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Molluscs of the "Real Orto Botanico di Napoli"

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Abstract

The results of two years of research on the molluscs present in the Botanical Garden of Naples are reported and compared with the sole similar study published in 1875 and with other reports in the literature, the last of which published in 1930 by Boettger. As a general result, a noticeable decrease in the number of species present in the site was recorded. However, some species not reported before have also been observed, and namely *Vallonia costata* (O.F. Müller, 1774), *Orcula dolium* (Draparnaud, 1801) and *Planorbarius corneus* (Linnaeus, 1758), all recorded for the first time in Campania, and in addition *Carychium minimum* O.F. Müller, 1774, which appears to be well settled in the studied enclave; for this latter species the only previous indication was found in the bibliography for Campania (Bellini 1898). Finally, some limacid slugs, previously found and recorded only by Boettger (1930), have been found.

Keyword: terrestrial malacofauna; freshwater molluscs; Botanical Garden

Riassunto

Sono riportati i risultati di due anni di ricerca sulle specie di molluschi presenti nell'Orto Botanico di Napoli e confrontati con l'unico studio simile pubblicato nel 1875 e con altri resoconti in letteratura, l'ultimo dei quali pubblicato nel 1930 da Boettger. Come risultato generale, è stata registrata una notevole diminuzione del numero di specie presenti nel sito. Tuttavia, sono state osservate anche alcune specie non segnalate prima e precisamente *Vallonia costata* (OF Müller, 1774), *Orcula dolium* (Draparnaud, 1801) e

Planorbarius corneus (Linnaeus, 1758), tutte registrate per la prima volta in Campania, e in aggiunta *Carychium minimum* OF Müller, 1774, che sembra essersi ben insediata; per quest'ultima specie l'unica indicazione precedente è stata trovata in bibliografia per la Campania (Bellini 1898). Infine, sono stati trovati alcuni limacidi, precedentemente trovati e riportati solo da Boettger (1930).

Parole chiave: malacofauna terrestre; molluschi d'acqua dolce; Orto Botanico

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Introduction

The study of malacofauna, both terrestrial and freshwater, of a place as controlled and varied as the Royal Botanical Garden of Naples (Orto Botanico di Napoli – OBN, at present a research center of the University of Naples "Federico II") poses many methodological obstacles, but provides important information on the composition of the "urban malacofauna" of the City of Naples. The importance is not only due to the historical and cultural value place but also to the fact that, in large urban settlements, it is rarely possible to have "green" places so controlled and rich of different environments.

About one hundred and forty years from the publication of the first systematic study on molluscs in the grounds and pools of the Botanical Garden of Naples (1875) by the Director of the structure at the time, prof. Vincenzo Cesati, we carried out a comparative study to verify the variations in the composition of the malacofauna.

In addition to this most important work by Cesati (1875); other minor contributions have been published by Oronzio Gabriele Costa (1829; 1839), Rudolph-Amandus Philippi (1844), Raffaello Bellini (1898; 1899a; 1899b; 1904; 1907; 1915) and Caesar-Rudolf Boettger (1930); the most recent of these works, however, is over one century old.

During this long period, the deep changes that have affected the area where the Botanical Garden of Naples is located and the increasingly dense anthropization of the surrounding places have certainly influenced the malacofauna present on the site; for this reason, some brief historical information will certainly be helpful in providing a better understanding of the modifications of places from the time of the first study to present.

Historical notes

To better understand the reasons that induced the reigning houses of Naples, the Bourbons first and later the French to prepare a botanical garden, it is necessary to refer to the major public works realized after the middle of the XVIII century. The original area of the Botanical garden was approx. 13

ha; later, after a compulsory purchase by the Municipality in order to open a road, the garden area was reduced to the present-day 12 ha. From then onwards Naples spread out of the narrow constraints of the city walls, now devoid of strategic value, and the obvious expansion took place towards the neighbouring countryside. At the same time Naples was reaching a European stance, rich of intellectual ferments, and had to be provided with public structures adequate to its rank. In those years, for example, the Zoological and Mineralogical Museums, the Astronomical Observatory and the San Carlo Theatre were founded. With this in mind, the layout of the new road axis (via Foria), designed and built as a straight, wide and tree–lined avenue, favoured the connection between the city and the Real Albergo dei Poveri which overlooks the wide Piazza Carlo III. The road then proceeds towards the sites where the Cemetery of the Three Hundred and Sixty–Six Graves and that of Poggioreale arose. Along the new road numerous noble palaces and the Teatro San Ferdinando was built; the same area was chosen for the Royal Botanical Garden (Doria 1979).

Material and Methods

As the research site is a closed enclave far from any possibility of exchange with cement–free and asphalt–free land, being completely surrounded by the urbanized areas, it was decided not to collect live animals as far as possible. For cases where further observations were necessary, the specimen were brought back *in situ* after being photographed. The material was collected in about two years (from June 2013 to September 2015) in order to cover all seasonal, climatic and reproductive conditions. The collection of macroscopic specimens was made *ictu oculi*. In addition, transepts of about one square meter for a depth of about 5 cm of the litter, have been sampled and observed under an optical microscope, to collect small specimen. The retaining walls built with blocks of tuff (a typical volcanic rock of the Neapolitan subsoil, widely used in construction; it is a very light and porous stone that retains moisture well) were also explored on various occasions and weather conditions. The pools for aquatic plants have been explored by collecting sediment samples, where possible, with a mesh of less than 0.5 mm. The mesh has also been used for the collection of the material present along the walls and on the plants themselves. These pools have an average depth of no more than one meter, but for the most part they are provided with a thick iron grate that rises from the bottom and on which the plant pots rest. Some samples were provided to us by the staff responsible for the maintenance of the garden; they offered a fruitful collaboration facilitating the work in any possible way. Particular attention was then given to the material coming from the pruning and cutting of tall trees, observing what was under the bark of the plants themselves; this material had been accumulated in areas of the Garden specifically set for this purpose. It should be noted that during the research some sites of the OBN have undergone radical maintenance and renovation work.

The nomenclature was set in accordance with Bank (2017) and MolluscaBase (www.molluscabase.org, accessed on October 7, 2019).

The collected material is housed in the museum connected to the OBN (www.ortobotanico.unina.it/p_aree_espositive/Zone_espo.htm, accessed on October 7, 2019).

Results and Discussion

As reported in the Tab 1, 37 species have been found and identified, plus some specimens belonging to the Limacidae that require further investigation to be classified. The species found are much less than the 49 reported in the bibliography but few additional species were also found. Specifically: *Vallonia costata* (O.F. Müller, 1774) and *Planorbarius corneus* (Linnaeus, 1758) for the first time in Campania; *Orcula dolium* (Draparnaud, 1801) reported for the first time for southern Italy, *Carychium minimum* O.F. Müller, 1774 reported for southern Italy only once by Bellini back in 1898.

In addition to the progressive urbanization of the surrounding areas, the injuries of the Second World War have certainly had an impact on the marked depletion of the malacofauna. The OBN, in fact, was used as a station for troops based in Naples. Last but not least, the crop protection products, including molluscicides, frequently used not only in cultivated areas but also in green areas, certainly have detrimental effects. Given the extreme contiguity of land lots prepared to accommodate various types of plants, a full correspondence between the various species and their elective habitats has not always been found.

Twenty–five terrestrial and nine freshwater gastropods species have been found, as well as two species of bivalves. Among the terrestrial species, the Helicidae family is the one most represented, with four species; the dominant species is *Cornu aspersum* (O.F. Müller, 1774) followed by *Massylaea vermiculata* (O.F. Müller, 1774). Among the freshwater species we mention *Unio mancus* Lamarck, 1819, purposely introduced in the pools by the OBN staff, but not detected in the last weeks of research and sampling.

The strong disparity of the species found in terrestrial environments with respect to freshwater ones is due both to the small extent of freshwater environments in OBN and to their isolation.

The lack of a museum hosting the species reported in the literature did not allow comparison and control over the classification of the items previously reported by the other authors in the literature, as also highlighted in the case of *Carychium minimum*. We therefore take the exact determination of the material itself for granted, also recalling that the malacological collection of prof. Cesati was included in his private collection, all traces of which have been lost. On the other hand, there is a noteworthy and definite presence of *Vallonia costata*, *Planorbarius corneus* and *Orcula dolium* which represent, as already said, the first indication of their existence in Campania and, for the second species, even in peninsular Italy. The present report, given the peculiarity of the area of discovery, does

not allow to consider the species found as fully belonging to the Campanian malacofauna but shows, however, their adaptability to our land and latitude. The need for further investigations on *Carychium minimum* is reiterated. The question of the absence of limacid slugs in previous works remains insoluble.

The possibilities for the colonisation of new species are mainly due to possible phenomena of phoresy (due to birdlife) and anthropogenic contributions through the acquisition of plant specimen.

Finally, for historical completeness, we should mention that the information relative to the OBN, taken from a card without corresponding specimens, is present at the Museum of Zoology of the University of Naples Federico II for *Physa hypnorum,* currently *Aplexa hypnorum* (Linnaeus, 1758).

For more exhaustive consultation see Tab. S1 (Checklist of Molluscs of the "Real Orto Botanico di Napoli").

Table 1: Historical Mollusca checklist of Orto Botanico di Napoli (alphabetical order).
Species: actual scientific name; Current presence: Y = yes, N = no, (l) =living specimen; Synonyms (as reported in the source) and references: [n] = 1 Costa, 1829; 2 Costa, 1839; 3 Philippi, 1844; 4 Cesati, 1875; 5 Bellini, 1898; 6 Bellini, 1899a; 7 Bellini, 1899b; 8 Bellini, 1904; 9 Bellini, 1907; 10 Bellini, 1915.

Species	Current presence	Synonyms and references
GASTROPODA		
Melanoides tuberculata (O.F. Müller, 1774)	Y (l)	
Aplexa hypnorum (Linnaeus, 1758)	N	*Physa hypnorum* (Linnaeus, 1758) [8, 10]
Pomatias elegans (O.F. Müller, 1774)	Y (l)	*Cyclostoma elegans* (O.F. Müller, 1774) [4]
Platyla gracilis (Clessin, 1877)	Y	
Bithynia tentaculata (Linnaeus, 1758)	Y (l)	[4, 8, 10]
Bithynia boissieri (Küster, 1852)	N	[7, 8, 10]
Bithynia rubens (Menke, 1830)	N	[10]; *Paludina rubens* Menke, 1830 [8]; *Codiella rubens* Menke [9]
Valvata piscinalis (O.F. Müller, 1774)	N	[7]
Pseudamnicola macrostoma (Küster, 1853)	N	[8, 10]
Xerosecta explanata (O. F. Müller, 1774)	N	*Helix explanata* O.F. Müller, 1774 [1]
Galba truncatula (O. F. Müller, 1774)	N	*Lymnaea truncatula* (O. F. Müller, 1774) [10]
Peregriana peregra (O.F. Müller, 1774)	Y (l)	*Limnaea peregra* O.F. Müller, 1774 [7]
Radix auricularia (Linnaeus, 1758)	Y	*Limnaea auricularia* (Linnaeus, 1758) [7, 8, 10]

Stagnicola palustris (O.F. Müller, 1774)	Y (I)	*Limnaea palustris* (O. F. Müller, 1774) [4, 8, 9, 10]
Physa fontinalis (Linnaeus, 1758)	N	[7, 8, 10]
Physella acuta (Draparnaud, 1805)	Y (I)	
Planorbarius corneus (Linnaeus, 1758)	Y (I)	
Planorbis planorbis (Linnaeus, 1758)	Y (I)	*Planorbis marginatus* Draparnaud, 1805 [7]
Planorbis carinatus O.F. Müller, 1774	N	[7]
Hippeutis complanatus (Linnaeus, 1758)	Y	*Planorbis complanatus* (Linnaeus, 1758) [4, 8, 10]; *Planorbis fontanus* (Lightfoot, 1786) [10]
Acroloxus lacustris (Linnaeus, 1758)	Y	
Carychium tridentatum (Risso, 1826)	Y	
Carychium minimum O.F. Müller, 1774	Y	[4]
Succinea putris (Linnaeus, 1758)	N	[7]
Lauria cylindracea (da Costa, 1778)	Y	*Pupa umbilicata* Draparnaud, 1801 [4]
Orcula dolium (Draparnaud, 1801)	Y	
Vallonia pulchella (O.F. Müller, 1774)	Y (I)	
Vallonia costata (O.F. Müller, 1774)	Y (I)	
Acanthinula aculeata (O.F. Müller, 1774)	Y	*Helix aculeata* O.F. Müller, 1774 [4, 7]
Truncatellina callicratis (Scacchi, 1833)	Y	*Pupa callicratis* Scacchi, 1833 [4]
Merdigera obscura (O.F. Müller, 1774)	Y	*Bulimus obscurus* O.F. Müller, 1774 [4]
Vertigo pusilla O.F. Müller, 1774	N	[9, 10] *Pupa pusilla* O.F. Müller, 1774 [4]
Vertigo antivertigo (Draparnaud, 1801)	N	[10]
Rumina decollata (Linnaeus, 1758)	Y (I)	*Bulimus decollatus* (Linnaeus, 1758) [4]
Cecilioides acicula (O.F. Müller, 1774)	Y	*Cionella acicula* O.F. Müller, 1774 [4]
Ferussacia folliculum (Schröter, 1784)	N	*Cionella folliculus* Gronovius, 1781 [4]
Hohenwartiana hohenwarti (Rossmässler, 1839)	N	*Cionella hohenwarthi* Rossmässler, 1839 [4 (fide Tiberi)]
Papillifera papillaris (O.F. Müller, 1774)	Y (I)	*Clausilia papillaris* (O.F. Müller, 1774) [4]
Charpentieria gibbula (Rossmässler, 1836)	Y	
Punctum pygmaeum (Draparnaud, 1801)	N	*Helix pygmaea* Draparnaud, 1801 [4, 9]
Discus rotundatus (O.F. Müller, 1774)	Y (I)	*Helix rotundata* O.F. Müller, 1774 [4]
Aegopinella nitens (Michaud, 1831)	Y	
Zonitoides nitidus (O.F. Müller, 1774)	N	*Helix nitida* O.F. Müller, 1774 [10]
Vitrea crystallina (O.F. Müller 1774)	N	*Helix crystallina* O. F. Müller, 1774 [4, 9, 10]
Oxychilus draparnaudi (H. Beck, 1837)	Y (I)	[4]

Mediterranea hydatina (Rossmässler, 1838)	N	*Helix hydatina* Rossamässler 1838 [4 (fide Tiberi)]
Limax maximus Linnaeus, 1758	Y (I)	
Limax spp.	Y (I)	
Campylaea planospira setulosa (Briganti, 1825)	Y (I)	
Theba pisana (O.F. Müller, 1774)	Y (I)	*Helix pisana* O.F. Müller, 1774 [4]
Massylaea vermiculata (O.F. Müller, 1774)	Y (I)	*Helix vermiculata* O.F. Müller, 1774 [4]
Cornu aspersum (O.F. Müller, 1774)	Y (I)	*Helix adspersa* O.F. Müller, 1774 [4]
Marmorana muralis (O.F. Müller, 1774)	N	*Helix muralis* O.F. Müller, 1774 [4]
Cantareus apertus (Born, 1778)	N	*Helix aperta* Born 1778 [4]
Helicodonta obvoluta (O.F. Müller, 1774)	N	*Helix obvoluta* O.F. Müller, 1774 [4]
Xerotricha conspurcata (Draparnaud, 1801)	Y (I)	*Helix conspurcata* Draparnaud, 1801 [4]
Cernuella cisalpina (Rossmässler, 1837)	Y (I)	
Cernuella virgata (da Costa, 1778)	N	*Helix variabilis* Draparnaud,1801 [4];
		Helix profuga Schmidt, 1854 [4, 6, 7]
Candidula unifasciata (Poiret, 1801)	N	*Helix candidula* Studer, 1820 [4, 9];
		Helix unifasciata Poiret, 1801 [10]
Cochlicella acuta (O.F. Müller, 1774)	N	*Bulimus acutus* O.F. Müller, 1774 [4]
Hygromia cinctella (Draparnaud, 1801)	N	*Helix ranzani* O.G. Costa, 1839 [2];
		Helix cinctella Draparnaud, 1801 [10]
Monacha cartusiana (O.F. Müller, 1774)	N	*Helix carthusiana* O.F. Müller, 1774 [4]
Monacha cantiana (Montagu, 1803)	N	*Helix cantiana* Montagu, 1803 [4]
Monachoides incarnatus (O.F. Müller, 1774)	N	*Helix incarnata* O.F. Müller, 1774 [4 (fide Tiberi), 9, 10]
BIVALVIA		
Unio mancus Lamarck, 1819	Y	
Euglesa casertana (Poli, 1791)	Y	*Pisidium fontinale* Draparnaud [5, 6, 7];
		Pisidium pusillum Gmelin, 1799 [8, 9, 10];
		Pisidium australe Philippi, 1836 [10]
Pisidium nitidum Jenyns, 1832	N	[9, 10]

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Author contributions

All authors contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Data availability

The collected material is housed in the museum connected to the OBN (www.ortobotanico.unina.it/p_aree_espositive/Zone_espo.htm, accessed on October 7, 2019).

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Supporting Information

Table S1: Checklist of Molluscs of the "Real Orto Botanico di Napoli"

GASTROPODA

Order Caenogastropoda

Superfamily Cerithioidea

Family Thiaridae

Genus *Melanoides* Olivier, 1804

Melanoides tuberculata (O.F. Müller, 1774): its presence is due to the anthropic contribution. Live specimens were found both at young and adult stages, so the presence of the species is established (Fig. S1a). Incidentally, in the pools there is an abundance of ornamental fishes freed from repentant aquarists; this presence has created problems related to the survival and reproductive cycle of *Lissotriton italicus* (Peracca, 1898) present in the pools of the Fern groove; thus, it was decided to transfer the fishes to other pools.

Order Littorinimorpha

Superfamily Littorinoidea

Family Pomatiidae

Genus *Pomatias* S. Studer, 1789

Pomatias elegans (O.F. Müller, 1774): this species was found frequently and in various stages of growth (Fig. S1b).

Order Architaenioglossa

Superfamily Cyclophoroidea

Family Aciculidae

Genus *Platyla* Moquin–Tandon, 1856

Platyla gracilis (Clessin, 1877): found only on the lawn of the pool in front of the Succulents' area with very few specimens; it is absent in the literature concerning the OBN but reported in 2008 for Campania (Bodon & Cianfanelli 2008). The species is present in Italy with a sparse distribution and greater density in the north of the peninsula; it is reported as absent in Sicily and Sardinia (Boeters et al., 1989). In view of the particular nature of the OBN and the small number of specimens found, no one of which living, we cannot consider for the moment the species as part of the OBN malacofauna.

Order Littorinimorpha

Superfamily Truncatelloidea

Family Bithyniidae

Genus *Bithynia* Leach, 1818

Bithynia tentaculata (Linnaeus, 1758): always well represented in the pools (Fig. S1c).

Order Basommatophora

Superfamily Lymnaeoidea

Family Lymnaeidae

Genus *Radix* Montfort, 1810

Radix auricularia (Linnaeus, 1758): some of the specimens collected present the spire more depressed than usual; the species is present only in a pool with papyrus and water lilies, facing the area of the Succulents. Given the minimal diffusion, only 3 specimens were taken that are on display in the malacological showcase of the Botanic Museum.

Genus *Peregriana* Servain, 1881

Peregriana peregra (O.F. Müller, 1774): present in various pools always in good numbers (Fig. S1d).

Genus *Stagnicola* Jeffreys, 1830

Stagnicola palustris (O.F. Müller, 1774): also represented by large specimen (32 mm), flanked by young specimen. In addition to the pools, it is also present in some large pots with a constant presence of water, particularly in the area of the Fern groove.

Family Physidae

Genus *Physella* Haldeman, 1843

Physella acuta (Draparnaud, 1805): abundant and present in all the pools. It was observed at all stages of growth and only few large specimens were collected (Fig. S1e). Many studies have highlighted the constant rarefaction, until the disappearance in Italy, of *Physa fontinalis* (Linnaeus, 1758) in favour of *Physella acuta*, introduced in Europe from North America since the mid–1800s (Cianfanelli et al., 2007). The comparison between the current specimens and those of the historical reports is impossible by now. As a consequence, we are unable to state whether *Physa fontinalis* was indeed present at OBN.

Family Planorbidae

Genus *Planorbis* O. F. Müller, 1773

Planorbis planorbis (Linnaeus, 1758): it is very abundant in all the areas with the exception of the Fern groove, where it is rare. However, *Planorbis carinatus* O.F. Müller, 1774, reported in the literature for OBN, has not been found (Fig. S1f).

Planorbarius corneus (Linnaeus, 1758): found in various stages of growth; abundant and very active in a pool in the central alley. The species is reported here for the first time in Campania

in the wild. The species had already been found in 1979 in the fern-groove area of the Botanical garden, but this information was never published (Carlo Guarino, pers. comm.).

Genus *Hippeutis* Charpentier, 1837

Hippeutis complanatus (Linnaeus, 1758): present in the bottom sediments of some pools.

Family Acroloxidae

Genus *Acroloxus* H. Beck, 1838

Acroloxus lacustris (Linnaeus, 1758): a good number of specimens was found in the sludge of the bottom of the pool overlooking the Succulents' area, in which *Radix auricularia* was also collected. The presence of this species is not new for southern Italy (Paulucci 1879).

Order Ellobiida

Superfamily Ellobioidea

Family Ellobiidae

Genus *Carychium* O.F. Müller, 1773

Carychium tridentatum (Risso, 1826): absent in the historical OBN checklist, is today well represented with a large population. Specimen were collected in various growth stages; it is therefore reasonable to assume its stable presence.

Carychium minimum O.F. Müller, 1774: signalled for southern Italy only by Bellini (1898), precisely in the malacofauna of the OBN. There are no subsequent reliable reports for southern Italy; it is limited to the north of Italy. A limited number of specimens was collected (Califano greenhouse), all fresh but lacking the soft parts (Fig. S1g). This does not allow to confidently affirm its stable presence in the OBN. This species is therefore reported as doubtful, awaiting for further studies. It is to point out, however, that no recent releases of material coming from the typical localities of the species into the OBN are known that could justify its presence.

Order Stylommatophora

Superfamily Pupilloidea

Family Pupillidae

Genus *Lauria* Gray, 1840

Lauria cylindracea (da Costa, 1778): well represented in some stations such as the flowerbed of the rocks and Gasparrini area.

Family Orculidae

Genus *Orcula* Held, 1838

Orcula dolium (Draparnaud, 1801): it is not mentioned by any of the authors who sampled the OBN. The distribution area in Italy is limited to the Alps and the Pre-Alps (Alzona 1971; Kerney & Cameron 1979). Field research conducted by prof. Folco Giusti while expanding the distribution area of *Vallonia costata* (reported here for the first time in Campania), do not affect

Orcula dolium. The specimen collected in the soil are always numerous and present at various stages of growth. It is true that the particular habitat of the present study cannot configure a real expansion of the distribution range of the two species. However, it is still interesting to note the setting of the species in a climatic situation far from the usual ones. The original diagnosis of *Orcula dolium* is reported: «8. M. Baril. P. dolium. Coq[uille] ventrue, lisse; ouverture blanche, I-plissée, bord columellaire sub-3-plissé. Long. 6-7 mill. diam. 3½-4 m. H[abitat] Avec la précédente, dont elle est un peu voisine. (8-9 tours), Coq[uille] roussâtre.» (Draparnaud 1801).

Family Vallonidae

Genus *Vallonia* Risso, 1826

Vallonia pulchella (O.F. Müller, 1774): found sometimes numerous and rarely alive. In some soil samples, the congeneric *Vallonia costata* was also present.

Vallonia costata (O.F. Müller, 1774): reported now for the first time in Campania. Until now the species has been reported, for southern Italy, by Ferreri, Bodon and Manganelli (2005) for the province of Lecce. In Alzona (1971) the spread of the species was indicated as limited to northern and central Italy; the same spread was also indicated in the work of Cossignani and Cossignani (1995). Ferreri et al. (2005) expanded the distribution area of *Vallonia costata* up to Puglia. The species is also present in Sicily (Viviano 2017). Numerous specimens have been found in different stations, almost all fresh and well preserved (Fig. S1h). The species, due to its diagnostic morphology, cannot be confused with other members of the same genus. The spread of the species in the territory should be further investigated to better define its distribution. The first specimen was found in very small numbers in loam collected at the foot of a laurel tree (*Laurus nobilis* L.), along Viale Giuseppe Caputo, in the first period of the study (October 2013). Subsequently the presence of *Vallonia costata* was confirmed in numerous stations, in the presence of different tree species, with an abundant number of specimens, as previously mentioned. The comparison between the original description of the species and the photos of the specimen can be useful: Müller in his *Vermium terrestrium et fluviatilum* of 1774 describes the species as follows: «Helix head subdepressa, umbilicata, cinerea; spiris costatis; circular opening; labro albo, reflexo.»

Kerney and Cameron (1979) give these identification data: «discoidal shell, with a nearly flat spire; 3 ¼ whorls, often slightly shouldered; umbilicus very broad. Mouth almost circular, oblique; mouth-edge sharply reflected to form a strong, pure-white flange-like lip. Shell greyish-white, slightly translucent, with a sculpture of rather regularly-spaced sharp ribs, often giving a characteristic sparkle to fresh shell».

Genus *Acanthinula* H. Beck, 1847

Acanthinula aculeata (O.F. Müller, 1774): very few specimens were found, near the Califano greenhouse.

Family Truncatellinidae

Genus *Truncatellina* R. T. Lowe, 1852

Truncatellina callicratis (Scacchi, 1833): often found during the analysis of the soil of various stations.

Family Enidae

Genus *Merdigera* Held, 1838

Merdigera obscura (O.F. Müller, 1774): never frequent or abundant.

Superfamily Achatinoidea

Family Achatinidae

Genus *Rumina* Risso, 1826

Rumina decollata (Linnaeus, 1758): found in a living state, only in a flower bed in the coastal dune area; in the remaining territory only very few shells were found.

Family Ferussacidae

Genus *Cecilioides* J. Férussac, 1814

Cecilioides acicula (O.F. Müller, 1774): found in a limited number of stations and still rare (Fig. S1i).

Superfamily Clausilioidea

Family Clausiliidae

Genus *Papillifera* W. Hartmann, 1842

Papillifera papillaris (O.F. Müller, 1774): found in numerous sites but only a few living specimens have been collected on a tufaceous stones wall (Fig. S1l).

Genus *Charpentieria* Stabile, 1864

Charpentieria gibbula (Rossmässler, 1836): very few samples were collected on tufaceous stones walls.

Superfamily Punctoidea

Family Discidae

Genus *Discus* Fitzinger, 1833

Discus rotundatus (O.F. Müller, 1774): found living and always in good number of individuals.

Superfamily Gastrodontoidea

Family Gastrodontidae

Genus *Aegopinella* Lindholm, 1927

Aegopinella nitens (Michaud, 1831): poorly represented, found mainly in the Fern groove.

Family Oxychilidae

Genus *Oxychilus* Fitzinger, 1833

Oxychilus draparnaudi (Beck, 1837): present only in the area of the Fern groove in a good number of specimens. As foreseen by Boettger (1930), at present *O. cellarius* (O. F. Müller, 1774) has been substituted by the more resistant *O. draparnaudi*.

Superfamily Limacoidea

Family Limacidae

Genus *Limax* Linnaeus, 1758

Limax maximus Linnaeus, 1758: it is certainly the most striking limacid among those found, due to the considerable size it reaches; the population is abundant and widespread in the OBN.

Limax spp.: Various found specimen require further studies such as anatomical and radular examination.

Superfamily Helicoidea

Family Helicidae

Genus *Campylaea* H. Beck, 1837

Campylaea planospira setulosa (Briganti, 1825): found a small number of specimen and only in an area adjacent to the greenhouse for the cultivation of orchids and other epiphytic plants. It is a fairly widespread species in Campania.

Genus *Theba* Risso, 1826

Theba pisana (O.F. Müller, 1774): a good number of specimens was observed in the area of succulent plants among the thorns of *Astrophytum ornatum*; it is also present in other stations.

Genus *Massylaea* Möllendorff, 1898

Massylaea vermiculata (O.F. Müller, 1774): it is abundant but, as always, after having ascertained the presence of living and vital specimen, only fresh shells have been collected without any soft parts.

Genus *Cornu* Born, 1778

Cornu aspersum (O.F. Müller, 1774): invasive and dominant throughout the territory.

Family Geomitridae

Genus *Xerotricha* Monterosato, 1892

Xerotricha conspurcata (Draparnaud, 1801): always well represented.

Genus *Cernuella* Schlüter, 1838

Cernuella cisalpina (Rossmässler, 1837): quite common (Fig. S1m).

BIVALVIA

Order Unionida

Superfamily Unionoidea

Fam. Unionidae

Genus *Unio* Philipsson, 1788 (in: Retzius A.J., 1788)

Unio mancus Lamarck, 1819: the maintenance staff provided a full sample from the tropical greenhouse pools.

Order Venerida

Superfamily Sphaerioidea

Family Sphaeriidae

Genus *Euglesa* Jenyns, 1832

Euglesa casertana (Poli, 1791): only very few valves were found, scraping on the bottom not protected by metal grids of one of the pools. Said grids, present in almost all the other pools for both the arrangement of the vases containing the various species of aquatic plants and safety reasons, did not allow a systematic collection of the sediment. Bellini (1898) records this species, attributing the original report to (1836), but no reference to the botanical Garden is present in the latter source.

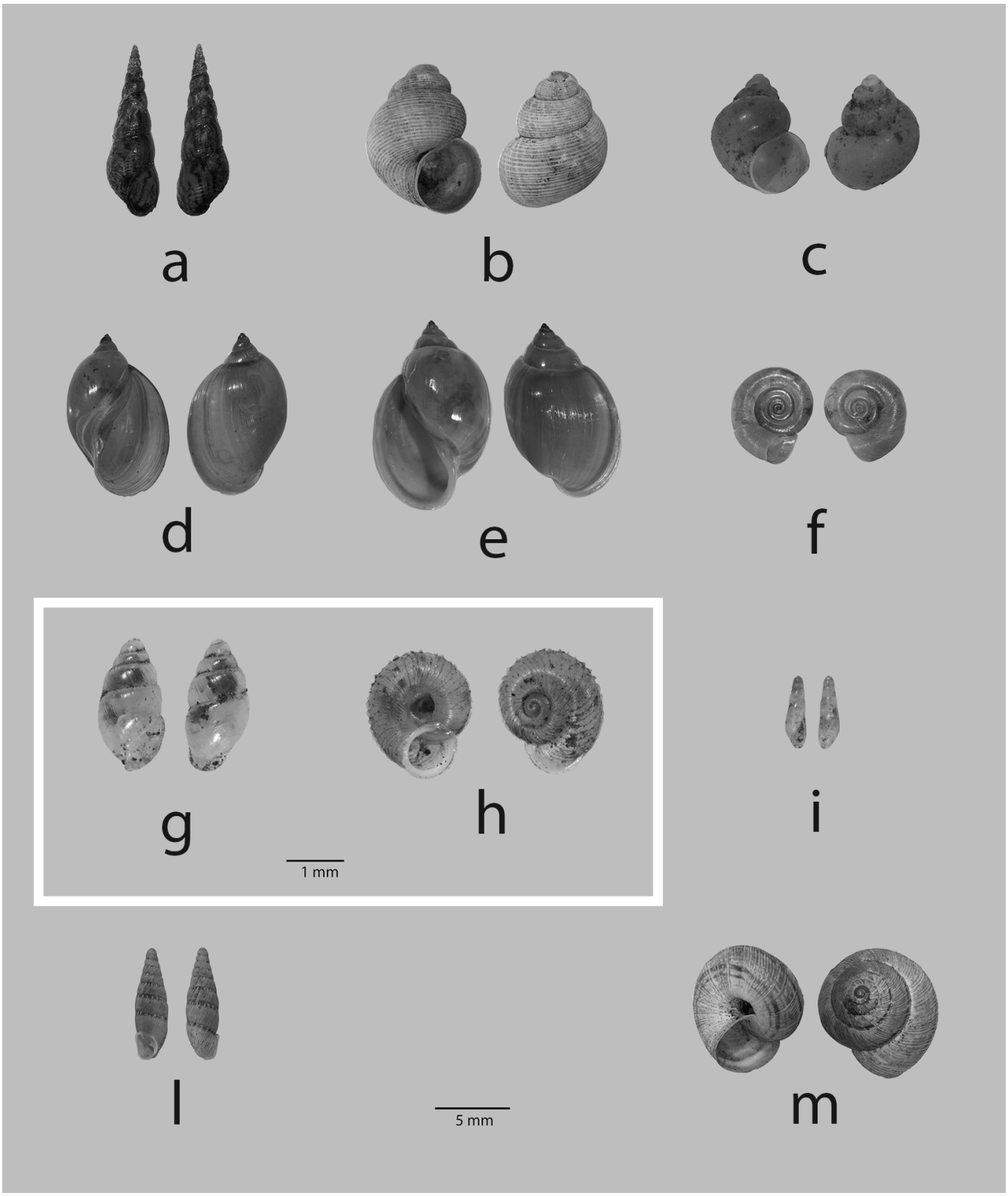

Figure S1: Shells of: a) *Melanoides tuberculata*; b) *Pomatias elegans*; c) *Bithynia tentaculata*; d) *Peregriana peregra*; e) *Physella acuta*; f) *Planorbis planorbis*; g) *Carychium minimum*; h) *Vallonia costata*; i) *Cecilioides acicula*; l) *Papillifera papillaris*; m) *Cernuella cisalpina*.