

First record of the marine snail *Xenophora crispa* (Gastropoda: Xenophoridae) from Madeira Island (Northeastern Atlantic Ocean)

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The marine snail *Xenophora crispa* (d' Orbigny, 1847) is recorded for the first time in Madeira Island (NE Atlantic). This species is currently distributed throughout the central and western Mediterranean, western Atlantic from France (Gulf of Biscay) to North Africa (up to Morocco), including the Archipelagos of the Azores, Canary Islands, and now Madeira.

Key words: new record; geographical distribution; *Xenophora crispa*; Madeira

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INTRODUCTION

In Europe, the only single representative of the family Xenophoridae Philippi, 1853, is the marine snail *Xenophora crispa* (Koenig, 1825). It is relatively well documented in the literature (Ponder 1983; Manganelli et al. 2004 and references therein). This species has a wide geographic distribution, including the western half of the Mediterranean Sea (Italy, Sardinia, Sicily,

Tunisia, Algiers, Spain: Valencia), North Africa (Algiers, Morocco), and the Atlantic archipelagos of the Azores and Canary Islands (Ponder 1983 and references therein; Hernández et al. 2011).

The present paper represents the first study to record *Xenophora crispa* (Koenig, 1825) in Madeira Island, located in the Northeastern Atlantic Ocean and a contribution to the biogeography of the species in the whole Macaronesia.

MATERIAL AND METHODS

The Madeira Archipelago is a group of Portuguese volcanic islands located in the NE Atlantic Ocean on the southwest of continental Europe and about 700 km off the Moroccan coast. It comprises two inhabited islands: Madeira and Porto Santo (Fig. 1). Madeira Island is the largest island with 144 km of coastline, whereas Porto Santo Island is about 42 km northeast of Madeira Island with about 33 km of coastline.

On July 4th, 2019, the fishing vessel "Orvalho"

collected three specimens using the bottom horizontal longline fishing method at about 140 m depth, off the north-eastern coast of Madeira Island in the fishing area "Pesqueiro do Barlavento" located north of Ponta de São Lourenço (32°80.9113' N, 16°64.5128' W, Figure 1). Unfamiliar with the species, the vessel captain Manuel Santos reported the capture and delivered the specimens for taxonomic identification. Specimens were visually inspected, measured (max. diameter and height), and photographed with Canon EOS 5D mark III (lenses Canon EF 100mm f/2.8L IS USM).

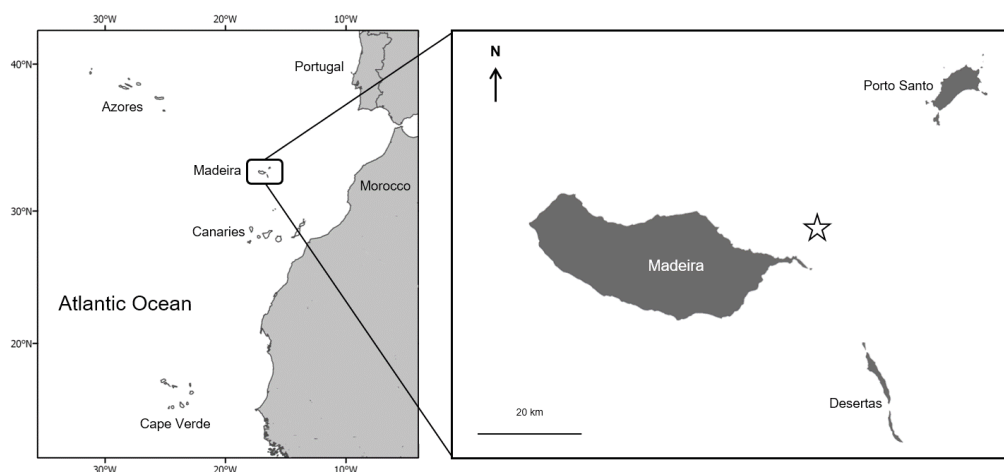


Fig. 1. Madeira Archipelago with the fishing area's location "Pesqueiro do Barlavento" shown by "☆" located north of Ponta de São Lourenço of Madeira Island where the *Xenophora crispa* specimens were collected.

RESULTS

The three collected specimens (Figure 2A, B and C) were identified as:

Order LITTORINIMORPHA Golikov & Starobogatov, 1975

Family XENOPHORIDAE Troschel, 1852 (1840)
Genus *Xenophora* Fischer von Waldheim, 1807

Xenophora crispa (Koenig, 1825)

Material examined: MFC478, MMF (48848), and M. Santos (04/07/2019, Madeira)

Following an inspection, analysis, and photo collection, specimens were catalogued and deposited as Specimen A (live specimen, shell, 41,9 mm of maximum diameter, excluding attachments) in the author's collection (MFC 478); specimen B (live specimen, shell, 42,8 mm of maximum diameter, excluding attachments) in the Museu Municipal do Funchal (Natural History) collection (MMF 48848), and specimen C (live specimen, shell, 37,5 mm of maximum diameter, excluding attachments) in Manuel Santos personal collection (MS).

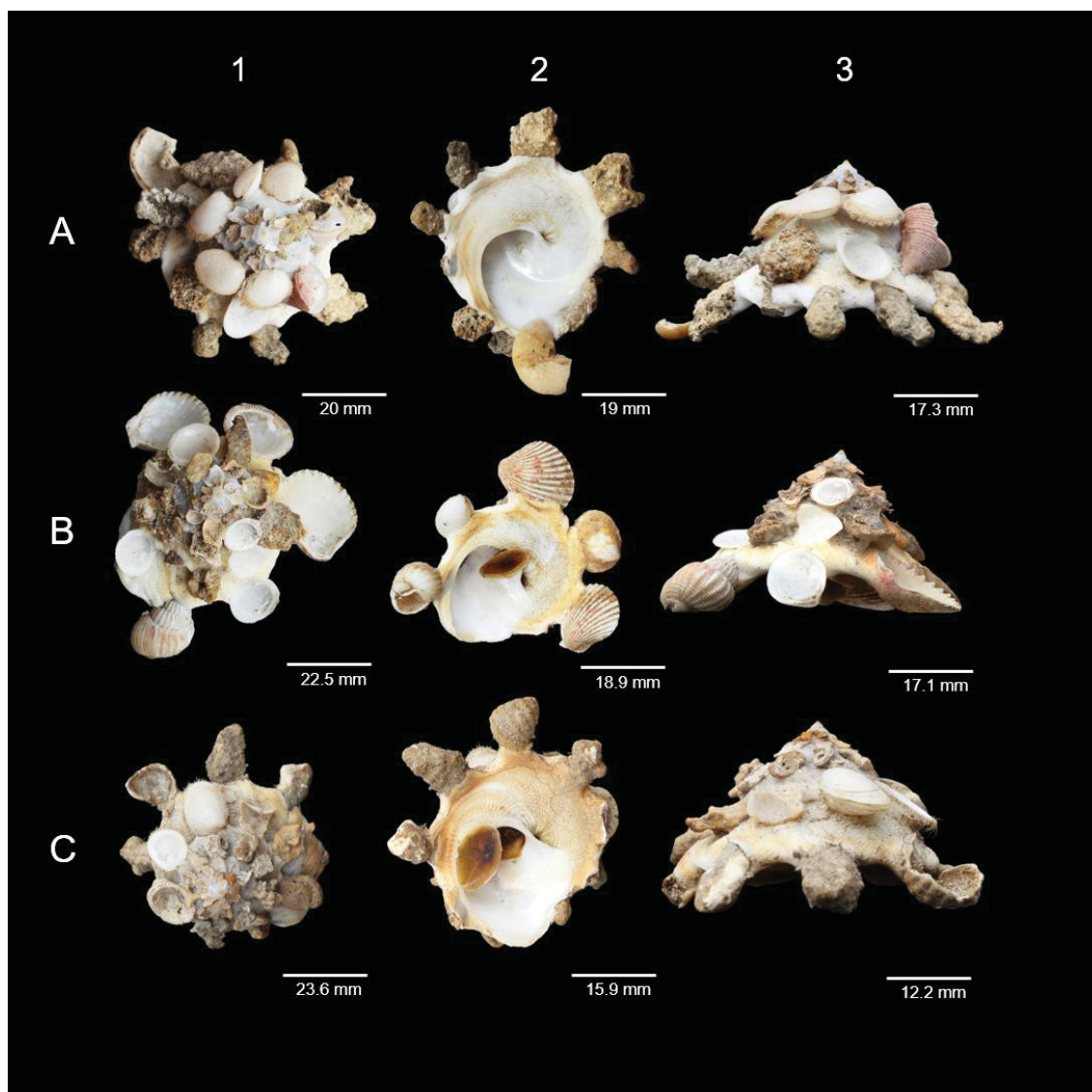


Fig. 2. *Xenophora crispa* specimen A, B, and C (with top, bottom, and side view 1, 2, and 3, respectively) were collected in July 2019 by the fishing vessel "Orvalho" on the north coast of Madeira Island.

Description

Shell solid, trochoidal, small to medium size (about 40 mm in diameter), with whorls flat to moderately convex, with moderate to low spire. Whorls sculptured with spiral wavy riblets, which cross irregular, weak growth folds and lines. The protoconch is multispiral, depressed, and conical. Foreign objects are attached to all whorls and usually occupy almost the dorsal surface (more

than 1/3). The umbilicus is relatively wide, deep, partly covered by the inner lip, and not bordered by a distinct angulation. Base relatively flat, sculpture with spiral threads (15 to 20) and growth lines and intersection points more-or-less beaded. Spiral sculpture does not enter the umbilicus. Colour yellowish-white to yellowish-brown. The operculum is oval, relatively thin, yellowish-brown, transparent, with all sides convex, very

weak concentric striae and nucleus displaced slightly to the left.

Remarks

Xenophora crispa has never been recorded in Madeira Archipelago. This study represents the first record of this species for Madeira Island, filling the Azores and Canary Islands gap. The shell, formerly called *trochiformis* (Born, 1778), presents the sides of the spire evenly conical.

Specimen A, in the last whorl, tiny pebble, and a fragment of the gastropod *Calliostoma lusitanicum* is attached. In the upper whorls, as we ascend, the attachments are mostly *Calliostoma granulatum* and *Limopsis aurita* (some live specimens seem to have been added). Immediately below the protoconch, the attachments are small shell fragments (with a uniform size). Base concave with small tubercles and yellowish-white colour (Fig. 2A1-3, respectively).

Specimen B, mostly bivalve shells (*Aequipecten commutatus*, *Glycymeris vanhengstumi* and *Limopsis aurita*), are attached in the last whorl. The bivalves are almost invariably placed with their concave sides facing up, arranged not to impede the animal's progress. Also, a shell of the gastropod *Nassarius denticulatus* is attached. The upper whorls present a mixture of tiny pebble, fragments of shells, and valves of *Glycymeris vanhengstumi* and *Limopsis aurita*, with small tubercles in the yellowish concave base (Fig. 2B1-3, respectively).

Specimen C presents the last whorl with small pebbles. The immediate whorl above has attached *Limopsis aurita* and *Glycymeris vanhengstumi* valves and pebbles of identical dimensions. Around the protoconch (immediately below), small fragments of shells are arranged in the spiral, with small tubercles in the yellowish concave base (Fig. 2C1-3, respectively).

Biometric features

Our specimens have dimensions equivalent to large specimens, collected in the Mediterranean, in Algeria (Oran, deposited in the Dautzenberg Collection, in the Royal Institute of Natural

Sciences of Belgium, Brussels and Alger Bay), Sicily, Italy (Strait of Sicily, Mazara del Vallo and Trapani), Spain (Fuengirola, Malaga) and Canary Islands (Fuerteventura) (Ponder 1983 and references therein; Nappo & Nappo 2014). Subsequently, the dimensions related to our specimens are presented (Table 1).

Table 1 - The dimensions of the *Xenophora crispa* specimens (measurements shown are only of the shell, therefore excluding attachments) collected from the north-eastern coast of Madeira Island.

Dimensions / Specimens	Specimen A	Specimen B	Specimen C
Maximum diameter (mm)	41,9	42,8	37,5
Maximum height (mm)	33,1	31,6	29,7

Biogeographic status

Xenophora crispa is distributed throughout the western Mediterranean, North Africa (up to Morocco), and the Macaronesia region (Archipelagos of the Azores, Madeira, and the Canary Islands). Consequently, it is considered native to the Madeira Archipelago.

DISCUSSION

It is uncertain how long has *X. crispa* been present in the Madeira Archipelago. However, the fact that previous studies have not detected its presence in Madeira (Nobre 1889; Watson 1891; Nobre 1895; Watson 1897; Nobre 1937; Segers et al. 2009) suggests low abundance in the region and highlights the need for increasing surveys and sampling efforts to detect inconspicuous taxa and assess diversity in a range of local habitats. The three *Xenophora* specimens analysed in this study all have dimensions greater than 37 mm and prominent basal sculpture, both morphological characteristics compatible with the Mediterranean species, *X. crispa*.

Xenophora crispa was first described by Koenig (1825), formerly *Trochus crispus*, with an unknown location of the type, but type locality is designated Asti, Italy (Astian, Upper Pliocene).

This species is distributed throughout the central and western Mediterranean, western Atlantic from France (Gulf of Biscay) to North Africa (up to Morocco), Azores, and the Canary Islands. Now, this study fills the gap between these two latter regions.

There have been divergences in species identification and nomenclature of *Xenophora* individuals from the Mediterranean, Macaronesia, and West Africa. For example, Nordsieck (1986) and Nordsieck & García-Talavera (1979) differentiated specimens from the Mediterranean and the Atlantic using the specific epithet *crispa* and *caperata*, respectively, while representatives from Macaronesia, Cabo Verde and West Africa generally use the specific epithet *senegalensis*. Consequently, when Nordsieck (1986) recognised three species: *X. crispa* (Mediterranean), *X. caperata* (Atlantic), and *X. senegalensis* (Cape Verde and Azores Islands), was not aware that Fischer (1873) proposed the name *senegalensis* to replace *caperata* Petit de la Saussaye, non Philippi. The usage of the name *X. caperata* for West African specimens of *X. crispa* is discussed at length by Adam & Knudsen (1955) (Ponder 1983). Other authors (Ponder 1983; Poppe & Goto 1991) consider differences in the morphology of the shells and their protoconchs to be ecological driven variations of *X. crispa* and insufficient to warrant species differentiation. Past studies have also considered *X. crispa* and *X. mediterranea* as a single species (Sacco 1896;1904). However, detailed comparisons of Pliocene and Recent shells have failed to acknowledge relevant differences that would discriminate them as species or subspecies, except that some of the fossil shells are larger (up to 55mm in diameter) than recent shells (Ponder 1983). Nevertheless, smaller fossil shells and many adult specimens are identical to recent shells (Sacco 1896; Ponder 1983). More recently, with the increase in studies on the Macaronesia and Cabo Verde archipelagos, and West Africa, some authors present arguments that allow a separation between the specimens of these regions to be valid, as different species, respectively *X. crispa* and *X. senegalensis* (Gofas et al. 1985; Rolán 2005).

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