

## *Additions to Moss Flora of Kosovo from "Bjeshkët e Nemuna" Mountains*

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**Abstract.** The moss flora of Kosovo is the least explored in South East Europe, with 346 moss taxa known so far. The aim of the present study is to further increase the knowledge of the moss flora of Bjeshkët e Nemuna Mountains (Prokletije) in Kosovo, which are a hot spot for plant biodiversity in the Balkans. In several field trips conducted in Bjeshkët e Nemuna, about 1140 moss samples were collected and identified. From the current investigation of the moss flora in Bjeshkët e Nemuna, 13 taxa are new records for Kosovo and 41 species are recorded for the first time in Bjeshkët e Nemuna. Therefore, this study brings to 359 the number of moss species for Kosovo and 239 for Bjeshkët e Nemuna. Concluding, much more efforts are needed towards a better knowledge of mosses of Kosovo, and thereafter the protection of potential threatened species.

**Key words:** Plant biodiversity, moss flora, Bjeshkët e Nemuna, Prokletije.

### **Introduction**

The bryophyte flora of Kosovo is poorly known. The main reason is the lack of local bryologists and low investigation by foreigner bryologists as well. Recently, Pantović & Sabovljević (2017) have summarized the checklist of Kosovo bryophytes based on the review of 13 literature sources - reporting 303 mosses and 28 liverworts. However, these 303 moss taxa are reported based on ca. 700 records, which is a very low number. In addition, new moss records are reported for Kosovo from Germia Regional Park and Sharr Mountain (Krasniqi & Marka, 2018, 2019). Hence, the actual number of moss taxa for Kosovo has reached up to 346 taxa. However, this

number is still very low compared with the neighboring Balkan countries from one side (Sabovljević et al., 2011), and especially the presence of two important mountain ranges present in Kosovo - and hot spots for plant biodiversity - namely Sharr Mountains (also known as Šar planina) and Bjeshkët e Nemuna (also known as Prokletije) from the other side. In the check list of Kosovo bryophytes for Bjeshkët e Nemuna are reported 198 moss taxa (Pantović & Sabovljević, 2017). The aim of the present study is to further increase the knowledge of the moss flora of Bjeshkët e Nemuna, in addition to those reported mainly by Martinčić (2006).

Bjeshkët e Nemuna is one of the most

attractive and beautiful mountain massifs in Europe (Muratagic, 1975). They are a continuation of the Dinaric mountain system and are part of the system of new mountains which are mainly composed of limestone-dolomite rocks. In Kosovo territory it has an area of 63,027.75 ha, which in administrative terms belongs to several municipalities: Istog, Peja, Deçan, Junik and Gjakova (Çadraku et al., 2014). The altitude varies from 500 to 2656 m (Maja Gjeravica) and the average altitude is 1600 m. Bjeshkët e Nemuna include the western and northwestern part of Dukagjini region which is a continuation of the mountains from Liqeni i Shkodrës lake (Albania), Plavë and Guci (Montenegro) to the Ibar tectonic valley. There are found variable forms which are created by fluvio-glacial processes, and as a consequence of which is the formation of deep gorges. Erosion is quite pronounced in these mountains, due to the structural composition of the soil and heavy rainfall that makes the rocks washed away (Sherifi et al., 2005). Bjeshkët e Nemuna Mts. are characterized by gorges, valleys, karstic, glacial, fluvio-glacial and denudation phenomena (Sherifi et al., 2005). Rugova Gorge and Deçan Gorge by Lumbardhë River represent the most important geomorphological elements (Pasha, 1975).

In Bjeshkët e Nemuna dominates the continental Mediterranean and mountain climate intertwined with micro climates conditioned by the alternation of river valleys (Pllana, 1991). Average monthly temperatures range from -0.33 ° C to 21.37 ° C in Peja Locality and from 0.3 ° C to 20.8 ° C in Istog Locality (Instituti për Hidroekonomi, 1983). In terms of seasons, it turns out that the coldest month is January, while the hottest month is August. The average annual rainfall varies from 650 mm (plain part) to over 1400 mm (mountain part) (Instituti për Hidroekonomi, 1983).

The hydrographic network is quite developed. The main rivers are: Lumbardhë River of Peja, Deçan, Lloqan, and Erenik River. All waters flow east and southeast and are

discharged into the Drini i Bardhë River (Çadraku et al., 2014). Underground water sources are present in almost the entire area of the mountains, but have the highest density in carbonate formations. Based on existing data within the boundaries of the Bjeshkët e Nemuna there are about 730 underground water sources (Çadraku et al., 2014).

### Material and Methods

A total of 1140 moss samples were collected in different localities in Bjeshkët e Nemuna during several field trips carried out in 2015 and 2019 (Table 1). The identification of the material was done jointly by both authors. The voucher specimens are preserved in the herbarium collection at Faculty of Education, University of Pristina. Nomenclature of the moss taxa follows Hodgetts et al. (2020). The conservation status of moss taxa at European and regional level, as well as their distribution in South East Europe, follows Hodgetts & Lockhart (2020). The floristic element for each taxon is retrieved from Smith (2004).

**Table 1.** The collecting site details in Bjeshkët e Nemuna.

No.	Locality name	Coordinates and altitude
1	Lagjia e Kaprojve	42°42'52"N, 20°9'3"E, 1103 m
2	Reka e Allagës	42°43'60"N, 20°9'26"E, 1403 m
3	Hajla	42°44'24"N, 20°9'7"E, 1650 m
4	Hajla	42°44'37"N, 20°9'33"E, 1703 m
5	Hajla	42°45'2"N, 20°9'13"E, 2027 m
6	Hajla	42°44'58"N, 20°8'51"E, 2081 m
7	Hajla	42°44'32"N, 20°8'49"E, 1795 m
8	Liqenat	42°40'29"N, 20°5'11"E, 1671 m
9	Liqenat	42°40'6"N, 20°5'24"E, 1865 m
10	Bogë	42°45'34"N, 20°3'25"E, 1543 m
11	Bogë	42°46'3"N, 20°3'32"E, 1619 m
12	Bogë	42°46'25"N, 20°3'34"E, 1659 m
13	Bogë	42°46'44"N, 20°3'36"E, 1767 m
14	Hajla	42°45'25"N, 20°8'22"E, 2362 m
15	Hajla	42°45'34"N, 20°8'3"E, 2350 m
16	Hajla	42°45'35"N, 20°7'47"E, 2249 m
17	Hajla	42°45'40"N, 20°6'55"E, 2240 m
18	Hajla	42°45'33"N, 20°5'43"E, 1809 m
19	Hajla	42°44'58"N, 20°6'38"E, 1615 m

In the Results section is given the list of moss taxa found in Bjeshkët e Nemuna. Taxa marked with one asterisk (\*) are new records for Kosovo, whereas those with two asterisks (\*\*) are new records for Bjeshkët e Nemuna. Each moss taxa is followed immediately with the number of locality where it was found and its substrate, floristic element, conservation status and distribution comments in the context of SE European countries. Abbreviations used for conservation status are: CR - critically endangered, EN - endangered, VU - vulnerable, NT - near threatened and DD - data deficient.

### Results and Discussion

Altogether 124 moss taxa are given in the following list. 13 are new records for Kosovo (\*) and 41 (\*\*) are new records for Bjeshkët e Nemuna:

- Abietinella abietina* (Hedw.) Fleisch. - 3, 4, 5, 12: on soil and limestone rocks. This Circumpolar Boreo-arctic Montane species is common and widespread in SE Europe.
- Barbula unguiculata* Hedw. - 3: on limestone rocks. This Circumpolar Wide-temperate species is common and widespread in SE Europe.
- Bartramia ithyphylla* Brid. - 4, 5, 14, 15, 19: on basic soil. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.
- Brachytheciastrum velutinum* (Hedw.) Ignatov & Huttunen - 5, 7, 9, 13, 14, 15, 17, 18: on soil, limestone rocks. This Circumpolar Temperate species is very common and widespread in SE Europe.
- \*\**Brachythecium albicans* (Hedw.) Schimp. - 13: in grassland. This Circumpolar Boreo-temperate species although is recently reported for Kosovo (Krasniqi & Marka, 2018, 2019) is common and widespread in SE Europe.
- \*\**Brachythecium geheebii* Milde. - 9, 13: on acidic rocks. This is an endemic species of Europe and red list species (VU) (Hodgetts & Lockhart, 2020). It is reported for almost all SE European countries and red listed as follows: EN-Bulgaria, CR-Romania and NT-Slovenia. As for Kosovo, it has been recently reported in the Sharr Mountain National Park (Krasniqi & Marka, 2019).
- Brachythecium glareosum* (Bruch ex Spruce) Schimp. - 4, 6, 7, 11, 12, 13, 14, 15, 17, 18, 19: on soil, on limestone rocks. This Eurasian Boreo-temperate species is common and widespread in SE Europe.
- Bryoerythrophyllum recurvirostrum* (Hedw.) P.C.Chen - 6, 14, 15: on basic soil. This Circumpolar Boreo-temperate species is common and widespread in SE Europe.
- Calliargonella cuspidata* (Hedw.) Loeske - 4: on spring. This Circumpolar Temperate species is very common in SE Europe.
- \**Calliargonella lindbergii* (Mitt.) Hedenas - 12: on wet rocks by stream. This Circumpolar Wide-boreal species is a new record for Kosovo; it is known from many SE European countries but, however, its conservation status is not clear (e.g. DD-Montenegro, Serbia).
- \**Campyliadelphus chrysophyllus* (Brid.) R. S. Chopra - 14, 15, 16: limestone grassland. This Circumpolar Boreo-temperate species is a new record for Kosovo. However, it is known and common from all SE European countries.
- Campylium stellatum* (Hedw.) Lange & C.E.O.Jensen - 3, 4, 6, 7, 14, 15, 16: humid soil, wet rocks. This Circumpolar Boreo-temperate species is known from all SE European countries except for Albania.
- Campylophyllum halleri* (Hedw.) M.Fleisch. - 6, 8: on wet limestone rocks. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.
- Ceratodon purpureus* (Hedw.) Brid. - 2, 3, 4, 6, 7, 8, 9, 11, 12, 14, 17: on acidic soils and rocks. This Circumpolar Wide-boreal species is very common in SE Europe.
- Cirriphyllum crassinerviium* (Taylor) Loeske & M.Fleisch. - 8: on limestone humid rock. This European Temperate species is very common in SE Europe.

- Cirriphyllum piliferum* (Hedw.) Grout – 5: on wet rocky soil. This Circumpolar Boreo-temperate species is known from all SE European countries except for Albania.
- Cratoneuron filicinum* (Hedw.) Spruce – 3: on spring. This Circumpolar Wide-temperate species is common in SE Europe.
- Ctenidium molluscum* (Hedw.) Mitt. – 6, 7, 8, 9, 14, 15, 18, 19: on limestone rocks. This European Boreo-temperate species is common in SE Europe.
- \**Cyrtomnium hymenophylloides* (Huebener) T.J.Kop. – 7: on soil. This Circumpolar Boreo-temperate species is a new record for Kosovo. It is recorded in many SE European countries but, however, its conservation status is not clear (EN-Romania, DD-Montenegro, Serbia).
- \**Dialytrichia mucronata* (Brid.) Broth. – 5: on rock beside stream. This Mediterranean-Atlantic species is a new record for Kosovo. However, its presence in high altitudes is not a normal situation for the species.
- \**Dicranella varia* (Hedw.) Schimp. – 6, 15: on wet rocks. This Circumpolar Boreo-temperate species is common and widespread in SE Europe.
- Dicranum scoparium* Hedw. – 3, 4, 5, 7, 8, 9, 14, 15, 16: on silicate rocks. This Circumpolar Wide-boreal species is widespread in SE Europe.
- Dicranum tauricum* Sapjegin – 3, 7, 8, 9, 14, 15, 16: on coniferous and oak bark. This European Temperate species is widespread in SE Europe. It is red listed for Slovenia (EN) and Serbia (VU).
- Didymodon fallax* (Hedw.) R. H. Zander – 8: on calcareous rock. This Circumpolar Southern-temperate species is common and widespread in SE Europe.
- \*\**Didymodon rigidulus* Hedw. – 5, 7, 9, 13, 15: on limestone rocks. This Circumpolar Boreo-temperate species is widespread in SE Europe.
- \*\**Didymodon spadiceus* (Mitt.) Limpr. – 4: on spring. This European Temperate species is widespread in SE Europe.
- \*\**Didymodon vinealis* (Brid.) R.H.Zander – 7, 14: on limestone rocks. This European Southern-temperate species is widespread in SE Europe.
- Distichium capillaceum* (Hedw.) Bruch & Schimp. – 6, 7, 8, 9, 15, 19: on limestone rocks. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.
- \*\**Distichium inclinatum* (Hedw.) Bruch & Schimp. – 6, 8, 9, 18: on limestone rocks. This Circumpolar Boreo-arctic Montane species is widespread in SE. It is red listed for Bulgaria (VU)
- Encalypta affinis* R. Hedw. – 3, 17: on rocks. It is known from several SE European countries and red listed for Romania (CR).
- Encalypta ciliata* Hedw. – 6: on calcareous soil. This Circumpolar Boreal-montane species is known from all SE European countries and red listed for Serbia and Montenegro (VU).
- Encalypta rhaptocarpa* Schwägr. – 7, 14, 15: on limestone rocks. This Circumpolar Boreo-arctic Montane species is known from many SE European countries.
- Encalypta streptocarpa* Hedw. – 6, 7, 8, 9, 10, 12, 14, 16: on limestone rock crevices. This Euroasian Boreo-temperate species is the commonest *Encalypta* in SE Europe.
- Eurhynchiastrum diversifolium* (Schimp.) J.Guerra – 6, 7, 11, 14, 15, 18: on wet rocks, on soil. This Circumpolar Temperate species is known from many SE European countries and red listed for Slovenia (EN).
- Eurhynchiastrum pulchellum* (Hedw.) Ignatov & Huttunen – 8, 9: on wet rocks. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.
- Fissidens taxifolius* Hedw. – 7, 15, 16, 18: on rocks and soil. This European Southern-temperate species is common and widespread in SE Europe.
- Flexitrichum flexicaule* (Schwägr.) Ignatov & Fedosov – 6, 7, 8, 9, 10, 13, 15, 17: on limestone rocks and soil. This Circumpolar Wide-temperate species is

- very common and widespread in SE Europe.
- Flexitrichum gracile* (Mitt.) Ignatov & Fedosov - 5, 7, 8, 9, 10, 13, 17, 18. This Circumpolar Boreo-temperate species is widespread in SE; however, not as common as *F. flexicaule* and red listed for Romania (CR).
- \**Grimmia anodon*. Bruch & Schimp. - 7, 16: on limestone rocks. This Circumpolar Wide-temperate species is known from many SE European countries; however, not very common and it is red listed for Romania (VU).
- Grimmia hartmanii* Schimp. - 1, 2, 3, 4: on acidic rocks. This European Boreal-montane species is widespread in SE Europe and often locally abundant.
- \*\**Grimmia muehlenbeckii* Schimp. - 7, 16: on acidic rocks. This species is known from many countries in SE Europe, and it is also red listed for Bulgaria and Romania (VU).
- Grimmia ovalis* (Hedw.) Lindb. - 1, 3: on acidic rocks. This Circumpolar Boreal-temperate species is widespread in SE Europe.
- \*\**Grimmia ramondii* (Lam. & DC.) Margad. - 1, 2, 3, 4, 7, 8, 15, 16: on dry acidic rocks. This European Boreal-montane species is widespread in SE Europe. It is locally abundant in high altitudes. It is red listed for Romania (EN) and Bulgaria (VU).
- \*\**Hedwigia ciliata* (Hedw.) P.Beauv. - 2: on acidic rock. This species is widespread in SE Europe.
- \**Hedwigia emodica* Hampe ex Müll.Hal. - 3: on acidic rock. This Oceanic Temperate species is known from several countries in SE Europe and it is red listed for Slovenia (VU).
- Heterocladiella dimorpha* (Brid.) Ignatov & Fedosov - 9, 15: on rocks. This European Boreal-montane species is widespread in SE Europe.
- \*\**Homalothecium lutescens* (Hedw.) H.Rob. - 6, 7, 15, 16: on limestone rocks and soil. This European Southern-temperate species is very common and widespread in SE Europe.
- Homalothecium philippeanum* (Spruce) Schimp. - 7: on soil. This species is common and widespread in SE Europe.
- Hylocomiadelphus triquetrus* (Hedw.) Ochyra & Stebel. - 8, 9: on rocks. This Circumpolar Boreo-temperate species is widespread in SE Europe.
- Hylocomium splendens* (Hedw.) Schimp. - 6, 7, 8, 9: on limestone rocks. This Circumpolar Wide-boreal species is widespread in SE Europe.
- Hymenoloma crispulum* (Hedw.) Ochyra - 7: on acidic rock. This Circumpolar Boreal-Arctic Montane species is widespread in SE Europe.
- \**Hypnum andoi* A.J.E.Sm. - 1: on acidic rock. This Suboceanic Temperate species is known from many SE European countries, and it is red listed for Serbia (VU), near threatened for Romania and data deficient for Montenegro.
- Hypnum cupressiforme* Hedw. - 1, 2, 3, 4, 5, 6, 13: on rocks, on fir bark. This Circumpolar Wide-temperate species is common and widespread in SE Europe.
- Hypnum cupressiforme* var. *lacunosum* Brid. - 3: on wet rock. This Circumpolar Boreo-temperate species is widespread in SE Europe.
- \*\**Kiaeria starkei* (F.Weber & D.Mohr) I.Hagen - 7, 16: on silicate rocks. This Circumpolar Arctic-montane species is known from several SE European countries, it is red listed for Slovenia (EN). As for Kosovo, it has been recently reported in the Sharr Mountain National Park (Krasniqi & Marka, 2019).
- Lescuraea incurvata* (Hedw.) E.Lawton - 7, 8, 9, 10, 11, 13: on rocks. This European Boreal-montane species is common and widespread in SE Europe.
- Lescuraea patens* Lindb. - 13: on limestone rock. This European Boreal-montane species is widespread in SE Europe but, however, not very common.
- Lescuraea plicata* (Schleich. ex F.Weber & D.Mohr) Broth. - 6, 7, 8, 9: on rocks. This

- European Boreo-arctic Montane species is widespread in SE Europe and red listed for Romania (VU).
- \*\**Lewinskya striata* (Hedw.) F.Lara, Garilleti & Goffinet - 13: on beech bark. This European Boreal-temperate species is widespread in SE Europe. As for Kosovo, it has been recently reported in the region of Prishtina and the Sharr Mountain National Park (Krasniqi & Marka, 2018, 2019).
- Mnium spinosum* (Voit.) Schwagr. - 7, 18, 19: on humid rocks and soil. This Circumpolar Boreal-montane species is widespread in SE Europe.
- Mnium stellare* Hedw. - 7, 8, 9, 14: on rocks. This Circumpolar Boreo-temperate species is widespread in SE Europe.
- Mnium thomsonii* Schimp. - 8, 9, 11: on rocks. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.
- \*\**Orthotrichum anomalum* Hedw.- 9, 11: on limestone rocks. This European Wide-temperate species is common and widespread in SE Europe.
- \*\**Oxyrrhynchium speciosum* (Brid.) Warnst. - 13: on beech bark. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe. As for Kosovo, it has been recently reported in the region of Prishtina and the Sharr Mountain National Park (Krasniqi & Marka, 2018, 2019).
- Palustriella commutata* (Hedw.) Ochyra - 5, 6, 7, 10, 11, 12, 16: on limestone rocks near stream, water flows and creeks. This Circumpolar Boreal-temperate species is widespread in SE Europe.
- Palustriella decipiens* (De Not.) Ochyra - 4: near springs. This European Boreo-arctic Montane species is widespread in SE Europe.
- \*\**Palustriella falcata* (Brid.) Hedenäs - 3, 12: on limestone rocks and near stream. This Circumpolar Boreal-temperate species is widespread in SE Europe.
- \*\**Paraleucobryum longifolium* (Hedw.) Loeske - 4, 7, 16: on limestone rocks. This Circumpolar Boreal-montane species is known from many SE European countries and it is red listed for Serbia (VU). As for Kosovo, it has been recently reported in the Sharr Mountain National Park (Krasniqi & Marka, 2019).
- Philonotis calcarea* (Bruch & Schimp.) Schimp. - 3, 4, 10, 12, 13: near springs and on wet calcareous rocks. This European Boreo-montane species is widespread in SE Europe. It is near threatened in the European red list of bryophytes (Hodgetts & Lockhart, 2020).
- Philonotis fontana* (Hedw.) Brid. - 7, 15: on wet rocks. This Circumpolar Wide-temperate species is widespread in SE Europe.
- Philonotis seriata* Mitt. - 4: in acidic spring. This Eurosiberian Boreo-arctic Montane species is widespread in SE Europe and red listed for Slovenia (EN).
- Plagiomnium affine* (Funck) T.J.Kop. - 7, 15: on soil. This European Temperate species is widespread in SE Europe.
- \*\**Plagiomnium ellipticum* (Brid.) T.J.Kop.-7, 14, 16: on shaded and humid soil. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe and red listed for Romania (VU).
- Plagiomnium medium* (Bruch & Schimp.) T. J. Kop. - 1: on soil in rock crevices. This Circumpolar Boreal-montane species is widespread in SE Europe.
- Plagiopus oederianus* (Sw.) H.A.Crum & L.E.Anderson - 8: on limestone rock. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.
- Plagiothecium denticulatum* (Hedw.) Schimp. - 7, 16: on acidic shaded rocks. This Circumpolar Boreal-temperate species is widespread in SE Europe.
- \**Pleuridium acuminatum* Lindb. - 6, 18: on poor soil. This European Temperate species is widespread in SE Europe.
- Pleurozium schreberi* (Willd. ex Brid.) Mitt. - 7: on wet soil. This Circumpolar Boreal-temperate species is widespread in SE Europe.
- Pogonatum urnigerum* (Hedw.) P.Beauv. - 6, 7, 11, 12, 13, 15: on acidic rocks, on disturbed soil. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.

- Pohlia cruda* (Hedw.) Lindb. – 6, 7, 16, 18, 19: on rock crevices and on soil. This Circumpolar Boreo-arctic Montane species is common and widespread in SE Europe.
- Pohlia elongata* (Hedw.) – 9: on rock crevices. This Circumpolar Boreal-montane species is widespread in SE Europe.
- Polytrichastrum alpinum* (Hedw.) G.L.Sm. – 7, 14: on poor soil. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.
- Polytrichum commune* Hedw. – 13: on bogs. This Circumpolar Wide-boreal species is widespread in SE Europe.
- Polytrichum formosum* Hedw. – 3, 5: on wet soil. This Circumpolar Boreal-temperate species is widespread in SE Europe.
- Polytrichum juniperinum* Hedw. – 4, 9, 14: on acidic rocks. This Circumpolar Wide-boreal species is widespread in SE Europe.
- \**Polytrichum strictum* Menzies ex Brid. – 7, 9, 13, 14, 15, 16: in bogs. This Circumpolar Wide-boreal species is known from many SE European countries and it is red listed for Serbia (VU).
- Pseudoleskeella catenulata* (Brid. ex Schrad.) Kindb. – 7, 8, 9, 10, 14, 15, 16: on limestone rocks. This European Boreal-Montane species is widespread in SE Europe.
- Pseudoleskeella nervosa* (Brid.) Nyholm. – 7, 10, 12, 13, 14, 15, 16: on beech barks and on rocks. This Circumpolar Boreal-montane species is widespread in SE Europe.
- Pterigynandrum filiforme* Hedw. – 1, 2, 3, 4, 5, 7, 13, 15: on bark, on limestone rocks. This Circumpolar Boreal-montane species is common and widespread in SE Europe.
- \*\**Ptychostomum capillare* (Hedw.) Holyoak & N.Pedersen – 1, 6, 7, 9, 15, 16, 19: on soil and on rocks. This Circumpolar-temperate species is widespread in SE Europe.
- \*\**Ptychostomum elegans* (Nees) D.Bell & Holyoak – 9, 10, 11, 12, 13, 14: on limestone rocks. This European Boreal-montane species is widespread in SE Europe, it is also red listed for Bulgaria and Slovenia (VU). It has been recently reported for Kosovo in the Sharr Mountain National Park (Krasniqi & Marka, 2019).
- \*\**Ptychostomum moravicum* (Podp.) Ros & Mazimpaka – 7, 9, 13, 14: on tree bark and on limestone rocks. This Circumpolar-temperate species is widespread in SE Europe. As for Kosovo, it has been recently reported in the region of Prishtina (Krasniqi & Marka, 2018) and in the Sharr Mountain National Park (Krasniqi & Marka, 2019).
- Ptychostomum pseudotriquetrum* (Hedw.) J.R.Spence & H.P.Ramsay ex Holyoak & N.Pedersen – 4, 7: in humid situations near springs. This Circumpolar Wide-boreal species is widespread in SE Europe.
- Ptychostomum pseudotriquetrum* var. *bimum* (Schreb.) Holyoak & N.Pedersen – 7: in spring. This Circumpolar Wide-boreal species is known from many SE European countries.
- \*\**Racomitrium affine* (F.Weber & D.Mohr) Lindb. – 2: on acidic rock. This European Temperate species is known from many SE European countries and it is red listed for Bulgaria (VU). It has been recently reported for Kosovo in the Sharr Mountain National Park (Krasniqi & Marka, 2019).
- \*\**Racomitrium canescens* (Hedw.) Brid. – 3, 4, 6, 9, 10, 11, 12, 13, 15, 17, 18, 19: on rocks and on soil. This Circumpolar Boreal-arctic Montane species is widespread in SE Europe.
- Racomitrium elongatum* Ehrh. ex Frisvoll – 7, 16: on silicate rocks. This Suboceanic Boreo-temperate species is known from many SE European countries.
- \*\**Racomitrium ericoides* (Brid.) Brid. – 3, 5: on rocks. This Suboceanic Wide-boreal species is known from many SE European countries and it is red listed for Romania (EN).

- \*\**Racomitrium macounii* subsp. *alpinum* (E.Lawton) Frisvoll - 2, 7, 16: on silicate rocks. This European Boreal-montane species is rare in SE Europe and it is red listed for Romania (CR) and Bulgaria (VU). It has been recently reported for Kosovo in the Sharr Mountain National Park (Krasniqi & Marka, 2019).
- Racomitrium sudeticum* (Funck) Bruch & Schimp. - 7, 16: on silicate rocks. This Circumpolar Boreo-arctic Montane species is known from many countries in SE Europe.
- Rhytidiadelphus loreus* (Hedw.) Warnst. - 7, 15: on root bark. This Suboceanic Boreo-temperate species is known from many countries in SE Europe.
- \*\**Rhytidiadelphus squarrosus* (Hedw.) Warnst. - 9, 10, 11, 12: on rocks. This European Boreo-temperate species is widespread in SE Europe.
- Rhytidium rugosum* (Hedw.) Kindb. - 7, 16, 18: on calcareous rocks. This Circumpolar Boreo-Montane species is widespread in SE Europe.
- Roaldia revoluta* (Mitt.) P.E.A.S.Câmara & M.Carvalho-Silva - 6, 7, 9, 15, 16, 17: on limestone rocks. This Circumpolar Arctic-montane species is known from several countries in SE Europe and it is red listed for Romania (EN) and Bulgaria (VU).
- Sanionia uncinata* (Hedw.) Loeske. - 4, 7, 8, 9, 13, 18, 19: on rocks, on soil. This Circumpolar Boreo-arctic Montane species is widespread in SE Europe.
- Schistidium apocarpum* (Hedw.) Bruch & Schimp. - 12, 13: on limestone rocks. This Eurasian Boreo-temperate species is widespread in SE Europe.
- \*\**Schistidium confertum* (Funck) Bruch & Schimp. - 12, 13, 14, 15, 16, 17, 18: on limestone rocks. This Circumpolar Boreo-temperate species is widespread in SE Europe.
- \**Schistidium helveticum* (Schkuhr) Deguchi - 7, 15: on limestone rocks. This species is known from many SE European countries; however its conservation status is still uncertain for many countries.
- \*\**Schistidium papillosum* Culm. - 11: on acidic rock. This Circumpolar Boreo-arctic Montane species is known from many SE European countries, but its status is data deficient for many countries.
- \**Schistidium rivulare* (Brid.) Podp. - 13: on humid rock. This species is known from many SE European countries and it is red listed for Montenegro (CR) and Slovenia (EN).
- Sciuro-hypnum reflexum* (Starke) Ignatov & Huttunen - 6, 7, 14, 15: on *Juniperus* bark. This Circumpolar Boreal-montane species is widespread in SE Europe.
- \**Sphagnum centrale* C.E.O. Jensen - 5: on bog. This species is known from many SE European countries and it is red listed for Montenegro and Serbia (VU) and near threatened for Slovenia.
- Stereodon callichrous* (Brid.) Lindb. - 13: on limestone rock. This Circumpolar Boreo-arctic Montane species is known from several SE European countries and it is red listed for Bulgaria (VU).
- Syntrichia norvegica* F.Weber. - 7, 9, 10, 12, 13, 18, 19: on limestone rocks. This Circumpolar Boreo-arctic Montane species is known from most of the SE European countries, it is red listed for Romania (VU) and near threatened for Bulgaria.
- Syntrichia ruralis* (Hedw.) F.Weber & D.Mohr - 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18: over rocks and soil. This Circumpolar Wide-temperate species is widespread in SE Europe.
- Thuidium assimile* (Mitt.) A. Jaeger - 12: on limestone rock. This Circumpolar Temperate species is widespread in SE Europe.
- Thuidium delicatulum* (Hedw.) Schimp. - 7: on soil. This Circumpolar Temperate species is widespread in SE Europe.
- Thuidium tamariscinum* (Hedw.) Schimp. - 12: on rock. This European Temperate species is widespread in SE Europe.
- Timmia austriaca* Hedw. - 6, 7, 8, 9, 17, 18, 19: on limestone rocks. This Circumpolar



Boreo-arctic Montane species is widespread in SE Europe.

\*\**Tortella nitida* (Lindb.) Broth. - 9: on limestone rock. This Mediterranean-Atlantic species is known from many SE European countries and it is red listed for Bulgaria (CR) and Romania (EN).

*Tortella tortuosa* (Hedw.) Limpr. - 4, 5, 8, 9, 10, 11, 12, 13: on limestone rocks. This Circumpolar Boreo-temperate species is common and widespread in SE Europe.

*Tortula hoppeana* (Schultz) Ochyra - 7, 14: rocks. This species is widespread in SE Europe.

*Tortula subulata* Hedw. - 3, 7, 9, 13, 16: on soil and rocks. This Eurosiberian Southern-temperate species is widespread in SE Europe.

*Weissia controversa* Hedw. - 6, 7, 15, 16, 17, 18, 19: on basic rocks and soil. This Circumpolar Wide-temperate species is widespread in SE Europe.

### Conclusions

From the current investigation of the moss flora in Bjeshkët e Nemuna, 13 taxa are new records for Kosovo. Some of these (e.g. *Campyliadelphus chrysophyllus*, *Dicranella varia*, *Pleuridium acuminatum* etc.) are common species in the context of the SE European countries, and some are less common or rare and with conservation interest (e.g. *Cyrtomnium hymenophylloides*, *Hedwigia emodica*, *Schistidium rivulare*, *Sphagnum centrale* etc.). In addition, 41 species are recorded for the first time in Bjeshkët e Nemuna. Therefore, this study brings to 359 the number of moss species for Kosovo and 239 for Bjeshkët e Nemuna. In the European level, *Brachythecium geheebii*, an endemic species of Europe, is red listed in the vulnerable threatened category. Concluding, much more efforts are needed towards a better knowledge of mosses of Kosovo, and thereafter the protection of potential threatened species.

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