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New data on land and freshwater molluscs of Sifnos Island and Kitriani Islet (Cyclades, Greece)

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ABSTRACT

The present report provides an updated checklist of land and freshwater molluscs from Sifnos Island and, for the first time, from the nearby uninhabited islet Kitriani (Greece, Cyclades) with a critical review of available literature. Taxonomy, distribution, biogeographic issues, and the potential effect of human activities on these molluscs' communities are discussed. New morphological data for some snail species are presented, particularly for the genera *Limax* Linnaeus, 1758; *Xerocrassa* Monterosato, 1892; *Monacha* Fitzinger, 1833; and *Albinaria* Vest, 1864. Finally, based on shell and genitalia morphology, a new subspecies - *Albinaria turrita rosettae* n. ssp. - is described.

1. Introduction

Land molluscs represent one of the most diversified groups of terrestrial animals, as they occupy almost all available habitat types (see [Cameron, 2016](#)) and have managed to colonize even the most isolated islands. The Aegean islands host more than 400 species of land molluscs, with 51 % being regional endemics ([Vardinoyannis & Mylonas, 2019](#)). Consequently, the Aegean islands have long attracted the scientific attention of taxonomists and biogeographers ([Fuchs & Käufel, 1936](#); [Hausdorf, 2003](#); [Hausdorf & Henning, 2005](#); [Triantis et al., 2005; 2008](#); [Kornilios et al., 2009](#); [Szarowska et al., 2014; 2016](#); [Psonis et al., 2015](#); [Sfenthourakis & Triantis, 2017](#); [Vardinoyannis et al., 2018](#); [Mylonas & Vardinoyannis, 2022](#)). Despite their spread worldwide, land snails represent one of the most threatened groups of terrestrial animals. Many Aegean snail species are also threatened with extinction and urgently need conservation measures ([Lydeard et al., 2004](#); [Neubert et al., 2019](#)).

The terrestrial snail fauna of Sifnos Island collected in two different periods of sampling carried out on the island is shown, including also taxonomic, distribution, and diversity issues; moreover, non-marine mollusc fauna from Kitriani Islet is reported for the first time. Finally,

the potential effect of human activities on these molluscs' communities is discussed.

1.1. Study area

Sifnos is located at the southwestern end of the Cyclades Island group (36°13'15"N - 37°59'59"N, 24°06'02"E - 26°05'10"E) ([Fig. 1A](#)). It is 17 km long, 8 km wide and covers an area of 74 km². Off the island's southeastern coast (about 350 m) is an uninhabited islet named Kitriani. Sifnos is a semi-mountainous island and mainly consists of limestone and schist ([Fig. 1B](#)). It shows the typical Cycladic landscape characterized by land terraces cultivated with cereal crops, vineyards, and olive trees interspersed with bushy vegetation ([Fig. 1C](#)). The western side of the island and precisely the area between Kamares and Vathy is mainly occupied by Profitis Ilias, the highest peak of the island (682 m a.s.l.), which is a Special Protection Area and a Site of Community Importance according to European directives (GR 4220008). The botanical relevant element of this site is the *Juniperus phoenicea* L. maquis, which also consists of other typical phryganic elements such as *Thymbra capitata* (L.) Cav., *Salvia fruticosa* Mill., *Origanum onites* L. and *Genista*

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acanthoclada DC (Fig. 1D). Sifnos lacks permanent watercourses; there are only small streams, and the most important is Leivadas, which runs through the valley of Kamares. Sifnos is rich in minerals, and its metal wealth has been known since ancient times. The visible abandoned mines have left an indelible mark on the island's landscape (Fig. 1E) (Cattaneo & Grano, 2024). The climate can be defined as Mediterranean,

with mild, short winters and warm, dry summers. Rainfall is scarce and is mainly limited between October and March. The annual rainfall is less than 400 mm (Bougiatioti & Oikonomou, 2008).

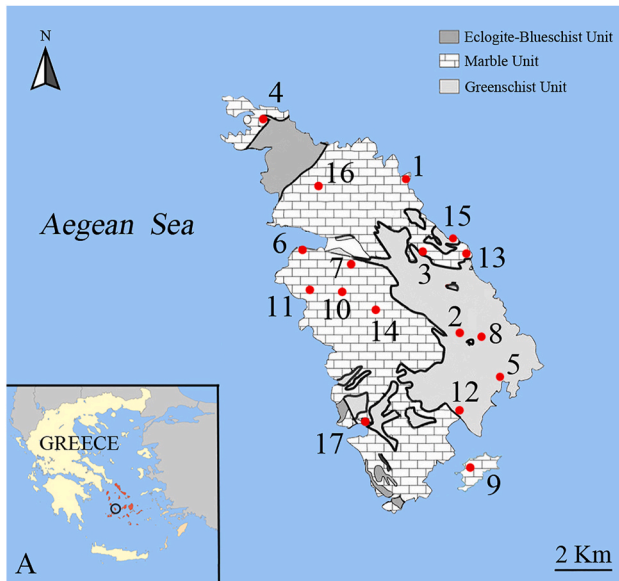


Fig. 1. (A) Map of Sifnos Island and Kitriani Islet. The red dots depict the sampling stations: 1. Aghios Sostis; 2. Apollonia; 3. Artemonas; 4. Cherronisos; 5. Faros; 6. Kamares (lighthouse); 7. Kamares (mines); 8. Kastros; 9. Kitriani Islet; 10. Ksero Ksylo; 11. Panaghia Toso Nero; 12. Platy Gialos; 13. Poulati; 14. Profitis Ilias; 15. Sotiros; 16. Troullaki; 17. Vathi. Details are in 1.2. Sampling and collection sites section; (B) limestone rocks in Aghios Sostis, type locality of *Albinaria turrita rosettæ* n. ssp.; (C) olive groves and cereal crops on Sifnos Island; (D) *Juniperus phoenicea* maquis; (E) abandoned mine between Kamares and Apollonia.

1.2. Sampling and collection sites

M. Grano and C. Cattaneo carried out sampling of land and freshwater snails between 31st July and 17th August 2022 and between 6th and 10th April 2023. Various environments were sampled, including scrublands (phrygana, maquis, or mixed), riparian vegetation, and cultivated or peri-urban areas. Specimens were collected from the following localities (listed in alphabetical order):

- 1) Aghios Sostis, 37°00'43"N 24°42'43"E, 32 m, 11.VIII.2023
- 2) Apollonia, 36°57'36"N 24°43'59"E, 168 m, 1.VIII.2022; 17.VIII.2022; 6.IV.2023
- 3) Artemonas, 36°59'02"N 24°43'20"E, 257 m, 17.VIII.2022
- 4) Cherronisos, 37°02'02"N 24°39'11"E, 29 m, 7.VIII.2022; 8.IV.2023
- 5) Faros, 36°56'45"N 24°44'58"E, 22 m, 8.VIII.2022
- 6) Kamares (lighthouse), 36°59'22"N 24°40'06"E, 29 m, 2.VIII.2022
- 7) Kamares (mines), 36°59'04"N 24°41'24"E, 153 m, 6.VIII.2022
- 8) Kastro, 36°57'34"N 24°44'05"E, 195 m, 3.VIII.2022
- 9) Kitriani Islet, 36°54'14"N 24°43'26"E, 3 m, 13.VIII.2022
- 10) Ksero Ksylo, 36°58'31"N 24°41'12"E, 626 m, 4.VIII.2022; 7.IV.2023
- 11) Panaghia Toso Nero, 36°58'34"N 24°40'16"E, 210 m, 31.VII.2022; 10.IV.2023
- 12) Platy Gialos, 36°56'02"N 24°43'58"E, 27 m, 5.VIII.2022; 9.IV.2023
- 13) Poulati, 36°59'02"N 24°44'10"E, 57 m, 3.VIII.2022
- 14) Profitis Ilias, 36°58'02"N 24°42'00"E, 650 m, 1.VIII.2022; 7.IV.2023
- 15) Sotiros, 36°59'18"N 24°43'50"E, 114 m, 9.IV.2023
- 16) Troullaki, 37°00'33"N 24°40'36"E, 289 m, 9.VIII.2022
- 17) Vathi, 36°56'02"N 24°41'28"E, 6 m, 12.VIII.2022

A geological map, modified from Papadopoulou et al. (2016), is provided (Fig. 1A). The names of local places follow the map of Sifnos produced by Terrain Cartography Group in 2018.

Empty shells and living specimens were collected in the field on sight, under rocks, and in crevices of limestone cliffs. The shells were cleaned with an alternate and repeated washing in sodium hypochlorite and hydrogen dioxide for a few minutes and subsequently brushed in water with a flat-tipped and bristles paintbrush. Dry shells have been studied in size, colour, morphology, sculpture, aperture, plicae, lamellae, and lunella; a description of the clausilium has been provided. On average, eight shells per population, randomly chosen, were examined. To study and illustrate genital organs, the specimens were fixed in 75 % ethanol. The bodies were isolated from the shells and dissected under a stereomicroscope (Optika) using a fine-pointed scalpel, scissors, and needles. The anatomical nomenclature follows Giusti et al. (1995), De Mattia et al. (2021), and Nordsieck (2022). Female genitalia are not described since they are uninformative. Photographs were taken with a digital camera. The height and maximum diameter of the shell, along with some parts of the genitalia, were measured (in mm) with a digital calliper or a stereomicroscope with a micrometer lens. Taxonomic references rely on MolluscaBase (2024) and other cited literature. Based on their distributions, we classified the (sub)species into five chorotypes: (i) Endemics/Subendemics (i.e., (sub)species endemic to Sifnos or Sifnos and one or more nearby Cycladic islands); (ii) Aegean Endemics (i.e. (sub)species occurring in two or more Aegean archipelagos); (iii) East Mediterranean; (iv) Mediterranean; and (v) Palearctic (Mylonas & Vardinoyannis, 2022) (see Table 1). The samples used for this study are preserved in the following Museums and private collections: CMMGR = Mauro Grano collection, Rome, Italy; CL = Fabio Liberto collection, Cefalù, Italy; MNB = Museum für Naturkunde, Berlin, Germany; MCZR = Civic Museum of Zoology, Rome, Italy; NHM = Natural History Museum, London, England; SMF = Senckenberg Museum, Frankfurt, Germany.

Table 1

List of species or subspecies. Taxa in bold indicate single island endemics. N: a new record for the island; B: bibliographic reference only; +: bibliographic reference further recorded in this paper; E: Endemics/Subendemics (i.e., Sifnos or Sifnos and a few surrounding Cycladic islands); Ae: Aegean Endemics (i.e. (sub)species occurring in two or more Aegean archipelagos); EM: East Mediterranean; M: Mediterranean; P: Palearctic; F: subfossil specimens; NF: new record of subfossil specimens.

Species/Subspecies	Siphnos	Kitriani	Chorotype	(Sub) fossil
<i>Melanopsis astropaliae</i> Gambetta, 1929	N		Ae	
<i>Orculella critica</i> (L. Pfeiffer, 1850)	+		EM	
<i>Rupestrella philippii philippii</i> (Cantraine, 1841)	B		M	
<i>Granopupa granum</i> (Draparnaud, 1801)	B		M	
<i>Pyramidula chorismenostoma</i> (Westerlund & Blanc, 1879)	B		Ae	
<i>Mastus etuberculatus</i> (Frauenfeld, 1867)	+	N	EM	
<i>Mastus pusio</i> (Broderip, 1836)	+		E	
<i>Ceciloides acicula</i> (O. F. Müller, 1774)	B		P	
<i>Rumina saharica</i> Pallary, 1901	+		M	
<i>Tandonia cretica</i> (Simroth, 1884)	B		EM	
<i>Tandonia sowerbyi</i> (A. Férussac, 1823)	B		P	
<i>Deroceras (Deroceras) seriphium</i> Wiktor & Mylonas, 1981	B		E	
<i>Limax conemenosi</i> O. Boettger, 1883	+		EM	
<i>Albinaria turrta syphnia</i> (O. Boettger, 1883)	+	N	E	
<i>Albinaria turrta rosettae</i> n. ssp.			E	
<i>Vitrea clessini</i> (P. Hesse, 1882)	+		Ae	
<i>Vitrea contracta</i> (Westerlund, 1871)	B		P	
<i>Mediterranea hydatina</i> (Rossmässler, 1838)	B		P	
<i>Eopolita protensa protensa</i> (Férussac, 1832)	+		EM	NF
<i>Zonites siphnicus</i> A. Fuchs & Käufel, 1936	+			F
<i>Zonites chloroticus polycrates</i> E. von Martens, 1889	N		Ae	
<i>Cochlicella acuta</i> (O. F. Müller, 1774)	+		P	
<i>Caracollina lenticula</i> (Michaud, 1831)	+		M	
<i>Xerotricha conspurcata</i> (Draparnaud, 1801)	N		M	
<i>Xeromunda candiota</i> (L. Pfeiffer, 1849)	+		EM	
? <i>Candidula syrensis</i> (L. Pfeiffer, 1846)	N	N	Ae	
<i>Xerocrassa siphnica</i> (Kobelt, 1883)	+	N	E	
<i>Trochoidea pyramidata</i> (Draparnaud, 1805)	+		M	
<i>Monacha rothii</i> (L. Pfeiffer, 1841)	+		Ae	F
<i>Metafruticicola pellita</i> (A. Férussac, 1832)	+		E	
<i>Thiessa melpomene</i> (Subai, 1996)	+		E	
<i>Theba pisana</i> (O. F. Müller, 1774)	B		M	
<i>Eobania vermiculata</i> (O. F. Müller, 1774)	+		M	
<i>Cantareus apertus</i> (Born, 1778)	+		M	NF
<i>Cornu aspersum aspersum</i> (O. F. Müller, 1774)	N		P	
<i>Helix (Aegaeohelix) godetiana</i> Kobelt, 1878	B			F
<i>Helix (Pelasga) figulina</i> Rossmässler, 1839	N			NF

1.3. Abbreviations and acronyms

a: atrium; aa: atrial appendix; bc: bursa copulatrix; ca: conical appendix; caa: crest-like structure of the atrial appendix; cl: columellar lamella; d: shell maximum diameter; dbc: duct of the bursa copulatrix; dg: digitiform glands; div: diverticulum of the bursa copulatrix; dsc:

dart-sac complex; e: epiphallus; elp: epiphallar longitudinal pleats; ex/x: specimen/s; f: flagellum; fd: first duct of the bursa copulatrix; fo: free oviduct; g: penial papilla; h: shell maximum height; l: lunella; p: penis; pa: penial appendix; pc: penial caecum; pcr: penial crest; pl: parietal lamella; plp: penial longitudinal pleats; pp: principal plica; pr: penial retractor muscle; ps: penial sheath; pupp: posterior upper palatal plica;

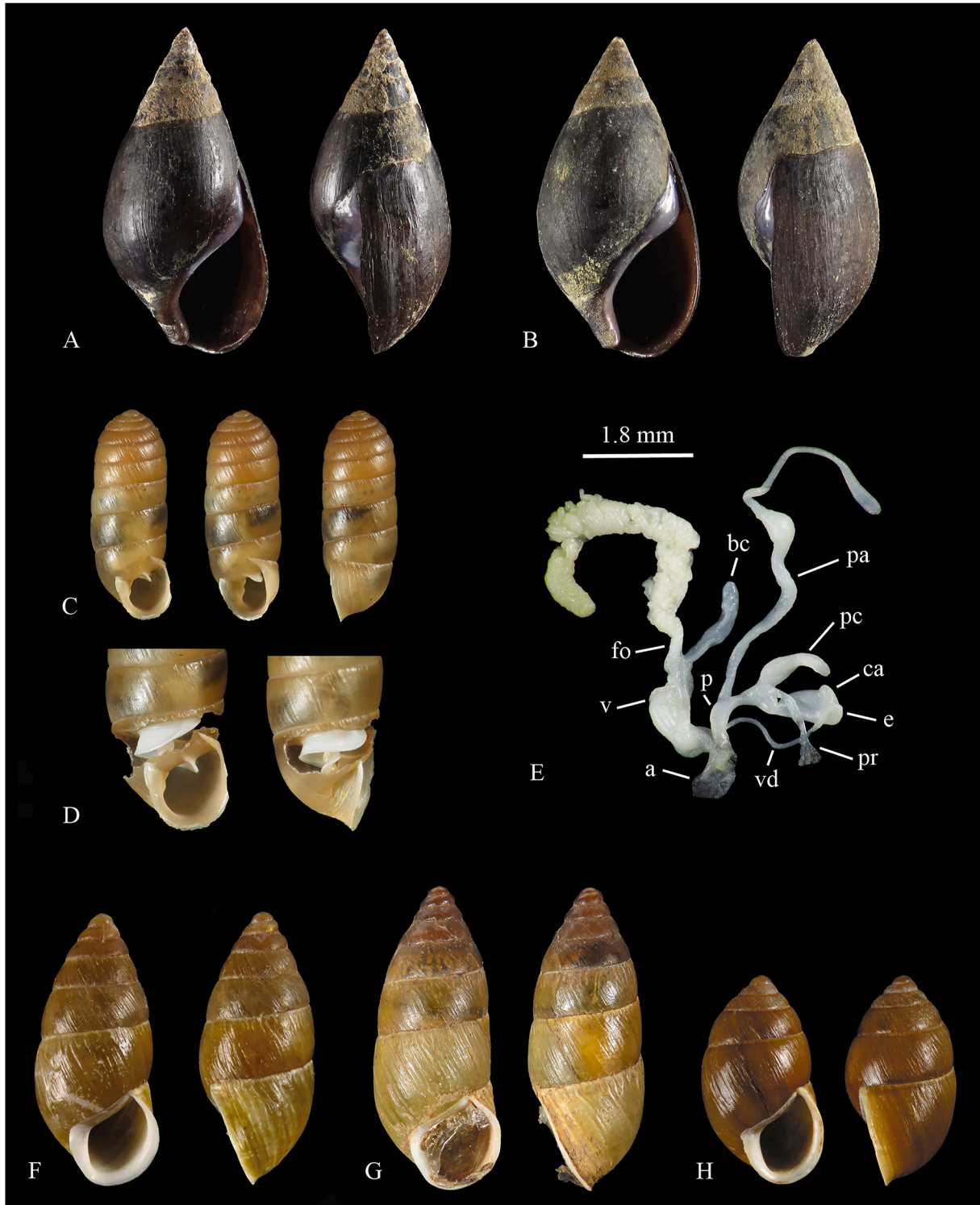


Fig. 2. (A–B) *Melanopsis astropaliae* Kastro (A) shell h: 15.2 mm, d: 7.6 mm (CL G2605); (B) shell h: 14.3 mm, d: 7.2 mm (CL G2606); (C) *Orculella critica* shell h: 8.8 mm, d: 2.9 mm, Kamares (CL G2568); (D) parietal lamella, Ksero Ksylo (CL G3117); (E) genitalia, same specimen as in (C); (F–G) *Mastus etuberculatus* (F) shell h: 15.8 mm, d: 7.2 mm, Profitis Ilias (CL G2356); (G) shell h: 18.8 mm, d: 7.8 mm, Kamares (mines) (CL G2914); (H) *Mastus pusio* shell h: 13.5 mm, d: 7.6 mm Cherronisos (CL G2711).

r2: ribs number on 2 mm of the penultimate whorl; scl: subcolumellar lamella; sd: second duct of the bursa copulatrix; sh/s: shell/s; sl: spiral lamella; st: stylophore; v: vagina; va: vaginal appendicula; vd: vas deferens; vg: vaginal gland; vp = vaginal pleats; vpp: V-shaped pleat.

2. Systematics

In this section, we present new data for land and freshwater molluscs of Sifnos Island and Kitriani Islet (organized in living and subfossil species) acquired through the study of our samplings.

Living species.

Melanopsis astropaliae Gambetta, 1929.

Kastro, 3.VIII.2022, 10 exx, CL 2605–2614;

Sotiros, 9.IV.2023, 12 exx, CL 3433–3444.

REMARKS. Described from the island of Astypalea. Based on molecular data, [Falniowski et al. \(2020\)](#) referred to the Naxos, Samos, and Tinos Islands populations as this species. This is the first record of a freshwater mollusc from Sifnos Island ([Bank, 2006](#)). *M. astropaliae* was sampled inside a residual pool of a Kastro stream and a Sotiros monastery tank ([Fig. 2A](#) and [B](#)).

Orculella critica (L. Pfeiffer, 1850)

Orcula (*Sphyradium*) *doliolum turcica* – [Fuchs & Käufel, 1934](#): 544 – Insel Siphnos

Orcula (*Sphyradium*) *doliolum turcica* – [Paget, 1976](#): 705–707 – Siphnos

Orculella scyphus – [Mylonas, 1982](#): 93 – Siphnos

Kamares (lighthouse), 2.VIII.2022, 1 ex, 3 shs, CL 2549–2552;

Ksero Ksylo, 4.VIII.2022, 1 ex, 4 shs, CL 2615–2619;

Kamares (mines), 6.VIII.2022, 1 ex, 3 shs, CL 2668–2671;

Cherronisos, 7.VIII.2022, 6 shs, CL 2705–2710;

Apollonia, 6.IV.2023, 2 shs, CL 2931–2932;

Profitis Ilias, 07.IV.2023, 2 shs, CL 3028–3029;

Ksero Ksylo, 07.IV.2023, 1 ex, 1 juven ex, 35 shs, CL 3117–3153;

Panaghia Toso Nero, 10.IV.2023, 1 sh, CL 3445.

REMARKS. This species ([Fig. 2C–E](#)) was reported by [Fuchs & Käufel \(1936\)](#) and by [Paget \(1976\)](#) from Sifnos Island as *O. turcica* A. Letourneux, 1884, currently regarded as a synonym of *O. critica*. Genitalia examination of one specimen from Kamares, NW Sifnos, showed the diagnostic characters of *O. critica*: long penial appendix (three times the length of penis + epiphallus) and penial retractor inserts at the basis of the caecum ([Hausdorf, 1996](#); [Gittenberger & Hausdorf, 2004](#)). However, this specimen has a vagina twice as long as that of the specimen depicted in [Hausdorf \(1996: 25, Fig. 6\)](#) and shows a small conical appendix on the epiphallus apex ([Fig. 2E](#)). It is believed that these characteristics fall within the variability of the species. However, more in-depth investigations, including molecular analyses, would be desirable.

Mastus etuberculatus (Frauenfeld, 1867)

Mastus (*Mastus*) *pupa etuberculatus* – [Fuchs & Käufel, 1934](#): 559, 561–562 – Insel Siphnos

Mastus pupa etuberculatus – [Heller, 1976](#): 381–382 – Sifnos

Mastus etuberculatus – [Mylonas, 1982](#): 93 – Siphnos

Mastus (*Mastus*) *pupa etuberculatus* – [Frank, 1987](#): 119 – Sifnos

Profitis Ilias, 1.VIII.2022, 13 shs, CL 2356–2368;

Aghios Sostis, 11.VIII.2022, 1 sh, CL 2811;

Kamares (mines), 6.VIII.2022, 1 sh, CL 2914;

Apollonia, 6.IV.2023, 4 shs, CL 2935–2938;

Profitis Ilias, 7.IV.2023, 6 shs, CL 3030–3035;

Cherronisos, 8.IV.2023, 4 shs, CL 3171–3174;

Platy Gialos, 9.IV.2023, 3 shs, CL 3317, 3427–3428;

Panaghia Toso Nero, 10.IV.2023, 3 shs, CL 3447–3449.

REMARKS. Shells from Sifnos are pretty variable in shape (rounded-oval to cylindrical-conical) and in colour (horny-brown to pale olive green). The mouth is somewhat squarish to oval-oblong, and a very small tubercle may occur in the upper angle of the aperture ([Fig. 2F](#) and [G](#)). The maximum shell height is 14–19 mm, and the diameter is 6.3–7.9 mm. There were no living specimens among our samples.

Mastus pusio (Broderip, 1836)

Buliminus pusio – [Boettger, 1885](#): 23–24 – Syphanto

Buliminus pusio – [Westerlund, 1887](#): 19–20 – Syphantus

Buliminus pusio – [von Martens, 1889](#): 219 – Siphnos

Buliminus (*Mastus*) *pusio* – [Germain, 1921](#): 273 – Syphantus

Mastus pusio – [Mylonas, 1982](#): 93 – Siphnos

Profitis Ilias, 1.VIII.2022, 1 sh, CL 2369;

Cherronisos, 7.VIII.2022, 1 sh, CL 2711; idem, 8.IV.2023, 1 sh, CL 3175.

REMARKS. As regards the genus *Mastus* H. Beck, 1837, while *M. etuberculatus* turned out to be a common species on Sifnos (37 shells found), only three empty shells of *M. pusio* were collected ([Fig. 2H](#)). The classification is based only on the shell features, in the same way as for *M. etuberculatus*.

Limax conemenosi O. Boettger, 1883

Limax conemenosi – [Mylonas, 1982](#): 93 – Siphnos

Limax (*Limax*) *conemenosi* – [Wiktor, 2001](#): 68–71, Fig. 15, map. 7 – Sifnos Island: Kamares, Taxiarchis; Vripia

Profitis Ilias, 7.IV.2023, 3 exx, CL 3037–3039;

Platy Gialos, 9.IV.2023, 5 exx, CL 3224–3228.

REMARKS. For the first time, the species was reported for Sifnos Island by [Mylonas \(1982\)](#); based on our findings, we confirm its presence in two new localities in a natural environment ([Fig. 3A](#)). The examination of an adult specimen allowed us to describe the distal genitalia and its internal structure ([Fig. 3B](#) and [C](#)). Penis is about half of the body length (30 mm) with broad folds in its posterior end; penial retractor insertion is at 1/4 of the penis from the posterior end; the vas deferens opens laterally, at a short distance (4.3 mm) from posterior penial apex; the latter forms a broad (not narrowing) section. The inner wall of the penis shows a long convoluted crest, decreasing in height towards the atrium, and some irregular annular pleats on the anterior two-thirds of the penis. The last few millimetres before the penial opening into the atrium are smooth. The bursa copulatrix (3 mm) with its short duct (1.5 mm) opens into the atrium. The vagina is short (3.3 mm), and its inner wall is smooth with an annular pad at the vagina-free oviduct transition. Our specimen shows a distance between the insertion point of the retractor muscle and that of the vas deferens in the proximal penis, slightly greater than that described by [Wiktor \(2001\)](#).

Albinaria turrta syphnia (O. Boettger, 1878)

Clausilia turrta – L. Pfeiffer, 1850: 135 – Siphanto

Clausilia turrta – L. Pfeiffer, 1877: 477 – Siphanto

Clausilia turrta – O. Boettger, 1877: 49 – Siphanto

Clausilia turrta var. *syphnia* – O. Boettger, 1878: 114 – Insel Siphno

Clausilia turrta var. *syphnia* – [Westerlund & Blanc, 1879](#): 110 – Siphno

Clausilia turrta var. *syphnia* – O. Boettger, 1883: 336 – Sipheno

Clausilia turrta – [von Martens, 1889](#): 221 – Siphnos

Clausilia turrta var. *syphnia* (sic!) – [Westerlund, 1899](#): 45 – I. Siphno

Albinaria (*Albinaria*) *turrta syphnia* – [Wagner, 1922](#): 37 – Insel Syphnos

Albinaria (*Albinaria*) *turrta syphnia* – [Wagner, 1924](#): 37 – Insel Syphnos

Albinaria (*Albinaria*) *turrta syphnia* – [Fuchs & Käufel, 1934](#): 576–577, Figs. 18–20 – Insel Siphnos: Chora

Albinaria turrta syphnia – [Nordsieck, 1977](#): 305.

Albinaria turrta syphnia – [Zilch, 1977](#): 325, pl. 26, Fig. 17 – Insel Sifnos

Albinaria turrta turrta – [Mylonas, 1982](#): 93 – Siphnos

Albinaria turrta turrta – [Ayoutanti et al., 1987](#): 155–160 – Siphnos

Albinaria turrta turrta – [Ayoutanti et al., 1993](#): 19–23 – Siphnos

Profitis Ilias, 1.VIII.2022, 18 exx, CL 2373–2390; idem, 7.IV.2023, 11 exx, 9 shs, CL 3040–3059;

Panaghia Toso Nero, 31.VII.2022, 11 exx, CL 2491–2501; idem, 10. IV.2023, 8 exx, CL 3450–3457;

Apollonia, 1.VIII.2022, 4 exx, CL 2526–2529;

Kamares (lighthouse), 2.VIII.2022, 6 exx, 6 shs, CL 2571–2582;

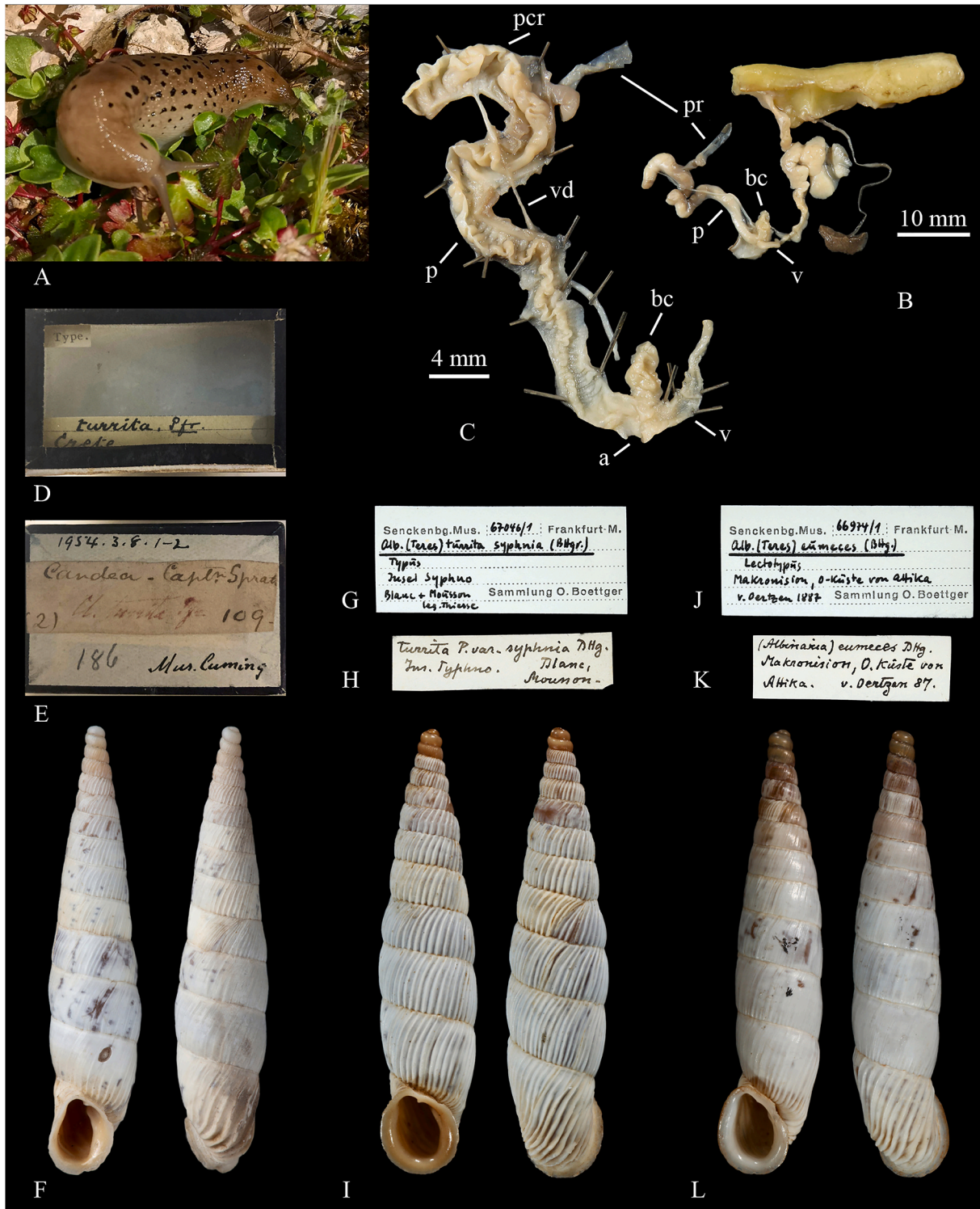


Fig. 3. (A) *Limax conemenosi*, Profitis Ilias (CL G3039) living specimen; (B) genitalia; (C) internal view of distal genitalia; (D–F) *Albinaria t. turrita* syntype, labels and shell h: 21 mm (NHM 1954.3.8.1); (G–I) *Albinaria t. syphnia* holotype, label and shell h: 20 mm, Sifnos Island (SMF 67046/1); (J–L) *Albinaria t. eumeces* lectotype, label and shell h: 18.5 mm, Makronissos Island (SMF 66974/1).

Ksero Ksylo, 4.VIII.2022, 8 exx, 2 shs, CL 2620–2629; idem, 7. IV.2023, 5 exx, CL 3152–3156;
 Platy Gialos, 5.VIII.2022, 4 exx, 3 shs, CL 2661–2667; idem, 9. IV.2023, 9 exx, 10 shs, CL 3319–3337;
 Kamares (mines), 6.VIII.2022, 8 exx, 5 shs, CL 2672–2684;
 Cherronisos, 7.VIII.2022, 10 exx, 10 shs, CL 2712–2731; idem, 8. IV.2023, 8 exx, CL 3528–3535;

Faros, 8.VIII.2022, 10 exx, CL 2767–2776;
 Troullaki, 9.VIII.2022, 2 shs, 10 exx, CL 2790–2801;
 Vathi, 12.VIII.2022, 10 exx, CL 2860–2869;
 Artemonas, 17.VIII.2022, 13 exx, CL 2872–2884;
 Remarks. *Albinaria turrita* is widespread in the western Cyclades with three subspecies: *A. turrita turrita* (L. Pfeiffer, 1850) described from the islands of Sifnos and Crete (wrong locality) but regarded as an endemic

subspecies from Milos Island (Boettger, 1878; Fuchs & Käufel, 1936; Zilch, 1977); *A. turrita syphnia* (O. Boettger, 1878) endemic to Sifnos Island; and *A. turrita eumeces* (O. Boettger, 1889) endemic to Kea and Macronissos Islands.

Boettger (1889) doubtfully reports *A. t. eumeces* also from Sifnos based on a single shell (Zilch, 1977). We have examined this paratype (SMF 66976) and consider it a specimen of *A. t. syphnia* with smooth

central whorls. We also examined the two shells of *A. t. turrita* reported by Boettger (1878) from the island of Amorgos (SMF 67044/2). It is indeed *A. t. turrita*; however, subsequent research did not confirm its presence in Amorgos.

Like other *Albinaria* species, *A. turrita* is a rock-dwelling, mainly limestone obligate door snail. The syntypes of the three known subspecies are illustrated (Fig. 3D–L). The Natural History Museum of

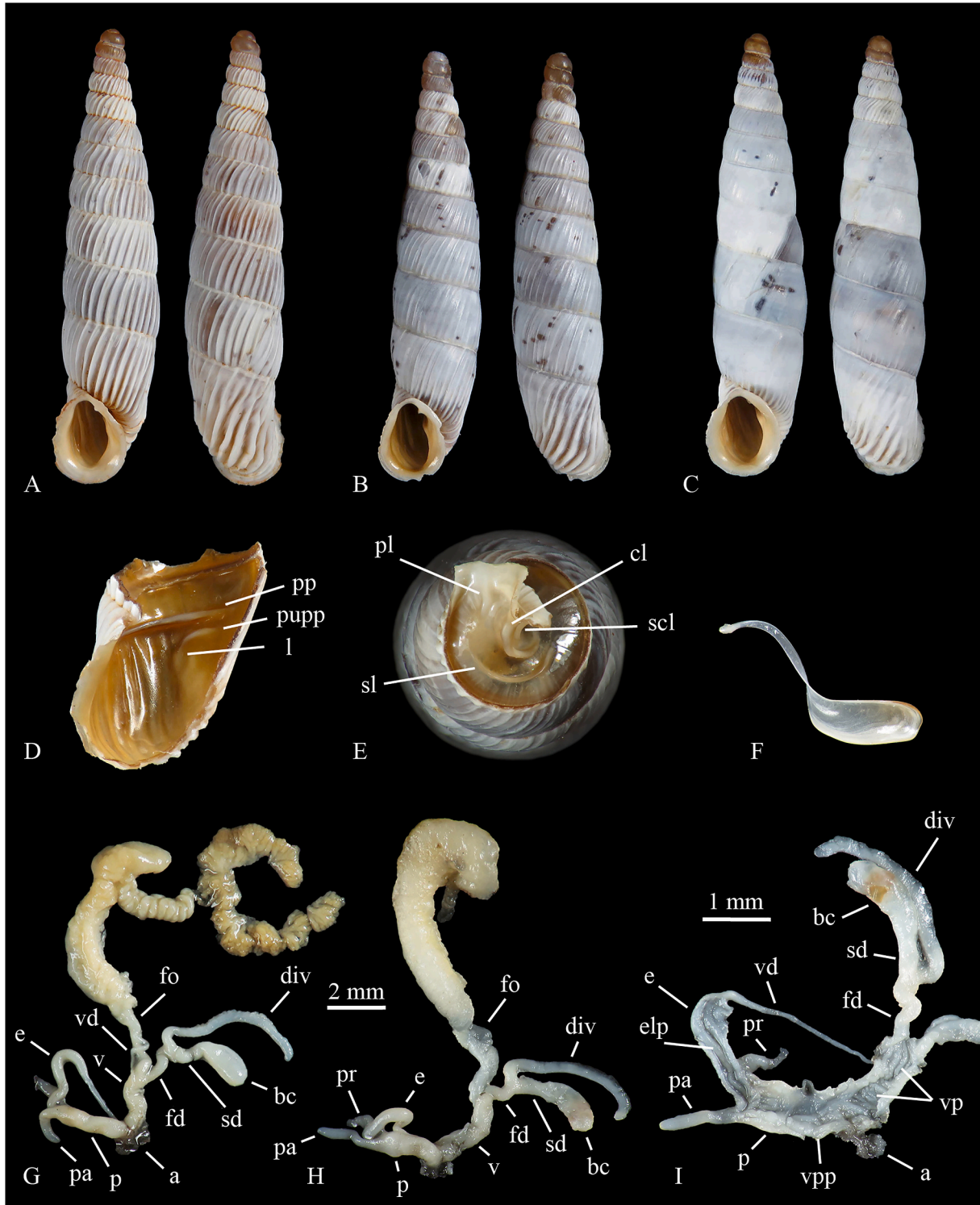


Fig. 4. *Albinaria t. syphnia* variability of shell sculpture (A) shell h: 18 mm, Kamares (mines) (CL G2673); (B) shell h: 15.4 mm, Kamares (mines) (CL G2672); (C) shell h: 17.3 mm, Profitis Ilias (CL G2373); (D) palatum, Kamares (mines) (CL G2672); (E) parietum, Profitis Ilias (CL2378); (F) clausilium, same specimen as in (D); (G) genitalia, Profitis Ilias (CL G2376); (H) genitalia, Kamares (mines) (CL G2672); (I) internal view of distal genitalia, same specimen as in (H).

London stores in the Cuming Collection some lots of *Clausilia turrita*; however, only the one with the location Crete (wrong locality, see Boettger, 1878) is accompanied by a handwritten label by Pfeiffer bearing the inscription “*Cl. turrita* Pf.” in addition to a typed label with

the inscription “Type” (Fig. 3D–F). *Albinaria t. turrita* and *A. t. eumeces* show a reduced morphological variability. Instead, *A. t. siphnia* (Fig. 4A–I) shows a notable morphological polymorphism (Douris et al., 1995: 76, present paper) both in shell dimension (Profitis Ilias h:



Fig. 5. *Albinaria turrita rosettae* n. ssp. syntypes, Sifnos Island (A) holotype, Aghios Sostis, shell h: 17.2 mm (MCZR-M-TYPE00113); (B) paratype, shell h: 22.6 mm, Poulati (CL G2590); (C) palatum, Aghios Sostis (CL G2823); (D) parietum, Aghios Sostis (CL G2818); (E–F) clausilium, Aghios Sostis (CL 2818–2819); (G) genitalia, Poulati (CL G2590); (H) genitalia, Aghios Sostis (CL G2816); (I) internal view of distal genitalia, same specimen as in (H).

15.6–21.4 mm; Faros: h: 18–22.3 mm; Cherronisos h: 17.1–23.1 mm) and in the sculpture of the lower whorls. It is possible to find (within the same population) smooth, rib-striated, or ribbed specimens (localities: Kamares, Platy Gialos, Profitis Ilias, Cherronisos) (Fig. 4A–C). The genitals show a noteworthy variability as well (seven specimens examined) (Fig. 4G–I), with length of the penial appendix ranging from half to 3/4 of the penial length and length of the diverticulum of the bursa copulatrix ranging from the same size to almost double length of bursa copulatrix + duct of bursa copulatrix, see also Fuchs & Käufel (1936: 577, Figs. 18–20). Molecular analyses showed a significant variability in mtDNA restriction sites of *A. turrita* from Sifnos Island, even though mtDNA and morphological polymorphisms are not correlated (Douris et al., 1995).

Fuchs & Käufel (1934, 1936) (1934: 75; 1936: 577) and, dubiously, Boettger (1883: 331) recorded *Albinaria caerulea* (Deshayes, 1835) from Sifnos but we were not able to find this species during our research on the island. In the northeastern part of Sifnos, we found populations of *A. turrita* morphologically different from the three known subspecies. This led us to the description of a new subspecies.

***A. turrita rosettae* n. sp.**

Type locality: Aghios Sostis, North-East Sifnos Island, Cyclades Archipelago, Greece (Fig. 1B).

Type material: Holotype (Fig. 5A). Aghios Sostis, 37°00'43"N 24°42'43"E, 32 m, M. Grano and C. Cattaneo leg., 11.VIII.2022, (MCZR-M-TYPE00113). Paratypes: idem, 31 exx, 3 shs, (CL 2812–2845); idem, 6 exx, 2 shs, (MCZR-M-TYPE00114); CMMGR 4241, 4242.

Poulati, 36°59'02"N 24°44'10"E, 57 m, M. Grano and C. Cattaneo leg., 3.VIII.2022, 7 exx, 7 shs, (CL 2588–2601).

Diagnosis. The slender shell is brown with white ribs. On the cervix, the ribbing is coarser and winding, and the palatal edge of the clausilium plate is rounded.

Description. Shell (Fig. 5A–F): slender, height-diameter ratio 5.5; spire of 1.5 smooth apical whorls + 9.5–11 teleoconch whorls, brown (Aghios Sostis) or with few traces of the white layer (Poulati); white ribs, r2: 10, on the cervix ribbing coarser and winding, sometimes interrupted; cervix rounded without prominent keels; upper lamella short, not reaching spiral lamella; columellar lamella low; subcolumellar lamella not visible in frontal and also in oblique view; under the long principal plica the posterior upper palatal plica slightly surpasses the lunella, with which is merged; lunella raised but short, basal missing; the palatal edge of the clausilium plate rounded.

Genitalia (Fig. 5G–I): cylindrical penis (1.2 mm long); however, in some specimens, with the proximal part wider and spherical; digitiform penial appendix, slightly shorter than the penis (1 mm); epiphallus double length of the penis. On the internal wall of the distal penis, there is a V-shaped pleat; in the distal part, there may be three parallel pleats more or less developed, and one of these enters the penial appendix. The internal walls of the penial appendix show some small longitudinal pleats, and the epiphallus has two or three longitudinal pleats. The vagina is the same length as the penis, internal walls with longitudinal folds in the distal part and annular folds in the proximal part. The bursa copulatrix complex is characterized by the first duct shorter than the vagina (0.7 mm), the second duct + bursa copulatrix twice as long as the vagina, and a very long diverticulum, up to four times the length of the vagina. The genitalia of *A. turrita rosettae* are similar to those of *A. turrita syphnia* but proportionally smaller, except the diverticulum of the bursa copulatrix, which is - on average - the same length. Consequently, the vagina/diverticulum of the bursa copulatrix ratio differs in the two subspecies: 3.5 in *A. t. rosettae* and 2.2 in *A. t. syphnia*.

Etymology. It is named in honour of Prof. Rosetta Vesci (Rome, Italy).

Distribution. Widespread on a narrow coastal strip of the eastern Sifnos, from Aghios Sostis to Poulati.

REMARKS. *Albinaria turrita rosettae* differs from other *A. turrita* subspecies in the brown colour (without white layer); in the more numerous ribs r2: 10 (in ribbed specimens of *A. t. syphnia* r2: 8, the other two

subspecies being striated or smooth); and in its greater slenderness h/d: 5.5 (*A. t. turrita* h/d: 4.8, *A. t. syphnia* h/d 4.8, *A. t. eumeces* h/d 4.7). The clausilium plate's palatal edge is more rounded than that of *A. t. syphnia* (Fig. 4F) (unknown in the other two subspecies). The diverticulum of bursa copulatrix is approximately twice as long as the bursa copulatrix + duct of bursa copulatrix [in six *A. t. syphnia* specimens examined it is shorter than double, see also Fuchs & Käufel (1936)]. No intermediate form was observed, the populations of Apollonia, Artemona, and Troullaki being typical *A. t. syphnia*. We prefer to regard *rosettae* as a subspecies because, in our opinion, the morphological features are not different enough to elevate it to the species rank. It shares with *A. turrita* some characteristics, including the cervix (rounded without prominent keels), the features of plicae and lamellae inside the mouth, and much of the reproductive system; in addition, *Albinaria* is one of the most speciose genera among land molluscs, and many other Aegean islands host two or more subspecies belonging to the same *Albinaria* species.

***Eopolita protensa protensa* (Férussac, 1832)**

Eopolita protensa – Mylonas, 1982: 93 – Siphnos

Eopolita protensa protensa – Riedel, 1992: 100–102, map. 35 – Apollonia-castle.

Kamares (mines), 6.VIII.2022, 1 sh, CL 2702;

Profitis Ilias, 7.IV.2023, 1 ex, 2 shs, CL 3077–3079;

Cherronisos, 8.IV.2023, 1 sh, CL 3176;

Platy Gialos, 9.IV.2023, 1 sh, CL 3381;

Panaghia Toso Nero, 10.IV.2023, 3 shs, CL 3468–3470.

REMARKS. *Eopolita protensa protensa* (Fig. 6A–D) has an Aegean distribution, while the other two subspecies have a more eastern distribution. *Eopolita p. tenerrima* (Hesse, 1931) is scattered in SE Anatolia, NW Syria and Cyprus. *Eopolita p. jebusitica* (Roth, 1855) is widespread from S Lebanon, N Israel to W Jordan (Riedel, 1992; *MolluscaBase*, 2024). We have examined the genitals of an adult specimen of *E. p. protensa* from Sifnos (Fig. 6B and C), which showed the typical features of the subspecies (Riedel, 1959a; 1959b; 1962): long cylindrical penis with its distal end wrapped in a sheath, its proximal end noticeably thinner at the transition to the epiphallus; cylindrical epiphallus, slightly shorter and thinner than the penis; vas deferens which opens apically to the epiphallus and linked to the penial sheath; vagina of the same length as the penis, almost surrounded by a vaginal gland; free oviduct and duct of the bursa copulatrix of about 1/4 of the penial length; internal penial walls with longitudinal pleats, thicker in the distal part and thinner and more numerous in the proximal part; internal walls of the epiphallus with irregular folds; internal vaginal walls with thin longitudinal folds. The transverse grooves on the internal walls of the distal penis described by Riedel (1959b) were not observed in our specimen from Sifnos. We also found *E. p. protensa* as subfossil (Fig. 6D).

***Zonites chloroticus polycrates* E. von Martens, 1889**

Panaghia Toso Nero, 31.VII.2022, 1 sh, CMMGR 4243.

REMARKS. *Zonites chloroticus polycrates* is reported from Chios, Samos, and Ikaria Islands, but in the 20th century, it was collected only from Samos. Moreover, Pfeffer (1930: 436) reported a young shell from Naxos as *Z. chloroticus* (MNB 42506, Von Örtzen leg.). We found a fresh empty shell of *Z. c. polycrates* in the western part of Sifnos (Panaghia Toso Nero) (Fig. 6H–J). The present finding and the specimen from Naxos would extend the range of this species westward. Regarding Pfeffer's finding, Riedel (1985) hypothesizes a mix-up of the labels. We have traced Von Örtzen's specimen to the Berlin Museum (Fig. 7A–H) and confirm Pfeffer's classification.

The genus *Zonites* is in decline, especially in the Aegean islands, where some (sub)species are extinct (*Zonites siphnicus* from Sifnos, *Zonites santoriniensis* A. Riedel & Norris, 1987 from Santorini Island, *Zonites embolium elevatus* Riedel & Mylonas, 1997 from Dyo Adelfoi Islet) and some others are known based on a few specimens, in some cases mainly as subfossil shells [*Z. c. polycrates*, *Z. embolium embolium* A. Fuchs & Käufel, 1936, *Zonites nikariae* Pfeffer, 1930, *Zonites nisyrius* Riedel & Mylonas, 1997, *Zonites sariae* Riedel, 1985; (see Riedel, 1985; Riedel &

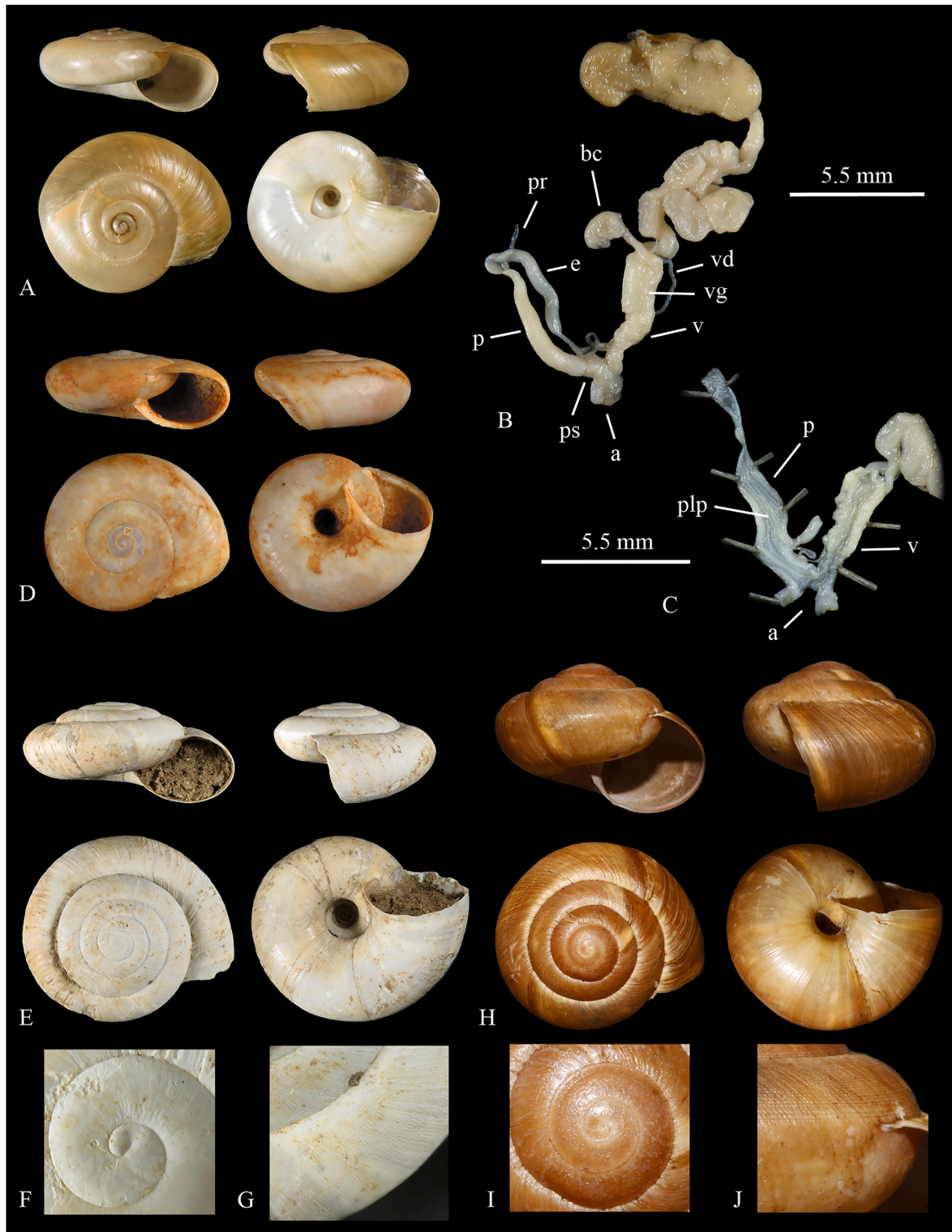


Fig. 6. (A–D) *Eopolita protensa protensa* Sifnos Island (A) shell h: 7 mm, d: 14.8 mm, Profitis Ilias (CL G3078); (B) genitalia, Profitis Ilias (CL G3077); (C) internal view of distal genitalia, same specimen as in (B); (D) subfossil shell h: 5 mm, d: 11.6 mm, Kamares (mines) (CL 2702); (E–G) *Zonites siphnicus* Cherronisos (CL G3177) (E) shell h: 15 mm, d: 30 mm; (F) microsculpture of the shell apex; (G) microsculpture of the last whorl; (H–J) *Zonites chloroticus polycrates* Panaghia Toso Nero (CMMGR 4243) (H) shell h: 23 mm, d: 30 mm; (I) microsculpture of the shell apex; (J) microsculpture of the last whorl.

Mylonas, 1995; Riedel & Mylonas, 1997)]. Therefore, the present finding can be considered very interesting from the zoogeographical and conservation point of view.

***Caracollina lenticula* (Michaud, 1831)**

Caracollina lenticula – Mylonas, 1982: 93 – Siphnos

Apollonia, 6.IV.2023, 3 shs, CL 2967–2969.

REMARKS. Species with Mediterranean-Macaronesian distribution. *C. lenticula* is frequent in retro-dune habitats, rocky coasts, and anthropogenic habitats (gardens, greenhouses). We found only three shells around Apollonia (Fig. 7I), the same locality reported by Mylonas

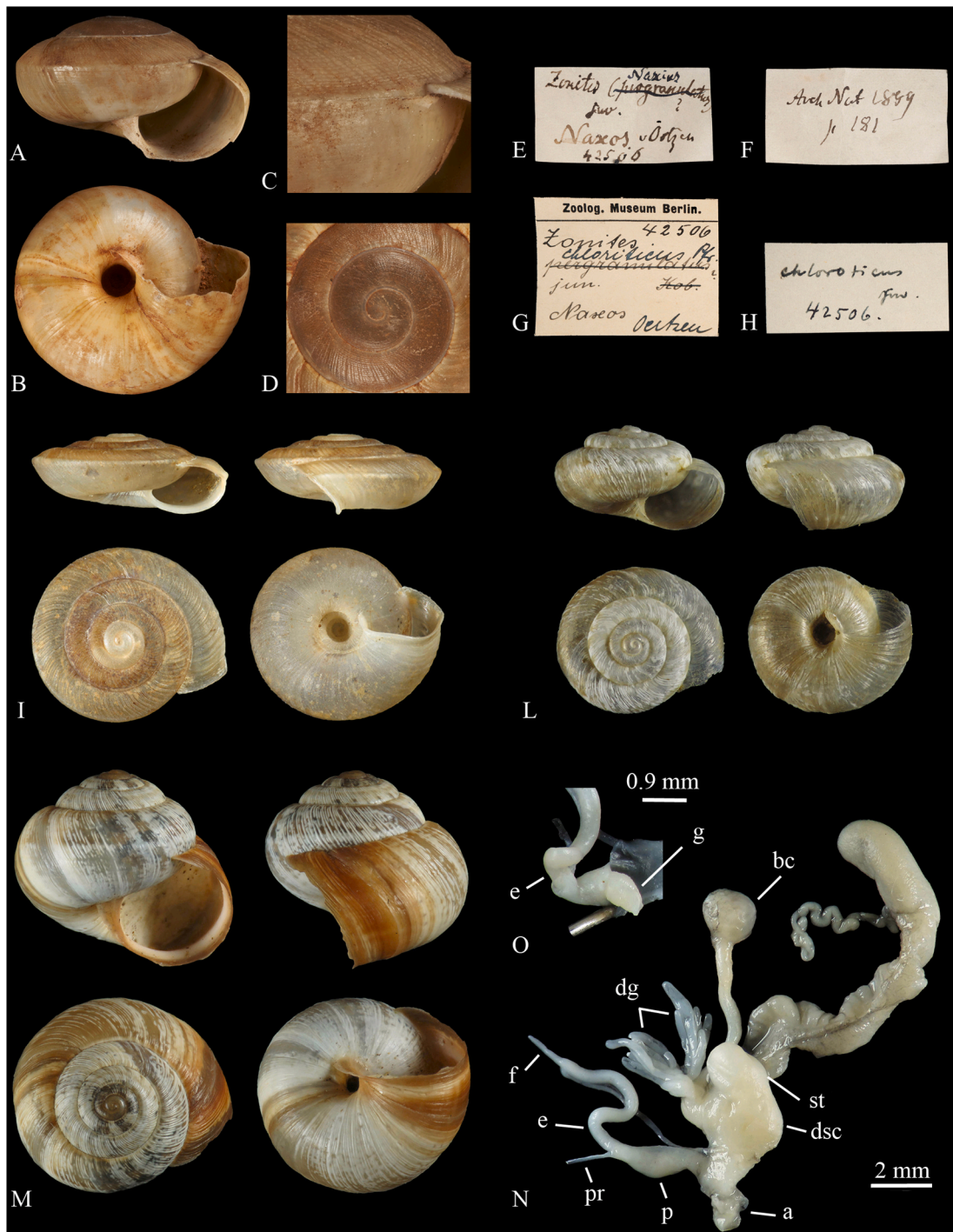


Fig. 7. (A–H) *Zonites chloroticus polycrates* Naxos, immature shell h: 11 mm, d: 17.5 mm (MNB 42506). (A) front view; (B) basal view; (C) microsculpture of the last whorl; (D) microsculpture of the shell apex; (E–F) Labels in E. von Martens’s handwriting; (G–H) Zoologisches Museum Berlin labels, correction after G. Pfeiffer (1930); (I) *Caracollina lenticula* shell h: 3.2 mm, d: 7.7 mm, Apollonia (CL G2967); (L) *Xerotricha conspurcata* shell h: 3.9 mm, d: 6 mm, Apollonia (CL G2548); (M–O) *Xeromunda candiota* Poulati (CL G2603) (M) shell h: 8 mm, d: 9.2 mm; (N) genitalia; (O) penial papilla.

(1982). We regard *C. lenticula* as an introduced species on Sifnos.

***Xerotricha conspurcata* (Draparnaud, 1801)**

Apollonia, 1.VIII.2022, 1 sh, CL 2548.

REMARKS. *Xerotricha conspurcata* shows a Mediterranean-Macaronesian distribution and mainly occurs in damp, shady sites, natural sites, and anthropic environments. Only a single empty shell near Apollonia was found (Fig. 7L). Man probably introduced it; this is the first finding on the island.

***Xeromunda candiota* (L. Pfeiffer, 1849)**

Helicella (Xeromunda) turbinata candiota – Fuchs & Käufel, 1934: 618 – Insel Siphnos

Ceruellia candiota – Mylonas, 1982: 93 – Siphnos

Xeromunda candiota – Manganelli & Giusti, 1989: 1–11 – Island of Siphnos

Poulati, 3.VIII.2022, 3 exx, CL 2602–2604;

Apollonia, 6.IV.2023, 7 shs, CL 2971–2977;

Platy Gialos, 9.IV.2023, 4 shs, CL 3382–3385.

REMARKS. Greek and Turkish species; it is widespread from the

Peloponnese to the Aegean islands and Crete. It lives in open habitats and cultivated areas. We have examined the genitalia of one specimen, which show the typical characteristics of the species (Fig. 7M–O): the stylophore is almost twice the length of the basal portion of the dart-sac complex; the external sheath wraps part of the stylophore and extends to envelop a long stretch of the distal vagina; two short longitudinal pleats occur on the internal walls of the basal portion of the dart-sac complex.

However, the Sifnos population differs from the other Aegean populations by having a longer flagellum [1.4–1.9 mm (i.e., approximately 1/4 of the epiphallus length) versus 0.8–1.1 mm (i.e., 1/5–1/7 of the epiphallus length)] (Manganelli & Giusti, 1989; Hausdorf, 1990; Hausdorf & Sauer, 2009). Furthermore, in the Sifnos population, the penial papilla is short, conical in shape, with a subapical opening almost half as long as the penial papilla (Fig. 7O), while in other Aegean populations,

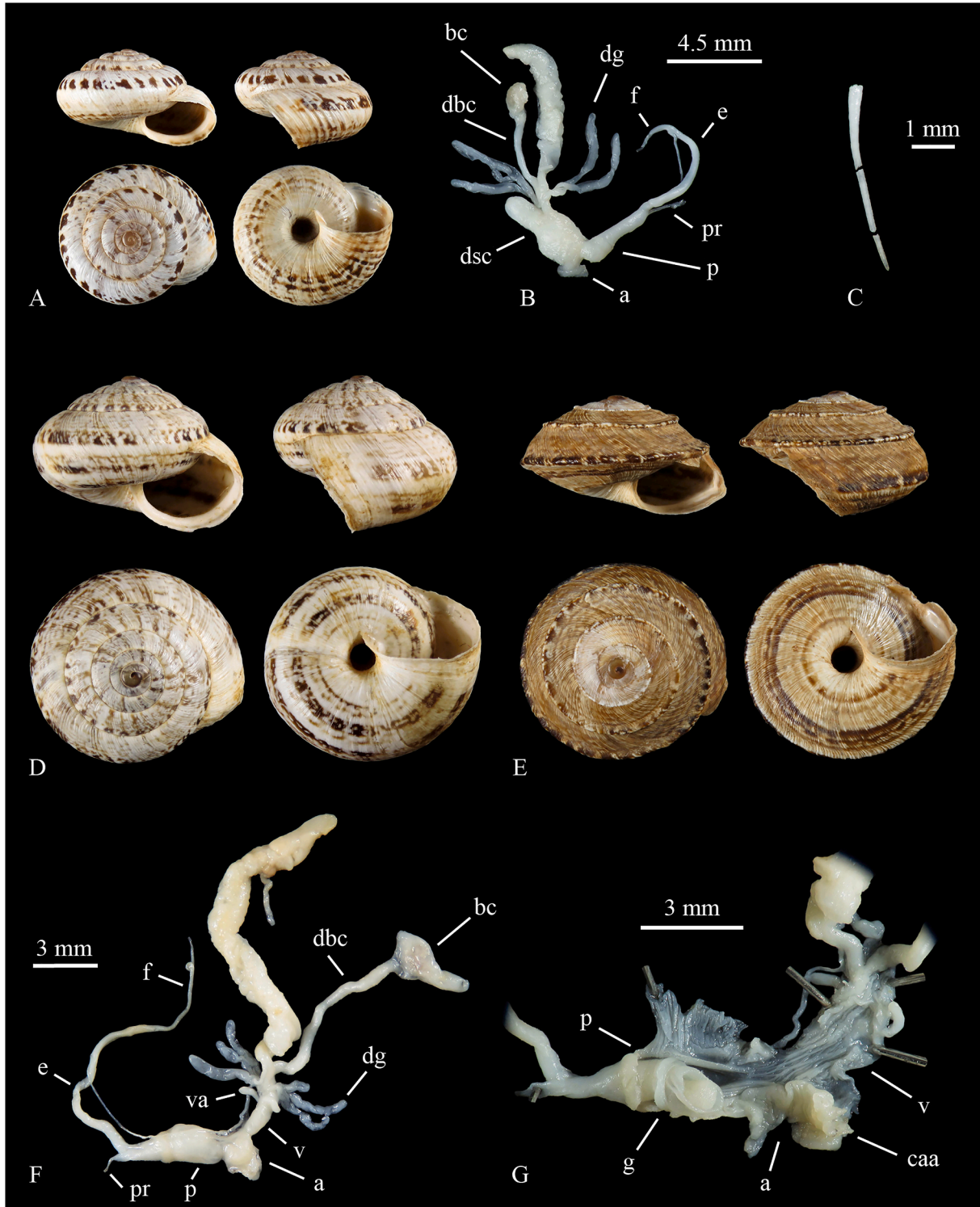


Fig. 8. (A–B) *Candidula syrensis* Kamarens (mines) (CL G2915) (A) shell h: 6.4 mm, d: 9.8 mm; (B) genitalia; (C) *Candidula syrensis* dart, broken into three parts, length: 4 mm, Ksero Ksylo (CL 3166); (D–G) *Xerocrassa siphnica* (D) shell, rounded form, h: 9.3 mm, d: 12 mm, Profitis Ilias (CL G2354); (E) shell, carinate form, h: 8 mm, d: 13.3 mm, Panaghia Toso Nero (CL G3473); (F) genitalia, Profitis Ilias (CL G3078); (G) internal view of distal genitalia, same specimen as in (F).

the penial papilla is cylindrical, longer, with a smaller apical aperture. One of our goals is to clarify this population's systematic position and the phylogenetic relationships by examining additional specimens from multiple localities.

?*Candidula syrensis* (L. Pfeiffer, 1846)

Profitis Ilias, 1.VIII.2022, 2 juven exx, 5 shs, CL 2447–2453; idem, 7.IV.2023, 3 shs, CL 3108–3110;

Panaghia Toso Nero, 31.VII.2022, 2 exx, 3 shs, CL 2520–2524; idem, 10.IV.2023, 9 shs, CL 3509–3517;

Kamares (lighthouse), 2.VIII.2022, 2 exx, 1 sh, CL 3596–3598;

Aghios Sostis, 11.VIII.2022, 1 ex, 2 shs, CL 2855–2857;

Kamares (mines), 6.VIII.2022, 2 exx, 12 shs, CL 2915–2928;

Ksero Ksylo, 7.IV.2023, 1 ex, CL 3166.

REMARKS. It was described from Syros Island and reported from other Aegean islands: Macronissos, Kea, Kythnos and Chalki (Mylonas & Vardinoyannis, 1989; Maroulis et al., 2022; 2024). We report for the first time the presence of this species on the island of Sifnos. ?*Candidula syrensis* from several Aegean islands exhibit high shell variability concerning the maximum height/diameter ratio, ribbing, diameter of the umbilicus, etc. The Sifnos populations show a shell with a slightly raised spire, last whorl rounded or angled somewhat at the periphery, smooth protoconch, first whorls with dense growth lines, becoming weaker on the last two whorls (Fig. 8A). Therefore, the shell is noticeably different from that (strongly keeled and densely ribbed) of the topotypical population from Syros. ?*Candidula syrensis* could be a species complex rather than a single species. Schubert (1892: 59, pl. 6, Figs. 18–20) was the first author to illustrate the genitalia, dart, and mandible of *C. syrensis* (sub. *Helix syrosiana* Bourguignat, 1876). Mylonas (1982) ascribed *C. syrensis* to the genus *Ceruellia* Schlüter, 1838 without providing further details, and Mylonas et al. (1995, Fig. 2E) illustrated the genitalia of a second specimen. Hausdorf (1991) hypothesized that this species belongs to the genus *Candidula* Kobelt, 1871 due to the presence of only one dart sac. Recently, Chueca et al. (2018), through a molecular phylogenetic approach, reallocated the western European *Candidula* species to six genera, while the genetic markers of the eastern European species have not yet been studied. Maroulis et al. (2024) recently highlighted the need to revise the genus *Candidula* s.l. in Greece. We have examined the genitalia of five specimens, whose external features are similar to those described by Schubert (1892) and Mylonas et al. (1995) (Fig. 8B). The dart is slightly curved, round in section, and slightly flattened at the tip (Fig. 8C). There are remarkable differences between the internal features of the genitalia of ?*C. syrensis* and *Candidula* s. str., but they won't be discussed herein because that's beyond the scope of this study.

***Xerocrassa siphnica* (Kobelt, 1883)**

Helicella (*Trochoidea*) *syrensis siphnica* – Fuchs & Käufel, 1934: 630–632, Fig. 63 genit. – Insel Siphnos

Trochoidea siphnicus – Mylonas, 1982: 93 – Siphnos

Trochoidea siphnica – Mylonas et al., 1995: 347–357 (anat.) – Siphnos island: Agios Symeon, Agios Andreas, Agios Nicolas, Profitis Ilias, Cheronisos, Agios Georgios.

Trochoidea siphnica – Douris et al., 1995: 76 – Sifnos

Xerocrassa siphnica – Hausdorf & Sauer, 2009: 375, 378.

Profitis Ilias, 1.VIII.2022, 4 shs, CL 2354–2457, 3 shs, CL 2444–2446; idem, 7.IV.2023, 6 exx, 25 shs, CL 3077–3107;

Kamares (lighthouse), 2.VIII.2022, 5 juven exx, 8 juven shs, CL 2583–3595;

Ksero Ksylo, 4.VIII.2022, 1 juven ex, 2 shs, CL 2658–2660; idem, 7.IV.2023, 6 shs, CL 3158–3163;

Cheronisos, 7.VIII.2022, 1 sh, CL 2766; idem, 8.IV.2023, 31 shs, CL 3184–3214;

Apollonia, 6.IV.2023, 1 ex, 24 shs, CL 2978, 2989–3012;

Platy Gialos, 9.IV.2023, 1 juven ex, 30 shs, CL 3386–3416;

Panaghia Toso Nero, 10.IV.2023, 7 exx, 29 shs, CL 3473–3508.

REMARKS. Sifnos Island endemic. Two ecological forms have been distinguished and described by Mylonas et al. (1995): (i) populations

with adult rounded shells, living in wetter habitats and with leafy vegetation cover (Fig. 8D); and (ii) populations with adult keeled shell, living in dry and stony habitats (Fig. 8E). *Xerocrassa cretica* (L. Pfeiffer, 1841) reported from Sifnos by Fuchs & Käufel (1936), Mylonas (1982) and Frank (1997) along with *Ceruellia cisalpina* (Rossmässler, 1837) reported by Mylonas (1982) require confirmation, as no data on genital morphology, which are essential for proper classification of these genera, are known from Sifnos specimens.

The genitalia of *X. siphnica* (Fig. 8F) were described by Fuchs & Käufel (1936: 630, Fig. 63) and by Mylonas et al. (1995, Fig. 2A–D). In addition, Hausdorf & Sauer (2009) reported the presence of a crestiform structure within the atrium. Here, we describe for the first time the penial papilla (Fig. 8G): cylindrical with wrinkled walls in the proximal part, while in the distal part, it is folded on itself, forming a large cavity at the bottom of which is the opening. In the transverse section, the proximal penial papilla shows the external wall separated from the central duct by a wide cavity.

***Trochoidea pyramidata* (Draparnaud, 1805)**

Trochoidea pyramidata – Mylonas, 1982: 93 – Siphnos

Apollonia, 6.IV.2023, 1 ex, CL 3009;

Panaghia Toso Nero, 10.IV.2023, 5 exx, CL 3523–3527.

REMARKS. Species with a Mediterranean distribution, thermophilic and xeroresistant; it inhabits natural or anthropized environments with herbaceous or shrubby vegetation (Fig. 9A and B). We examined the genitalia of three specimens, which show a crest-like structure in the atrial appendix of variable shape: triangular and raised, slightly raised and curved, or folded on itself and slightly fringed (Fig. 9C–E).

***Monacha rothii* (L. Pfeiffer, 1841)**

Monacha (*Paratheba*) *rothii rothii* – Fuchs & Käufel, 1934: 636–638 – Insel Siphnos

Monacha rothii – Mylonas, 1982: 93 – Siphnos

Metatheba rothii – Frank, 1997: 37 – Sifnos.

Monacha (*Paratheba*) cf. *rothii*. – Hausdorf, 2003: 36 – Sifnos.

Profitis Ilias, 1.VIII.2022, 1 sh, CL 2458;

Kamares (mines), 6.VIII.2022, 2 shs, CL 2703–2704;

Apollonia, 17.VIII.2022, 1 ex, CL 2870; idem, 6.IV.2023, 3 juven exx, 2 juven shs, CL 3014–3018;

Ksero Ksylo, 7.IV.2023, 1 sh, CL 3169;

Cheronisos, 8.IV.2023, 1 ex, 3 shs, CL 3304–3307;

Platy Gialos, 9.IV.2023, 1 sh, CL 3416;

Panaghia Toso Nero, 10.IV.2023, 1 sh, CL 3518.

REMARKS. *Monacha rothii* is an endemic species of the Cyclades (Hausdorf, 2003), also recorded as a fossil from Sifnos (Frank, 1997). It is characterized by a shell with distinct pits and indistinct incised spiral striae (Fig. 9F and G) (Hausdorf, 2003). We have examined for the first time the genitalia of one specimen from the island of Sifnos, whose characteristics fit well with those of the *M. rothii* populations from the islands of Syros, Rinia, Naxos, and Skinoussa (Hesse, 1931; Hausdorf, 2003). Genitalia (Fig. 9H) are characterized by a short and large penis, compared to the longer and thinner epiphallus; flagellum conical (1.3 mm long); a narrow, tube-like vaginal appendicular (1.4 mm long); three bifurcated digitiform glands; triangular bursa copulatrix. In addition, we examined for the first time the internal structure of the distal genitalia (Fig. 9I), showing an oval thick penial papilla with an apical aperture, some folds on the internal penial wall, and two more prominent folds on the internal vaginal wall.

***Thiessea melpomene* (Subai, 1996)**

Helicigona (*Thiessea*) *cyclolabris arcadica* – Fuchs & Käufel, 1936: 653 – partim, nur von der Insel Siphnos (non *arcadica* Frauendeld)

Helicigona cyclolabris – Knipper, 1939: 438 – partim, Insel Siphnos, (not *cyclolabris* Deshayes)

Helicigona cyclolabris cyclolabris – Mylonas, 1982: 93 – Siphnos

Helicigona cyclolabris arcadica – Frank, 1984: 132.

Helicigona (*Thiessea*) *cyclolabris* – Frank, 1988: 14.

Helicigona (*Thiessea*) *melpomene* – Subai, 1996: 24–27, pl. 3, Fig. 8a-d, pl. 3 Fig. 20 – Insel Siphnos: Kamares, Profitis Ilias.

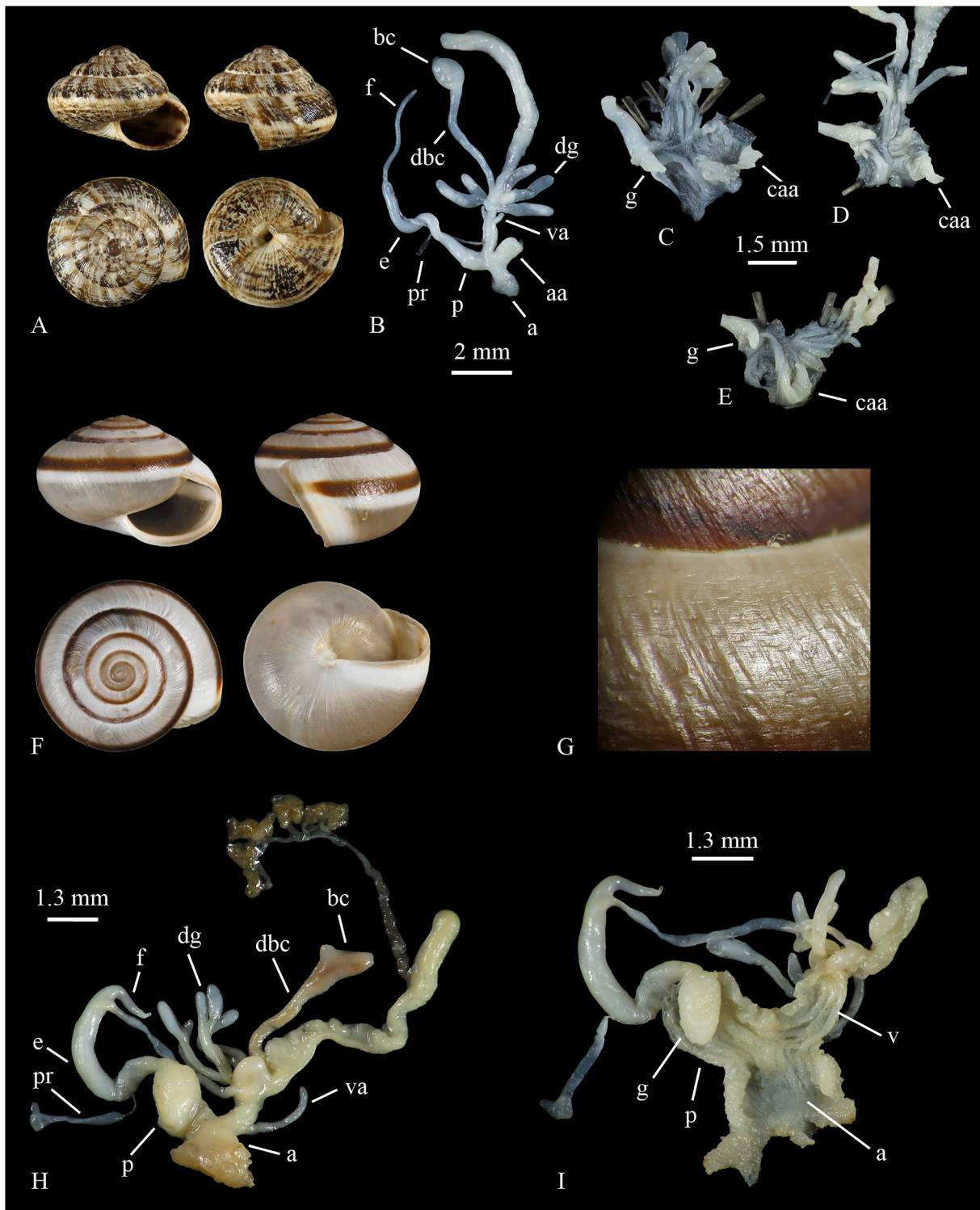


Fig. 9. (A–E) *Trochoidea pyramidata* Panaghia Toso Nero (A) shell h: 7.3 mm, d: 9.3 mm (CL G3524); (B) genitalia, same specimen as in (A); (C) internal view of distal genitalia, same specimen as in (A); (D) internal view of distal genitalia (CL G3525); (E) internal view of distal genitalia (CL G3523); (F–I) *Monacha rothii* (F) shell h: 8.3 mm, d: 11.5 mm, Kamares (mines) (CL G2703); (G) shell sculpture of the last whorl, Cherronisos (CL 3304); (H) genitalia; (I) internal view of distal genitalia.

Panaghia Toso Nero, 31.VII.2022, 1 sh, CMMGR 4290.

REMARKS. Endemic species for the islands of Sifnos, Anafi, and Folegandros. We found only a single empty shell near Panaghia Toso Nero (Fig. 10A). It is known as a Holocene fossil on Folegandros and would seem uncommon on Anafi from where only about ten shells from two different sites have been reported (Knipper, 1939; Subai, 1996).

***Eobania vermiculata* (O. F. Müller, 1774)**

Helix vermiculata – Westerlund & Blanc, 1879: 78 – Siphno
Helix (Macularia) vermiculata – von Martens, 1889: 218 – Siphnos
Eobania vermiculata – Fuchs & Käufel, 1936: 655–656 – Insel Siphnos
Eobania vermiculata – Mylonas, 1982: 93 – Siphnos
Eobania vermiculata – Frank, 1997: 103 – Sifnos.
 Profitis Ilias, 1.VIII.2022, 1 sh, CL 2464;
 Apollonia, 6.IV.2023, 1 ex, 1 sh, CL 3022–3023;



Fig. 10. (A) *Thiessea melpomene* shell h: 18 mm, d: 27 mm, Panaghia Toso Nero (CMMGR 4290); (B) *Eobania vermiculata* shell h: 17.3 mm, d: 23.3 mm, Apollonia (CL G3022); (C) *Cornu aspersum aspersum* shell h: 33 mm, d: 34 mm, Apollonia (CL G3027); (D) *Cantareus apertus* shell h: 20 mm, d: 20 mm, Apollonia (CL 3025); (E) *Cantareus apertus* subfossil shell h: 25 mm, d: 24 mm, Cherronisos (CL G3316); (F) *Helix (Pelasga) figulina*, subfossil shell h: 24.6 mm, d: 23.2 mm, Panaghia Toso Nero (CL 3521).

Cherronisos, 8.IV.2023, 3 juven shs, CL 3213–3215;
Platy Gialos, 9.IV.2023, 2 juven exx, 5 shs, CL 3417–3423.

REMARKS. Holomediterranean species, spread by Man outside Europe. It is common in the Aegean region and also in tiny islands. It lives in various natural and anthropogenic habitats with some plant cover, mainly in coastal and inland areas. Young specimens were observed in April on Sifnos. [Westerlund & Blanc \(1879\)](#) highlighted the small shell size of the Sifnos population, which is confirmed by our data (four shells examined) h: 16.5 mm, d: 24 mm ([Fig. 10B](#)).

***Cornu aspersum aspersum* (O. F. Müller, 1774)**

Apollonia, 6.IV.2023, 1 sh, CL 3027;
Panaghia Toso Nero, 10.IV.2023, 1 ex, CL 3522.

REMARKS. West European-Holomediterranean species, spread by Man all over the world. It lives in a great variety of natural and anthropogenic habitats. This is the first report of *C. aspersum* for Sifnos ([Fig. 10C](#)), contrarily to *E. vermiculata* and *Cantareus apertus* (Born, 1778) ([Fig. 10D](#) and E) reported since the nineteenth century. This would indicate a very

recent introduction of *C. aspersum* on the island.

Subfossil species.

***Zonites siphnicus* A. A. Fuchs & Käufel, 1936.**

Zonites siphnicus – [Fuchs & Käufel, 1934](#): 610–612, pl. 7, Fig. 20 A–C – Insel Sifnos

Zonites siphnicus – [Riedel & Mylonas, 1981](#): 247 – Siphnos, Pholegandros und Sikinos

Zonites siphnicus – [Mylonas, 1982](#): 97 – Siphnos

Zonites siphnicus – [Riedel, 1985](#): 38–40, Fig. 29; pl. 3, Figs. 28–35; pl. 6, Fig. 70 – Siphnos, Sikinos, Folegandros

Zonites (Zonites) siphnicus – [Riedel, 1987](#): 36 – Siphnos, Sikinos, Folegandros

Zonites (Zonites) siphnicus – [Riedel, 1992](#): 68, map. 24 – Agia Marina, Agriampelo

Zonites siphnicus – [Riedel & Mylonas, 1997](#): 156, 163 – Siphnos, Sikinos, Folegandros

Zonites siphnica – [Douris et al., 1995](#): 76 – Sifnos

Zonites siphnicus – Triantis et al., 2005: 139 – Island of Siphnos, Sikinos, and Folegandros

Zonites siphnicus – Kornilios et al., 2009: 109 – Sifnos, Sikinos and Folegandros

Ksero Ksylo, 7.IV.2023, 1 sh fossil, CL 3157;

Cherronisos, 8.IV.2023, 5 shs fossil, CL 3177–3181;

Panaghia Toso Nero, 10.IV.2023, 2 shs fossil, CL 3471–3472.

REMARKS. Species known only as subfossil (Fig. 6E–G). It is described from the island of Sifnos and reported from the islands of Sikinos and Folegandros, where the species is probably represented by distinct subspecies (Riedel, 1985; 1992).

Helix (Pelasga) figulina Rossmässler, 1839.

Apollonia, 17.VIII.2022, 1 fossil sh, CL 2929;

Panaghia Toso Nero, 10.IV.2023, 1 fossil sh, CL 3521.

REMARKS. *Helix figulina* is widespread in Greece and is recorded from the west Mediterranean Turkish coast and the northern slopes of the Rhodope Mountains in Bulgaria (Neubert, 2014). We sampled two subfossil shells from two localities: Apollonia and Panaghia Toso Nero (Fig. 10F). This is the first finding of the species on Sifnos Island.

Kitriani Islet.

Living species.

Mastus etuberculatus (Frauenfeld, 1867) (Frauenfeld, 1867)

Kitriani Islet, 13.VIII.2022, 2 shs, CL 2886–2887.

Albinaria turrita siphnia (O. Boettger, 1878)

Kitriani Islet, 13.VIII.2022, 5 exx, 11 shs, CL 2888–2903.

?*Candidula syrensis* (L. Pfeiffer, 1846) (L. Pfeiffer, 1846)

Kitriani Islet, 13.VIII.2022, 1 ex, 6 shs, CL 2904–2906; 2910–2913.

Xerocrassa siphnica (Kobelt, 1883) (Kobelt, 1883)

Kitriani Islet, 13.VIII.2022, 3 shs, CL 2907–2909.

Please note that, as these taxa have already been reported above, the sampling data are only given herein; for all other information, please refer to the back pages.

3. Discussion

Based on our findings and the results from previous studies, a total of 37 living and extinct species and subspecies (including six new records) of land and freshwater snails are reported for Sifnos and Kitriani (Table 1). The findings of the new records could be mainly attributed to three different factors. Firstly, the anthropophilous species (e.g., *X. conspurcata* and *C. aspersum*) not previously reported for the island may have arrived in the last decades by human activity, directly or indirectly, either deliberately or accidentally. For example, *X. conspurcata*, similarly to *C. lenticula*, was sampled only in the surroundings of Apollonia, the main built-up area of the island. Secondly, the research carried out through 17 localities enabled us to examine a diversified array of ecological space and to identify (sub)species with reduced range and peculiar environmental needs (e.g., *M. astropaliae*, *Z. chloroticus polycrates*, *A. turrita rosettae* n. ssp.). Thirdly, anatomical investigations allowed us to correctly classify those species whose shells provide too few elements for a reliable classification (e.g., ?*C. syrensis*). On the other hand, some small (sub)species [*Rupestrella philippii* (Cantaine, 1841), *Granopupa granum* (Draparnaud, 1801), *Pyramidula chorismenostoma* (Westerlund & Blanc, 1879), *Cecilioides acicula acicula* (O. F. Müller, 1774), *Vitrea contracta* (Westerlund, 1871)] were not found during our research on the island. Concerning the four slug species, the only record reported here, *L. conemenosi*, is presumably due to the lack of sampling during the fall-winter period, preventing us from collecting the other three species. *Zonites siphnicus*, *Helix (Aegaeohelix) godetiana* Kobelt, 1878, and *H. figulina* were found only as subfossils. The quantity and freshness of *Z. siphnicus* shells indicate a dense population that thrived until the Holocene. *Zonites chloroticus polycrates*, based on the results from previous studies and our findings (only one fresh dead shell), would appear to be in decline or, at least, survived in small and isolated populations. Overall, the extinction or decline of the large-size native mollusc species (in our opinion) could be due to (i) human

activities leading to the modification of the original woodland and scrub vegetation; (ii) the introduction of alien species such as *E. vermiculata* and *C. aspersum* (Mylonas, 1985); and (iii) the global trend towards climate warming that has been underway since the last glaciation to our times. As far as concerns subfossil species, up to now, three species have been reported as Holocene subfossils from Sifnos: *Z. siphnicus* A. Fuchs & Käufel, 1936 and *H. (Aegaeohelix) godetiana* Kobelt, 1878 subfossil and extinct and *M. rothii* subfossil but not extinct. In the present paper, we report for the first time three other subfossils, including *E. protensa protensa* (Fig. 6D), *C. apertus* (Fig. 10E), and *H. figulina* Rossmässler, 1839 (Fig. 10F), only the latter no longer living on the island.

As regards the chorotypes, based only on living (sub)species (see Table 1), the Mediterranean element is dominant (nine species and subspecies). This can be considered indicative of the dispersal capacity of some common Mediterranean land molluscs, which, in many cases, have also benefited from centuries-old human activities and dispersed in passive and anthropochoric modes. The “island character” is represented by the Aegean element (six species and subspecies) and the Endemic/Subendemic one (seven species and subspecies on the whole). The remaining two chorotypes, the East Mediterranean and Palearctic ones, include six species and subspecies each.

Sifnos local endemisms are *A. t. siphnia*, *A. t. rosettae* and *X. siphnica*. As supposed by Douris et al. (1995: 76), the extensive distribution of *A. turrita* on Sifnos Island and the observed remarkable polymorphism of some populations, in contrast to the almost monomorphic populations of Milos and Kea Islands, may indicate that *A. turrita* populations have lived on Sifnos for a longer time and/or that some of them evolved independently on the island thanks to a certain degree of isolation. Alternatively, stochastic factors may be involved, especially multiple colonizations. Lastly, in the genus *Albinaria* radiation (up to 120 species widespread in Greece and south-western Turkey), several natural selection processes seem to have been involved under the influence of abiotic and biotic factors (see Gittenberger, 1991; Schilthuzen, 2018).

Available data indicate Sifnos as a refuge for many endemic Aegean molluscs [*M. astropaliae*, *M. pusio*, *Deroceras (Deroceras) seriphium* Wiktor & Mylonas, 1981, *Vitrea clessini* (P. Hesse, 1882), *Z. chloroticus polycrates*, ?*C. syrensis*, *Metafruticicola pellita* (A. Férussac, 1832), *T. melpomene*] (Mylonas, 1982; present paper). During the Late Glacial Maximum (ca 20,000 BP) at the end of the last glacial period, when the sea level dropped 120 m, many of the eastern Cycladic islands formed one large island called “Mega-Kyklades palaeo-island”. To the west of this mega island, the islands of Kithnos, Serifos, and Sifnos, along with the group of Milos, Kimolos, and Polyaiagos, remained distinct from each other as well as from the Greek mainland (Gaki-Papanastassiou et al., 2005; Kapsimalis et al., 2009). Hence 18,000 years ago, Sifnos was already isolated (Gaki-Papanastassiou et al., 2005). Based on the idea that the reduction of the contiguous area should, according to the island theory, imply losses of species, in recent studies, it has been suggested that, among the Cyclades, big palaeo-islands experienced the highest area-reduction rates with higher species extinction rates and dramatic consequences for biodiversity conservation; on the contrary, smaller islands suffered lower species extinction rates (see Simaiakis et al., 2017). This could be the case of Sifnos, a small island characterized by a remarkable floristic richness with notable levels of endemism (Cattaneo & Grano, 2024).

The occurrence of subendemic species (including *M. pusio*, *D. seriphium*, *T. melpomene*) highlights the biogeographic proximity of Sifnos to other Cycladic islands, mainly to the western ones (Macronissos, Kea, Kithnos, Milos, Folegandros, Sikinos) and to Syros. The discovery of *Z. chloroticus polycrates* on Sifnos deserves particular attention. This species is native to Asia Minor, where the nominotypic subspecies lives, while the subspecies *Z. c. polycrates* is known from the northern Aegean islands of Chios, Samos, and Icaria, with a report of an immature shell from Naxos (MNB 42506) (Fig. 7A–H). The presence of *Z. chloroticus* in the Cyclades would indicate a process of westward expansion/colonization with interesting biogeographical implications

(Riedel, 1969; Kornilios et al., 2009). However, in the absence of molecular data and awaiting further findings, consideration of this hypothesis has been postponed.

Finally, for the first time, we conducted a sampling campaign on the uninhabited Kitriani Islet. This small island (0.85 Km²) is separated from Sifnos by a distance of about 350 m and a shallow sea depth (i.e., a few meters), which implies the existence of land connections between the two islands in the past not too far. The (sub)species sampled are the Sifnos endemics, *A. t. syphnia* and *X. siphnica*, the Aegean endemic *C. syrensis*, and the eastern Mediterranean *M. etuberculatus*. Although other species could be found through further sampling efforts, this species complex and the lack of anthropophilic species highlight the reduced impact of human activities on small islands and the role of these latter as a refuge for some native species.

4. Conclusions

The present checklist covers historical and current information, providing valuable data for conservation reports, sustainable land management, and further analyses related to insular biodiversity and ecology. More specifically, coupling the data on subfossil shells found on Sifnos (some of which belong to species no longer existing there) with the data on molluscs recently introduced by Man, the conclusion that the malacofauna of Sifnos in the recent past was partly different from the current one can be drawn. Notably, Sifnos is a potential field for studying patterns of isolation and diversification of snail communities, and, on the other hand, is an emblematic case of the decline and extinction processes of endemic species due to the alteration of habitats by centuries-old human activities and to the ongoing climate warming. In conclusion, Sifnos is an interesting case of a relatively small portion of terrestrial habitats of great scientific and ecological importance. In this view, it does deserve further studies and protection.

CRedit authorship contribution statement

Fabio Liberto: Writing – original draft, Data curation, Conceptualization. **Mauro Grano:** Writing – original draft, Investigation, Data curation. **Cristina Cattaneo:** Writing – original draft, Investigation, Data curation. **Armando Gregorini:** Funding acquisition. **Mariastella Colomba:** Writing – review & editing, Supervision, Funding acquisition.

Declaration of competing interest

The authors have no competing interests to declare.

Data availability

Data will be made available on request.

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