

Six species of sea slugs (Gastropoda: Heterobranchia) new for the marine fauna of Bosnia and Herzegovina

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Abstract: In this paper six heterobranch mollusc species are reported for the first time for Bosnia and Herzegovina: *Berthellina edwardsi* (Vayssiere, 1896), *Felimida luteorosea* (Rapp, 1827), *Thuridilla hopei* (Verany, 1853), *Dendrodoris grandiflora* (Rapp, 1827), *Camachoaglaja africana* (Pruvot-Fol, 1953) and *Felimare villafranca* (Risso, 1818). The study was conducted in October 2021 on Klek Peninsula and in Neum Bay (eastern Adriatic Sea, Bosnia and Herzegovina). This paper significantly extends the knowledge of the national marine heterobranch molluscs fauna, almost doubling the number of species known for the country, as only seven heterobranch species were reported for Bosnia and Herzegovina until now.

Key words: molluscs, Neum Bay, Adriatic Sea, Mediterranean, distribution

Introduction

Out of 660 heterobranch sea slug species that have been reported from the Mediterranean (Costello *et al.* 2001), 271 is known for the Adriatic Sea (Croatia, Italy, Albania, Montenegro, Slovenia) (Prkić *et al.* 2018). However, the marine heterobranch fauna of Bosnia and Herzegovina has never been systematically investigated and so far only seven species have been reported for the country.

The first data on heterobranch sea slugs in Bosnia and Herzegovina were provided by Šoljan (1980) who reported two species, *Philine quadripartita* Ascanius, 1772 and *Tethys fimbria* Linnaeus, 1767 (as *Tethys leporina* Linnaeus, 1758). More than 35 years later *Berthella aurantica* (Risso, 1818) was recorded (Nahić *et al.* 2016), and soon after additional four species were registered for the country: *Aplysia fasciata* Poiret, 1789, *Apysia punctata* Cuvier, 1803, *Bursatella leachii* Blainville, 1817 (Delić *et al.* 2019), and *Elysia timida* (Risso 1818) (Kahrić *et al.* 2021).

This paper provides first records of additional six heterobranch sea slug species for Bosnia and Herzegovina.

Material and methods

The Heterobranch species were recorded during two short field studies conducted from 1st to 3rd and from 16th to 19th October 2021. They were found at two locations in Opuće Bay on Klek Peninsula (Loc. 1.: 42.931435° N, 17.567228° E, on 02.-03. and 17.-19.10.2021., Loc. 2.: 42.929995° N, 17.568865° E, on 02.-03. and 16.-17.10.2021.), and at one location in Neum city (Loc. 3.: 42.924193° N, 17.612256° E, on 19.10.2021.) (Figs. 1&2). The Neum Bay represents the major part of the sea territory that belongs to Bosnia and Herzegovina. It is app. 6 km long, 1,2 km wide and up to 30 m deep bay located on central part of Eastern Adriatic Sea coast, completely enclosed by the Croatia waters. It is characterized by muddy and sandy bottom with rocky intertidal zone. On its south and west sides, the bay of Neum is bounded by the Klek Peninsula, with a small Opuće bay located near its apex.

All observed specimens were found in intertidal zone, along the 300 m of the northern or northeastern shore of the Opuće Bay (Loc. 1-2; Fig. 2a-c), and along small stretch of rocky shore in the Neum City (Loc. 3, Fig. 2a). We conducted visual inspection on algal habitat in the littoral zone up to 1 m depth. The specimens were photographed, preserved in 70 % ethanol and deposited in the invertebrate collection of National Museum of Bosnia and Herzegovina. Two specimens of *Berthellina edwardsi* (Vayssiere, 1896) were dissected and their internal shell was measured (Fig. 4). Species identification is based on Prkić *et al.* (2018) while taxonomy and nomenclature are in accordance with World Register of Marine Species (WoRMS 2021). Distribution in the Adriatic Sea is given based on Zenetos *et al.* (2016) and Prkić *et al.* (2018).

Results

In this paper six heterobranch species are reported for the first time in Bosnia and Herzegovina, namely: *Berthellina edwardsi* (Vayssiere, 1896), *Felimida luteorosea* (Rapp, 1827), *Thuridilla hopei* (Vérany, 1853), *Dendrodoris grandiflora* (Rapp, 1827), *Camachoaglaja africana* (Pruvot-Fol, 1953) and *Felimare villafranca* (Risso, 1818) (Fig. a-f).

Family Plakobranchidae Gray, 1840

Thuridilla hopei (Vérany, 1853)

Material examined: Loc. 1: 3.10.2021, 1 specimen; 17.-18.10.2021, 4 specimens.

Distribution in the Adriatic Sea: Italy, Slovenia, Croatia and Montenegro.

Remarks: Total of five small specimens of this sacoglossan sea slug (Fig. 3a) were recorded at the northern side of the Opuće Bay in the tidal zone on rocks covered in sciaphilic algae, at depth of around 20 cm. Body length of the largest specimen was 5,5 mm, while other specimens were between 1,5 and 3,5 mm long.

Family Chromodorididae Bergh, 1891

***Felimida luteorosea* (Rapp, 1827)**

Material examined: Loc. 2: 2.10.2021, 2 specimens.

Distribution in the Adriatic Sea: all Adriatic countries beside Albania.

Remarks: A heterobranch *Felimida luteorosea* (Rapp, 1827) (Fig. 3b) was recorded at the beach in Opuće Village (Fig. 1). Two specimens were found under different stones app. 5 meters away from each other, at the depth of 30 cm. A total body of specimens was 2 and 2,5 mm.

Family Pleurobranchidae Gray, 1827

***Berthellina edwardsi* (Vayssiere, 1896)**

Material examined: Loc. 2: 2.-3.10.2021, 3 specimens; 16.-17.10.2021, 3 specimens; Loc. 3: 19.10.2021, 2 specimens.

Distribution in the Adriatic Sea: Italy and Croatia.

Remarks: A total of eight specimens of this orange nudibranch sea slug (Fig. 3c) was found under different stones at the depth of app. 30 cm. Body length of observed specimens varied between 1 and 2,5 cm. Two larger specimens have been dissected and their internal shell was found to be 4 mm long (Fig. 4). According to Prkić (2021a&b) this species can be confused with *Berthella aurantiaca* Risso (1818) because of their very similar external morphology. This resulted with many reports of *B. aurantiaca* from the Adriatic Sea that possibly pertain to *B. edwardsii* (Cervera *et al.* 2004). Prkić (2021a&b) claims that *B. edwardsii* is very common, while *B. aurantiaca* does not occur in the Adriatic Sea. One of the main characteristics for distinguishing these two species is the size of the inner shell of adult specimens (Prkić 2021b). In *B. edwardsii* it never exceeds 5.5 mm, and it stops growing when animal is around 15 mm in length, while in fully grown specimens of *B. aurantiaca* shell is app. 15 mm long. Generally, inner shell is proportionally larger in *B. aurantiaca* (Prkić 2021b). Based on this characteristic (Fig. 4) our specimens pertain to *Berthellina edwardsi* (Vayssiere, 1896).

Dendrodorididae O'Donoghue, 1924 (1864)

***Dendrodoris grandiflora* (Rapp, 1827)**

Material examined: Loc. 1: 18.10.2021, 1 specimen.

Distribution in the Adriatic Sea: Italy, Slovenia and Croatia.

Remarks: A single specimen (Fig. 3d) with creamy colored flat body and dark spots was found on stone covered with algae at app. 15 cm depth on rocky shore in Opuće Village. A total length of recorded specimen was 18 mm.

Aglajidae Pilsbry, 1895 (1847)

***Camachoaglaja africana* (Pruvot-Fol, 1953)**

Material examined: Loc. 1: 17.-18.10.2021, 4 specimens; Loc. 3: 19.10.2021, 3 specimens.

Distribution in the Adriatic Sea: Croatia.

Remarks: This cephalaspidean sea slug (Fig. 3e) was recorded on rocky shore in Opuće Village on stones covered with algae at the depth of app. 10 cm, and app. 2 m apart., while additional three specimens were found in Neum City. The length of specimens varied from 1 to 2 cm. All of them had the same coloration, dark brown body with white spots and yellow upper edge of parapodia. Several specimens were collected, photographed and conserved in 70 % ethanol. According to Zenetos *et al.* (2016) and Prkić *et al.* (2018) our records represent the easternmost point of the species distribution in Adriatic Sea.

Chromodorididae Bergh, 1891

***Felimare villafranca* (Risso, 1818)**

Material examined: Loc. 1: 19.10.2021, 1 specimen.

Distribution in the Adriatic Sea: Italy, Slovenia and Croatia.

Remarks: This colorful sea slug (Fig. 3f) was recorded in the tidal zone on rocks covered with algae in Opuće Bay at the depth 30 cm. Its length was 9 mm, the body was slim and colored dark blue with yellow lines present on the back and sides of body. Ortea *et al.* (1996) discussed the variability of this species and pointed that the larger animals had more complicated coloration and design of the yellow lines. Our specimen was smaller and had clear and simple positions of yellow lines, including submarginal yellow lines, and central and lateral lines with white elongated spots. According to Zenetos *et al.* (2016) and Prkić *et al.* (2018) our record represents the easternmost point of species distribution in the Adriatic Sea.

Discussion

As marine fauna, and particularly the malacofauna of the country, is poorly investigated, Bosnia and Herzegovina is often excluded from marine biodiversity inventory studies (e.g. Zenetos *et al.* 2016; Prkić *et al.* 2018), and therefore each new record is significant for a better knowledge of the national molluscs fauna. Our study significantly extends the knowledge of its malacofauna, almost doubling the known number of heterobranch sea slug species (Kahrić *et al.* 2021). It is also filling the gap in data on the distribution of these species in the Adriatic Sea and indicates the necessity of further studies, as it is expected that many more heterobranch species inhabit the small part of the Adriatic Sea that belongs to Bosnia and Herzegovina.

According to Zenetos *et al.* (2016), the study in which Bosnia and Herzegovina was not included, all six species reported in this paper are known in the Adriatic Sea and expected in Bosnia and Herzegovina. The data on their current presence and the distribution in the Adriatic is variable between countries, all six have been reported for Croatia, five are reported for Italy (*B. edwardsi*, *F. luteorosea*, *T. hopei*, *D. grandiflora*, *F. villafranca*), four for Slovenia (*F. luteorosea*, *T. hopei*, *D. grandiflora*, *F. villafranca*) and two for Montenegro (*F. luterosa*, *T. hopei*), while none of these species is known from Albania (Zenetos *et al.* 2016).

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Fig 1: The map of the study area and the finding sites of recorded species (Loc. 1. square, Loc. 2. circle, Loc. 3. pentagon; 1. *Berthellina edwardsi* (Vayssiere, 1896), 2. *Felimida luteorosea* (Rapp, 1827), 3. *Thuridilla hopei* (Verany, 1853), 4. *Dendrodoris grandiflora* (Rapp, 1827), 5. *Felimare villafranca* (Risso, 1818) and 6. *Camachoaglaja africana* (Pruvot-Fol, 1953).

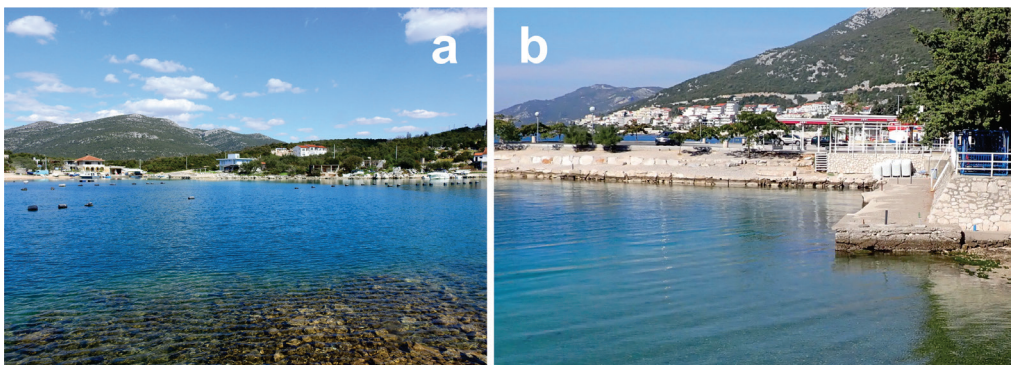


Fig 2: a) Opuće Bay; b) Loc. 4 in Neum city (photo: Dejan Kulijer).

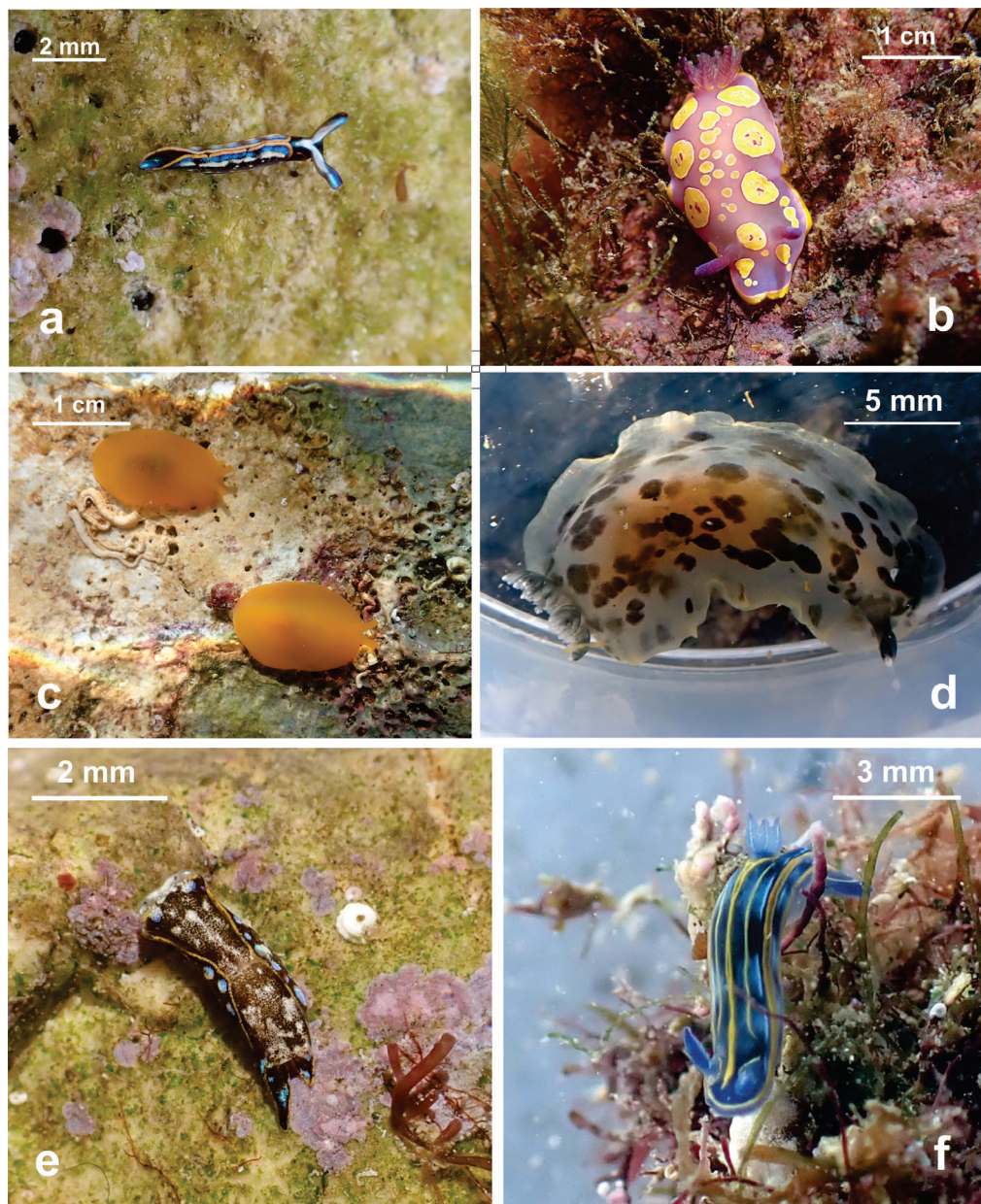


Fig 3: Four new heterobranch mollusks for Bosnia and Herzegovina registered in October 2021 in Opuće Bay: a) *Thuridilla hopei* (Vérany, 1853), b) *Felimida luteorosea* (Rapp, 1827) and c) *Berthellina edwardsi* (Vayssiere, 1896), d) *Dendrodoris grandiflora* (Rapp, 1827), e) *Camachoaglaja africana* (Pruvot-Fol, 1953) and f) *Felimare villafranca* (Risso, 1818) (photo: a, e, f – Adla Kahrić, b-d – Dejan Kulijer).

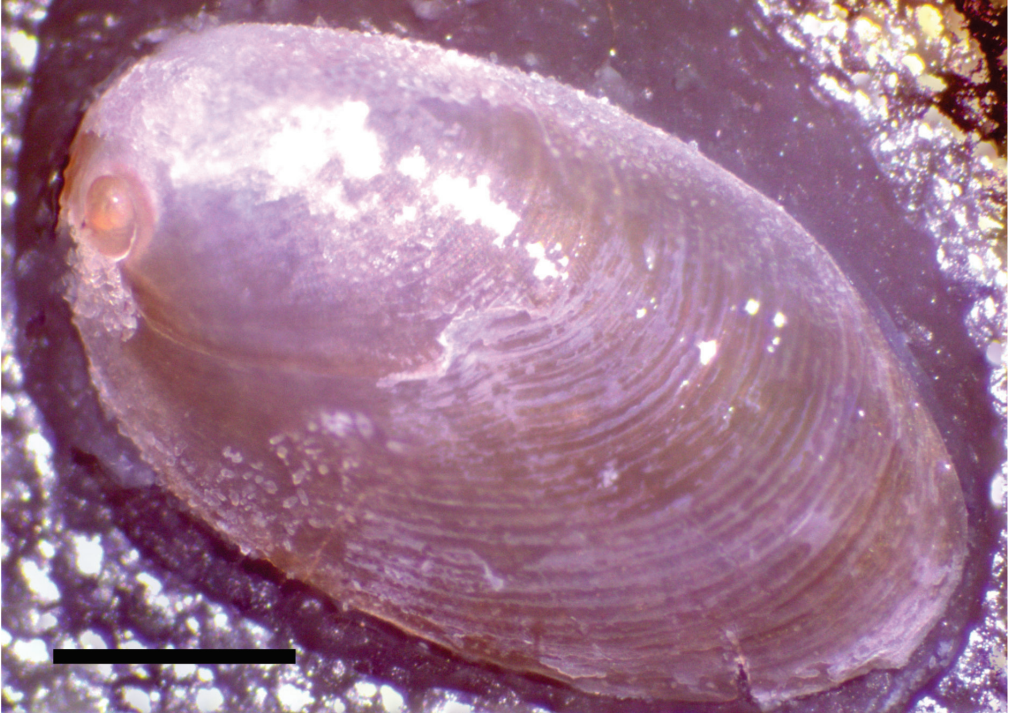


Fig 4: Internal shell of *Berthellina edwardsi* (Vayssiere, 1896), 1 mm scale (photo: Dejan Kulijer).

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