

# On the presence of the less known arminid nudibranch *Dermatobranchus rubidus* (Gould, 1852) in the Adriatic Sea

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**Abstract:** Two cases of the occurrence of the alien heterobranch species, *Dermatobranchus rubidus* (Gould, 1852) are reported for the Adriatic Sea. The first record originates from June 2019 from the island of Brač (Croatia, Middle Adriatic Sea), when a specimen was found during the collection of clams, while the second specimen was sighted at Fiesa (Gulf of Trieste, Northern Adriatic Sea) in October 2023, photographed on coarse sand bottom. These are the first records for the Adriatic Sea and indications of the possible establishment of this species in the Mediterranean Sea. Due to its cryptic behaviour and perhaps nocturnal habits, it is difficult to assess whether the species has been overlooked so far or whether it is extending its distribution in the Mediterranean.

**Keywords:** *Dermatobranchus rubidus*; Arminidae; first Adriatic record; occurrence; Heterobranchia

**Sažetak:** PRISUSTVO MANJE POZNATE VRSTE PUŽA GOLOŠKRŽNJAKA *DERMATOBRANCHUS RUBIDUS* (GOULD, 1852) U JADRANSKOM MORU. U Jadranskom moru zabilježena su dva nalaza strane vrste puža stražnjoškržnjaka, *Dermatobranchus rubidus* (Gould, 1852). Prvi nalaz je iz lipnja 2019., s otoka Brača (Hrvatska, srednji Jadran), kada je jedan primjerak pronađen tijekom sakupljanja školjkaša, dok je drugi primjerak uočen u Fiesi (Tršćanski zaljev, sjeverni Jadran) u listopadu 2023. te je fotografiran na grubo pjeskovitom dnu. Ovo su prvi nalazi za Jadran, koji ukazuju na moguću uspostavu populacije ove vrste u Sredozemnom moru. Zbog svog kriptičnog ponašanja i pretpostavljenog noćnog načina života, teško je sa sigurnošću utvrditi poveća li se rasprostranjenost ove vrste u Sredozemnom moru ili jednostavno do danas nije bila uočena.

**Ključne riječi:** *Dermatobranchus rubidus*; Arminidae; prvi zapis u Jadranu; pojava; Heterobranchia

## INTRODUCTION

The Arminidae nudibranch family (Heterobranchia, Gastropoda) is a rather poorly investigated group of sea slugs. They are characterized mainly by a flattened and elongated body with longitudinal ridges on the notum (Báez *et al.*, 2011). This family is divided in six genera, of which only two are present (up to now) in the Mediterranean, namely the genus *Armina* (Rafinesque, 1814) with three species, and the genus *Dermatobranchus* van Hasselt, 1824, represented by only one species recently reported from the Mediterranean. In fact, the first Mediterranean finding of *Dermatobranchus rubidus* Gould, 1852 was published by Colucci *et al.* (2015) who found three specimens at 3 m of depth in Porto Pirrone near Taranto (Italy, Ionian Sea). This paper aims to extend the knowledge on range of distribution of *D. rubidus* in the Adriatic Sea based on two findings from Northern and Middle Adriatic Sea.

## MATERIAL AND METHODS

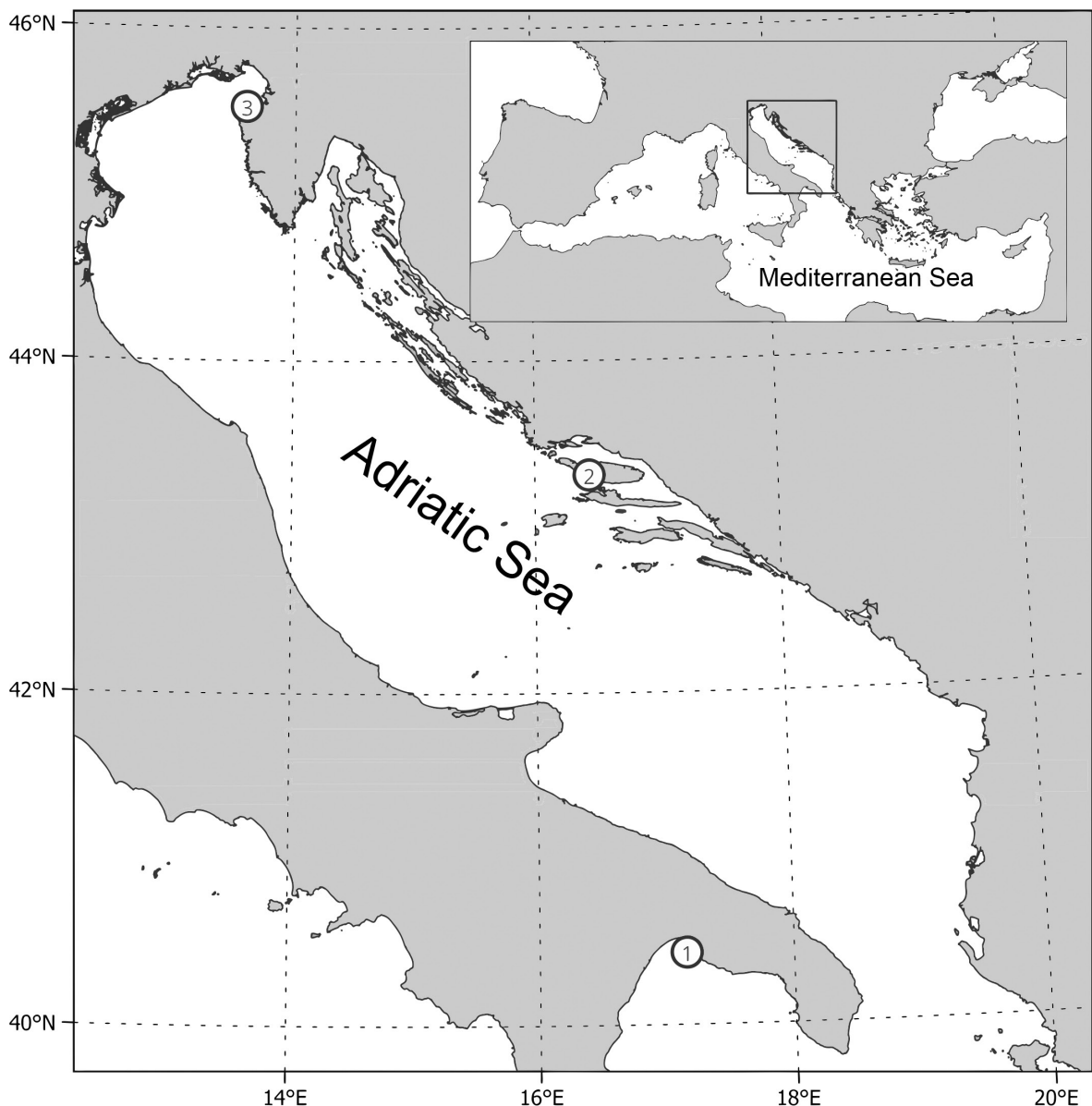
The specimens of the heterobranch *Dermatobranchus rubidus* reported here were found coincidentally, while performing underwater activities using scientific SCUBA diving at two different localities in the Adriatic Sea. The first specimen was collected while searching for bivalves *Venus verrucosa* Linnaeus, 1758 in the Bay of Lučice (43°18'41"N / 16°26'48"E) on the southern part of the Island of Brač, Croatia (Fig. 1) on 13 June 2019. It was photographed on land with Olympus Mark III and preserved in 98% ethanol allowing for future molecular identification and comparison with Genbank sequences of specimens from extra-Mediterranean localities. The specimen is kept in the personal collection 'Adriatic malacological collection of Rino Stanić' under the identification number 17. The second specimen was sighted on 10 October 2023 during a night dive at Fiesa, Piran, Slovenia (45°31'34.6N, 13°34'52.6E)

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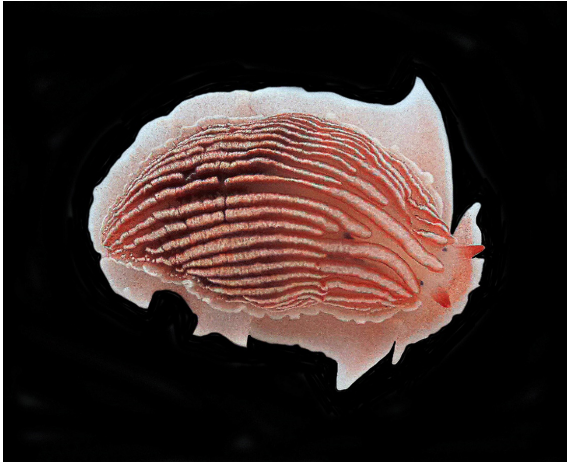
**Fig. 1.** The records of *Dermatobranchus rubidus* in the Mediterranean Sea: 1 – 31 October 2014, Porto Pirrone, Italy (Colucci *et al.*, 2015), 2 – 13 June 2019, Bay of Lučice, the Island of Brač (this study) and 3 – 10 October 2023, Fiesa, Gulf of Trieste (this study).

(Fig. 1) and was photographed on the spot using Olympus TG6 camera within underwater housing and Wurkos DL40 Diving Flashlight Bright 5000lm Dive light. The animal was not collected.

Both specimens were determined based on morphological characteristics that matched those reported by Miller and Willan (1986) and Gosliner and Fahey (2011). The nomenclature follows those validated and listed in the World Register of Marine Species (WoRMS). The specimen from Croatia was measured directly, while the length of the specimen from Slovenia was estimated based on the photographs.

## RESULTS AND DISCUSSION

Both specimens of *Dermatobranchus rubidus* reported here (Fig. 2 and Fig 3.) showed characteristic morphology of the species as reported by Miller and Willan (1986) and Gosliner and Fahey (2011). The species is a flattened, broad arminid nudibranch with many dorsal ridges. The notum is large and rounded in the front and tapering at the end. The photographed specimens exhibit an orange notum with 11 longitudinal white ridges comprising one median ridge and five ridges on each side. The rhinophores and the oral veil are red and white. The rhinophores have longitudinal lamellae and are separated, ending in a rounded cub. Behind the basis of rhinophores, two small black eyes are visible. The species could also be identified by the



**Fig. 2.** Specimen of *Dermatobranchus rubidus*, photographed on 13 June 2019 at Bay of Lučice (Island of Brač, Adriatic Sea) (Photo: R. Stanić).

tentacular extensions of the oral veil. The foot is wider than the mantle; both are edged with a broad white line. The specimen from Croatia measured 32 mm in length, while the length of the Slovenian specimen was estimated to be 50 mm in length while crawling and being extended.

The habitats in which the specimens were found fit well with the mention of Colucci *et al.* (2015) and Morley and Haywards (2015), who stated that the species lives on sand in semi-sheltered areas. The specimen from Croatia was buried in fine sediment mixed with small stones at a depth of 8 m. The specimen from Slovenia was sighted during a night dive in a depth range between 9 and 10 m, on bare muddy bottom. After the nudibranch was spotted and illuminated by a torch, it immediately began burrowing itself in the mud, starting with the frontal part of the body (Fig. 3C). The broad foot is presumably an adaptation to inhabiting the soft bottom habitats (Rudman, 2002). The ecology of *D. rubidus*, which was described recently, is still poorly known. The behaviour of the specimen from Fiesa resembles those of the three specimens in Porto Pirrone reported by Colucci *et al.* (2015). In both cases, sea slugs were spotted during night dive in October and began to bury themselves in the sediment immediately after being illuminated by a light torch.

The species was discovered and originally described by Gould (1852) from Hawaiian archipelago as *Diphylidia rubida*. Miller and Willan (1986) reported this species in the waters of outer Hauraki Gulf (New Zealand) and described it as *Dermatobranchus pulcherrimus* but was later renamed by Gosliner and Fahey (2011) as *D. rubidus*. *Dermatobranchus rubidus* is native to Indo-Pacific, from Philippines, Hawaii (Gosliner and Fahey, 2011), Japan (Suzuki, 2000), Australia, New Zealand, and from Tasmania (Miller and Villan, 1986) to Mauritius (Ah-Shee-te *et al.*, 2019).

According to the existing reports and distribution ranges, we can conclude that the species originates from



**Fig. 3.** Specimen of *Dermatobranchus rubidus*, sighted and photographed on 10 October 2023 at Fiesa (Gulf of Trieste, northern Adriatic) (A); close-up of the head with rhinophores (B); specimen while trying to bury itself into the sediment (C) (Photos: T. Knapič).

Indo-Pacific and should be therefore considered as alien in the Mediterranean Sea. The introductions to new areas are most probably related to maritime transport. Information on the life cycles of species of the genus *Dermatobranchus* are very scarce. Some species, like *D. striatellus* Baba, 1949 (Todd, 1981), have lecithotrophic larvae and are thus most probably not being able to survive long transport. On the other hand, Furuhashi *et al.* (2006) described a species of *Dermatobranchus* with a long larval pelagic stage which could be transported for longer periods *via* ballast waters. Colucci *et al.* (2015) support the idea that the species arrived in the Mediterranean with ballast waters or mariculture. However, due to the lack of knowledge on its biology and ecology, so far it is unclear whether it can endanger the native species.

After checking the published heterobranch surveys in the Adriatic Sea (e.g. Barletta (1980); Betti (2011); Zenetos *et al.* (2016); Ciriaco and Poloniato (2016); Lipej *et al.* (2018); Prkić *et al.* (2018)), we noticed that the species was not yet recorded in the Adriatic. The finding of the specimen in the Middle Adriatic (Bay of Lučice) represents the first record of *D. rubidus* in the Adriatic Sea and the second for the Mediterranean Sea. The two recorded Adriatic findings of *D. rubidus*, together with the specimen reported from the Ionian Sea (Colucci *et al.*, 2015), indicate that the species could be

considered as established. Due to its cryptic (fossorial) behaviour and perhaps nocturnal habits, it is difficult to assess whether the species was overlooked so far, or it is extending its distribution in the Mediterranean. Interestingly, *Elysia nealae* Ostergaard, 1955, another Indo-Pacific sea slug, was recently reported from the Mediterranean Sea showing the same burrowing behaviour (Trainito *et al.* 2022), suggesting that more similar cases of non-visible or neglected species may still exist in the Mediterranean basin.

These findings represent another case where the involvement of citizen science in mapping and monitoring marine biodiversity has been beneficial for gathering important new data on marine biodiversity (Garner and Oosthuizen, 2023). In some Australian localities, sea slug census is organized for citizen scientists to help gathering data on local heterobranch fauna and it was in one such occasion that one specimen of *D. rubidus* was sighted and photographed from Melbourne area (Smith and Nimbs, 2019). This collaborative effort not only

enhances our understanding of local marine ecosystems but also fosters a sense of community engagement and shared responsibility for environmental stewardship.

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## AUTOR CONTRIBUTION

Conceptualization; T.K., B.M., R.S., L.L., Investigation; T.K., B.M., R.S., L.L., Methodology; T.K., R.S., Supervision; T.K., B.M., R.S., L.L.; Roles/Writing - original draft; L.L., Writing - review & editing, L.L., B.M., R.S, T.K.

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