



First Records of Five Opisthobranch Mollusc Species (Gastropoda: Heterobranchia) from South Adriatic Waters, Montenegro

Milica Jovanović¹, Vesna Mačić², Domen Trkov³, Martina Orlando-Bonaca³ & Lovrenc Lipej³

¹ Faculty of Mathematics and Natural Sciences, University of Montenegro, G. Washington Street, 81000 Podgorica, Montenegro; E-mail: milicaj@ucg.ac.me

² Institute of Marine Biology, University of Montenegro, P.O. Box 69, 85330 Kotor, Montenegro; E-mail: macic.v@ucg.ac.me

³ Marine Biology Station, National Institute of Biology, Fornače 41, Piran, SI-6330, Slovenia; E-mail: Lovrenc.Lipej@nib.si

Abstract: Five new records of opisthobranch molluscs were reported for the first time in Montenegrin waters. *Berghia verrucicornis* and *Doris ocelligera* were collected as a bycatch with macroalgal samples, which were further analysed in the laboratory. Other three species: *Aglaja tricolorata*, *Pleurobranchus testudinarius* and *Eubranchnus tricolor*, were identified and photographed during underwater visual census performed from 2011 to 2019. The total number of opisthobranchs recorded so far in the Montenegrin part of the Adriatic Sea increased to 76 species.

Key words: opisthobranch, molluscs, Montenegro, Adriatic Sea.

Introduction

Even though the interest at the marine malacofauna in Montenegro increased during the last years, data on Montenegrin molluscs could be mainly found in scientific papers related to the Boka Kotorska Bay. The first systematic study of the macromolluscs of the Boka Kotorska Bay was carried out in the 1960-ies (STJEPČEVIĆ 1967), followed by KARAMAN & GAMULIN BRIDA (1970) and STJEPČEVIĆ & PARENZAN (1980, 1982). From that time, only a small number of opisthobranch species was recorded but recent studies performed by SCUBA divers and underwater photographers provided more information and, consequently, 41 opisthobranch species were reported for Montenegro (ZENETOS et al. 2016). Later on, an annotated checklist of molluscs species recorded for Montenegro was published by PETOVIĆ et al. (2017); amongst the 354 mollusc taxa listed, 198 are gastropods, of which 49 are opisthobranchs. Later on, six new sea-slug species were added to this checklist and

four of them were opisthobranchs (PETOVIĆ 2018, MAČIĆ et al. 2018). In the last study, summarising all available data on opisthobranch molluscs in the Boka Kotorska Bay, a total of 71 species were recorded (JOVANOVIĆ et al., under review).

The aim of this article is to extend the existing checklist by five species recorded for the first time in the South Adriatic, specifically in Montenegrin marine waters, thus improving the knowledge of distribution and habitat preferences of these (mostly rare) species.

Materials and Methods

Opisthobranchs were collected by SCUBA diving techniques in 2011–2019. Some specimens were photographed *in situ* and not collected, while during surveys for macroalgae and other organisms, few other species were collected, photographed and fixed in 96% ethanol in the laboratory. Monographs published by TRAINITO & DONNEDU (2014), LIPEJ et

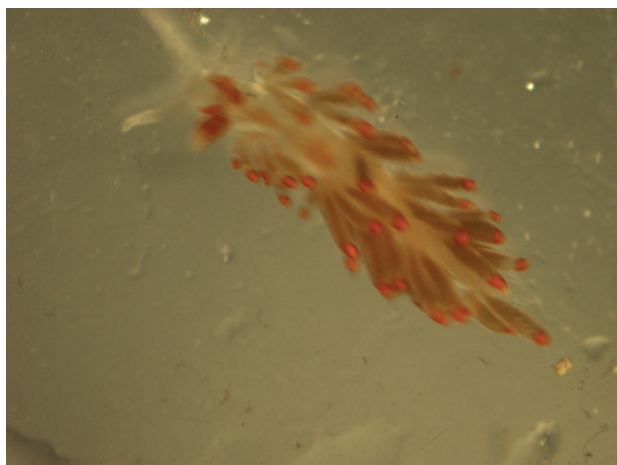


Fig. 1. *Berghia verrucicornis* (photo by M. Jovanović).



Fig. 4. *Eubranchus tricolor* (photo by V. Mačić).

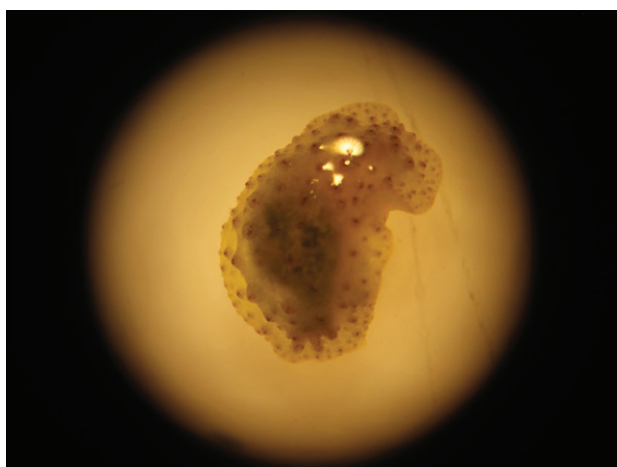


Fig. 2. *Doris ocelligera* (photo by V. Mačić).



Fig. 5. *Aglaja tricolorata* (photo by V. Mačić).



Fig. 3. *Pleurobranchus testudinarius* (photo by V. Mačić).

al. (2018) and PRKIĆ et al. (2018) were used for the identification of species. The taxonomy and nomenclature is in accordance with the World Register of Marine Species (WoRMS 2019).

Results

In the present work, five opisthobranch species are reported for the first time for the Montenegrin part of the Adriatic Sea. Two species, *Berghia verrucicornis* (Costa A., 1867) and *Doris ocelligera* (Bergh, 1881) were recorded during the fieldwork in 2017. The other three species: *Aglaja tricolorata* Renier, 1807, *Pleurobranchus testudinarius* Cantaine, 1835 and *Eubranchus tricolor* Forbes, 1838, were identified and photographed during underwater visual census. The details of the newly recorded species are listed below.

Family Aeolidiidae

Berghia verrucicornis (Costa A., 1867)

This nudibranch was recorded in Zlatna Vala (Luštica Peninsula, N42.380921°, E18.589884°) in June 2017. Only one specimen was collected on algae at 5 m depth, photographed in the laboratory and conserved in 96% ethanol (Fig. 1). This species reaches up to 25 mm. This species feeds on anemo-

nes of the genus *Aiptasia* Gosse, 1858 (CARROLL & KEMPF 1990, LIPEJ et al. 2018).

Family Dorididae

Doris ocelligera (Bergh, 1881)

Only one specimen of this dorid nudibranch was recorded in Zlatna Vala (Luštica Peninsula, N42.380921°, E18.589884°) in June 2017 (Fig. 2). It could grow up to 20 mm. It feeds on sponges of the genus *Haliclona* Grant, 1836 (LIPEJ et al. 2018).

Family Aglajidae

Aglaja tricolorata Renier, 1807

This cephalaspidean was found in the Bay of Trašte (N42.381786°, E18.657643°) in 2011 (Fig. 3). One specimen was photographed in the upper infralittoral, within its typical habitat, sandy bottom, where it is usually buried. This species reaches up to 30 mm. It is very variable in colour (TRAINITO & DONNEDU 2014).

Family Pleurobranchidae

Pleurobranchus testudinarius Cantraine, 1835

One of the biggest opisthobranch species (growing up to 20 cm). It was found in the Boka Kotorska Bay, at the location of Sv. Nedjelja (N42.458811°, E18.677077°). A single specimen was photographed on detritic bottom at 25 m depth on 4th August 2018 (Fig. 4). ZENETOS et al. (2016) have previously reported this species for the West and East Adriatic coast only for Croatia and Italy (Gulf of Trieste).

Family Eubranchidae

Eubranchus tricolor Forbes, 1838

Three specimens of this cold-water species were found during spawning in the marina Port of Montenegro (Tivat, Boka Kotorska Bay, N42.431889°, E18.691408°) on 20th February 2019 (Fig. 5).

Discussion

The findings of these five species represent their first records in the Montenegrin part of the Adriatic Sea and, according to ZENETOS et al. (2016), they have not been confirmed in the adjacent waters of Albania. Four of the species (*B. verrucicornis*, *D. ocelligera*, *A. tricolorata* and *P. testudinarius*) are known from the Mediterranean and Eastern Atlantic regions (TRAINITO & DONNEDU 2014) while *D. ocelligera* is considered as a not very common species in the Adriatic Sea (ZENETOS et al. 2016, LIPEJ et al. 2018, PRKIĆ et al. 2018). However, it is possible that it has been rather neglected due to its small size, colour and hidden habitats under the rocks. *Eubranchus tricolor* has been reported for the Atlantic from Scandinavia and the British Islands while in the Mediter-

anean Sea it is rare, reported mostly for northern Spain and the North Adriatic Sea (LIPEJ et al. 2018). It seems that this record is the southernmost point of its geographical range, both in the Adriatic Sea and in general. However, PRKIĆ et al. (2018) consider reports of this species for the Adriatic Sea and other Mediterranean areas as misidentified specimens of an undescribed species. Hopefully, further morphological and molecular analysis of specimens collected in the Mediterranean and the Atlantic Regions will elucidate their taxonomic status.

Taking into account previous studies (JOVANOVIĆ et al., under review), 76 opisthobranch species have been recorded so far in the Montenegrin marine area. However, the newly obtained data suggest that only a small portion (about 15%) of the 540 known Mediterranean opisthobranchs (TRAINITO & DONNEDU 2014) inhabit the Montenegrin waters. The number of species increases almost at every sampling survey and further studies on this group will significantly improve the present checklist.

References

- CARROLL D. & KEMPF C. 1990. Laboratory culture of the Aeolid nudibranch *Berghia verrucicornis* (Mollusca, Opisthobranchia): Some aspects of its development and life history. *Biology Bulletin* 179: 243–253.
- GAMULIN-BRIDA H. 1983. Crnogorsko primorje – specifični dio Jadrana s gledišta bentoskih biocenoza i njihove zaštite (Coast of Montenegro – a specific part of the Adriatic Sea from the viewpoint of the benthic biocenosis and their protection). *Studia Marina* 13–14: 205–214.
- JOVANOVIĆ M., MAČIĆ V., TRKOV D., ORLANDO-BONACA M. & LIPEJ L. 2019. Review of opisthobranch molluscs fauna in the Boka Kotorska Bay, Montenegro. *Acta Adriatica* (under review).
- KARAMAN G. & GAMULIN-BRIDA H. 1970. Prilog istraživanju bentoskih biocenoza Bokokotorskog zaliva. *Studia Marina* 4: 3–43.
- LIPEJ L., TRKOV D. & MAVRIČ B. 2018. Polži zaškrjarji Slovenskega morja, Nacionalni inštitut za biologijo, Morska biološka postaja, Piran. 306 p.
- MAČIĆ V., JOVANOVIĆ M., TRKOV D. & LIPEJ L. 2018. First record of the nudibranch *Marionia blainvillea* (Risso, 1818) (Gastropoda: Heterobranchia) for Montenegro. *Acta Adriatica* 59(1): 149–152.
- PETOVIC S., GVOZDENOVIC S. & IKICA Z. 2017. An annotated checklist of the marine molluscs of the South Adriatic Sea (Montenegro) and a comparison with those of neighbouring areas. *Turkish Journal of Fisheries and Aquatic Sciences*, DOI: 10.4194/1303-2712-v17_5_08.
- PETOVIC S. 2018. Additions to the checklist of the malacofauna of the Boka Kotorska Bay (south-east Adriatic Sea). *Studia Marina* 31(1): 23–36. DOI: 10.5281/zenodo.1321703.
- PRKIĆ J., PETANIĆ A., IGLIĆ D. & LANČA L. 2018. Stražnjaškržnjaci Jadranskoga mora – Slikovni atlas i popis hrvatskih vrsta, Grafikart d.o.o. 464 p.

- STJEPČEVIĆ J. & PARENZAN P. 1982. Survey on benthic Mollusca population of the inner part of the Boka Kotorska Bay. *Studia Marina* 11–12: 3–28.
- STJEPČEVIĆ J. 1967. Macro-Mollusca of Boka Kotorska Bay. *Studia Marina* 2: 1–64.
- STJEPČEVIĆ J. & PARENZAN P. 1980. Il Golfo delle Boche di Cattaro-condizioni generali e biocenosi bentoniche con carta ecologica delle sue due baie interne: di Kotor (Cattaro) e Risan (Risano). *Studia Marina* 9–10: 3–148.
- TRAINITO E. & M. DONEDDU 2014. Nudibranchi del Mediterraneo. 2a Edizione, riveduta e ampliata. Il Castello, 190 p.
- Zenetos A., MAČIĆ V., JAKLIN A., LIPEJ L., POURSANIDIS D., CATTANEO-VIETTI R., BEQIRAJ S., BETTI F., POLONIATO D. & KASHA L. 2016. Adriatic “Opisthobranchs” (Gastropoda: Heterobranchia): shedding light on biodiversity issues. *Marine Ecology* 37(6): 1239–1255.
- WoRMS (World Register of Marine Species) 2019. Available from <http://www.marinespecies.org>. Accessed 2019-06-25. DOI: 10.14284/170

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