

## ***Alvania dalmatica* Buzzurro et Prkic, 2007 (Gastropoda Rissoidae): range extension, shell variability, habitat and relationships with *A. hallgassi* Amati et Oliverio, 1985**

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### **ABSTRACT**

Shell samples of *Alvania dalmatica* Buzzurro et Prkic, 2007 (Gastropoda Rissoidae) were obtained from Corfu. This is the first record of the species from the Ionian Sea and Greece. The shells show a wide morphological variation not previously reported for the species. Numerous shells of *A. hallgassi* Amati et Oliverio, 1985 were also found in the same localities. Some unreported features of this species are pointed out and the relationships with *A. dalmatica* are considered.

### **KEY WORDS**

Rissoidae; *Alvania*; variability; Mediterranean Sea; new findings.

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### **INTRODUCTION**

*Alvania* Risso, 1826 (Gastropoda Rissoidae) is a rissoid genus represented in the Mediterranean Sea by more than 70 species (Gofas, 2014). Its intrageneric relationships are still largely unresolved, lacking large-scale investigations on anatomical and molecular grounds. Some widely distributed and polymorphic taxa are probably complex of cryptic species while others often form quite uniform groups of species with not clear interspecific boundaries. Most of the latter have been recently described with very limited ranges.

*Alvania dalmatica* Buzzurro et Prkic, 2007 was described from some Dalmatian islands (Croatia), from bottoms rich of *Corallium rubrum* (Linnaeus, 1758) (Buzzurro & Prkic, 2007), no further records are known.

It is closely related, on conchological grounds, to *A. hallgassi* Amati et Oliverio, 1985 and *A. di-*

*aniensis* Oliverio, 1988. All these species occur in central Mediterranean and share a paucispiral protoconch sculptured with spiral threads and an ovate-conical teleoconch with a reticulated pattern, formed by the intersection of spiral and axial sculptures which are comparable in size.

*Alvania hallgassi* is known from Ionian coasts of Southern Italy and Sicily (Amati & Oliverio, 1985; Oliverio et al., 1986; Giannuzzi-Savelli et al., 1997; Trono, 2006; Cossignani & Ardevini, 2011; Scuderi & Terlizzi, 2012) and reported from central Tyrrhenian Sea (Scaperrotta et al., 2012). *Alvania daniensis* is distributed along Tyrrhenian coasts from southern France to Sicily and recently found in northern Adriatic Sea (Oliverio, 1988; Buzzurro et al., 1999; Cossignani & Ardevini, 2011; Micali & Siragusa, 2013; pers. obs.).

Relying on published data, the three species can be characterized by shell morphology, habitat and distribution, as reported in Table 1.

	<i>Alvania dalmatica</i>	<i>Alvania hallgassi</i>	<i>Alvania daniensis</i>
<b>Total height</b>	2.6-3.5 mm	2-2.3 mm	2-2.4 mm
<b>Teleoconch whorls</b>	3.6	3	3.2
<b>Number of axial ribs on the last whorl</b>	16-17	15-30	14-23
<b>Spiral cords on the last whorl</b>	7-9	8-11	6-7
<b>Spiral cords above the aperture</b>	4-5	4-7	3
<b>Denticles in the outer lip</b>	Yes	No	No
<b>Protoconch whorls</b>	1.4	1.5	1.5
<b>Protoconch spiral threads</b>	6-7, running throughout its extension	5-6, the nucleus with only the first and last threads	5-6, running throughout its extension
<b>Protoconch interspaces</b>	smooth	smooth	papillose
<b>Colour</b>	Background light yellow with two small darker bands (one sutural and one basal)	Background yellow with two darker bands (one sutural and one basal)	Whitish-yellowish, uniform
<b>Habitat</b>	<i>Corallium rubrum</i>	photophilic algae	photophilic algae
<b>Depth</b>	60-90	down to 20	18-48
<b>Distribution</b>	Dalmatian coasts	Ionian Sea	Tyrrhenian and Ligurian seas

Table 1. Characters of *Alvania dalmatica*, *A. hallgassi*, *A. daniensis* from literature.

## MATERIAL AND METHODS

All shells were found in bottom samples collected by SCUBA diving. The protoconch whorls are counted according to the method as described by Verduin (1977).

**EXAMINED MATERIAL.** *A. dalmatica*. 4 shs from Lastovo Island (Croatia), 60-90 m, in CBC and SBC; 80 shs from Skeloudi Island (Paleokastritza, Corfu, Greece), 40-50 m, Kolowri island (Paleokastritza, Corfu, Greece), 53 m, Liapades reef off Cape Agios Iliodoros (Liapades, Corfu, Greece), 45 m, in SBC and ARC.

*Alvania* cf. *hallgassi*-*dalmatica*. About 40 shs from the aforementioned Corfu localities, dates and collectors, in SBC and ARC; about 15 shs from Lastovo Island (Croatia), 40 m, in SBC.

*Alvania hallgassi*: holotype (MCZR); more

than 180 shs from the aforementioned Corfu localities, dates and collectors, in SBC and ARC; about 200 shs from Punta Campanella and Scoglio Vervece (Naples, Italy), 50 m, in SBC and ARC; about 150 shs from Lastovo Island (Croatia), 40 m, in SBC; 6 shs from Gallipoli (Lecce, Italy), 80 m, in CBC; 2 shs from Torre Suda (Lecce, Italy), 82 m, in APC; 4 shs from Cannizzaro (Catania, Italy), 35 m, in LRC; 2 shs from Scilla (Reggio Calabria, Italy), 50 m, in LRC.

*Alvania daniensis*. some hundred shs from Palinuro (Salerno, Italy) 30 m, in SBC and CBC; 8 shs from Giglio Island (Grosseto, Italy), in SBC and CBC; 15 shs from Cres (Croatia), 36 m, in FSC.

*Alvania oliverioi*. 10 shs from Protaras (Cyprus), 25 m, in SBC and CBC; 2 shs from N Cyprus, 2-6 m, in CBC.

ABBREVIATIONS AND ACRONYMS. APC: Attilio Pagli collection (Lari, Italy); ARC: Alessandro Raveggi collection (Florence, Italy); CBC: Cesare Bogi collection (Livorno, Italy); FSC: Franco Siragusa collection (Livorno, Italy); LRC: Luigi Romani collection (Lucca, Italy); SBC: Stefano Bartolini collection (Florence, Italy); MCZR: Zoological Museum Rome, Italy; shs: shells.

## DISCUSSION

*Alvania dalmatica* original description was based on the holotype, with no mention of the other shells' features (except size), so the morphological variability of the species cannot be properly assessed. It's however supposed to be very limited. Despite the low number of the examined topotypical shells, they match very well with the original description and show a great uniformity (Table 2, Figs. 1–8).

The greek shells share all diagnostic characters with topotypical *A. dalmatica*: paucispiral protoconch sculptured by spiral threads and smooth interspaces (Fig. 13); teleoconch with quite regular cancellate sculpture, axial microsculpture on the surface among spiral and axial ribs, outer lip inter-

nally lirate and thickened. While the protoconchs are very uniform in the two samples, the teleoconchs show a far greater variability previously unreported, both in size, sculpture and colour (Table 2, Figs. 1–8). Measured shells are fully developed adult (labial lirae and varix present) but their average size is lower than topotypical ones, although it varies considerably.

Shells outline is more or less slender (Figs. 5, 8), while the number of labial lirae is regularly lower, probably due to the smaller size. The genesis of the spiral chords follows the same pattern in both samples: two chords starting immediately after metamorphosis, later a third chord rising between them; finally in a few specimens a fourth and/or a fifth chord appearing. The teleoconch sculpture is highly variable due to the interaction between axial and spiral elements: from coarse and sparse (Figs. 2, 5, 7) to quite delicate and close-set (Fig. 6).

The number of spiral cords is on average lower compared to the Croatian shells but the appearance of the 3rd one is far more variable as well as the number of axial ribs. Consequently the spiral cords above the aperture numbering from 2 (Fig. 2) to 4 (Fig. 4) or 5 (Fig. 6), most commonly 3 with an incipient subsutural chord (Fig. 3). The intersec-

	<i>Alvania dalmatica</i> Croatia (4 shs)	<i>Alvania dalmatica</i> Greece (70 shs)
<b>Total height</b>	3.2–3.5 mm	2.3–3.1 mm (average 2.7 mm)
<b>Teleoconch whorls</b>	3.7–4	3.1–4 (average 3.5)
<b>Number of axial ribs on the last whorl</b>	16–17	13–22 (average 17.5)
<b>3rd spiral cord appearance (whorl)</b>	1.5–1.7	1.3–2.7 (average 1.9)
<b>Spiral cords on the last whorl</b>	8–9	5–9 (average 6.7)
<b>Spiral cords above the aperture</b>	4	2–5 (average 3)
<b>Number of lirae in the outer lip</b>	9–11	7–8
<b>Protoconch diameter</b>	400–410 µm	380–410 µm (average 400 µm)
<b>Nucleus diameter</b>	130–140 µm	130–140 µm
<b>Protoconch whorls</b>	1.4–1.5	1.3–1.5 (average 1.5)
<b>Protoconch spiral threads</b>	6–7	6–7

Table 2. Shell morphological features of *Alvania dalmatica*.

tions are generally nodulous, but varying from weak and barely raised (Fig. 6) to strong and somewhat spinous (Figs. 2, 7). The cancellation from squarish (Figs. 2, 3) to clearly rectangular (Figs. 7, 8). The size and sculpture features appear substantially continuous. The colour also is not constant: generally it is uniform whitish to caramel (Figs. 3, 4), some specimens are brownish (Fig. 8), others have two faint subsutural and columellar hazelnut bands (Fig. 7), or spiral cords more marked than background colour (Fig. 5).

Up to now *A. dalmatica* range was restricted to south-central Adriatic Sea, with the present note it is extended 400 km southward into Ionian Sea. This suggests a wider distribution probably overlooked due to the confusion with other *Alvania* species. Concerning the habitat, *A. dalmatica* was reported in exclusive association with *Corallium rubrum* and with a restricted bathymetrical range (60–90 m), here it is extended to 40 m depth and coralligenous bottoms. Surprisingly no *A. dalmatica* shells were found in Lastovo Is., the type locality of the species. The depth 40 m is shallower than that reported for the type material but coincide with that of *A. dalmatica* from Corfu.

A large population of *A. hallgassi* was found sympatrically with *A. dalmatica* in Corfu. The shells fit with the original diagnosis in some respects: paucispiral protoconch (Fig. 14); general outline; quite delicate, reticulate sculpture with axial ribs ranging from 20 to 40 (most commonly around 30) and 8–10 spiral cords on the body whorl; outer lip relatively thin with a faint external varix. Yet some features disagree: the total height is on average greater, spanning from 2.4 mm to 3 mm; the protoconch size and sculpture are substantially identical to *A. dalmatica* with spiral threads all beginning from the nucleus, not only the first and last ones as stated in the original description; the outer lip (in fully developed shells, about 15% of the samples) has inner denticles (lirae) yet weaker than *A. dalmatica*. The teleoconch sculpture is also quite variable and in some shells is rather coarse (Figs. 9, 10). The genesis of the spiral chords is very similar to *A. dalmatica* but fourth and/or a fifth chords are present in most shells (Figs. 9, 11).

The colour in most cases shows typical pattern: two brown bands (a sutural and a basal) on a yellowish background, but several shells are uni-

formly whitish-yellowish sometimes with spiral cords darker.

To better place these characters in a more general context, *A. hallgassi* shells from various southern Italy localities were examined: The holotype is a slightly worn shell with a pebble occluding the aperture, so it is not very useful in order to examine these features. But in two large samples very near the type locality about 20% of fully developed shells are lirate (50 shs from Punta Faci, 36 m, and 40 shs from Torre del Serpe, 25 m, both south of Otranto, Lecce, Italy, Macrì pers. com.). *Alvania hallgassi* from Naples have typical size (maximum 2.2 mm) colour pattern, shell sculpture, but the protoconch is identical to *A. dalmatica* and a small percentage of shells exhibit weak denticles in the aperture. Also *A. hallgassi* from Sicily share the same protoconch and denticulation features (the size of the sample is small, yet two specimens are weakly lirate). It seems, therefore, that a protoconch wholly marked by spiral threads beginning from the nucleus and the presence of labial lirae in a small percentage of adult shells are typical of the species.

## CONCLUSION

Concluding, *A. hallgassi* and *A. dalmatica* share some key diagnostic features (protoconch size/sculpture and inner lip denticulation). On the other hand, examining large samples, several specimens of *A. hallgassi* and *A. dalmatica* come close in terms of sculpture and colour in an apparent continuous spectrum, so being difficult to attribute them with certainty to each species (Figs. 6, 12); these latter features indeed are so variable in each individual that it's difficult to use them for diagnostic purposes. Also some *A. hallgassi* shells from Lastovo Is., with particularly coarse sculpture, overlap with delicate-sculptured *A. dalmatica*.

*A. daniensis* has a papillose protoconch surface, no labial denticles and seems to have more uniform shell sculpture, but Micali & Siragusa (2013) attributed to *A. daniensis* a population from N Adriatic Sea with a very coarse teleoconch sculpture, largely different from the typical pattern of the species. So, in this context, extensive investigations involving also molecular tools, are desirable to better understanding the boundaries within *A. hallgassi-daniensis-dalmatica* complex of species.





Figures 1–12. *Alvania* spp. Fig. 1. *A. dalmatica*, Lastovo is., Croatia, 3.3 mm; Figs. 2–8. *A. dalmatica*, Corfu, Greece, 2.6 mm (2), 3.2 mm (3), 3 mm (4), 3 mm (5), 2.8 mm (6), 2.7 mm (7), 2.9 mm (8). Figs. 9–10. *A. hallgassi*, Corfu, Greece, 2.8 mm (9), 3 mm (10). Fig. 11. *A. hallgassi*, Lastovo is., Croatia, 2.9 mm. Fig. 12. *A. hallgassi-dalmatica*, Corfu, Greece, 2.8 mm.

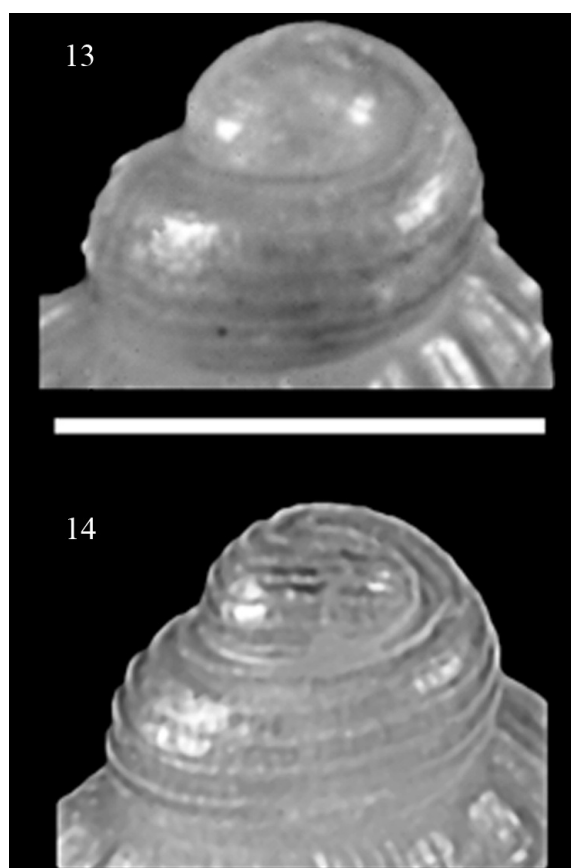


Figure 13. Protoconch of *A. dalmatica*.  
Figure 14. Protoconch of *A. hallgassi*.

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