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Fissidens fontanus, a new species to Montenegro

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During field investigations of semi-natural habitats of the city of Podgorica and its vicinity, the aquatic moss, *Fissidens fontanus* was found in the rivers Sitnica and Cijevna. This is the first report of the species from Montenegro. The species grows together with *Fissidens crassipes* and *Fontinalis antypiretica*, which are common mosses in the Montenegrin rivers. At the Balkan Peninsula, *Fissidens fontanus* is also known from Bulgaria, Greece and Romania.

The family *Fissidentaceae* contains 450 species worldwide. Most of them are tropical (Pursell 2007), but 34 species are present in Europe (Hill et al. 2006). Considering the genus *Fissidens*, 15 taxa are listed in the Montenegrin bryophyte flora (Dragićević and Veljić 2006, Papp and Erzberger 2007, Papp et al. 2013, Hodgetts 2015).

Fissidens fontanus (Bach.Pyl.) Steud differs from other species of the genus *Fissidens* Hedw., by missing a central strand in the stem, and the sheathing laminae reach only 1/4–1/3 of the total leaf length. In addition, the capsule is ± immersed and lacks stomata (Privitera and Puglisi 1994). The species grows in clean to moderately polluted rivers; its substrates are rocks, woods or dams, frequently flooded by water (Neumayr 1971). *Fissidens fontanus* has a scattered distribution all over Europe, it is rare but sometimes locally abundant (Smith 2004). Outside of Europe, it is present in Africa, North and Central America, West Indies; in Asia at Israel, Iran and Turkey (Yayintaş and Alen 2009) and Australia (Duell 1984, 1985). In the Mediterranean areas (Ros et al. 2013), it has recent data from Bulgaria, Baleares, France, Israel, Italy, Sicily, Portugal, Sardinia and Turkey. Data from Algeria, Morocco and Madeira are based on collections published before 1962. Duell et al. (1999) reported it from the territory of former Yugoslavia from the Slovenian Adriatic coast. However, neither the Slovenian moss checklist (Martinčič 2003) nor the recent Mediterranean moss checklist (Ros et al. 2013) *F. fontanus* for Slovenia and none of them gives any further explanations about the record cited in Duell et al. (1999). Therefore, in the Balkan Peninsula, this species is known only in Bulgaria, Greece and Romania (Hodgetts 2015, Blockeel and Nieuwkoop 2016).

National conservation status of *F. fontanus* varies in its European distribution range. It is red listed in several countries, NT (near threatened) in the Czech Republic and Finland, VU (vulnerable) in Estonia, Ireland, Luxemburg, Poland, Switzerland, EN (endangered) in Latvia, and CR (critically endangered) in Bulgaria and Romania. This species is also a candidate for the new European Red List (Hodgetts 2015).

The investigation of semi-natural habitats of the urban area of Podgorica, which included the rivers Sitnica and Cijevna (Fig. 1), was carried out between 2011 and 2016. The river Sitnica starts from two springs, Vučji studenci and Modra oka (Bandići) situated west of Podgorica. The river often floods the surrounding areas, therefore the riverside is very inaccessible. It is mostly covered by willows (*Salix alba* L., *Salix elaeagnos* Scop.) and reeds (*Phragmites australis* (Cav.) Trin. The Cijevna river springs from the mountain Prokletije in Albania, at an altitude of 2694 m. The length of the river in Albania is 26.5 km, where it belongs to the catchment area of Skadar Lake. The length of the river in Montenegro is 32 km. From a nature conservation aspect, the most important section of the river in Montenegro is Cijevna canyon with 959 registered plant species (Bulić et al. 2008). The studied site also belongs to this canyon. The investigated area of Cijevna and Sitnica rivers are predominantly made of mesozoic and cenozoic limestone rocks (Radulović 1976). The whole area is under Mediterranean climatic influence (mild and short winters, without snow, and hot and long summers) (Stešević et al. 2014).

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Figure 1. Rivers Sitnica (marked with) and Cijevna (marked with), locality of *Fissidens fontanus* in Montenegro.

Fissidens fontanus was found in two rivers in Montenegro.

1) Sitnica river (Podgorica city), collected from an artificial wooden dam submerged in the water, accompanied by Fissidens crassipes Wilson ex Bruch & Schimp. and Fontinalis antypiretica Hedw., 42°26′34.32″N, 19°12′11.95″E, 30 m a.s.l., 17 August 2013.; leg. and det. B. Anđić (conf. B. Papp). The population *of F. fontanus* in the Sitnica river covers only a few centimetres.

2) Cijevna river (Podgorica city area), in a slowly running part of the river, 42°25′12.84″N, 19°27′01.95″E, 130 m a.s.l., 9 July 2016; leg. and det. B. Anđić (conf. S. Dragićević). In this locality, *F. fontanus* grows in patches together with *Fontinalis antypiretica* on lime containing conglomerate rocks. This bryophyte community is also known in Sweden, Germany, Romania and Belgium (Hübschmann 1986). *Fissidens fontanus* were found in the Cijevna river in four patches of ca 3 cm^2.

The specimens are stored in the herbarium of the Natural History Museum of Montenegro, Podgorica (581p,2088/6673; 659p,(II)77)/6848) and the TGU – herbarium of Faculty of Natural Sciences and Mathematics, Dept of Biology, Podgorica, Montenegro (TGU 1186947).

According to the IUCN categorisation of the risk factors (IUCN 1994), the following anthropogenic effects were registered in the investigated area: Pollution of water and soil, and loss of habitat due to sand exploitation. Both localities of *F. fontanus* in Montenegro are near the capital city, Podgorica, which cause mild anthropogenic influence due to the inflow of communal water into the rivers. Species is known from similar habitats in Europe, and can tolerate and grow in a reasonable range of pollution levels (Privitera and Puglisi 1994, Bednarek-Ochyra et al. 1996, Dierßen 2001, Godfrey 2005). However, increasing pollution could endanger the survival of the species. Increasing pollution in aquatic environments was a reason of its decline in many British localities (Preston and Smith 1992). Exploitation of the sand, which is one of major problems for river ecosystems, especially in developing countries (Gavriletea 2017), is also a threat factor in the Cijevna and Sitnica river. This human activity could directly destroy the habitat and the populations of *F. fontanus*.

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Considering all the above mentioned facts, we urge a better protection of the Cijevna and Sitnica river, monitoring of water quality, surveys on aquatic bryophyte communities, tracing the survival of *F. fontanus* and other more sensitive bryophytes, and other bioindicator aquatic organisms.

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