

## A new Atlantic immigrant in the Mediterranean Sea: *Pleurobranchus wirtzi* Ortea, Moro et Caballer, 2014 (Gastropoda Pleurobranchida)

Andrea Lombardo & Giuliana Marletta

Department of Biological, Geological and Environmental Sciences, Section of Animal Biology, University of Catania, via Androne 81, 95124 Catania, Italy

\*Corresponding author: e-mail: andylombardo94@gmail.com

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### ABSTRACT

This report of *Pleurobranchus wirtzi* Ortea, Moro et Caballer, 2014 (Gastropoda Pleurobranchida Pleurobranchidae) here presented is the first record in the Sicilian waters and the first one in the Mediterranean Sea. *Pleurobranchus wirtzi* is a species only distributed in Canary islands, Madeira and Azores (Atlantic Ocean). Nowadays, it is still not known if this species is really taxonomically distinct from *P. garciagomezi* Cervera, Cattaneo-Vietti et Edmunds, 1996. However, the specimen found in Sicily is undoubtedly a non-native species in the Mediterranean Sea and therefore its possible naturalization could have negative effects on the indigenous marine ecosystem. In this work, we talk about the possible pattern of introduction in the Mediterranean Sea of this species and its questionable systematic status.

### KEY WORDS

Atlantic species; non-indigenous species; *Pleurobranchus*; Sicily.

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### INTRODUCTION

*Pleurobranchus wirtzi* Ortea, Moro et Caballer, 2014 is a notaspidean of the family Pleurobranchidae Gray, 1827 (Mollusca Opisthobranchia) found only in the islands of Macaronesia, in the Atlantic Ocean. Previously, all specimens of this species observed in the Canary Islands, Madeira and Azores were recognized as *P. garciagomezi* Cervera, Cattaneo-Vietti et Edmunds, 1996 (Ortea et al., 2014).

In 1999, Fontes et al. (2001) encountered, while snorkeling at night, a large snail of the genus *Pleurobranchus* Cuvier, 1804, in the western coast of Faial Island (Azores) and called it as *Pleurobranchus* sp. to distinguish it from *P. garciagomezi*. In fact, *P. garciagomezi* described in Ilha do Sal

(Cape Verde archipelago) had white lines on a cream-coloured to dark brown smooth body; while the specimen found by Fontes et al. (2001) had a network of thinner pale lines on an orange-coloured rugose body. For the authors (Fontes et al., 2001) the behavior was different too: *P. garciagomezi* was a day-active species that lived on open substrates in the islands of Cape Verde; while their specimen, from Azores, was active at night. Moreover, the specimen found by Fontes et al. (2001) was similar to the specimens of Canary Islands (Wirtz, 1995) and Madeira island (Wirtz, 1999). Nevertheless, Cervera in a personal communication to Wirtz (Fontes et al., 2001) suggested that the species of Canary Islands and Madeira was a colour morph of *P. garciagomezi*.

This view was shared from Malaquias (2000) who found the same species at Selvagens Islands. Finally, Ortea et al. (2014) described this cryptic species as *P. wirtzi*. In fact, they highlighted that *P. garciagomezi* is an endemic species of Cape Verde (Fig. 1), active and visible during the day on rocky substrates of this archipelago. In contrast, *P. wirtzi* is distributed in the rest of the islands of Macaronesia (Fig. 1), is active during the night, remaining hidden under stones or in hollows during the day. Moreover, they proposed that *P. garciagomezi* corresponds to the specimen figured in the original description (Cervera et al., 1996, plate 1C). For the authors (Ortea et al., 2014), *P. wirtzi* can have a body coloured from orange to red; typically the maximum size is 100 mm or slightly more. The specimens smaller than 10 mm are pale-white with a white network and a reddish shell visible for transparency. The specimens from 10 to 15 mm begin to turn orange with a whiter network that fades in specimens of 30 mm.

The report of *P. wirtzi* here presented is the first record in the Sicilian waters and also the first one in the Mediterranean Sea.

## MATERIAL AND METHODS

This report was carried out in a station located between Catania and Aci Castello (eastern coast of Sicily), called Cannizzaro (Fig. 2). Specifically, a dive was conducted in the waters near the Lido Bellatrix (37°32'03.98"N - 15°07'34.12"E). This area is strongly anthropized because near the coastline there are many bathing establishments and apartment buildings.

The sea floor where the specimen was found is characterized by basaltic boulders and rocks of variable size, formed after the erosive activity of the sea. *Pleurobranchus wirtzi* specimen was photographed with an Olympus TG4 underwater camera.

## RESULTS

On 22nd December 2018, a small *P. wirtzi* specimen was found under a stone at 6.6 m depth, during a morning dive in waters near the Lido Bellatrix (Catania, Sicily) (Fig. 2). The specimen was pho-

tographed "in vivo". It corresponded to the description of *P. wirtzi* given by Ortea et al. (2014): it had a rugose and pale orange coloured body with a thin white network that creates polygons, without secondary networks as it happens in *P. garciagomezi* (Goodheart et al., 2015). The specimen was about 20 mm in length and had a strong tendency to seek the darkness, confirming probably to be a night active species.

## DISCUSSION

In this note, the first record of the Atlantic notaspidean, *P. wirtzi*, in the Mediterranean Sea is reported. Specifically, this species was found in a station of the Ionian Sea (central Mediterranean), without apparently other reports throughout the whole basin. This peculiar pattern of spread recently occurred also for other species coming from the Atlantic Ocean.

The first example is that of the anaspidean *Aplysia dactylomela* Rang, 1828 whose dispersal pathway into the Mediterranean was studied by Valdés et al. (2013). This species first appeared in 2002 at Lampedusa Island, in the Sicily Channel (Trainito, 2003) and has spread to the eastern Mediterranean, completely bypassing the western Mediterranean (Valdés et al., 2013). Another similar case is that of the moray *Enchelycore anatina* (Lowe, 1838) that reached firstly the eastern part of the basin, off the Israeli coast (Ben-Tuvia & Golani, 1984), and in the last decades has been expanding westwards (Katsanevakis et al., 2014). This pattern of introduction has been suggested by Valdés et al. (2013). Historically, there were barriers to dispersal preventing the spread of some Atlantic species into the Mediterranean Sea. Specifically, the cold Canary Current and Saharan Upwelling prevented the introduction of West African species into the Mediterranean Sea (Vermeij, 2012). The strength of these barriers recently has been reduced by the current global warming (Vermeij, 2012). Another important barrier is the Almería-Oran Front, a current that separates the Atlantic Ocean from the Mediterranean Sea (Tintoré et al., 1988). Nevertheless, the strength of this circulation pattern could be altered by the increased frequency of mild winters, due to the global climate change (Tintoré et al., 1994).

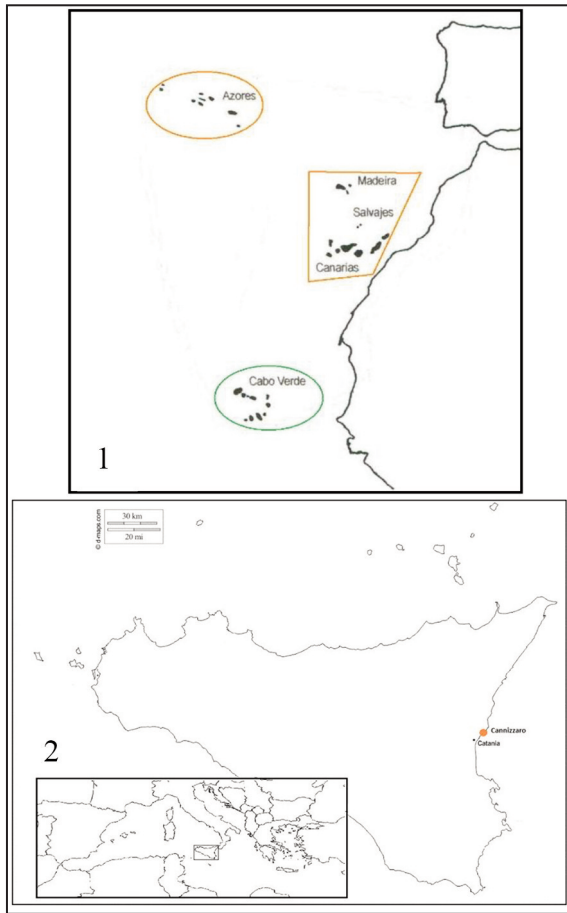


Figure 1. Distribution of the two species in the islands of Macaronesia: *Pleurobranchus garciagomezi* (green circle) and *P. wirtzi* (orange shapes). Figure 2. Sicily stations, central Mediterranean, (orange dot) where *P. wirtzi* was found.

Thereby this phenomenon could allow the introduction into the Mediterranean Sea of eggs and larvae of Atlantic species such as probably in the case of *P. wirtzi*. Subsequently, the powerful Algerian Current might carry them rapidly into the central Mediterranean, bypassing the western part of the basin (Di Silvestro et al., 2010). Another hypothesis could be that a veliger of *P. wirtzi* was carried by the ballast water of a ship directly into the central Mediterranean. In either case, the specimen found by us could demonstrate that there might be the right conditions that allow this species to live and to grow up.

*Pleurobranchus wirtzi* is a species described in the last years. It is still not known if this species is really taxonomically distinct from *P. garciagomezi*. Indeed, Goodheart et al. (2015) se-

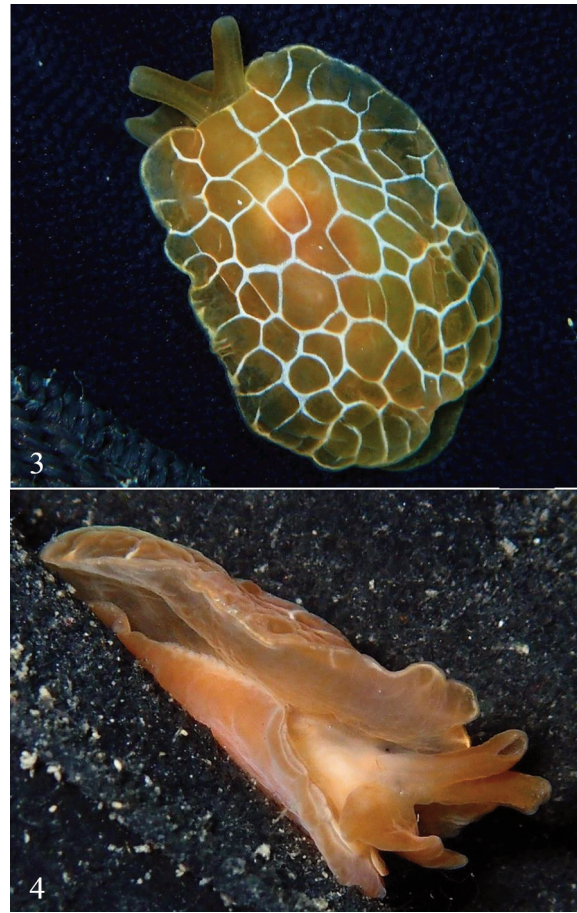


Figure 3. Dorsal view of the specimen of *Pleurobranchus wirtzi* found at the station of Cannizzaro (Sicily). Figure 4. Lateral right view of the same specimen (photos by A. Lombardo)

quenced specimens of Azores and Cape Verde, with colour patterns matching to the two hypothetical species and found them to be genetically indistinguishable. Those authors argue that there is a little molecular support to maintain *P. wirtzi* as a valid and distinct species, but they believe that additional research is necessary to confirm this point. However, the specimen found by us is undoubtedly a non-native species in the Mediterranean Sea and therefore its possible naturalization could have negative effects on the indigenous marine ecosystem. In view of all of this, it is needed to have more information about the systematic validity of this species and about the biology, ecology and behavioral aspects. Moreover, it is necessary to understand the peculiar pathway and to take care of its probable future propagation.

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