

## Notes on the ecology and species diversity of the inland molluscs of Samothraki Island (North-Eastern Greece)

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**Abstract.** New data on the species diversity and ecology of some snail species occurring in the island of Samothraki (north Aegean Greece) is presented. This island's malacological aspect has not been studied since 1988. Considering the results from previous molluscan studies on the island, our newly acquired data, and recent taxonomic changes, it was observed that a total of 38 species live on the island. The humid habitats in lowland plan (*Platanus orientalis*) forests with presence of artificial calcium sources were the richest in snail species.

**Key words:** north Aegean, Greece, island, malacofauna, species diversity.

### Introduction

A large number of islands of the Aegean Sea still remain understudied in terms of their molluscan species richness (see Triantis et al., 2008). The malacofauna (Mollusca: Gastropoda and Bivalvia) of the Aegean island of Samothraki in north-eastern Greece was studied by several authors (Reischütz 1986, 1988, Riedel & Reischütz 1988, Riedel 1992, Wiktor 2001). Until recently a total of 32 species was reported from both freshwaters and terrestrial habitats: *Theodoxus euxinus* (Clessin 1886), *Islamia bendidis* Reischütz 1988, *Bythinella charpentieri* (Roth 1855), *Ancylus fluviatilis* Müller 1774, *Ferrissia wautieri* (Mirolli 1960), *Pyramidula rupestris* (Draparnaud 1801), *Truncatellina rothi* (Reinhardt 1916), *Sphyradium doliolum* (Bruguère 1792), *Pupilla triplicata* (Studer 1820), *Lauria cylindracea* (Da Costa 1778), *Mastus rosmaessleri* (Pfeiffer 1847) (reported as *Mastus pupa* (Linnaeus 1758)), *Paralaoma servilis* (Shuttleworth 1852), *Oxychilus glaber* (Rossmässler

1835), *Balcanodiscus magnus* Reischütz 1988, *Vitrea contracta* (Westerlund 1871), *Vitrea schneideri* Riedel & Reischütz 1988, *Carpathica wirthi* Forcart 1971, *Tandonia sowerbyi* (Férussac 1823), *Deroceras oertzeni* Simroth 1889, *Cecilioides acicula* (Müller 1774), *Idyla bicristata* Rossmässler 1839, *Bulgarica mystica* (Westerlund 1893), *Monacha cartusiana* (Müller 1774), *Metafruticicola giurica* (Boettger 1892), *Xerolenta obvia* (Menke 1828), *Xeropicta krynickii* (Krynicky 1833), *Trochoidea pyramidata* (Draparnaud 1805), *Lindholmiola lens* (Férussac 1832) (reported as *Lindholmiola girva* (Frivaldszky 1835)), *Eobania vermiculata* (Müller 1774), *Helix lucorum* Linnaeus 1758, *Helix figulina* Rossmässler 1839, *Pisidium casertanum* (Poli 1791).

The last major contribution to the science of molluscs of this area was made by Reischütz (1988), based on material collected in 1985-1986. In this report we record some new information on the species diversity and ecology of some inland snail species occurring in the island of Samothraki.

### Materials and methods

The Greek island of Samothraki is located in the north-eastern part of the Aegean Sea (Fig.1). Its area is 180 square km, and its maximum altitude 1611 m (Fengári Peak). Its approximate closest distance from the mainland northward is 39 km. Samothraki is part of the Rodópi Mountain and is largely composed of Palaeozoic and volcanic rocks that extend over most of the island's central and south-eastern areas, leaving a narrow belt of flatlands along the northern, western, north-eastern, south-western and parts of the southern coastal zones (Coutsis 2004).

The survey was carried out from the 2<sup>nd</sup> to the 9<sup>th</sup> of August 2008. Specimens were collected chronologically from the following localities:

1. 02.08.2008: near the road between the port of Kamariotissa and village of Hora, N 40° 28' 26.3" E 25° 29' 35.8", 76 m alt.

2. 03.08.2008: vicinities of Hora, east side of the village, N 40° 28' 13.3" E 25° 31' 34.5", 242 m alt.

3. 03.08.2008: above (east of) Hora near the trail to Fengari peak, along a stretch about 1.3 km up from locality 2.

4. 03.08.2008: east of Hora, water source near the trail to Fengari peak, N 40° 27' 42.6" E 25° 31' 46.5", 334 m alt.

5. 03.08.2008: another water source near the trail to Fengari peak, above locality №4, N 40° 27' 41.1" E 25° 32' 56.3", 687 m alt.

6. 03.08.2008: rocks near the trail to Fengari peak, N 40° 27' 47.2" E 25° 33' 21.6", 802 m alt.

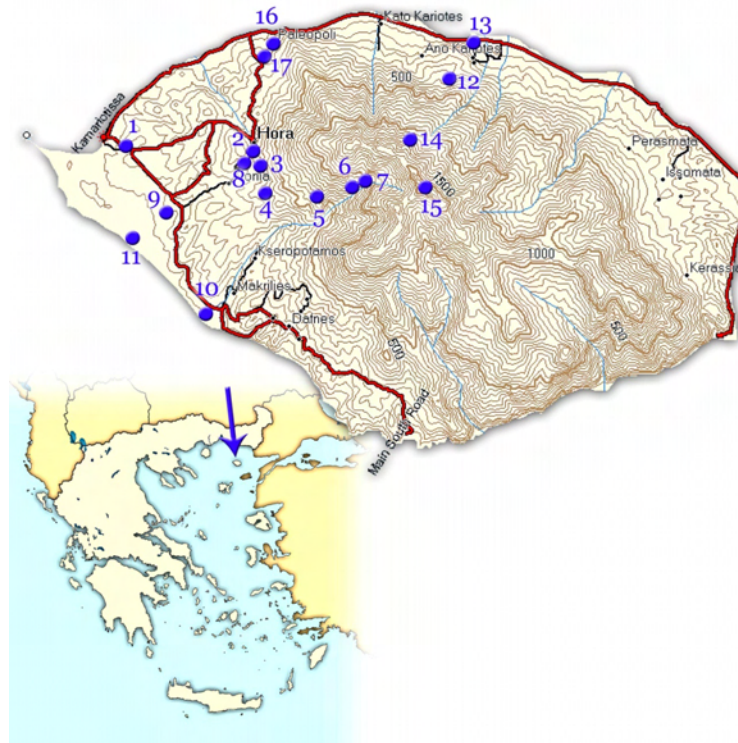
7. 03.08.2008: flat area below the steep part of the trail to Fengari peak, N 40° 27' 49.7" E 25° 33' 30.6", 883 m alt.

8. 03.08.2008: near the road from Hora to Alonia, N 40° 28' 14.3" E 25° 31' 23.7", 259 m alt.

9. 04.08.2008: at a small, canalized river west of Alonia, N 40° 27' 16.7" E 25° 29' 44.0", 47 m alt.

10. 04.08.2008: beach area at the dry mouthbed of Xeropotamos River.

11. 04.08.2008: beach area about 4 km east of Aeoli, N 40° 26' 46.4" E 25° 28' 57.1", 1 m alt.



**Figure 1.** Island of Samothraki with sampling localities of mollusc species in the present study.

12. 05-07.08.2008: above Therma, near a small river, N 40° 29' 39.9" E 25° 35' 53.2", 112 m alt.

13. 05-07.08.2008: near water source at the quay of Therma, N 40° 30' 10.8" E 25° 36' 11.5", 9 m alt.

14.06.08.2008: along the trail to Fengari peak from Therma, grass, bush vegetation, and oak forest

15.06.08.2008: the ridge of the mountain, area of Fengari peak, short grass vegetation and rocks

16. 08-09.08.2008: the ancient town of Palaiopolis

17. 08-09.08.2008: above (south of) Palaiopolis, N 40° 29' 57.8" E 25° 31' 46.1", 84 m alt.

Most of the localities were mapped by a GPS receiver and were plotted using the computer program Map Source (Garmin Inc. 2003).

Following Coutsis (2004) we have classified the island's habitats into the following types: Pf - broad leaf forest dominated by *Platanus orientalis*, Qv - xeric bush vegetation dominated by *Quercus coccifera* (maquis), Gv - xeric grass vegetation (phrygana), Ws - water sources. Furthermore, three main types of basal rock were considered: Lim - natural limestone areas, Art - artificial calcium sources (mortar, concrete, and others), and Vol - volcanic or non limestone rocks as granite, gabbro, diorite, basalt: all that was found on the island (Koglin et al. 2009). (see Table 1 and Fig.2).

The land snails were collected by hand or with the help of double sieve system (1x1 and 2x2 mm mesh width respectively) to separate them from other detritus,



**Figure 2.** Aspects of mollusc habitats of Samothraki: 1 - bush areas dominated by *Quercus coccifera* at low altitudes (loc. 3), 2 and 3 - rocks with short grass vegetation above 500 m alt. (loc. 6 and 7 respectively), 4 - water source (loc. 4), 5 - *Platanus orientalis* forest near a small river (loc.12), 6 - short grass and bush vegetation at the coastal area (close to loc. 11), 7 - the ancient town of Palaiopolis (loc. 16).

**Table 1.** Locality and habitat distribution of the inland snails found on the island of Samothraki. Legend: species: \* - a new record for the island, \*\* - species most probably misidentified and reported under another name, \*\*\* - species previously reported for Samothraki under a different name that is not used any more today for the species; habitat: Pf - broad leaf forest dominated by *Platanus orientalis*, Qv - xeric bush vegetation dominated by *Quercus coccifera* (maquis), Gv - xeric grass vegetation (phrygana), Ws - water sources; base rock: Vol - volcanic or non calcium rock, Lim - limestone, Art - artificial substrate as mortar, concrete and cement.

Species	locality	habitat				base rock		
		Pf	Qv	Gv	Ws	Vol	Lim	Art
<i>Bythinella charpentieri cabirius</i> Reischütz, 1988	4, 9				*			*
<i>Ancylus fluviatilis</i> Müller, 1774	5				*			*
<i>Galba truncatula</i> (Müller, 1774)*	5				*			*
<i>Lauria cylindracea</i> (Da Costa, 1778)	9, 16	*		*				*
<i>Sphyradium doliolum</i> (Bruguère, 1792)	9	*						*
<i>Acanthinula aculeata</i> (Müller, 1774)*	9, 17	*				*		*
<i>Mastus rossmaessleri</i> (L. Pfeiffer, 1847)**	2, 8, 11, 16	*	*	*		*	*	*
<i>Punctum pygmaeum</i> (Draparnaud, 1801)*	17	*				*		
<i>Paralaoma servilis</i> (Shuttleworth, 1852)***	9, 17	*				*		*
<i>Oxychilus glaber</i> (Rossmässler, 1835)	9, 12	*				*		*
<i>Balcanodiscus magnus</i> Reischütz, 1988	2, 3, 16	*		*		*		*
<i>Vitrea schneideri</i> Riedel & Reischütz, 1988	9, 12, 17	*				*		*
<i>Carpathica</i> cf. <i>wirthi</i> Forcart, 1971	17	*				*		
<i>Deroceras oertzeni</i> Simroth, 1889***	9	*						*
<i>Cecilioides acicula</i> (Müller, 1774)	9	*						*
<i>Idyla bicristata</i> Rossmässler, 1839	6	*	*	*		*		*
<i>Bulgarica mystica</i> (Westerlund, 1893)	2, 3, 6, 16	*	*	*		*		*
<i>Monacha subobstructa</i> (Bourguignat, 1855)***	2, 7, 13	*		*		*		*
<i>Metafruticicola giurica</i> (Boettger 1892)	3, 16	*	*	*		*		*
<i>Xerolenta obvia</i> (Menke, 1828)	1, 3, 7, 8			*				*
<i>Cerņuella virgata</i> (Da Costa, 1778)*	13			*				*
<i>Trochoidea pyramidata</i> (Draparnaud, 1805)	1, 3, 8, 13		*	*		*	*	*
<i>Xerotricha conspurcata</i> (Draparnaud, 1801)*	13			*				*
<i>Lindholmiola lens</i> (Férussac, 1832)**	2, 3, 8, 9, 13, 16	*		*		*		*
<i>Eobania vermiculata</i> (Müller, 1774)	1, 11, 13	*		*			*	*
<i>Helix lucorum</i> Linnaeus, 1758	1, 2	*	*	*		*		*
<i>Helix figulina</i> Rossmässler, 1839	2, 8, 16	*		*		*		*
<i>Cornu aspersum</i> (Müller, 1774)*	10			*		*		

and brought to the laboratory for further analysis (Kerney et al. 1983). Some of the material of *Bythinella* was sent to M. Haase (Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany) and those of *Ancylus* to P. Glöer (Hetlingen, Germany) for detailed studies. Some of the terrestrial snails endemics of Samothraki were deposited in the Haus der Natur Cismar Museum (Germany). The rest of the specimens are kept in the collection of the first author.

## Results and Discussion

We recorded a total of 28 snail species on the island (Table 1). Six of them were new records for this area (*Galba truncatula*, *Acanthinula aculeata*, *Punctum pygmaeum*, *Cerņuella virgata*, *Xerotrīcha conspurcata*, *Cornu aspersum*) (Fig.3).



**Figure 3.** Some of the snail species newly recorded for Samothraki or with corrected names: 1- *Mastus rosmaessleri*, 2 - *Punctum pygmaeum*, 3 - *Cerņuella virgata*, 4 - *Xerotrīcha conspurcata*, 5 - *Lindholmīola lens*.

The freshwater snails *G. truncatula* were found in a cement cattle watering basin near water source isolated by arid habitats (loc. 5). It was possibly transported by migrating birds there, which is a characteristic way of expansion of such snails (Bába 2006). This species is of major importance in transmitting fasciolosis due to *Fasciola hepatica* (see Makrouf et al. 2002), so invasion of *G. truncatula* possibly was negatively affecting the large semi-wild goat herds on Samothraki by spreading this disease. The terrestrial anthropophilic invaders, i.e. *Cerutuella virgata*, *Xerotracha conspurcata* and *Cornu aspersum* seem to be transported by man, which was supposed to happen for other Greek islands (Welter-Schultes 1998, Triantis et al. 2008). The same species (and other semi-synanthropic ones such as *Trochoidea pyramidata* and *Monacha subobstructa*) were found at the nearby Alexandroupolis town, on the mainland, about 40 km north of the island. Native species to the island were probably *Acanthinula aculeata*, *Mastus rossmaessleri* and *Punctum pygmaeum*, naturally occurring on the mainland (Reischütz, 1988).

Some of the previously reported species (Reischütz 1988) probably do not occur on Samothraki, and some were reported under different names. Considering the recent treatment of *Monacha* by Hausdorf (2000) and our findings, we could not confirm the presence of *Monacha cartusiana*, but found a lot of specimens of the morphologically similar *Monacha subobstructa* (Bourguignat 1855) in the study area. The last species was reported by Hausdorf (2000) as *M. claustralis* (Menke 1828), whose name was actually found to be *M. subobstructa* (see Welter-Schultes 2009). In our opinion, *Lindholmiola girva* described as a "race from Samothraki" by Reischütz (1988) is *L. lens*, the only *Lindholmiola* species we found on the island at localities described by the same author (near Hora and Palaiopolis). Although we were unable to find any *L. girva* specimens,

the presence of the species on the island certainly cannot be excluded. *Mastus pupa* was reported and most probably misidentified by Reischütz (1988) from some sites where we collected *M. rossmaessleri*, not *M. pupa*, in abundance (see Fig.3).

The species *Metafruticicola giurica* (Boettger 1892) and *Deroceras liebegotti* Reischütz 1988 reported by Reischütz (1988) were synonymized later with *M. noverca* (Pfeiffer 1853) (<http://www.faunaeur.org>) and *D. oertzeni* Simroth 1889 (see Wiktor 2001), respectively. The proposed classification for *Metafruticicola* is questionable, as *M. noverca* is a species of Crete and no published source suggests this synonymy. The genus needs a revision.

The clausiliid *Bulgarica mystica* (Westerlund 1893) was classified by Nordsieck (2007) as a subspecies of *B. denticulata* (Olivier 1801), without any argument or published study to justify this classification and without explanation why this differed from his 1973 revision, where *B. mystica* and *B. denticulata* were regarded as independent species (Nordsieck 1973).

According to Riedel (1992) the *Vitrea contracta zakynthia* Hesse, 1882 and *V. contracta* Westerlund 1871 are probably conspecific. So *zakynthia* is possibly not a valid taxon.

*Paralaoma servilis* was previously reported from Samothraki under the name *Toltecia pusilla* (Lowe, 1831) by Reischütz (1988). This species had also been known under other names (Welter-Schultes 2008).

The systematic position of the Balkan freshwater snails of the genera *Bythinella* and *Ancylus* are still unclear (Albrecht et al. 2006, Haase et al. 2007, Benke et al. 2009) so possibly after future investigations the taxonomical status of both *B. charpentieri* and *A. fluviatilis* on Samothraki would be changed.

For the Aegean land snails, it was found that species numbers were affected by environmental heterogeneity, considering both area and habitat (calcareous substrate, elevation)



effects (Welter-Schultes & Williams 1999, Triantis et al. 2005, 2008), which is in accordance with our observations. From all habitats in the island with snail species, the richest were the *Platanus orientalis* forests with 21 species (70% of the total malacofauna), followed by xeric grassy terrains (phrygana) – 16 species (55%). The malacofauna was also mainly accumulated in areas of human made calcium source structures (such as concrete and mortar). Most of the species were found at low altitudes below 300m a.s.l. At the high mountain of Fengari obvious limiting factors were drought, lack of calcareous substrates, goat grazing, and extreme temperatures during summer and winter. The few snails registered at higher mountain parts (500-1000 m alt.) were *M. subobstructa*, *X. obvia*, *B. mystica*, *G. truncatula*, *A. fluviatilis* and *I. bicristata* (the last three found only there). In the highest zones of Fengari Mts. (1000-1611 m alt.) we did not find any molluscs. In contrast the combination of plan (*Platanus orientalis*) forest at lowlands and concrete canal of the river of Alonia (locality 9) showed highest species diversity from all localities examined (9 species). It was the only locality where we found the slug *D. oertzeni*, the ecological requirements of which have almost been unknown (Wiktor, 2001, Welter-Schultes, pers. comm.). We found it crawling very early morning on the concrete bank of the river, in whose crevices the snail probably hides during very hot and dry daytime. From this finding, it is evident that night collecting might provide some live terrestrial snails from such sites.

## Conclusions

Based on our own findings and the results from previous molluscan studies on the island of Samothraki, a total of 38 species are currently present on the island. Six of these species were new records for the island. The species

*Monacha cartusiana* previously reported most probably do not inhabit Samothraki. The richest habitat in snail species was the lowland forests, where the species were abundant in a humid environment, and particularly where artificial calcium sources were present.

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