

Terrestrial gastropods of the minor islets of the Maltese Archipelago (Mollusca Gastropoda)

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ABSTRACT

For this study, the terrestrial malacofauna of minor islets of the Maltese archipelago was investigated. A number of new records were found and synthesized with previous records to produce a comprehensive list of species. A brief commentary on the population, environment, habitat, and morphology for most species is given.

KEY WORDS

Maltese islands; insularity; Gastropoda; systematics; taxonomy; new records.

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INTRODUCTION

The Maltese archipelago consists of three large islands, Malta, Għawdex (Gozo) and Kemmuna (Comino), and a number of smaller islets and rocks surrounding them. For this study, Kemmuna and most of the islets supporting macrophytes were investigated for terrestrial molluscs. From east to west, these islands are: Skoll tal-Barbaġanni, Halfa Rock, Taċ-Ċawl Rock, Kemmunett (Cominotto), Kemmuna (Comino), Small Blue Lagoon Rock, Large Blue Lagoon Rock, Pigeon Rock, Selmunett (St. Paul's Islands), and Ta' Fra Ben (Figs. 1-12).

The terrestrial gastropod species richness on these islands varies depending on their dimensions and relative exposure. The molluscs on natural island reserves of Filfla and General's Rock have been subjects of intensive studies in the past (e.g. Soós, 1933; Holyoak, 1986; Beckmann, 1987, 1992; Thake & Schembri, 1989) and are not investigated here.

MATERIALS AND METHODS

In the course of about fourteen years (1998-2012), the authors collected terrestrial molluscs from the investigated islands mainly as part of a survey dealing with vegetation, the results of which can be seen in Sciberras & Sciberras (2010). The majority of sites are inaccessible, and visits to these locations were mainly achieved by swimming and climbing. Snail specimens and soil sampled from the sites were sealed in waterproof plastic bags and labelled; these were later cleaned, identified and studied.

Specimens were also recovered from stored soil samples and from previous surveys in order to assemble a concise-as-possible list of records. Literature on the terrestrial molluscs of the Maltese islands, with particular attention to Schembri (1983) and Giusti et al. (1995), was consulted in the process. Supraspecific classification follows Bouchet & Rocroi (2005) and Kokshoorn & Gittenberger (2010).

Study area: the islands

To allow for a more readable text, authorities for mollusc species were omitted in this section. The complete nomenclature is available in the section dealing with systematics.

Skoll tal-Barbaġanni (36°1'39"N, 14°19'36"E) (Fig. 1). Sparsely populated by *Inula chrithmoides* L., this is the smallest member of the Gozitan archipelago, and is frequently covered by sea spray in rough weather. Only one terrestrial mollusc, *Ferrussacia folliculum*, was recovered from this island.

Halfa Rock (36°01'45"N, 14°19'52"E) (Fig. 2). The second largest island of the Gozitan group, Halfa Rock supports about 20 species of macrophytes on a sparse terra rossa soil cover.

Taċ-Ċawl Rock (36°01'33"N, 14°18'58"E) (Fig. 3). Taċ-Ċawl Rock is not an island in the accurate sense of the word, since a narrow Upper Coralline Limestone isthmus connects it to the Gozitan mainland. Due to this, it is hypothesized that individuals in the terrestrial mollusc populations present on it are subject to occasional migration and genetic mixing with the mainland population. Nevertheless, the isthmus is frequently inundated by waves or tidal fluctuations, especially during the winter months. The rock supports about 20 species of macrophytes.

Kemmunnett (Cominotto) (36°00'49"N, 14°19'13"E) (Fig. 5). The largest island of the Kemmuna group (bar Kemmuna itself), Kemmunnett hosts close to 50 macrophyte species in the large variety of microhabitats, including cliffs, disturbed ground, garigue and steppe, concentrated within its small surface area.

Small Blue Lagoon Rock (36°00'40"N, 14°19'25"E) (Fig. 6). This sloping landmass features a low species richness, both in macrophytic and in terrestrial molluscan species. A few patches of terra rossa support the sparse clumps of vegetation present.

Large Blue Lagoon Rock (36°00'39"N, 14°19'31"E) (Fig. 7). Like the island preceding it, this rock is a steep slope with vegetation predomi-

nant on its upper half, anchored mainly in karstic terra rossa pockets. The geology of the two islands and the vegetation present are similar, though the molluscan species richness here is much more pronounced.

Pigeon Rock (36°00'31"N, 14°19'45"E) (Fig. 8). This is a very steep, high and relatively inaccessible islet with an interesting macrophytic community, hosting three endemic taxa. It is also interesting as regards its molluscan representatives - it is the only island in the Kemmuna archipelago, and indeed out of all islands investigated, to host a population of the endemic calciphile *Murella melitensis*.

Selmunett (35°57'55"N, 14°24'03"E) (Fig. 10). Also known as St. Paul's Islands, Selmunett is a group of two connected landmasses that are separated by the sea during rough weather. Boasting a high macrophytic diversity (about 100 species), it is expected that the molluscan species richness reflects this; indeed, the 12 species of gastropods recorded here reveal that this landmass has the highest diversity out of all the islands investigated (with the exception of Kemmuna and Kemmunett, the former of which is much larger). In an edition of the journal *Potamon* devoted to the natural history of the same islands, Schembri (1983) mentions 7 species of landsnails: *Theba pisana*, *Eobania vermiculata*, *Helix aspersa*, *Pomatias sulcatus melitense*, *Rumina decollata*, *Lampedusa sycacusana*, *Trochoidea calcarata* and *Trochoidea schembri*. These names are herein reproduced as they appear in the original paper; current taxonomy clumps the latter two names into one species. The finds of *Rumina decollata* and *Theba pisana* were not replicated for the present study, and they are also listed as absent from the islands in Giusti et al. (1995). On the other hand, the records of two species of *Cermeuella*, *Oxychilus draparnaudi* and *Papillifera bidens* constitute new records. The terrain of the islands is varied and alkaline terra rossa soil and xerorendzina soils characterize most of the higher parts (Savona Ventura, 1983, Farrugia Randon, 2006).

Ta' Fra Ben (35°57'35"N, 14°25'43"E) (Fig. 11). This landmass is situated off Qawra in north-western Malta and is connected by a very thin isthmus. Molluscan species diversity is low, corre-



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Figure 1. Skoll tal-Barbaganni as viewed from the south. Figure 2. Halfa Rock. Figure 3. Taċ-Ċawl Rock. Figure 4. Map of the minor islets of Gozo: q = Halfa Rock; r = Skoll tal-Barbaganni; s = Taċ-Ċawl Rock. Figure 5. Kemmaunett, as viewed from Kemmauna. Figure 6. Small Blue Lagoon Rock as viewed from the Kemmauna mainland.



7



8

Comino



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11



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Figure 7. Large Blue Lagoon Rock. Figure 8. Pigeon Rock. Figure 9. Map of the minor islets of Comino: l = Pigeon Rock; m = Large Blue Lagoon Rock; n = Small Blue Lagoon Rock; o = Kemmunett. Figure 10. Selmunett. Fig. 11. Ta' Fra Ben. Figure 12. Map of the minor islets of Malta: i = Selmunett; h = Ta' Fra Ben.

sponding to the poor vegetation cover consisting mainly of halophytes, predominantly *Arthrocnemum macrostachyum* (Moris.) Moris.

Kemmuna (Comino). The third largest island of the Maltese archipelago, Kemmuna has the largest species richness of all. Past studies and collections have been helpful in determining the overall faunal diversity of this island; still, a new record of the very common *Cantareus aspersus* was noted during the present research.

ABBREVIATIONS. Skoll tal-Barbaganni (BR); Halfa Rock (HR); Taċ-Ċawl Rock (CR); Kemmunett (Cominotto) (KT); Small Blue Lagoon Rock (SBL); Large Blue Lagoon Rock (LBL); Pigeon Rock (PR); Selmunett (St. Paul's Islands) (ST); Ta' Fra Ben (FB); Kemmuna (Comino) (KM); David Cilia (DC); new record (nr).

RESULTS

The results of the present research, including several new records, were synthesized with those in Giusti et al. (1995) to formulate a grid with all the observations (Table 1). The number of species on each island was then compared to the number of macrophytes on the same island according to Borg (1927), Camilleri (1990), Lanfranco (2002), and Sciberras & Sciberras (2009, 2010) (Fig. 13). These results are elaborated upon in the 'Systematics' section below.

SYSTEMATICS

Clade Littorinimorpha Golikov & Starobogatov, 1975
Family Pomatiidae Newton, 1891 (1828)
Subfamily Pomatiinae Newton, 1891 (1828)
Tudorella Fischer, 1885

Tudorella melitense (Sowerby, 1843)

Present records: HR, CR (nr), KT (nr), SBL (nr), LBL (nr), PR (nr), ST, KM

Remarks: This operculate species is ubiquitous. The specific status of which is based on Pfenninger et al. (2007), was found on most of the islands investigated. It demonstrates a tolerance to hypersaline conditions, as its presence close to the first

occurrences of *Inula chrithmoides* L. shows. Its absence on ST, where suitable habitats are available, remains unexplained, though it is present on the opposite headland of Mistra on mainland Malta. Specimens of *Clibanarius* sp. hermit crabs bearing *T. melitense* shells were seen around KM coasts, close to the Għemieri peninsula and Santa Marija Bay.

Clade Stylommatophora A. Schmidt, 1855
Family Chondrinidae Steenberg, 1925
Subfam. Granariinae Kokshoorn & Gittenberger, 2010
Granopupa Böttger, 1889

Granopupa granum (Draparnaud, 1801)

Present records: KT (nr), ST, KM

Remarks: The presence of this common gastropod on ST and KM confirms earlier records by Giusti et al. (1995).

Family Enidae Woodward, 1903 (1880)
Subfamily Eninae Woodward, 1903 (1880)
Tribe Chondrulini Wenz, 1923
Mastus Beck, 1837

Mastus pupa (Linné, 1758)

Present records: KT (nr), LBL (nr), ST, KM

Remarks: This gastropod was generally found at the base of grass tufts and in associated loosely aggregated soils, mostly as single specimens. The KT, LBL and KM specimens are more slender than mainland populations in Malta and Gozo.

Family Ferussaciidae Bourguignat, 1883
Ferussacia Risso, 1826

Ferussacia (s. str.) *folliculum* (Schröter, 1784)

Present records: BR (nr), KM

Remarks: Schröter's 1784 publication, preceding Gmelin's 1791 work (the source for which this species' description is often mistakenly attributed), lists this species as *F. folliculum*, which is the correct spelling as opposed to *F. folliculus*. Therefore, Welter-Schultes' opinion regarding nomenclature

(2012) is followed here. Surprisingly, this was the only terrestrial gastropod species recovered from BR, where it is found in relatively high population densities beneath leaf debris surrounding *Inula chrithmoides* stems, incidentally also the only plant which can survive on this rock (Sciberras & Sciberras, 2010). The hardiness of *F. folliculum* is partly attributable to the hardy epiphragm formed during adverse conditions.

Cecilioides Férussac, 1814

Cecilioides acicula (Müller, 1774)

Present records: none.

Remarks: Reported for ST by Giusti et al. (1995), this subterranean snail was not encountered during the present research.

Family Subulinidae Fischer & Crosse, 1877

Subfamily Rumininae Wenz, 1923

Rumina Risso, 1826

Rumina decollata (Linné, 1758)

Present records: HR, ĆR (nr), KT (nr), LBL (nr), PR (nr)

Remarks: Individuals of this omnivorous species in various stages of growth were found on several of the islands investigated. Schembri (1983) mentions this species for ST, but this find was not repeated during the present study. Dead slender shells reminding one of *R. saharica* Pallary, 1901 were occasionally recovered in sympatry with the present species, but the absence of live specimens and the intrapopulation variability of *R. decollata* shells makes a case for the presence of *R. saharica* highly hypothetical. On the other hand, *R. saharica* was recently discovered on other circum-Sicilian islands (Liberto et al., 2012).

Family Clausiliidae Gray, 1855

Subfamily Aloiinae Wagner, 1913

Tribe Medorini Nordsieck, 1997

Muticaria Lindholm, 1925

Muticaria macrostoma (Cantraine, 1835)

Present records: HR, ĆR*, KT, LBL*, PR*, KM

Remarks: Several individuals of this species were found in crevices and overhangs across the investigated islands. Intermediates of some of the four subspecies mentioned by some authors (e.g. Nordsieck, 2007; Colomba et al., 2010) exist in several cases, in fact, some of the investigated specimens correspond to the nominate form (e.g. ST), others are intermediate (e.g. PR) while others are closer to the form *oscitans* Charpentier, 1852 (e.g. ĆR, HR). In the light of this research, unpublished records (DC) and other publications that discuss this situation (Giusti et al., 1995), *M. macrostoma* is herein recognized as a species complex referable to one taxon until more molecular data becomes available.

Tribe Delimini Brandt, 1956

Papillifera Hartmann, 1842

Papillifera bidens affinis (Philippi, 1836)

Present records: HR, ĆR (nr), KT (nr), LBL (nr), ST (nr), KM

Remarks: This clausiliid was found on limestone substrates and at the bases of tufts of grass. The absence of this mollusc on ST from previous surveys is remarkable, as where present, the snail occurs in sizeable populations; however, Selmunett remains under considerable anthropogenic influence, and the presence of *Papillifera* Hartmann, 1842 (which, unlike other clausiliids, is highly subject to passive dispersal by man (Nordsieck, undated)) could be a recently induced phenomenon.

Family Oxychilidae Hesse, 1927 (1879)

Subfamily Oxychilinae Hesse, 1927 (1879)

Oxychilus Fitzinger, 1833

Oxychilus (s. str.) *draparnaudi* (Beck, 1837)

Present records: ST (nr), KM

Remarks: Several individuals of *O. draparnaudi* were found beneath stones and in soil on ST. Some of the shells recovered contained unidentified coleopteran larvae.

Family Pristilomatidae Cockerell, 1891

Vitrea Fitzinger, 1833

	BR	HR	CR	KT	SBL	LBL	PR	ST	FB	KM
<i>Cantareus apertus</i>				*	*					*
<i>Cantareus aspersus</i>				*	*					*
<i>Caracollina lenticula</i>		*	*	*				*		*
<i>Cecilioides acicula</i>								*		
<i>Cerneuella caruanae</i>								*		*
<i>Cerneuella cisalpina</i>								*		
<i>Cochlicella acuta</i>				*	*		*			*
<i>Eobania vermiculata</i>		*		*		*	*	*	*	*
<i>Ferussacia folliculum</i>	*									*
<i>Granopupa granum</i>				*				*		*
<i>Mastus pupa</i>				*		*		*		*
<i>Murella melitensis</i>							*			
<i>Muticaria macrostoma</i>		*	*	*		*	*			*
<i>Oxychilus draparnaudi</i>								*		*
<i>Papillifera bidens</i>		*	*	*		*		*		*
<i>Rumina decollata</i>		*	*	*		*	*			
<i>Sphincterochila candidissima</i>				*						*
<i>Theba pisana</i>		*	*	*					*	*
<i>Trochoidea spratti</i>		*	*	*	*	*	*	*	*	*
<i>Tudorella melitense</i>		*	*	*	*	*	*	*		*
<i>Vitrea</i> sp.								*		*
<i>Xerotricha conspurcata</i>										*
Number of species	1	8	7	14	5	7	7	12	3	18

Table 1: Terrestrial mollusc species on the smaller islands of the Maltese archipelago. The asterisks (*) denote a presence, according to a synthesis of the present study and that by Giusti et al. (1995).

Vitrea sp. sensu Giusti et al., 1995

Present records: none

Remarks: This undescribed species, native to Malta and the Aeolian islands, was reported for KM and ST by Giusti et al. (1995), although it was not encountered during the present research on either of the islands.

Family Sphincterochilidae Zilch, 1960 (1910)

Subfamily Sphincterochilinae Zilch, 1960 (1910)

Sphincterochila Ancey, 1887

Albea Pallary, 1910

Sphincterochila (Albea) candidissima

(Draparnaud, 1801)

Present records: KT (nr), KM

Remarks: *S. candidissima* was found on both islands but at very low densities on the former, generally inhabiting terra rossa soil on garigue with considerable exposure to the sun. The shade of shrubs of *Thymbra capitata* (L.), *Capparis orientalis* Veill., *Euphorbia melitensis* Parl. and *Pistacia lentiscus* (L.) offer temporary respite to a number of specimens.

Family Trissexodontidae Nordsieck, 1987

Caracollina Beck, 1837

Caracollina (s. str.) *lenticula* (Michaud, 1831)

Present records: HR, ĆR (nr), KT, KM, ST

Remarks: The presence of *C. lenticula* on ĆR is confirmed by two bleached shells found under a rock.

Family Cochlicellidae Schileyko, 1972

Cochlicella Férussac, 1821

Cochlicella (s. str.) *acuta* (Müller, 1774)

Present records: KT (nr), SBL (nr), PR (nr), KM

Remarks: Several individuals of this species were found in the central part of KM. Two fresh specimens were obtained from KT and SBL each.

Family Hygromiidae Tryon, 1866

Subfamily Geomitrinae Böttger, 1909

Tribe Trochoideini Nordsieck, 1987

Trochoidea Brown, 1827

Trochoidea (s. str.) *spratti* (Pfeiffer, 1846)

Present records: HR, ĆR (nr), KT, SBL (nr), LBL (nr), PR (nr), FB (nr), KM, ST

Remarks: This snail comes in a variety of conchological forms that have formed the basis of several descriptions (e.g. Trechmann, 1938; Beckmann, 1987). The specimens from HR are wide as they are tall, corresponding to the nominotypical form, those from SBL and LBL are flatter and more globose, corresponding to the form *schembrii* Pfeiffer, 1848, while the specimens from ST lack the evident ribbing observable in the former populations, somewhat similar to the form *calcarata* Benoit, 1860. Where found, the species generally occurs in considerable quantities.

Subfamily Hygromiinae Tryon, 1866

Tribe Helicellini Ihering, 1909

Xerotricha Monterosato, 1892

Xerotricha conspurcata (Draparnaud, 1801)

Present records: none

Remarks: Reported for KM by Giusti et al. (1995), this species was not encountered during the present research.

Tribe Hygromiini Tryon, 1866

Cerneuella Schlüter, 1838

Cerneuella (s. str.) *cisalpina* (Rossmässler, 1837)

Present records: ST (nr)

Remarks: The single specimen found on ST is characteristically whitish with a pinkish lip, similar to individuals in populations on mainland Malta.

Xeroamanda Monterosato, 1892

Cerneuella (Xeroamanda) caruanae (Kobelt, 1882)

Present records: ST (nr), KM

Remarks: The single dead shell found on ST constitutes a new record of this supposedly Maltese endemism for the island.

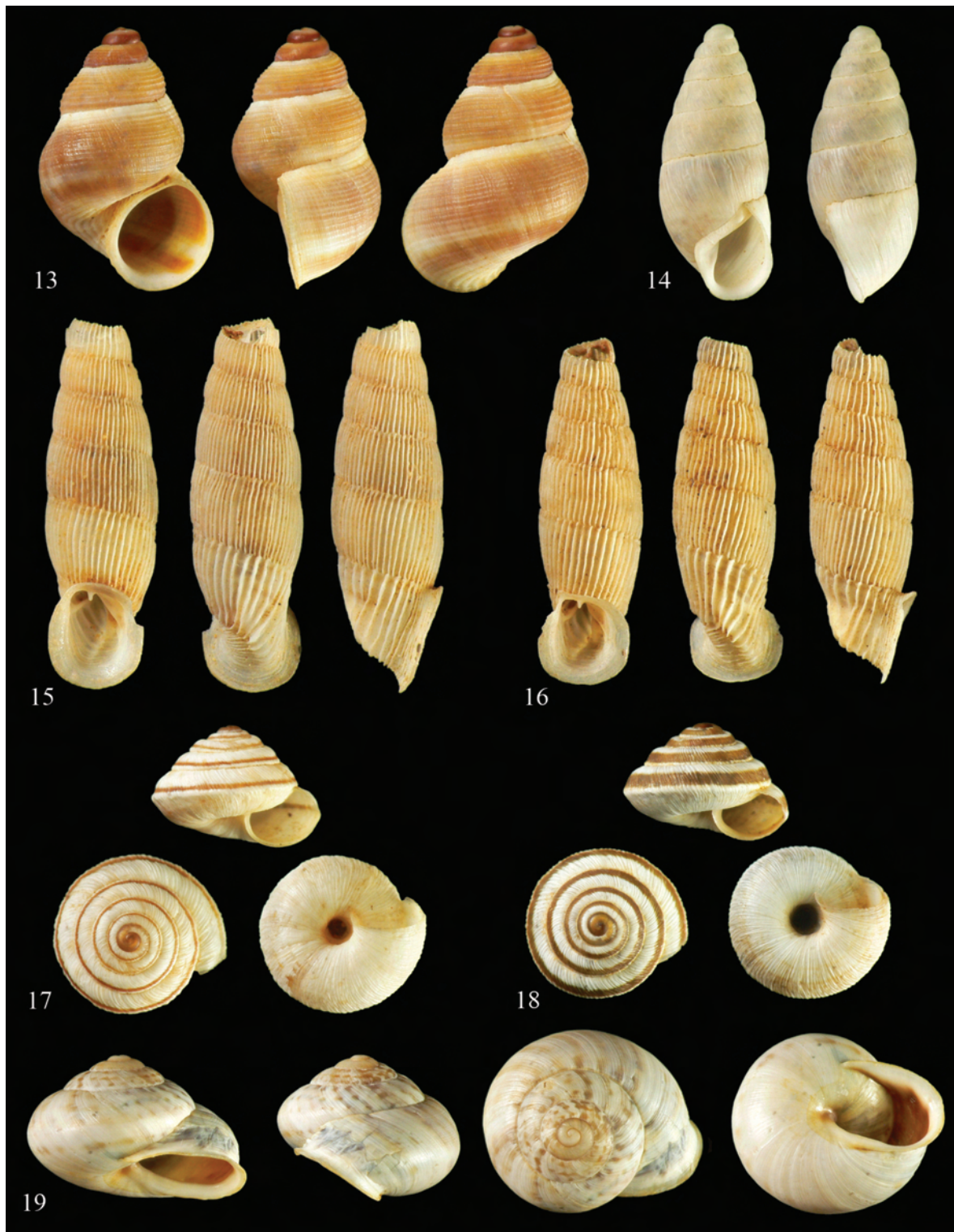


Figure 13. *Tudorella melitense*, h: 12.6 mm, 8.3 mm; Large Blue Lagoon Rock, Comino. Figure 14. *Mastus pupa*, h: 12.7 mm, D: 5.3 mm; Large Blue Lagoon Rock, Comino. Figure 15. *Muticaria macrostoma*, h: 12 mm, D: 3.6 mm; Halfa Rock, Gozo. Figure 16. *Muticaria macrostoma*, h: 12.8 mm, D: 3.8 mm; Selmunett, Malta. Figure 17. *Trochoidea spratti*, h: 5.3 mm, D: 7.1 mm; Large Blue Lagoon Rock, Comino. Figure 18. *Trochoidea spratti*, h: 4.9 mm, D: 6.7 mm; Small Blue Lagoon Rock, Comino. Figure 19. *Murella melitensis*, h: 11.3 mm, D: 17.1 mm; Pigeon Rock, Comino.

Family Helicidae Rafinesque, 1815
 Subfamily Helicinae Rafinesque, 1815
 Tribe Murellini Hesse, 1918
Murella Pfeiffer, 1877

Murella melitensis (Férussac, 1821)

Present records: PR (nr)

Remarks: This species was until recently classified under *Marmorana* Hartmann, 1844. Fiorentino et al. (2010) separate the two genera on the basis of molecular data and love-dart morphology. The three individuals of this highly variable species found on PR show very faint ribbing which is absent from other populations in Malta and Gozo, together with the highly characteristic brown mottling on a white background and a brown spot at the conjunction of the peristome and the columella. The absence of the species from the KM mainland and the surrounding isles may indicate that this represents a relict population.

Tribe Thebini Wenz, 1923
Theba Risso, 1826

Theba pisana pisana (Müller, 1774)

Present records: HR (nr), CR (nr), KT (nr), KM, FB (nr)

Remarks: FB supports a very dense population of this species, generally gathered on or beneath the base of *Arthrocnemum macrostachyum* (Moric.) Moris. shrubs. Schembri (1983) mentions this species for ST, but this find was not repeated during the present study.

Tribe Helicini Rafinesque, 1815
Eobania Hesse, 1913

Eobania vermiculata (Müller, 1774)

Present records: HR, KT (nr), LBL (nr), PR (nr), FB (nr), ST, KM

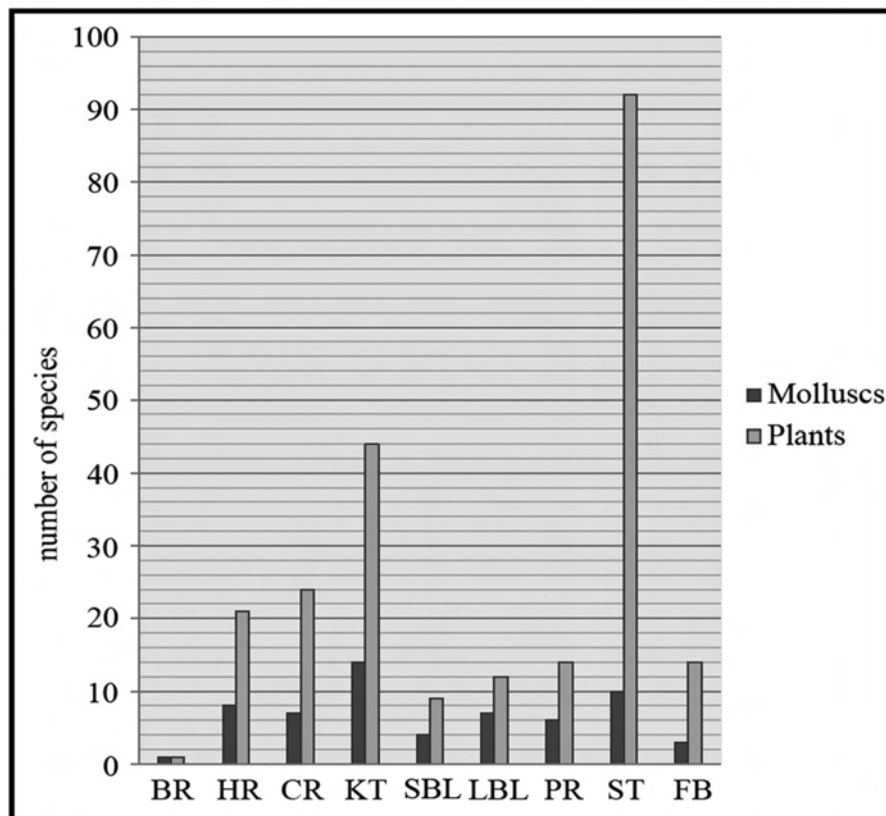


Figure 20. A graphical representation of the correlation between the number of terrestrial mollusc and macrophyte species (except *Kemmuna*, Comino).

Remarks: On ST, this is the commonest snail species. On the other hand, no live specimens were found on LBL, with the record being based on three subfossil shells.

Cantareus Risso, 1826

Cantareus apertus (Born, 1778)

Present records: KT (nr), SBL (nr), KM

Remarks: Single individuals of this species were encountered in moist grass or aestivating close to the soil. The species seems to prefer more open habitats than its congener, mentioned below.

Cantareus aspersus (Müller, 1774)

Present records: KT (nr), SBL (nr), KM (nr)

Remarks: The presence of the species on SBL is inferred from several fragments from adult shells. The population of KT consists of individuals thicker and taller than mainland shells.

The placement of *Helix aspersa* Müller, 1774 into the genus *Cantareus* here follows the molecular analyses of Koene & Schulenburg (2005), Manganelli et al. (2005), and Wade et al. (2006; 2007), where phylogenetic trees support a placement of the taxon together with *C. apertus*, *Eobania* and *Otala* Schumacher, 1817 in a monophyletic clade. These results support the anatomical data elaborated upon by Giusti et al. (1995).

CONCLUSIONS

A number of 22 species of terrestrial molluscs, all of which occur on mainland Malta and most of which occur also in Gozo, were recorded from the ten islands investigated. The species richness of non-marine molluscs on each of the islands is correlated to the island's size, variety of habitats, and floral diversity (Fig. 20).

It is interesting to note that although the area of most of the islands is relatively small, biodiversity and abundance of individuals is generally high; however, this does not mean that the islands (even close ones, such as those in the Kemmuna group) have a similar ecosystem, as can be seen from the species recovered on each. Present and future work on the distribution and abundance of these molluscs

in each particular case may be used to observe trends and assess threats to conservation, especially in the cases of endemic or rare species.

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