Cryptogamie, Bryologie, 2017, 38 (3): 275-280

A rare liverwort in the Mediterranean area, *Crossocalyx hellerianus* (Nees *ex* Lindenb.) Meyl., newly recorded for Montenegro

Snežana DRAGIĆEVIĆ[a], Anja VULEVIĆ[b] & Danka CAKOVIĆ[b]*

[a]Natural History Museum of Montenegro, Trg Vojvode Bećir-bega Osmanagića 16, 81 000 Podgorica, Montenegro

[b]University of Montenegro, Faculty of Natural Sciences and Mathematics, Džordža Vašingtona bb, 81 000 Podgorica, Montenegro

Abstract – A new species for Montenegro, *Crossocalyx hellerianus* was recorded during a bryological field investigation of the Durmitor Mountains. To our knowledge this is the first record of the genus *Crossocalyx* for the bryophyte flora of Montenegro. We report the distribution of *C. hellerianus* in the Mediterranean region, and provide a short description of the ecology of the species and its Montenegrin population.

***Crossocalyx hellerianus* / distribution / Durmitor/ liverwort / Montenegro / new record**

INTRODUCTION

The genus *Crossocalyx* comprises two species: *C. hellerianus* and C. *tenuis* (Söderström *et al.*, 2016). According to the checklist of the Hepatics and Anthocerotes of the Mediterranean (Ros *et al.*, 2007), *Crossocalyx hellerianus* occurs in France, Italy, Spain, Serbia (as a part of Yugoslavia), and Slovenia. The data pertaining to Serbia were published at the beginning of the 20th century (Katić, 1907). Similarly, the data on the distribution of *C. hellerianus* in Slovenia are based on collections from the end of the 19th – beginning of the 20th century by Glowacki and Breidler (Pavletić, 1955). In his list of liverworts from Slovenia, Martinčič (2011) did not cite any new collections of *C. hellerianus*. According to Sabovljević & Natcheva (2006), *C. hellerianus* is not widespread in Southeast Europe and occurs only in Romania, Serbia, and Slovenia. However, Hodgetts (2015) reported this species also from Greece.

The Durmitor is one of the highest mountain areas of the Dinaric Alps. It has more than 20 peaks above 2200 m asl; the highest of them (Bobotov kuk) reaches a height of 2523 m als. The Durmitor is characterized by impressive landscapes. The canyon of the river Tara, in places as deep as 1300 m, is the second deepest canyon in the world after the Grand Canyon of the Colorado River. Eighteen glacial lakes, including the largest of them, Crno jezero (Petrović & Karaman, 2009), contribute to the overall beauty of the Durmitor. The National Park Durmitor is the

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

doi/10.7872/cryb/v38.iss3.2017.275

largest national park in Montenegro and, since 1980, a UNESCO World Natural and Cultural Heritage Site.

Bryological investigations of the Durmitor started at the beginning of the 20th century (Vilhelm, 1923; Martinčič, 1964; Birks & Walters, 1973; Pavletić & Pulević, 1980; Kürschner & Parolly, 1997; Papp & Erzberger, 2010, 2011). As a result, the bryological flora of the Durmitor is one of the best studied in Montenegro. On the territory of the National Park Durmitor, 360 bryophyte taxa have been recorded representing half of the taxa of bryophytes known from Montenegro (Papp & Erzberger, 2010).

Recent field studies conducted in the Durmitor region showed that the bryoflora of the region is still incompletely known (Vulević, 2015).

STUDY AREA

The Tepačke Forests are located on a plateau in the northwest part of Žabljak municipality, the Durmitor (43°9′24″ and 43°12′58″N, 19°4′ 51″ and 19°10′47″E) (Fig. 1). Since the bedrock is made of limestone, dolomite dark soils and various types of brown soils are present in this area (Fuštić & Đuretić, 2000). Long winters with an abundant snow cover and cool summers are typical of the mountain climate of the Durmitor region. The average annual temperature is + 4.9°C; the coldest month is January and the warmest, July with the average monthly temperatures of – 5.4°C and + 13.2°C, respectively. The annual precipitation is 1550-1750 mm (Cerović, 1986). The Durmitor is dominated by forest vegetation. At lower elevations, there are deciduous forests of the alliance *Fagion moesiacae*, above which is the coniferous boreal vegetation belonging to the alliance *Abieti-Piceion*. The *Fagion moesiacae* alliance is represented with only one association, *Fagetum moesiacae montanum*, wheras the *Abieti-Piceion* alliance comprises three associations: *Daphno blagayanae-Picetum abietis, Abieti-Piceetum abietis Illyricum*, and *Piceo-Pinetum sylvestris*. The zone of coniferous forests is vertically followed by subalpine shrub vegetation of the alliance *Rhodoreto-Vaccinietea*, which is primarily composed of the mountainous pine forming widespread association *Pinetum mugi montenegrinum.* In addition, the endemic association *Potentillo montenegrinae-Juniperetum nanae* occurs in fragments within the zone of the coniferous forests (Lakušić, 2003). The collection site for *C. hellerianus* is located within spruce forests intersected by wetlands of the association *Caricetum vesicarie* Lakušić 1974, with *Carex otrubae* and *Carex vesicaria* as the dominant species.

MATERIAL AND METHODS

The field studies of the bryoflora of the Tepačke Forests were conducted in 2014. We collected 132 bryophyte taxa (104 mosses and 28 liverworts, Vulević *et al.*, 2016). Vouchers are deposited at the herbarium of the Natural History Museum of Montenegro in Podgorica.

Fig. 1. Map showing the location of the study area (Uskoci village, the Durmitor, Montenegro). The inset map shows the distribution of the liverwort *Crossocalyx hellerianus* in the Mediterranean region (country abbreviations: **ES** – Spain; **FR** – France; **GR** – Greece; **IT** – Italy; **ME** – Montenegro; **RS** – Serbia; **SI** – Slovenia).

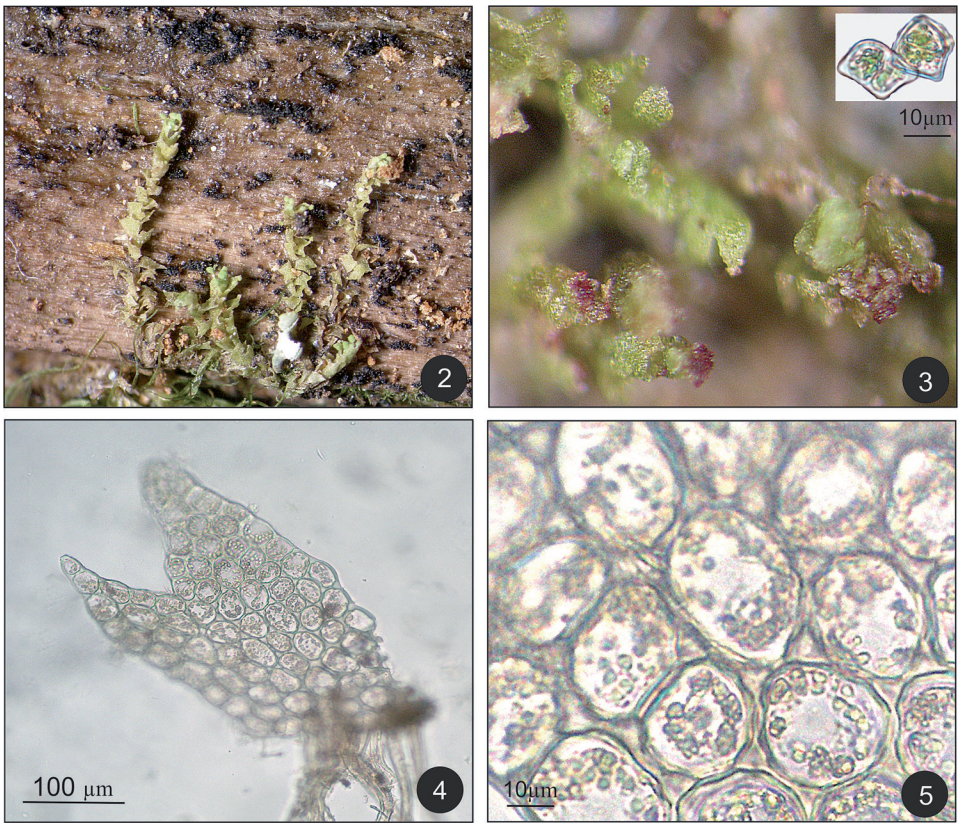
RESULTS AND DISCUSSION

According to Söderström *et al.* (2002), Dragićević & Veljić (2006), Ros *et al.* (2007), Sabovljević *et al.* (2008) and Hodgetts (2015) *Crossocalyx hellerianus* from the Durmitor is the first record of this species for the Montenegrin bryophyte flora. Moreover, this is the first record of the genus *Crossocalyx* for Montenegro. The locality is:

Municipality of Žabljak, area Tepačke Forests, village Uskoci, spruce forests, decaying log, 43°10′45.70″ N, 19°06′21.06″ E, 1532 m asl, 20.08.2014., *A. Vulević*, *NHM 273/576p-2081.*

According to Dierβen (2001), *C. hellerianus* has a boreosubtropical/montane-alpine-boreal circumpolar distribution. It is a dwarf and often inconspicuous liverwort, often growing in shade on damp rotting, usually debarked logs and stumps. It also grows on the bark of living oak trees and on stems and twigs of juniper (Hill *et al.*, 1991). Male plants of *C. hellerianus* can occur on the bark of newly fallen logs, whereas plants with perianths and sporophytes frequently occur on debarked logs. *Crossocalyx hellerianus* grows in association with *Nowellia curvifolia, Syzygiella autumnalis, Liochlaena lanceolata, Blepharostoma trichophyllum*, *Lophozia* and *Scapania* species (Damsholt, 2002).

In the Durmitor, *C. hellerianus* grows in greenish patches in association with *Ptilidium pulcherrimum* forming erect gemmiparous shoots (0.5-0.7 mm wide) with vinaceous clusters of gemmae at their apices (Figs 2-5).



Figs 2-5. Micrographs of *Crossocalyx hellerianus*. **2.** Habit. **3.** Attenuated shoots with red gemmae (upper right). **4.** Leaf. **5.** Cells of the leaf lamina.

Several small colonies of *C. hellerianus* have been observed. These are under threat from deforestation and other forms of commercial exploitation that reduce the extent of old-growth forests and/or the number of well-decayed logs. As a newly recorded species in Montenegro, *C. hellerianus* should be categorized as Data Deficient (IUCN 2014) because the information required to assess its status is insufficient. The species has the same status of Data Deficient in Slovenia, whereas in Italy and Spain it is listed as a Critically Endangered species (Hodgetts, 2015).

Acknowledgements. We thank Dr Beata Papp for her help with the identification of the samples, Dr Vesna Karaman-Castro, MSc Branka Knežević and Dr Nadia Bystriakova for corrections, constructive comments and linguistic revision of the manuscript.

REFERENCES

BIRKS H.J.B. & WALTERS S.M., 1973 — The flora and vegetation of Barno jezero, Durmitor, Montenegro. *Bulletin of the Republic institution for the protection of nature – Natural History Museum*, 5: 5-23.

CEROVIĆ B., 1986 — *Durmitor and the Tara canyon*. Beograd, Geokarta, 92 p.

DAMSHOLT K., 2002 — *Illustrated Flora of Nordic Liverworts and Hornworts*. Lund, Nordic Bryological Society, pp.174-176.

DIERβEN K., 2001 — Distribution, ecological amplitude and phytosociological characterization of European bryophytes. *Bryophytorum bibliotheca* 56: 1-289.

DRAGIĆEVIĆ S. & VELJIĆ M., 2006 — *Survey of Bryophyta of Montenegro.* A special edition of the Natural History Museum of Montenegro. Book I. Natural History Museum of Montenegro, 99 p.

FUŠTIĆ B. & ĐURETIĆ G., 2000 — *Lands of Montenegro*. Podgorica, University of Montenegro, Biotechical Faculty, 626 p.

HILL M.O., PRESTON C.D. & SMITH A.J.E., 1991 — *Atlas of the Bryophytes of Britain and Ireland.* Volume 1. Liverworts (Hepaticae and Anthocerotae). Colchester, Harley Books, 133 p.

HODGETTS N.G., 2015 — *Checklist and coutry status of European bryophytes – towards a new Red List for Europe*. Irish Wildlife Manuals No.84. National Parks and Wildlife Services, Department of Arts, Heritage and the Gaeltacht, Ireland, pp. 47-48.

IUCN, 2014 — *Guidelines for Using the IUCN Red List Categories and Criteria.* Version 11 (February 2014). Gland, International Union for the Conservation of Nature.

KATIĆ D., 1907 — Prilog građi za floru briofita u Srbiji. *Prosvetni glasnik*, pp. 369-380.

KÜRSCHNER H. & PAROLLY G., 1997 — Additions to the bryophyte flora of the Durmitor National Park (Crna Gora) and a first conspectus of all records. *Willdenowia* 27: 249-264.

LAKUŠIĆ D., 2003 — Ecological and morphological differentiation of narrow-leaved fescue (*Festuca* L. subgen. *Festuca*) in the area of Durmitor. Doctoral thesis. Faculty of Biology, University of Belgrade, 266 p.

MARTINČIČ A., 1964 — Contribution to the knowledge of the moss flora of Yugoslavia, I. Durmitor (Crna Gora). *Biološki vestnik* 12: 43-49.

MARTINČIČ A., 2011 — Annotated Checklist of Slovenian Liverworts (Marchantiophyta) and Hornworts (Anthocerotophyta). *Scopolia* 72: 1-38.

PAVLETIĆ Z., 1955 — *Prodromus bryophytes flora of Yugoslavia*. Yugoslav Academy of Sciences and Arts, Special editions of the Department of Natural Sciences, Book III, Zagreb, pp. 62-63.

PAVLETIĆ Z. & PULEVIĆ V., 1980 — Contribution to bryophytes flora of Montenegro. *Montenegrin academy of sciences and arts, Bulletin of the department of natural sciences* 3: 111-131.

PAPP B. & ERZEBERGER P., 2010 — Contributions to the bryophyte flora of Durmitor National Park, Montenegro. *Nova Hedwigia* 138: 147-163.

PAPP B. & ERZEBERGER P., 2011 — Additions to the bryophyte flora of the Tara river canyon and the Durmitor area, Montenegro. *Studia botanica hungarica* 42: 31-39.

PETROVIĆ D. & KARAMAN M., 2009 — *Important Plant Areas in Montenegro.* Podgorica, IPA Programme. NGO Green Forest, 34 p.

ROS R.M., MAZIMPAKA V., ABOU-SALAMA U., ALEFFI M., BLOCKEEL T.L., BRUGUÉS M., CANO M.J., CROS R.M., DIA M.G., DIRKSE G.M., EL SAADAWI W., ERDAĞ A., GANEVA A., GONZÁLEZ-MANCEBO J.M., HERRNSTADT I., KHALIL K., KÜRSCHNER H., LANFRANCO E., LOSADA-LIMA A., REFAI M.S., RODRÍGUEZ-NUÑEZ S., SABOVLJEVIĆ M., SÉRGIO C., SHABBARA H., SIM-SIM M. & SÖDERSTRÖM L., 2007 — Hepatics and Anthocerotes of the Mediterranean, an annotated checklist. *Cryptogamie, Bryologie* 28 (4): 351-437.

SABOVLJEVIĆ M. & NATCHEVA R., 2006 — Check-list of the liverworts and hornworts of Southeast Europe. *Phytologia Balcanica* 12 (2): 169-180.

SABOVLJEVIĆ M., NATCHEVA R., TSAKIRI E., DIHORU G., DRAGIĆEVIĆ S., ERDAĞ A. & PAPP B., 2008 — Check-list of the mosses of South-Eastern Europe. *Phytologia Balcanica* 14: 207-244.

SÖDERSTRÖM L., URMI E. & VÁŇA J., 2002 — Distribution of Hepaticae and Anthocerotae in Europe and Macaronesia. *Lindbergia* 27: 3-47.

SÖDERSTRÖM L., HAGBORG A., VON KONRAT M., BARTHOLOMEW-BEGAN S., BELL D., BRISCOE L., BROWN E., CARGILL D.C., COSTA D.P., CRANDALL-STOTLER B.J., COOPER E.D., DAUPHIN G., ENGEL J.J., FELDBERG K., GLENNY D.,GRADSTEIN S.R., HE X., HEINRICHS J., HENTSCHEL J., ILKIU-BORGES A.L., KATAGIRI T.,

KONSTANTINOVA N.A., LARRAÍN J., LONG D.G., NEBEL M., PÓCS T., PUCHE F., REINER-DREHWALD E., RENNER M.A.M., SASS-GYARMATI A., SCHÄFER-VERWIMP A., MORAGUES J.G.S., STOTLER R.E., SUKKHARAK P., THIERS B.M., URIBE J., VÁŇA J., VILLARREAL J.C., WIGGINTON M., ZHANG L. & ZHU R-L., 2016 — World checklist of hornworts and liverworts. *PhytoKeys* 59: 1-828.

VILHELM J., 1923 — Additamenta floristica in Bryofloram montenegriniam. *Acta botanica bohemica* 2: 46-50.

VULEVIĆ A., 2015 — *Briological study of the Tepačka area with the overview of vegetation of bryological habitats.* Master's thesis. University of Montenegro, Faculty of Natural Sciences, Department of Biology, Podgorica.

VULEVIĆ A., DRAGIĆEVIĆ S. & PETROVIĆ D., 2016 — Contribution to knowledge of the bryophyte flora of the Tepačke Forests (Durmitor Mts., Montenegro). *In*: Dragićević, S. (ed.), *Bryophyte Conservation – Towards the new European Red List of Bryophytes. 9th Conference of European Committee for Conservation of Bryophytes. Book of Abstracts*. Podgorica, Natural History Museum of Montenegro, 22 p.