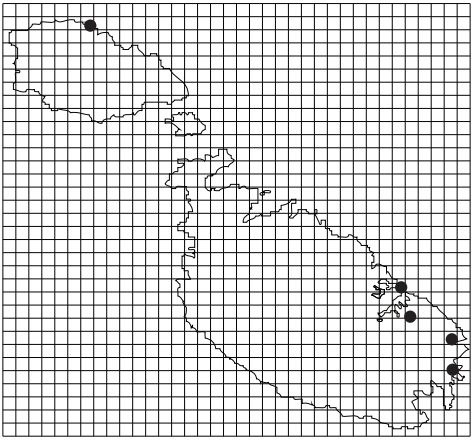
Erodius siculus melitensis



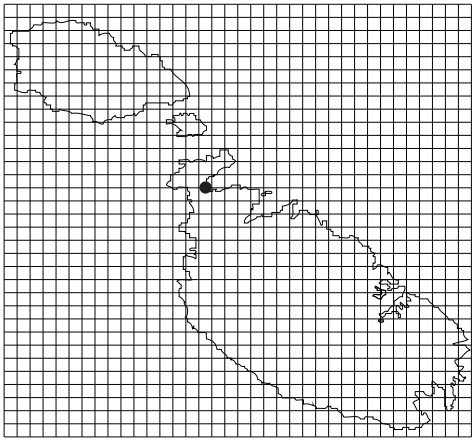
Gnatocerus cornutus



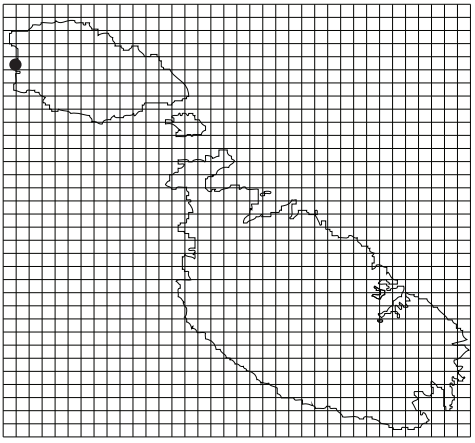
Gonocephalum rusticum



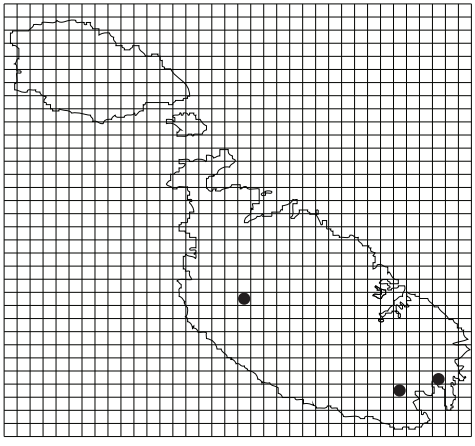
Gonocephalum setulosum setulosum



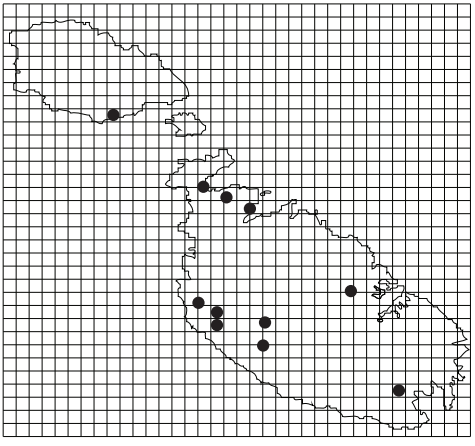
Gunarus parvulus



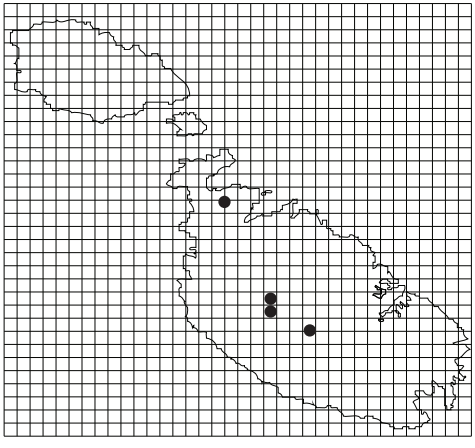
Heliopates avarus dwejrensis



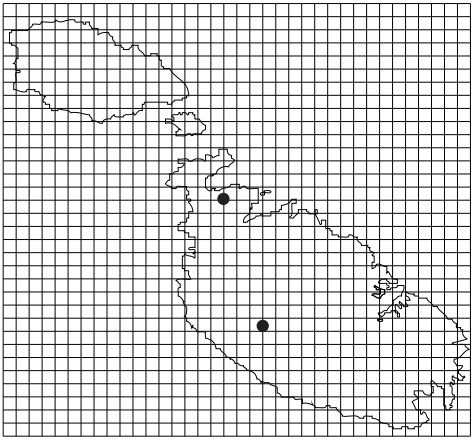
Helops rossii



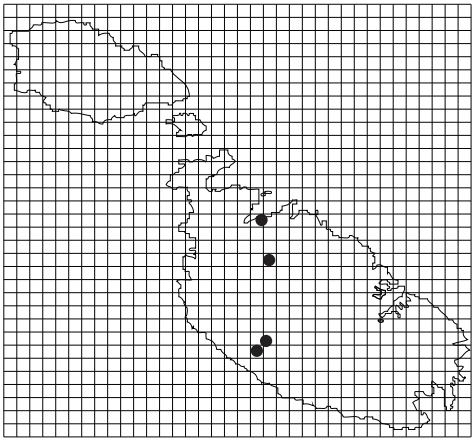
Isomira melanophthalma



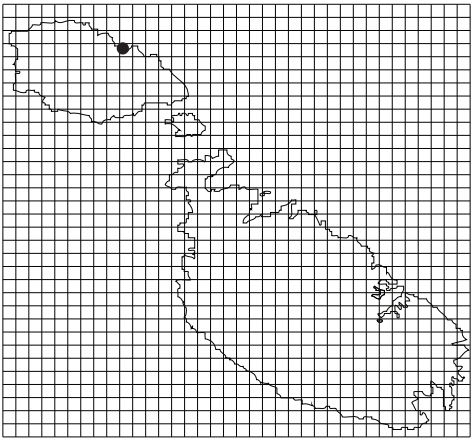
Leptoderis collaris



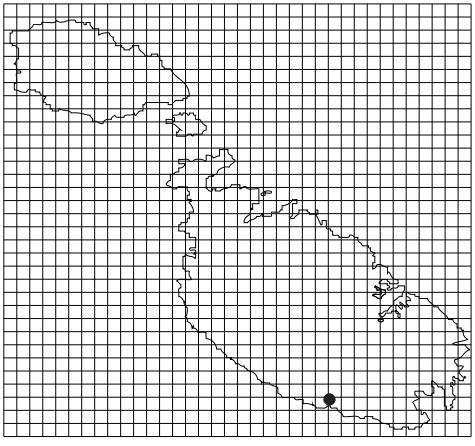
Lyphia tetraphylla



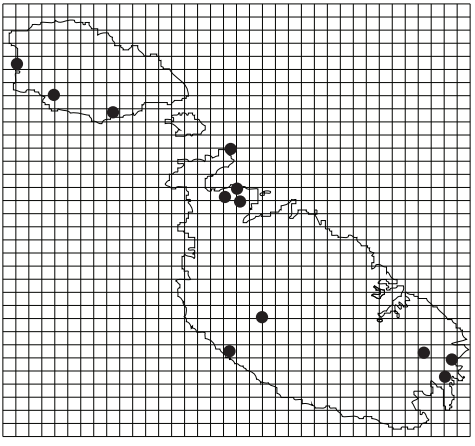
Myrmechixenus picinus



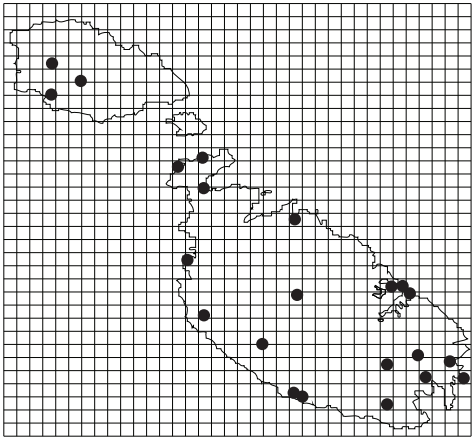
Nalassus aemulus aemulus



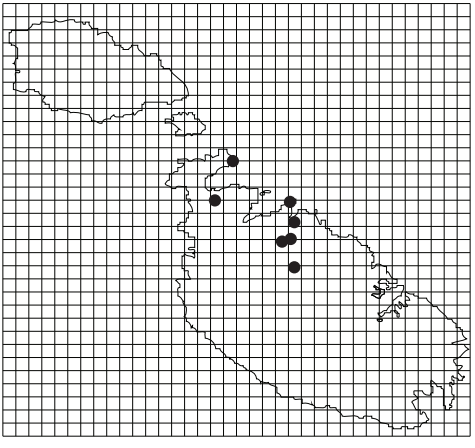
Odocnemis sp.



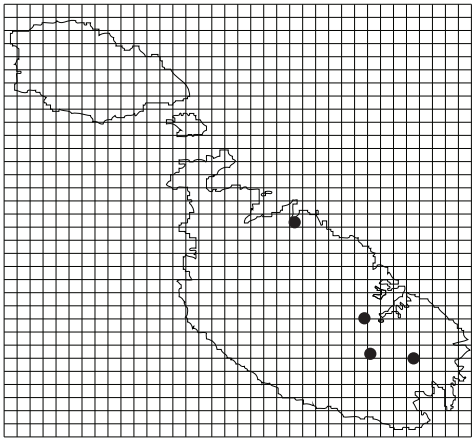
Omophlus melitensis



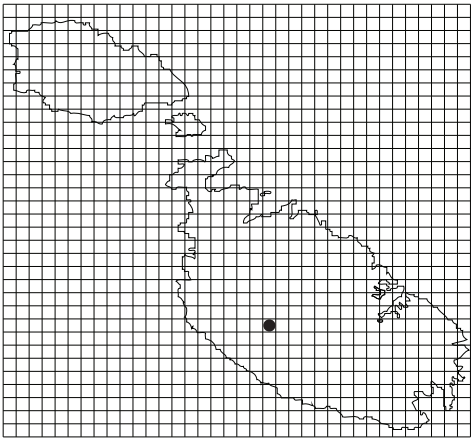
Opatroides punctulatus punctulatus



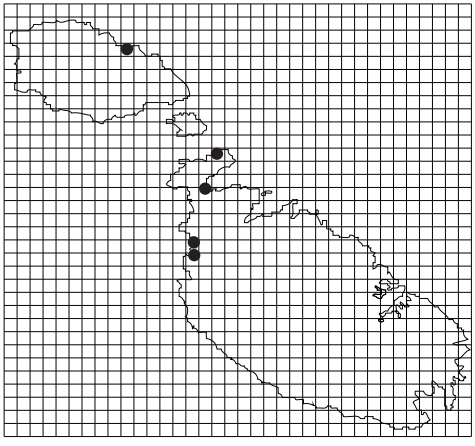
Opatrum emarginatum



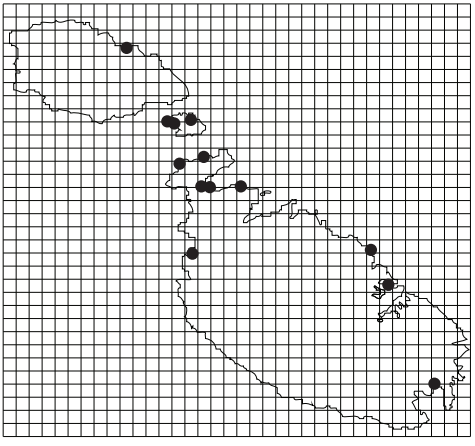
Palorus subdepressus



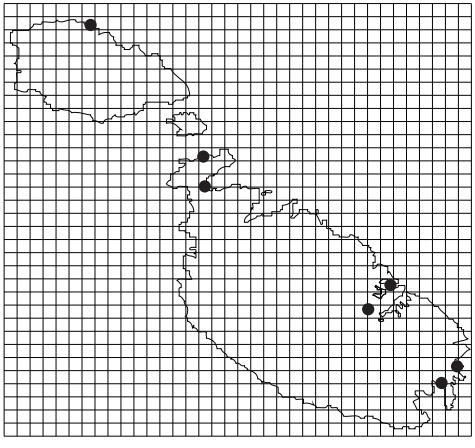
Pentaphyllus testaceus



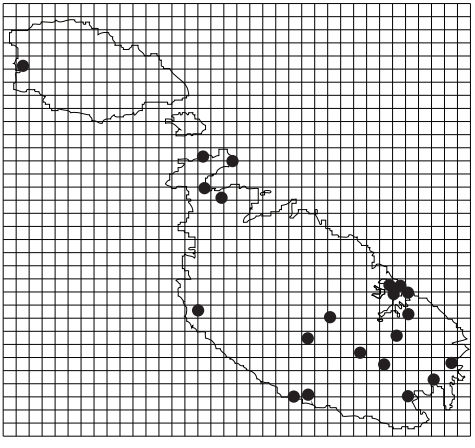
Phaleria acuminata acuminata



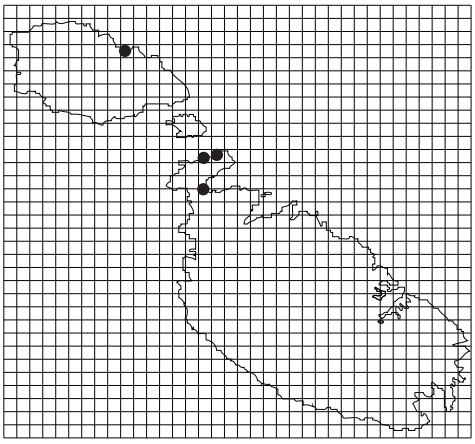
Phaleria bimaculata bimaculata



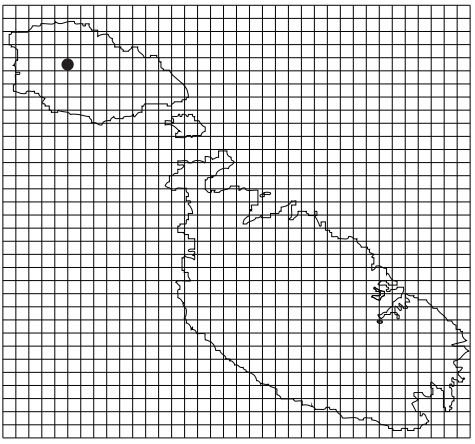
Phtora crenata



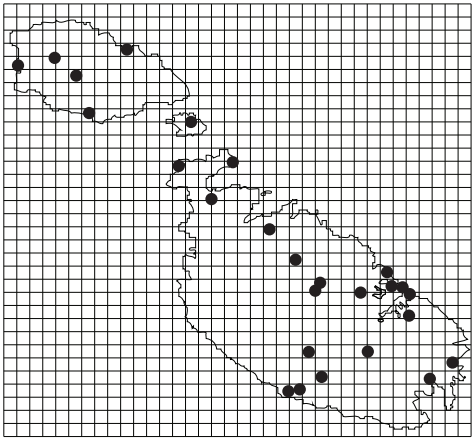
Pimelia rugulosa melitana



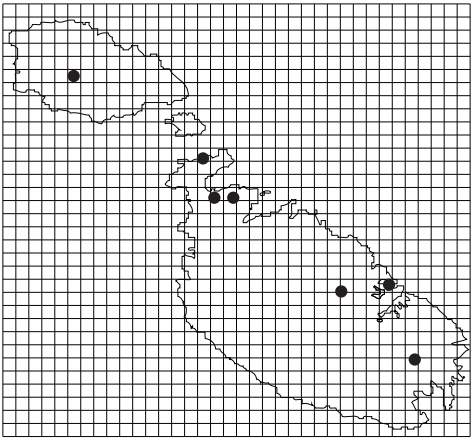
Pseudoseriscius cameroni



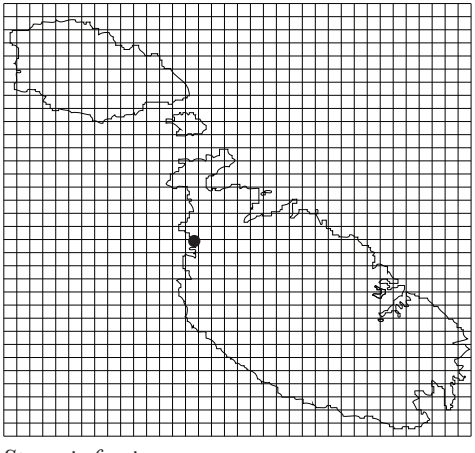
Scaurus aegyptiacus



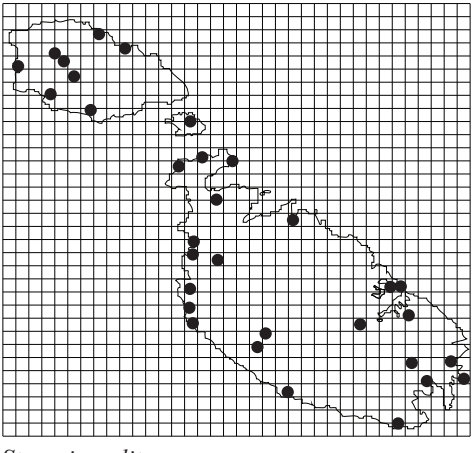
Scaurus striatus



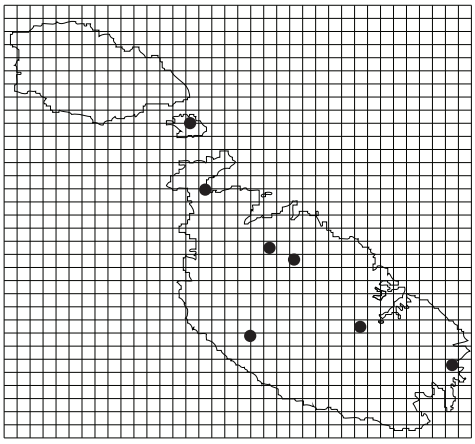
Scaurus tristis



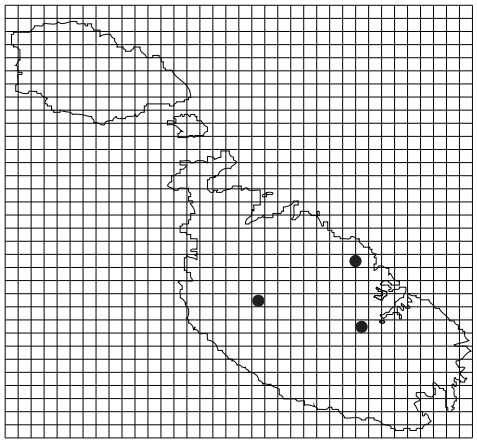
Stenosis freyi



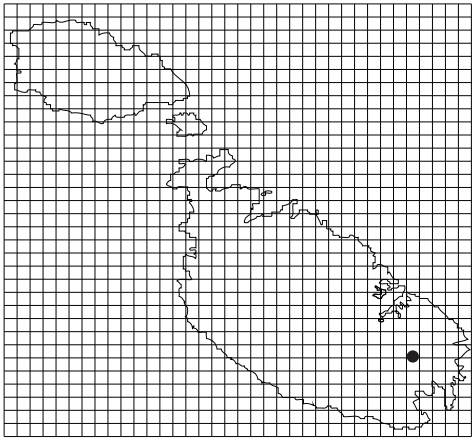
Stenosis melitana



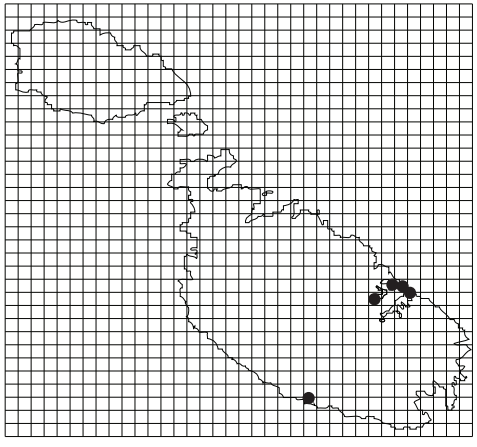
Stenosis schembrii



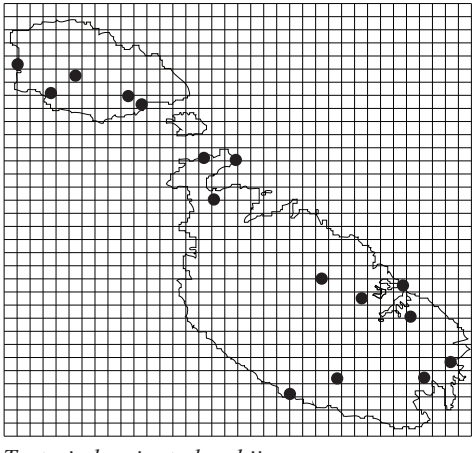
Tenebrio molitor



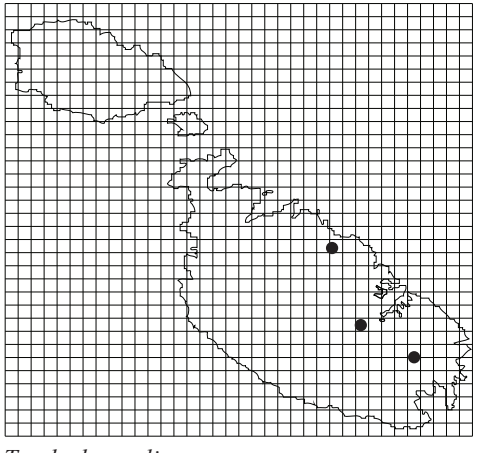
Tenebrio obscurus



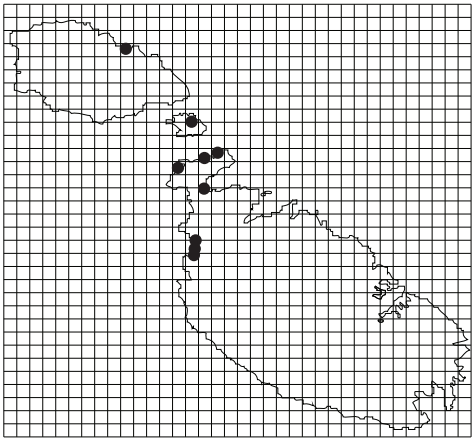
Tentyria grossa grossa



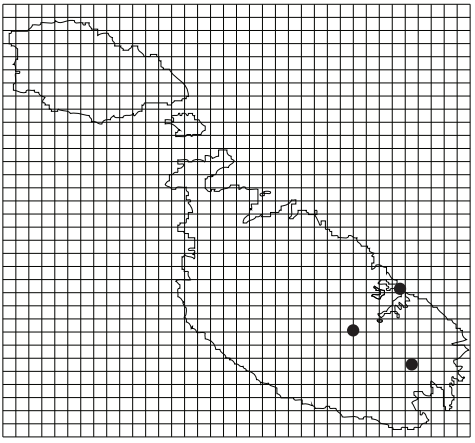
Tentyria laevigata leachii (recorded also from Filfla)



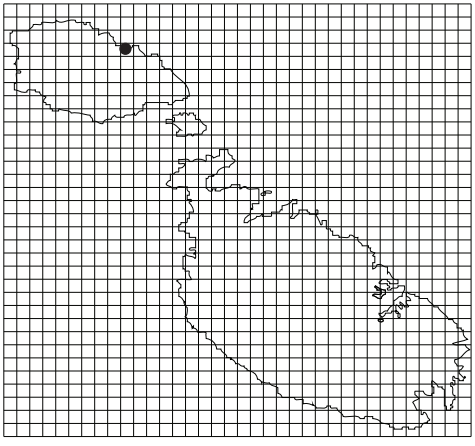
Trachyderma lima



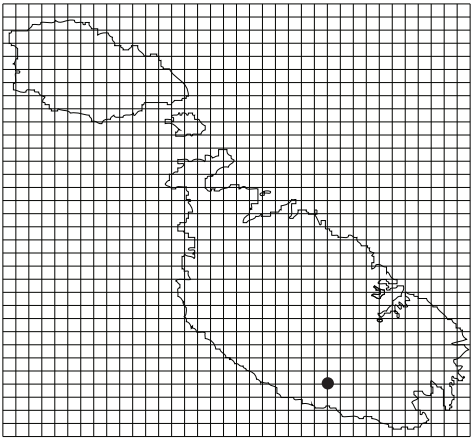
Trachyscelis aphodioides



Tribolium castaneum



Xanthomus pallidus



Zophobas opacus

Received: September 10, 2012
Accepted: October 25, 2012