

Short communication

Two moss species from Mt Durmitor new to the bryophyte flora of Montenegro

Anja Vulević¹, Snežana Dragičević², Danka Petrović¹¹ Faculty of Natural Sciences and Mathematics, University of Montenegro, Džordža Vašingtona bb, 81 000 Podgorica, Montenegro² Natural History Museum of Montenegro, Trg Vojvode Bećir-bega Osmanagića 16, 81 000 Podgorica, Montenegro

Abstract The present paper reports the first records of two moss species, *Orthotrichum obtusifolium* Brid. and *Dicranoweisia cirrata* (Hedw.) Lindb., in the flora of Montenegro. The mosses were found in the Tapački kraj area on Mt Durmitor. Some morphological features, the ecological characteristics and the distribution of the species are given, along with photographs of diagnostic details and their threat status in the countries of SE Europe.

Keywords: Bryophyta, *Dicranoweisia cirrata*, *Orthotrichum obtusifolium*, SE Europe

Introduction

Knowledge on the diversity and distribution of mosses in Montenegro has increased significantly in the last decade. And yet the bryophyte flora of a number of regions remains unexplored.

The area of Durmitor is one of the bryologically richest and best explored areas in Montenegro (Dragičević and Veljić 2006 and references therein, Papp and Erzberger 2010, 2011). Of the 694 bryophyte species (545 mosses and 149 hepatics) registered for Montenegro, 360 taxa have been recorded for the National Park of Durmitor alone, which thus accounts for almost the half of the known number of bryophytes in Montenegro (Papp and Erzberger 2010). Nevertheless, there are many zones in the area of Durmitor that remain underexplored.

Bryological studies of a section of Tapačke Forest, which included two management units (Podgora and Tmora) revealed that this area has a rich bryoflora. In total, 37 bryophyte species were recorded, of which 34 are mosses and 3 belong to liverwort species (Vulević 2012). Another study included 34 management units of Tapačke Forest and reported 132 bryophytes, with 104 mosses and 28 liverwort species (Vulević 2015).

According to Hill et al. (2006), the genus *Orthotrichum* Hedw. in Montenegro comprises 15 species and 2 varieties, whereas the genus *Dicranoweisia* Milde is represented by a single species, *Dicranoweisia crispula* (Hedw.) Milde, with a single record (Dragičević and Veljić 2006).

Material and methods

Study area

Durmitor is a high mountainous massif in the northwest of Montenegro, spreading over an area that is about 55 km long and 18–21 km wide (Lješević and Stijepović 1996). It belongs to one of the most attractive natural areas in Montenegro, with rocky vertical peaks, numerous valleys between the peaks, and mountain lakes and unique landscapes (Cerović 1986).

Limestone is the dominant substrate, and therefore, the hydrographic network is poorly developed. Limestone and dolomite dark soil on carbonate substrates and various types of brown soils are present in this area (Fušić and Đuretić 2000). The climate is alpine (long, cold winters and short summers), modified by continental and maritime influence, as the mountain range of Durmitor, acting as a barrier, hampers the flow of warm air from the southern regions to the north and the stream of continental air from the north to the south. Sub-zero temperatures are frequent – the town of Žabljak has on average 164 frosty days per year and they are not uncommon even in June and September. This territory has the greatest cloud cover in Montenegro, and only July, August and September have average monthly cloud cover below 50%. The climate is humid, with the average yearly rainfall between 1100 and 1700 mm. Most of the rainfall occurs during the autumn, and July and August are the driest months, although there is no clear period of drought (Ivezić 1984).

* Corresponding author, e-mail: sneza.dragicevic@t-com.me

A part of Durmitor was declared a national park in 1978 and a UNESCO World Natural Heritage site in 1980 (Minjević 1996).

The rich and diverse flora of Durmitor includes 1771 taxa, a large number of which belong to the ancient tertiary flora (Ludajić 2000). In line with the geographical position, altitude, and the significantly desegregated terrain and complex historical processes, the vegetation of the Durmitor region is also very complex and diverse.

Tepačke Forest belongs to the Durmitor mountain range and covers a plateau northwest from the town of Žabljak (Fig. 1). The area is dominated by forest vegetation. The collection site for the two moss species described in this paper is located in the zone of coniferous forests from the association *Piceo abietis–Pinetum sylvestris* Stefanović 1960. The floristic composition of the community is characterized by the following: edificators in the tree layer (*Picea abies* (L.) H. Karst. and *Pinus sylvestris* L.) are equally represented, but other species are very rare. In the shrub layer, beside the edificators, dominant species are: *Lonicera xylosteum* L., *Rosa pendulina* L., *Rhamnus fallax* Boiss. and *Rubus idaeus* L. The forest floor is well developed and dominated by *Brachypodium sylvaticum* (Huds.) P. Beauv., *Euphorbia amygdaloides* L., *Carex humilis* Leyss. and *Vaccinium myrtillus* L.



Fig. 1. Location of the investigated area in Montenegro and its position in SE Europe.

Country abbreviations: AT – Austria; AL – Albania; BA – Bosnia-Herzegovina; BG – Bulgaria; HR – Croatia; GR – Greece; HU – Hungary; IT – Italy; KO – Kosovo; MK – Republic of Macedonia; ME – Montenegro; RO – Romania; RS – Serbia; TR – Turkey.

During bryological field studies, material was collected from many different natural and anthropogenic micro-locations including tree bark and the decaying wood of a cottage.

The results were compared with the bryophyte checklists of Montenegro (Dragičević and Veljić 2006, Sabovljević et al. 2008, Ros et al. 2013). Voucher specimens are de-

posited in the Natural History Museum of Montenegro in Podgorica (Montenegro). The nomenclature followed that of Hill et al. (2006).

Results and discussion

During field studies conducted in the area of Tepačke Forest in 2014, we registered two moss species, *Orthotrichum obtusifolium* and *Dicranoweisia cirrata*. This is the first record of these species in the bryophyte flora of Montenegro.

Orthotrichum obtusifolium Brid. (Orthotrichaceae)

(= *Nyholmia obtusifolia* (Brid.) Holmen & Warncke, *Stroemia obtusifolia* (Brid.) I. Hagen)

O. obtusifolium is a circumpolar, tropical/montane-arctic subcontinental-suboceanic species, basiphyte, moderate xerophyte, photophyte (growing in well-lit sites or under full sun), preferably moderate thermophyte, nitrophyte (medium nitrogen content), a pioneer on exposed roots, trunks, and twigs of trees and shrubs (preferably on *Fraxinus*, *Alnus*, and *Populus*), occasionally found on old fence rails, and in alpine and arctic areas on calcareous rocks and cliffs (Dierßen 2001).

Site: Mt Durmitor, Žabljak, Podgora village, Omar Božovića, 43°12' 07.51" N, 19°08' 39.86" E, 1417 m a.s.l.

O. obtusifolium was collected on the bark of an elm tree. The population was solitary, of about 30 small tufts, up to 0.5 cm high, and concentrated on a small part of the tree (Fig. 2 A). On the same micro-location (tree bark and exposed roots) we found the mosses *Antitrichia curtispindula* (Hedw.) Brid., *Leucodon sciuroides* (Hedw.) Schwchw., *Pterigynandrum filiforme* Hedw., *Pseudoleskea incurvata* (Hedw.) Loeske and *Syntrichia ruralis* (Hedw.) F. Weber & D. Mohr, the liverworts *Frullania dilatata* (L.) Dumort. and *Radula complanata* (L.) Dumort., as well as lichens of the genus *Cladonia*.

Morphological characteristics of the collected specimens of *O. obtusifolium* fit the description of this moss species: leaves rounded with numerous green clavate gemmae, leaf margin flat, costa ending below the apex (Fig. 2 B).

This small population of *O. obtusifolium* was collected from a solitary elm tree growing in a wide meadow. It is not threatened by cutting, but future studies will confirm whether this species should be protected.

The region of Mt Durmitor is abundant in environments with no industry, heavy traffic, and rapid urbanization. Therefore, *O. obtusifolium*, which is susceptible to atmospheric pollution (Smith 2004), is expected to be present in pristine areas.

This record contributes to our knowledge of the distribution of *O. obtusifolium* in southeastern Europe. The species is registered in all countries of southeastern Europe, except European Turkey (Sabovljević et al. 2008). In Serbia, it has the status of vulnerable species (Sabovljević et al. 2004) and in Hungary and Great Britain the status of near threatened species (Hodgetts 2015).

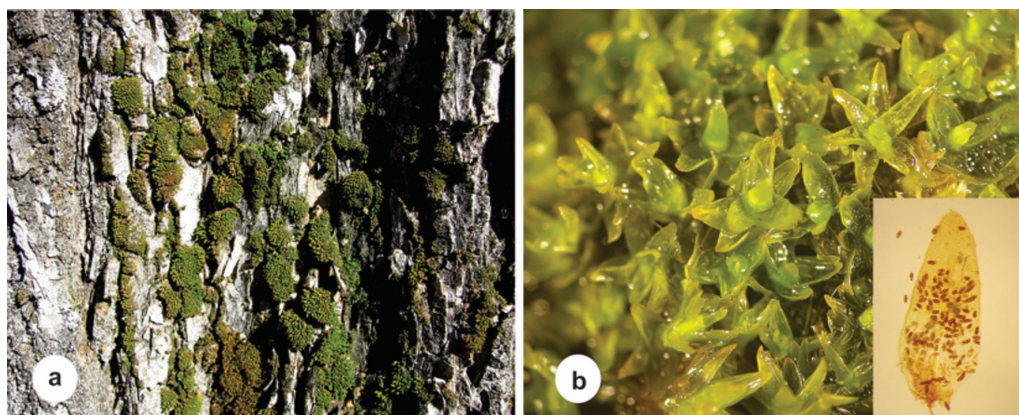


Fig. 2. The moss *Orthotrichum obtusifolium*: a) Montenegrin population on the bark of an elm tree, b) general view and leaf with gemmae.

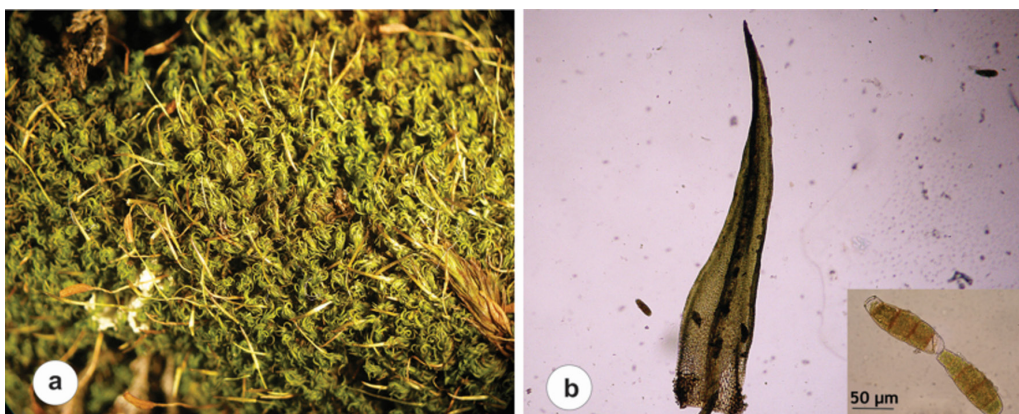


Fig. 3. The moss *Dicranoweisia cirrata*: a) greenish cushions up to 3 cm tall, b) leaf and gemmae.

***Dicranoweisia cirrata* (Hedw.) Lindb. (Rhabdoweisiaceae)**
(= *Mnium cirratum* L., *Barbula cirrata* Brid., *Grimmia cirrata* Schrad., *Tortula cirrata* Clairv., *Blindia cirrata* C.M., *Weissia cirrata* Hedw.)

According to Dierßen (2001) *Dicranoweisia cirrata* is: a cosmopolitan, austral-tropical/montane-hemiboreal sub-continental–suboceanic species, acidophyte (-subneutrophite), mesophyte–xerophyte (moderately dry), photophyte (growing in well-lit sites or under full sun), mesotherm, nitrophyte (medium nitrogen content), usually on tree trunks or wood in early stages of decomposition, on rocks and rooftops and stone or concrete walls.

Site: Mt Durmitor, Žabljak, Podgora village, Omar Božovića, 43°12' 04.66" N, 19°09' 43.37" E, 1441 m a.s.l.

The moss *Dicranoweisia cirrata* was found only at one micro-location, on the decaying roof of a cottage. The cottage is situated near the elm tree that was the collection site of *O. obtusifolium*, on the edge of the *Piceo abietis*–*Pinetum sylvestris* forest. On the same substrate, we found the mosses *Dicranum tauricum* Sapjegin, *Herzogiella seligeri* (Brid.) Z.Iwats., *Hypnum cupressiforme* Hedw., the liverworts *Blepharostoma trichophyllum* (L.) Dumort., *Lophozia*

incisa (Schrad.) Dumort., and *Ptilidium ciliare* (L.) Hampe, lichens from the genus *Cladonia*.

This population of *Dicranoweisia cirrata* was small, composed of a few green tufts or cushions, up to 1 cm high. Some individuals had sporophytes (Fig. 3 A). The leaves were crisped and incurved when dry, recurved at the middle, with costa ending below the apex. In addition, the leaves had dark, cylindrical gemmae up to 150 µm long (Fig. 3 B).

Dicranoweisia cirrata is a southeastern European species and in Slovenia and Bulgaria has been reported as a data deficient species (DD), whereas in Romania, where it was recently recorded, it is listed as endangered (Hodgetts 2015). In other European countries in which the species has been confirmed, it is placed on the endangered list only in Latvia as data deficient but recently recorded (DD*) (Hodgetts 2015). The Montenegrin population may gain endangered status with the destruction or removal of the cottage and therefore should be protected.

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