

First report of *Alvania scuderii* Villari, 2017 (Gastropoda: Mollusca) from Tyrrhenian Sea: Some biogeographic implications

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ABSTRACT

The cryptic gastropod *Alvania scuderii* Villari, 2017, recently described from the Strait of Messina as new species inside the *A. scabra* (Philippi, 1844) group, was known by restricted areas of eastern and southern Sicily. Some records from the type locality and south-eastern Tyrrhenian sea, which provided new data on habitat and bathymetric range, also enlarged northward, in a further basin, the known areal. Such areal, that overlaps a Mediterranean western-eastern biogeographic boundary, may be considered a further clue of an hydrological front that is responsible of a West-Mediterranean footprint more marked than in nearby North-westernmost areas.

Keywords: Motile fauna, Hard bottom, Rissoidae, *Alvania*, Biogeography, Mediterranean sea

Introduction

The recently described *Alvania scuderii* Villari, 2017, is a cryptic gastropod species belonging to the taxonomically problematic *A. scabra* (Philippi, 1844) group (Villari, 2017; Villari & Scuderi, 2017). The new species, described on specimens from the Strait of Messina was initially related to “a peculiar sciaphilous environment of the Eastern Sicilian coasts”, before other living specimens from S. Giovanni Li Cuti, near Catania, expanded the known habitat about 100 km to the south (Amati et al., 2020). Shells from Scilla testified the occurrence of *A. scabra* in the other side of the Messina Strait, whilst dead specimens from some localities of Linosa Island (Amati et al., 2020; Scaperotta et al., 2019) indicated a wider distribution which included the Strait of Sicily.

The present report of living specimens both from type locality and southern Tyrrhenian Sea, further expanding the known areal of this poorly known species, suggests some considerations about the western-eastern Mediterranean boundary line.

Material and Methods

Samples of motile macrofauna have been collected from the Strait of Messina and nearby localities of southern Tyrrhenian sea, in the framework of different research programs (MeBE; NIRS) Two sampling techniques have been employed, according to the main purposes of each investigation. In particular, qualitative samples have been collected by brushing of vegetated hard substrata, 1-4 m depth, while quantitative sampling have been carried out by scraping of 20x20 cm hard bottom surface at 3-6 m, 12-16 m and 24-32 m depth. Samples have been washed on a 0.5 mm mesh sieve and the retained rapidly fixed in 70% ethanol. Mollusc fauna was sorted under stereomicroscope and specimens determined at the species level, as far as possible. Most species were photographed under stereomicroscope.

ACRONYMS

- BEL:** Benthic Ecology Laboratory, Messina University, Italy.
- CWR:** Collection Walter Renda, Amantea, Cosenza, Italy
- MeBE:** The Strait of Messina Benthic Ecosystem Project
- NIRS:** Ecology and Spatial Dynamics of Marine Not Indigenous and Rare Species Project

Results and Discussion

Samplings carried out in the type locality, Cape Peloro, altogether provided 32 *A. scuderii* living specimens, all collected from the sheltered side of breakwater artificial reefs, 1-4 m depth, located at 38°15'43"N - 15°38'20"E (two specimens, repository code: BEL147Faro2019As1-5), and 38°15'35"N - 15°37'44"E, 200 m northward (22 specimens, repository codes: BEL147Gran2019As1-17 and CWR147-3121B1-5). In both sites, the sampled vertical surface was characterized by a dense algal covering, dominated by fleshy red algae under a brown algae canopy.

The other five specimens (BEL147Spez2019As6-10) were collected along a transect orthogonal to the line coast (38°15'46.66"N - 15°38'33.11"E), in a vegetated rocky bottom characterized by patch distributed fleshy and calcareous red algae, at 15 m (3 specimens) and 26 m depth (2 specimens).

Outside of the type locality, two specimens (Figure 1) have been collected near Briatico (VV) (38°43'37.65"N - 16° 1'20.67"E), about 4 m depth, from a rocky substrate partially covered by Cystoseiraceae brown algae (repository code: CWR147-3121A1-2).

In both type and new localities, *A. scuderii* was always found sympatric with the close congeneric *A. scabra* (Philippi, 1844).

Size ranged between 1.2 mm and 2.0 mm for Messina specimens and between 1.8 mm and 1.9 mm for Tyrrhenian specimens (Figure 1).



Figure 1. Ventral and dorsal view of a *Alvania scuderii* Villari, 2017 specimen from Briatico, South-eastern Tyrrhenian sea
Scale bar: 1 mm

The new records of *A. scuderii* provide further information about habitat and depth range of this rarely reported gastropod. The species, that Villari (2017) indicated as preferentially sciaphilous, colonizing both “rocky and very shallow waters, between algae on stones”, in present investigation has been found associated to different typologies of photophilic algal covering and, deeper, to variously vegetated rocky bottoms. Depth range was wider than initially described, since the species occurs at least from 1 m to 26 m depth. Deeper

records of living specimens, in general, agree with some reports of empty shells from Linosa, whilst dead specimen from 43-44 m depth, at Scilla (Amati et al., 2020), might be displaced from shallower rocky bottoms. Although poor information is available on the related mollusc assemblage, present data at least confirm that *A. scuderii* is normally sympatric with the close *A. scabra*, which is always more abundant, in agreement with Amati et al. (2020).

The present records of *A. scuderii* (Figure 2), confirming the stable settlement of this species in the type locality, also expand northward the known areal, in the nearby Tyrrhenian basin. Such distribution, defining an almost continuous corridor, which connects the Tyrrhenian Calabrian coasts to the

Strait of Sicily, throughout the Strait of Messina and Ionian coasts of Sicily (Figure 2), might suggest an areal restricted to the eastern boundary of the western Mediterranean, as it is drawn in Bianchi & Morri (2000), and in accordance with the local hydrology.

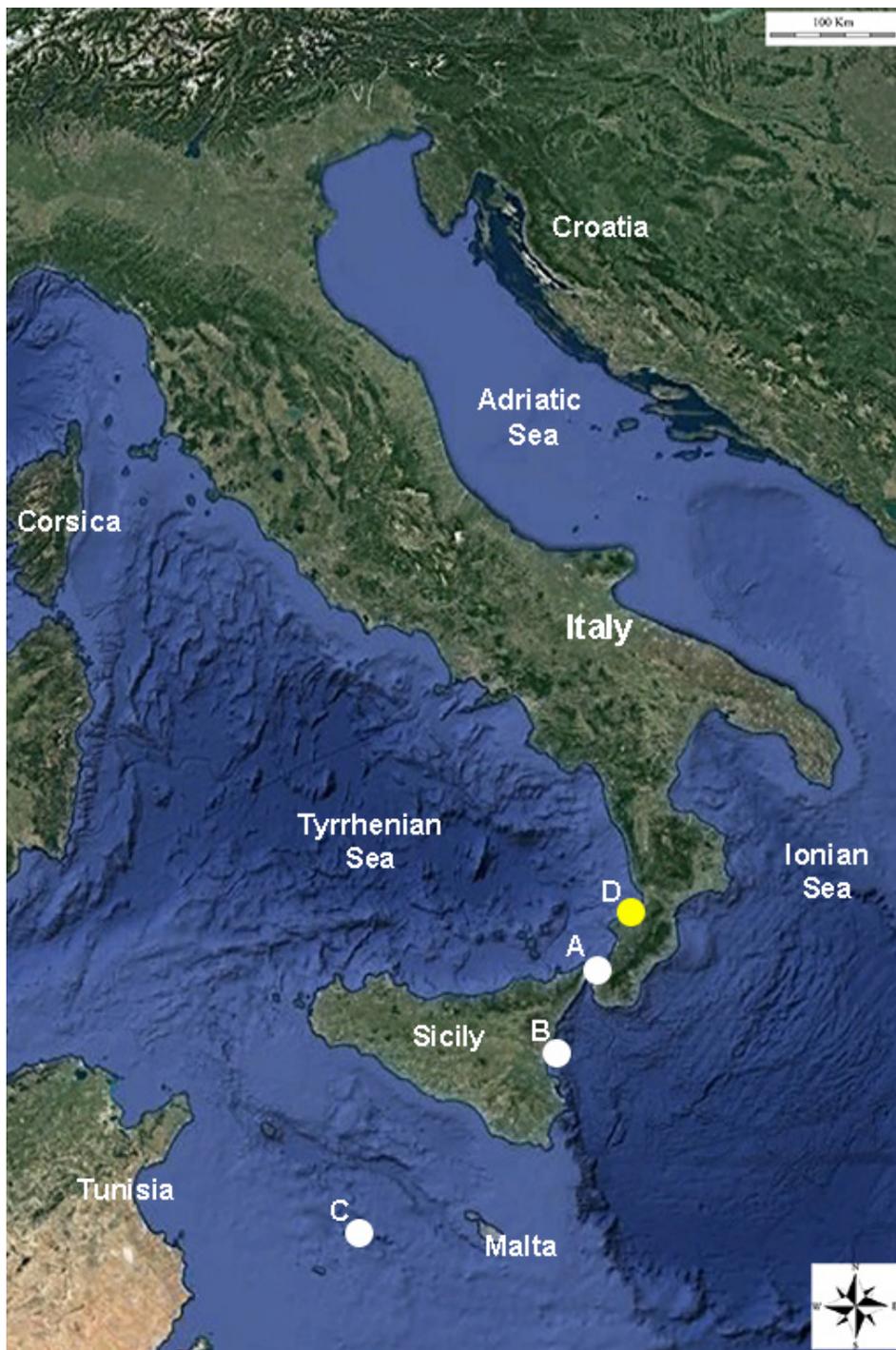


Figure 2. *Alvania scuderii* Villari, 2017 distribution. **A** –Strait of Messina (Type locality); **B** –San Giovanni Li Cuti; **C** – Linosa Island; **D** – Briatico (present record)

Satellite thermography's, in fact, show a well distinct “cold strip” superimposed to the southern and eastern Sicily shelf, and overflowing into the southern Tyrrhenian sea through the Messina Strait (Bôhm et al., 1987), which determines a substantial continuity throughout the whole *A. scuderii* areal. Such coastal waters, that are colder than the close Ionian and Tyrrhenian typical water masses, have different origin, since southward they are tied to a wind-induced upwelling regime (Levi et al., 2003), whilst northward the effect of the Messina Strait tidal upwelling is recognizable (Bôhm et al., 1987). The records from the isle of Linosa, although concerning an area that is almost peripheral in respect to the core of such peculiar water-masses, can be explained by the Atlantic-Ionian Current pathway, one branch of which originates an anticyclonic gyre circling around Linosa, before flowing towards Sicily (Reyes Suarez et al., 2019). We may suppose, in agreement with Cuttitta et al. (2016), that mesoscale oceanographic structures play a key role in shaping the actual distribution of *A. scuderii*. This species, in fact, whose paucispiral protoconch indicates a non-planktotrophic larval development (Nützel, 2014), has a moderate dispersion capacity, on turn conditioned by the effectiveness of lateral supply and availability of neighboring steppingstones. In this respect, we suggest that *A. scuderii* might almost continuously occur throughout the completely southern and eastern coast of Sicily, up to a southeastern Tyrrhenian area which is still affected by the Strait of Messina tidal regime. Such distribution, whose effectiveness is however conditioned by the recent splitting of *A. scabra* in a rich species complex which includes *A. scuderii* (Amati et al., 2020), contributes to a patchiness of closely related species which together, but also individually (*A. scabra*), cover the whole Mediterranean western basin.

Conclusion

The occurrence of *A. scuderii*, in particular, contributes to define a Mediterranean western-eastern biogeographic boundary line, which however cannot be considered as an ecotone, but as a front whose oceanographic features allow a West-Mediterranean footprint more marked than in nearby North-westernmost areas.

Compliance with Ethical Standard

Conflict of interests: The authors declare that for this article they have no actual, potential or perceived conflict of interests.

Ethics committee approval: Approved by institutional, regional and national animal ethical statements.

Funding disclosure: -

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Disclosure: -

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