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## CONTRIBUTIONS TO THE BRYOPHYTE FLORA OF THE KOMOVI MTS (MONTENEGRO)

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As a result of several field trips made into the Komovi Mts, 200 bryophyte taxa (43 liverworts and 157 mosses) were collected. Four species are reported for the first time in the country. Among the species recorded, six are red-listed in Europe.

Key words: liverworts, mosses, new national records, red-listed species

### INTRODUCTION

In spite of intensive bryological field explorations carried out in Montenegro, current knowledge of the bryophyte flora of this area is still far from complete. Regarding the bryophytes of Montenegro, recent summarisations are found in liverwort and moss checklists of SE Europe and the Mediterranean (ROS *et al.* 2007, 2013, SABOVLJEVIĆ and NATCHEVA 2006, SABOVLJEVIĆ *et al.* 2008). The liverwort checklist (ROS *et al.* 2007) contains 106 species from Montenegro. Subsequently, 43 additional liverworts were reported from the country in other works (ERZBERGER and PAPP 2007, ERZBERGER *et al.* 2008, PAPP and ERZBERGER 2007, PAPP *et al.* 2008, 2013a). The most recent moss checklist (ROS *et al.* 2013) reports 527 mosses from Montenegro. 14 additional moss species were reported in PAPP and ERZBERGER (2011) and PAPP *et al.* (2013a).

In the present paper we publish the complete floristical results of the collecting trips to the Komovi Mts made in 1998, 2006 and 2008.

### MATERIAL AND METHODS

#### Study area

Komovi Mts are located in the eastern part of Montenegro as part of the Dinaric Mts (Fig. 1). It has the shape of a horseshoe and is about 40 km long and 30 km wide. It is surrounded by plateaus with average altitude of 1,900 m

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a.s.l. (Štavna and Ljuban in the north, Rogam in the west, Crnja in the south and Varda in the west). The upper part of the Lim river forms the eastern border of the Komovi Mts, whereas the western border is formed by the canyon of the Tara river. The highest peaks are Kučki Kom (2,487 m), Ljevorečki Kom (2,469 m) and Vasojevički Kom (2,460 m).

The largest part of the Komovi Mts, especially the eastern and southeastern segments, is built up of Palaeozoic shales, sandstones and conglomerates, into which the rivers Tara, Lim and their tributaries have carved deep val-

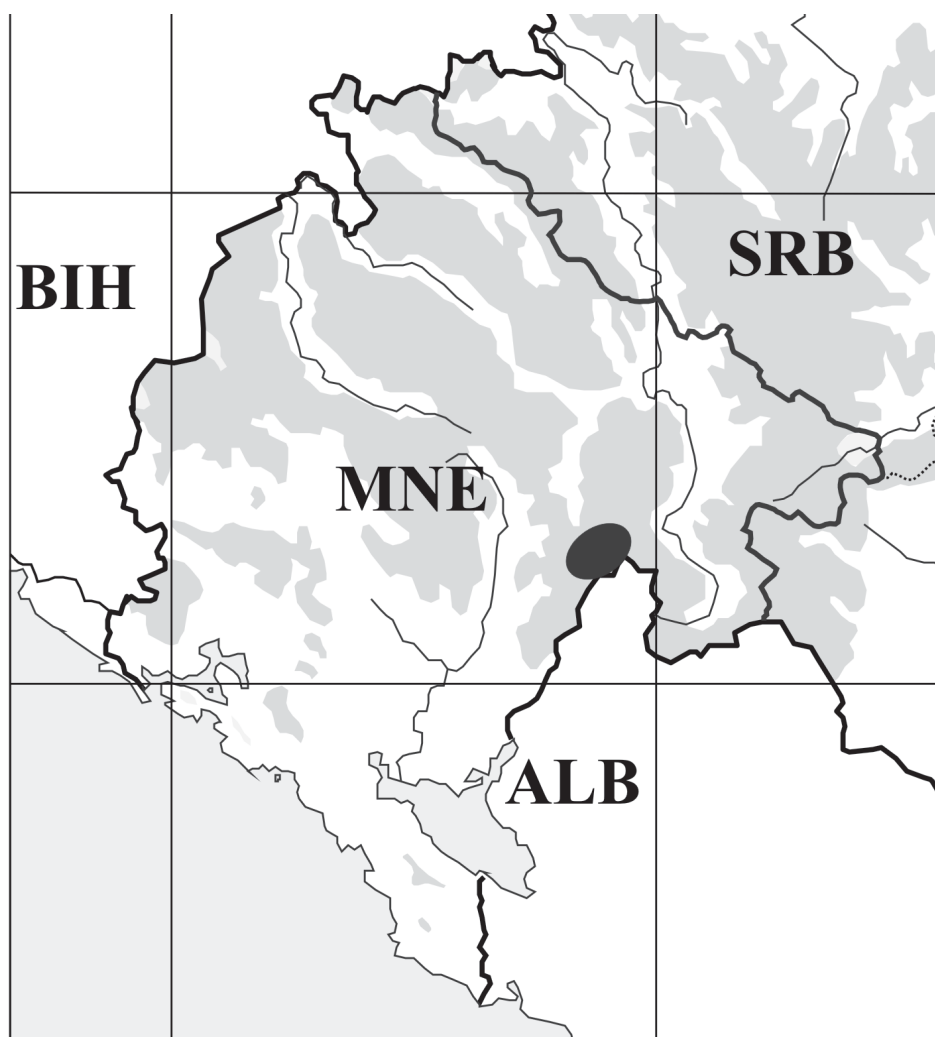


Fig. 1. Location of the investigated area

leys. Other parts of the mountains are characterised by limestone bedrock. Geomorphologically, the Komovi Mts were affected by intense glaciations, which is evidenced by numerous cirques. At higher altitudes strong erosion processes have led to the emergence of large moraines, especially on the southern slopes of Kučki Kom (KIĆOVIĆ and DRAGOVIĆ 2000).

Komovi Mts possess a dense hydrographical network. On the southern slopes of Kučki Kom, the source area of the longest river of Montenegro, the Tara river, can be found. Numerous streams of the northern slopes of the Vasojevički Kom (e. g. Perućica, Kutska, Zlorečica) flow into the Lim river (KIĆOVIĆ and DRAGOVIĆ 2000).

Generally, the Komovi Mts are characterised by temperate continental (up to 900 m a.s.l.) and mountain climates, practically meaning moderately cold to cold and mostly humid weather conditions with a mean annual temperature of about 3–8 °C and annual precipitation of 700–2,500 mm (KIĆOVIĆ and DRAGOVIĆ 2000).

The massif of the Komovi Mts has a very rich and still well preserved flora. Up to 1,800 m a.s.l. the area is covered by various forest types, e.g. beech, beech-coniferous and then pure pine forests. LAKUŠIĆ (1974) found a great variety of rare, endemic and relict forest communities e.g. *Pino-Amphoricarpetum bertiscei*, *Linario-Daphneetum oleoidis*, *Roso-Juniperetum nanae*, *Salicetum grandifoliae montenegrinum*, *Fago-Aceretum visianii*, *Asyneumo-Fagetum moesiacaе*, *Pinetum heldreichii bertiscum* and others. At higher altitudes, there are open habitats (scree, rocky grasslands, alpine meadows), which also support a large number of endemic species. PETROVIĆ *et al.* (2012) reported nine Natura 2000 habitat types: alpine and boreal heaths, alpine and subalpine calcareous grassland, species-rich *Nardus* grasslands on siliceous substrates in montane and submontane areas in continental Europe, hydrophilous tall herb fringe communities of plains and of the montane to alpine levels, mountain hay meadows, calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*), calcareous rocky slopes with chasmophytic vegetation, *Luzulo-Fagetum* beech forests, and high Oro-Mediterranean pine forests.

#### Site details

1. Komovi Mts, plateau Štavna, 1,787 m, N 42° 42' 15.8", E 19° 40' 54.7", 25.07.2006 and 27.07.2008, leg. Dragičević, S.
2. Komovi Mts, from plateau Štavna to peak Vasojevički Kom, 1,810–2,460 m, between N 42° 42' 03.3", E 19° 40' 59.9" and N 42° 41' 15.8", E 19° 40' 21.8", 05.07.1998, leg. Dragičević, S.
3. Komovi Mts, Margarita, below Rogamski Kom, 1,768–1,893 m, between N 42° 41' 54.3", E 19° 36' 56.2" and N 42° 41' 15.4", E 19° 37' 57.3", 13.08.2008, leg. Dragičević, S.
4. Komovi Mts, Margarita, stream Valove, 1,817 m, N 42° 41' 30.7", E 19° 37' 7.5", 13.08.2008, leg. Dragičević, S.

5. Komovi Mts, Margarita, spring Bijeli izvori, 1,972 m, N 42° 41' 01.6", E 19° 37' 56.0", 13.08.2008, leg. Dragičević, S.
6. Komovi Mts, pasture Ljuban, 1,812 m, N 42° 42' 04.9", E 19° 39' 20.1", 25.07.2006, leg. Dragičević, S.
7. Komovi Mts, near pasture Kojići, 1,829–1,876 m, between N 42° 41' 36.3", E 19° 37' 30.6" and N 42° 41' 46.8", E 19° 36' 55.5", 13.08.2008, leg. Dragičević, S.
8. Komovi Mts, from plateau Štavna to pasture Ljuban, 1,787–1,812 m, between N 42° 42' 15.8", E 19° 40' 54.7" and N 42° 42' 04.9", E 19° 39' 20.1", 25.07.2006, 28.07.2008, leg. Dragičević, S.
9. Komovi Mts, valley Ljubaštica to pasture Ljuban, 1,569–1,812 m, between N 42° 41' 35.6", E 19° 39' 50.1" and N 42° 42' 04.9", E 19° 39' 20.1", 26.07.2006, leg. Dragičević, S.
10. Komovi Mts, from plateau Štavna to pasture Ljuban, between N 42° 42' 27.4", E 19° 40' 41.5" and N 42° 41' 44.3", E 19° 33' 43.5", 1,770 m, 27–28.07.2008, leg. Papp, B. and Erzberger, P.
11. Komovi Mts, plateau Štavna towards Vasojevički Kom peak, between N 42° 41' 51.8", E 19° 40' 26.9" and N 42° 41' 33.9", E 19° 40' 04.9", 1,850–2,050 m, 29.07.2008, leg. Papp, B. and Erzberger, P.

### Methods

Material was collected during several field trips in 1998, 2006 and 2008. The investigated area is shown in Figure 1. Stream valleys, springs, forests and alpine grasslands were investigated, and bryophytes were collected from different substrates (soil, exposed and shaded rocks, tree bark, and decaying wood). Floristical results are considered as new to Montenegro, if there are no corresponding records in the bryophyte checklist of Montenegro (DRAGIĆEVIĆ and VELJIĆ 2006), the liverwort checklists of SE Europe and the Mediterranean (ROS *et al.* 2007, SABOVLJEVIĆ and NATCHEVA 2006), the moss checklist of SE Europe (ROS *et al.* 2013, SABOVLJEVIĆ *et al.* 2008) or other works containing additional data for Montenegro (ERZBERGER and PAPP 2007, ERZBERGER *et al.* 2008, PAPP and ERZBERGER 2007, 2011, PAPP *et al.* 2008, 2013a).

The specimens have been shared between the participating parties and are deposited in the Herbarium of the Hungarian Natural History Museum, Budapest, in the Natural History Museum of Montenegro and in the Herbarium of the Botanical Museum Berlin-Dahlem.

The nomenclature for liverworts follows GROLLE and LONG (2000), for mosses HILL *et al.* (2006) with the exception of *Conocephalum salebrosum*, which follows SZWEYKOWSKI *et al.* (2005).

The distribution of new and interesting species in SE European countries is given according to the checklists of SE Europe (SABOVLJEVIĆ and NATCHEVA 2006, SABOVLJEVIĆ *et al.* 2008) and the Mediterranean (ROS *et al.* 2007, 2013) or otherwise cited.

For the evaluation of nature conservation merit of the species recorded, the following literature sources were used: the Red data book of European bryophytes (ECCB 1995), and the bryophyte red list of Serbia and Montenegro (SABOVLJEVIĆ *et al.* 2004). Their symbols are as follows for the Red data book

of European bryophytes (ECCB 1995): Ex = extinct, Ev = vanished, E = endangered, V = vulnerable, R = rare, K = insufficiently known, T = taxonomically ill-defined taxa, RT = regionally threatened species and NT = not threatened. In the bryophyte red list of Serbia and Montenegro (SABOVLJEVIĆ *et al.* 2004): EX = extinct, CR = critically endangered, EN = endangered, VU = vulnerable, LR = lower risk or near threatened and DD = data deficient.

## RESULTS AND DISCUSSION

200 bryophytes (43 liverworts and 157 mosses) were collected in the Komovi Mts. Four mosses proved to be new to Montenegro (marked with \*). The numerals following the species names refer to the collection sites described above.

### Hepaticae

- Apometzgeria pubescens* (Schrank) Kuwah. – 10: limestone rock  
*Athalamia hyalina* (Sommerf.) S. Hatt. – 11: soil among limestone rock  
*Barbilophozia hatcheri* (A. Evans) Loeske – 7: limestone rock; 10: limestone rock and decaying wood  
*Barbilophozia lycopodioides* (Wallr.) Loeske – 2: soil; bottom of limestone rock; 6: soil in mixed forest; 10: bark of *Fagus sylvatica*; 11: siliceous rock  
*Blepharostoma trichophyllum* (L.) Dumort. – 2, 10: decaying wood; 11: limestone rock  
*Cephalozia bicuspidata* (L.) Dumort. – 3: at a spring; 7: soil  
*Cephalozia connivens* (Dicks.) Lindb. – 10: decaying wood  
*Cephaloziella divaricata* (Sm.) Schiffn. – 11: soil among limestone rock  
*Chiloscyphus pallescens* (Ehrh. ex Hoffm.) Dumort. – 7: soil and limestone rock  
*Conocephalum salebrosum* Szweyk., Buczkowska et Odrzykoski – 8: soil in deciduous forest  
*Jungermannia atrovirens* Dumort. – 10: soil (conf./det. J. Váňa); 11: limestone rock (conf. S. Ștefănuț, det. J. Váňa)  
*Jungermannia confertissima* Nees – 11: soil among limestone rocks  
*Jungermannia gracillima* Sm. – 3, 10: soil; 11: soil among limestone rocks  
*Jungermannia hyalina* Lyell – 5: soil; 8: soil in mixed forest; 6: soil in deciduous forest  
*Leiocolea bantriensis* (Hook.) Jörg. – 5, 11 (det. J. Váňa): soil  
*Leiocolea collaris* (Nees) Schljakov – 8: limestone in mixed forest; 10: limestone rock; 11: soil among limestone rocks  
*Leiocolea heterocolpos* (Thed. ex Hartm.) H. Buch – 11: limestone rock  
*Lepidozia reptans* (L.) Dumort. – 10: decaying wood  
*Lophocolea heterophylla* (Schrad.) Dumort. – 1: decaying wood in deciduous forest; 8: decaying wood in mixed forest  
*Lophozia ascendens* (Warnst.) R. M. Schust. – 10: decaying wood  
*Lophozia longiflora* (Nees) Schiffn. – 10: decaying wood (conf. S. Ștefănuț)  
*Lophozia sudetica* (Nees ex Huebener) Grolle – 2: soil among limestone rocks; 3: soil covering siliceous rock; 7: siliceous rock  
*Marchantia polymorpha* L. subsp. *polymorpha* – 5: soil; 8: soil in mixed forest; 9: soil in mixed forest and decaying wood  
*Marchantia polymorpha* L. subsp. *ruderalis* Bischl. et Boisselier – 6: mixed forest, wet soil with *Brachythecium rivulare*

- Marsupella funckii* (F. Weber et D. Mohr) Dumort. – 7: at a spring  
*Metzgeria furcata* (L.) Dumort. – 1: limestone rock in deciduous forest and bark of *Fagus sylvatica*;  
 3, 7: bark of *Fagus sylvatica*; 10: limestone rock and bark of *Fagus sylvatica* and *Picea abies*  
*Nardia scalaris* Gray – 3: wet rock and soil; 7: soil  
*Pedinophyllum interruptum* (Nees) Kaal. – 10: limestone rock  
*Pellia endiviifolia* (Dicks.) Dumort. – 7: soil and limestone rock; 9: soil in mixed forest and decay-  
 ing wood  
*Pellia neesiana* (Gottsche) Limpr. – 7: at a spring  
*Plagiochila porelloides* (Torrey ex Nees) Lindenb. – 1: decaying wood and limestone rock; 8: on  
 decaying wood and soil; 10: soil, limestone rock and bark of *Picea abies*; 11: limestone rock  
*Porella cordaeana* (Huebener) Moore – 1, 6: limestone rock in deciduous forest; 3, 7: bark of *Fagus*  
*sylvatica*; 8, 10, 11: limestone rock; 9: decaying wood  
*Preissia quadrata* (Scop.) Nees – 8: limestone in mixed forest; 10, 11: limestone rock  
*Radula complanata* (L.) Dumort. – 1: decaying wood, limestone rock and bark of *Fagus sylvatica*;  
 6: limestone rock and bark of *Fagus sylvatica*; 8: scree and limestone rock; 10: limestone rock  
 and bark of *Picea abies*  
*Reboulia hemisphaerica* (L.) Raddi – 10, 11: soil among limestone rocks  
*Riccia sorocarpa* Bisch. – 11: soil among limestone rocks  
*Scapania aequiloba* (Schwägr.) Dumort. – 1, 8: limestone rock in deciduous forest; 2, 11: limestone  
 rock; 6: limestone rock in mixed forest and meadow; 10: limestone rock and decaying wood  
*Scapania aspera* M. Bernet et Bernet – 10: limestone rock  
*Scapania calcicola* (Arnell et J. Perss.) Ingham – 2: soil among limestone rocks and decaying wood  
*Scapania cuspiduligera* (Nees) Müll. Frib. – 10: limestone rocky grassland  
*Scapania mucronata* H. Buch – 11: soil among limestone rocks (conf. S. Ștefănuț)  
*Scapania umbrosa* (Schrad.) Dumort. – 10: decaying wood  
*Scapania undulata* (L.) Dumort. – 3, 7: rock at a spring

## Musci

- Abietinella abietina* (Hedw.) M. Fleisch. – 2: soil  
*Amblystegium confervoides* (Brid.) Schimp. – 10: limestone rock  
*Amblystegium subtile* (Hedw.) Schimp. – 10: bark of *Fagus sylvatica*  
*Anoetangium aestivum* (Hedw.) Mitt. – 11: limestone rock  
*Anomodon rugelii* (Müll. Hal.) Keissl. – 1: limestone rock in deciduous forest  
*Antitrichia curtispindula* (Hedw.) Brid. – 9: bark of *Fagus sylvatica*  
*Atrichum undulatum* (Hedw.) P. Beauv. – 8: soil  
*Barbula unguiculata* Hedw. – 10: limestone rock  
*Bartramia ithyphylla* Brid. – 10: soil; 11: soil among limestone rock  
*Brachythecium velutinum* (Hedw.) Ignatov et Huttunen – 1: soil in deciduous forest and decay-  
 ing wood; 2: decaying wood; 6, 8: soil in mixed forest, decaying wood and limestone rock; 7:  
 bark of *Fagus sylvatica*; 10: soil, limestone rock and bark of *Fagus sylvatica*; 11: limestone rock  
*Brachythecium geheebi* Milde – 10: limestone rock  
*Brachythecium glareosum* (Bruch ex Spruce) Schimp. – 1: limestone rock in deciduous forest; 8:  
 soil in deciduous forest; 10: soil and limestone rock; 11: soil among limestone rock  
*Brachythecium rivulare* Schimp. – 5: limestone rock; 6, 9: wet soil in mixed forest; 7: at a spring  
*Brachythecium rutabulum* (Hedw.) Schimp. – 5: limestone rock  
*Brachythecium salebrosum* (Hoffm. ex F. Weber et D. Mohr) Schimp. – 10: limestone rock  
*Brachythecium tommasinii* (Sendtn. ex Boulay) Ignatov et Huttunen – 8: soil; 10: limestone rock

- Bryoerythrophyllum recurvirostrum* (Hedw.) P. C. Chen – 1: limestone rock in deciduous forest; 2: limestone rock; 6: soil mixed forest; 8: decaying wood in mixed forest; 11: soil among limestone rock
- Bryum argenteum* Hedw. – 2: soil
- Bryum caespiticium* Hedw. – 8: soil in deciduous forest (det. W. Schröder)
- Bryum capillare* Hedw. – 1: limestone rock in deciduous forest; 8: soil in deciduous forest; 11: limestone rock
- Bryum creberrimum* Taylor – 2: soil and limestone rocks (det. W. Schröder)
- Bryum elegans* Nees – 1: limestone rock in deciduous forest; 2: decaying wood and limestone rock; 6: soil, limestone rock in mixed forest and decaying wood; 10: limestone rock; 11: soil among limestone rock
- Bryum moravicum* Podp. – 1: limestone rock and decaying wood in deciduous forest; 8: limestone rock in mixed forest; 9: decaying wood and limestone rock in deciduous forest 10: bark of *Fagus sylvatica*
- Bryum pallens* Sw. ex anon. – 5: at the spring (det. W. Schröder); 2, 8: limestone rock in mixed forest; 10: limestone rocky grassland (conf./det. W. Schröder)
- Bryum pallescens* Schleich. ex Schwägr. – 4: siliceous rock (det. W. Schröder); 8: soil in deciduous forest
- Bryum pseudotriquetrum* (Hedw.) P. Gaertn. *et al.* – 4, 5, 9: soil
- Bryum schleicheri* DC. – 5, 9: limestone rocks at a stream (conf./det. W. Schröder)
- Bryum turbinatum* (Hedw.) Turner – 9: limestone rocks at a stream
- Buxbaumia viridis* (Moug. ex Lam. et DC.) Brid. ex Moug. et Nestl. – 10: decaying wood
- Campyliadelphus chrysophyllus* (Brid.) R. S. Chopra – 11: limestone rock
- Campylium protensum* (Brid.) Kindb. – 8: decaying wood; 10: limestone rock
- Campylium stellatum* (Hedw.) Lange et C. E. O. Jensen – 4: soil; 5: soil and limestone rock; 11: limestone rock
- Campylophyllum halleri* (Hedw.) M. Fleisch. – 1: limestone rock in deciduous forest; 6: soil; 8: limestone rock, scree, decaying wood in mixed forest; 10, 11: limestone rock
- \**Campylopus pyriformis* (Schultz) Brid. – 7: siliceous rock
- Ceratodon purpureus* (Hedw.) Brid. – 7: in meadow; 8, 10: soil; 9: soil in deciduous forest
- Ctenidium molluscum* (Hedw.) Mitt. – 1, 2, 8, 11: limestone rock; 6: limestone rock in mixed forest; 10: soil and limestone rock
- Cynodontium polycarpon* (Hedw.) Schimp. – 7: soil in deciduous forest
- Dichodontium palustre* (Dicks.) M. Stech – 7: at a spring
- Dichodontium pellucidum* (Hedw.) Schimp. – 7: wet siliceous rock and soil at spring; 9: soil mixed forest; 11: limestone rock
- Dicranella varia* (Hedw.) Schimp. – 2, 10: soil among limestone rocks
- Dicranoweisia crispula* (Hedw.) Milde – 7: siliceous rock
- Dicranum scoparium* Hedw. – 3, 7: soil; 10: limestone rock and bark of *Picea abies*; 11: soil among limestone rock
- Dicranum tauricum* Sapjegin – 9: decaying wood in mixed forest; 10: bark of *Picea abies* and decaying wood
- Didymodon fallax* (Hedw.) R. H. Zander – 6: soil in mixed forest; 10: limestone rock; 11: soil among limestone rock and limestone rock
- \**Didymodon nicholsonii* Culm. – 11: limestone rock at a rivulet
- Didymodon rigidulus* Hedw. – 10, 11: limestone rock
- Didymodon tophaceus* (Brid.) Lisa – 10: soil
- Distichium capillaceum* (Hedw.) Bruch et Schimp. – 2, 10, 11: limestone rock; 6: soil in mixed forest

- Distichium inclinatum* (Hedw.) Bruch et Schimp. – 2, 10: soil among limestone rocks; 11: limestone rock
- Ditrichum flexicaule* (Schwägr.) Hampe – 2, 11: limestone rock; 3: limestone rock in mixed forest
- Ditrichum gracile* (Mitt.) Kuntze – 2: soil and limestone rocks; 6, 8: limestone rock in mixed forest; 10, 11: limestone rock
- Ditrichum heteromallum* (Hedw.) E. Britton – 10: soil among limestone rocks
- Ditrichum pusillum* (Hedw.) Hampe – 7: soil in deciduous forest
- Drepanocladus polygamus* (Schimp.) Hedenäs – 11: limestone rock
- Encalypta ciliata* Hedw. – 11: limestone rock
- Encalypta streptocarpa* Hedw. – 3: in a meadow; 6, 8: soil in mixed forest; 10, 11: limestone rock
- Eurhynchiastrum pulchellum* (Hedw.) Ignatov et Huttunen var. *pulchellum* – 3: decaying wood in mixed forest, on decaying wood, with *Ditrichum flexicaule*; 11: limestone rock
- Eurhynchiastrum pulchellum* (Hedw.) Ignatov et Huttunen var. *diversifolium* (Schimp.) Ochyra et Żarnowiec – 11: soil among limestone rock
- Eurhynchiastrum pulchellum* (Hedw.) Ignatov et Huttunen var. *praecox* (Hedw.) Ochyra et Żarnowiec – 10: limestone rock
- Fissidens bryoides* Hedw. – 6: soil in mixed forest
- Fissidens dubius* P. Beauv. – 10, 11: limestone rock
- Fissidens taxifolius* Hedw. – 8: soil in mixed forest; 10: soil and limestone rock; 11: soil among limestone rock
- Fissidens viridulus* (Sw. ex anon.) Wahlenb. – 11: soil among limestone rock
- Funaria hygrometrica* Hedw. – 7: in a meadow
- Grimmia anomala* Hampe ex Schimp. – 11: siliceous rock
- Grimmia caespiticia* (Brid.) Jur. – 4: dry siliceous rock
- Grimmia muehlenbeckii* Schimp. – 7, 8, 11: siliceous rock
- Gymnostomum aeruginosum* Sm. – 11: soil among limestone rock
- Gymnostomum calcareum* Nees et Hornsch. – 5: limestone rock at a spring
- Herzogiella seligeri* (Brid.) Z. Iwats. – 8: decaying wood in mixed forest; 10: decaying wood
- Homalothecium lutescens* (Hedw.) H. Rob. – 1, 11: limestone rock
- Homalothecium philippeanum* (Spruce) Schimp. – 8, 10, 11: limestone rock
- Homalothecium sericeum* (Hedw.) Schimp. – 2, 5, 8, 10, 11: limestone rock
- Hylocomium splendens* (Hedw.) Schimp. – 2: soil in deciduous forest; 3: soil; 11: limestone rock
- \**Hypnum procerrimum* Molendo – 11: limestone rock
- Isopterygiopsis pulchella* (Hedw.) Z. Iwats. – 11: limestone rock
- Isothecium alopecuroides* (Lam. ex Dubois) Isov. – 9: bark of *Fagus sylvatica*; 11: limestone rock
- Lescurea saxicola* (Schimp.) Molendo – 1: limestone rock in deciduous forest; 10: limestone rock
- Leucodon sciuroides* (Hedw.) Schwägr. – 8, 9, 10: bark of *Fagus sylvatica*
- Meesia uliginosa* Hedw. – 2: soil among limestone rocks
- Mnium lycopodioides* Schwägr. – 10: bottom of *Picea abies*
- Mnium stellare* Hedw. – 8: soil in mixed forest; 9: soil in deciduous forest; 10: limestone rock
- Mnium thomsonii* Schimp. – 2, 10, 11: limestone rock
- Myurella julacea* (Schwägr.) Schimp. – 2, 10, 11: soil among limestone rocks
- Neckera menziesii* Drumm. – 10: limestone rock
- Orthothecium intricatum* (Hartm.) Schimp. – 11: limestone rock
- Orthothecium rufescens* (Dicks. ex Brid.) Schimp. – 2, 11: limestone rock
- Orthotrichum pallens* Bruch ex Brid. – 10: bark of *Fagus sylvatica*
- Orthotrichum stramineum* Hornsch. ex Brid. – 10: bark of *Fagus sylvatica*
- Orthotrichum striatum* Hedw. – 8, 10: bark of *Fagus sylvatica*



- Oxyrrhynchium hians* (Hedw.) Loeske – 6: limestone rock in mixed forest  
*Palustriella commutata* (Hedw.) Ochyra var. *commutata* – 2: limestone rock at a spring; 5: limestone rocks at a stream  
*Palustriella commutata* (Hedw.) Ochyra var. *sulcata* (Lindb.) Ochyra – 5: limestone rocks at a stream  
*Palustriella decipiens* (De Not.) Ochyra – 5, 7: limestone rock at a spring  
*Palustriella falcata* (Brid.) Hedenäs – 5: limestone rock at a spring  
*Paraleucobryum sauteri* (Bruch et Schimp.) Loeske – 10: decaying wood  
*Philonotis arnellii* Husn. – 11: soil among limestone rocks  
*Philonotis fontana* (Hedw.) Brid. – 4, 5: soil at a stream  
*Philonotis seriata* Mitt. – 3, 4, 5: in a meadow; 7: siliceous rock and soil at a spring  
*Philonotis tomentella* Molendo – 4: soil at a stream, 7: at a spring  
*Plagiobryum zieri* (Hedw.) Lindb. – 11: limestone rock  
*Plagiomnium affine* (Blandow ex Funck) T. J. Kop. – 7: soil at a spring  
*Plagiomnium rostratum* (Schrad.) T. J. Kop. – 9: soil in deciduous forest; 10: limestone rock  
*Plagiopus oederianus* (Sw.) H. A. Crum et L. E. Anderson – 2, 10, 11: limestone rock  
*Plagiothecium cavifolium* (Brid.) Z. Iwats. – 11: soil over limestone rock  
*Plagiothecium denticulatum* (Hedw.) Schimp. – 3, 7: bark of *Fagus sylvatica*; 10: bark of *Picea abies*  
*Platydictya jungermannioides* (Brid.) H. A. Crum – 8: limestone rock in mixed forest; 10: limestone rock  
*Pogonatum aloides* (Hedw.) P. Beauv. – 2: soil  
*Pogonatum urnigerum* (Hedw.) P. Beauv. – 10: soil  
*Poblia cruda* (Hedw.) Lindb. – 1: decaying wood in deciduous forest; 2: soil and decaying wood; 6: soil and the bottom of limestone rock; 8: soil in mixed forest; 10: limestone rock and bottom of *Picea abies*; 11: soil among limestone rocks  
*Poblia drummondii* (Müll. Hal.) A. L. Andrews – 11: soil among limestone rocks  
*Poblia nutans* (Hedw.) Lindb. – 7, 10: soil  
*Poblia wahlenbergii* (F. Weber et D. Mohr) A. L. Andrews – 4: soil at a stream  
*Polytrichastrum alpinum* (Hedw.) G. L. Sm. – 7, 8, 9, 10: soil; 11: soil among limestone rocks  
*Polytrichastrum formosum* (Hedw.) G. L. Sm. – 1, 8, 9: soil in deciduous and mixed forest; 10: soil and limestone rock; 11: soil among limestone rocks  
*Polytrichum juniperinum* Hedw. – 2: decaying wood; 3: soil; 8: soil in mixed forest; 9: soil in deciduous forest; 10: soil and bark of *Fagus sylvatica*; 11: soil among limestone rocks  
*Polytrichum piliferum* Hedw. – 7: soil  
*Pseudoleskea incurvata* (Hedw.) Loeske – 1: limestone rock in deciduous forest; 3: limestone rock and bark of *Fagus sylvatica*; 6, 8, 10: limestone rock; 9: decaying wood in deciduous forest  
*Pseudoleskea saviana* (De Not.) Latzel – 1, 9: limestone rock and bark of tree in deciduous forest; 7, 8: bark of *Fagus sylvatica* and decaying wood; 10: limestone rock and bark of *Fagus sylvatica*; 11: limestone rock  
*Pseudoleskeella catenulata* (Brid. ex Schrad.) Kindb. – 11: limestone rock  
*Pseudoleskeella nervosa* (Brid.) Nyholm – 1: bark of *Fagus sylvatica*; 8, 9: decaying wood in deciduous forest; 10: limestone rock and bark of *Fagus sylvatica*  
*Pterigynandrum filiforme* Hedw. – 8, 9: decaying wood in deciduous forest; 10: bark of *Fagus sylvatica* and *Picea abies*  
*Ptychodium plicatum* (Schleich. ex F. Weber et D. Mohr) Schimp. – 1, 2, 8: limestone rock in deciduous forest; 6: limestone rock in mixed forest; 10, 11: limestone rock  
*Racomitrium canescens* (Hedw.) Brid. – 3, 7: soil  
*Racomitrium elongatum* Ehrh. ex Frisvoll – 3, 6, 7, 8, 9, 10 (conf/rev. H. Bednarek-Ochyra): soil; 11: siliceous rock

- Rhizomnium pseudopunctatum* (Bruch et Schimp.) T. J. Kop. – 5: soil at a spring  
*Rhizomnium punctatum* (Hedw.) T. J. Kop. – 8: decaying wood in mixed forest; 9: soil and decaying wood in mixed forest; 10: decaying wood  
*\*Rhynchostegiella tenuicaulis* (Spruce) Kartt. – 1: bark of *Fagus sylvatica*; 2: limestone rock  
*Rhynchostegium murale* (Hedw.) Schimp. – 10: limestone rock  
*Rhytidiadelphus triquetrus* (Hedw.) Warnst. – 2, 3, 6, 10: soil; 11: soil among limestone rocks  
*Rhytidium rugosum* (Hedw.) Kindb. – 2: soil  
*Saelania glaucescens* (Hedw.) Broth. – 2, 10, 11: soil among limestone rocks  
*Sanionia uncinata* (Hedw.) Loeske – 8: decaying wood in mixed forest; 10: limestone rock and decaying wood  
*Schistidium apocarpum* (Hedw.) Bruch et Schimp. – 11: limestone rock  
*Schistidium atrofuscum* (Schimp.) Limpr. – 11: limestone rock  
*Schistidium brunnescens* Limpr. subsp. *griseum* (Nees et Hornsch.) H. H. Blom – 2, 11: limestone rock  
*Schistidium confertum* (Funck) Bruch et Schimp. – 11: siliceous rock  
*Schistidium crassipilum* H. H. Blom – 1: limestone rock in deciduous forest; 2, 3, 6, 8: limestone rock in mixed forest; 10: limestone rock (det. W. Schröder)  
*Schistidium dupretii* (Thér.) W. A. Weber – 8, 10: limestone rock  
*Schistidium pruinatum* (Wilson ex Schimp.) G. Roth – 11: siliceous rock  
*Schistidium robustum* (Nees et Hornsch.) H. H. Blom – 11: limestone rock  
*Sciuro-hypnum populeum* (Hedw.) Ignatov et Huttunen – 10: bark of *Fagus sylvatica*  
*Syntrichia norvegica* F. Weber – 1: limestone rock in deciduous forest; 10, 11: limestone rock  
*Syntrichia ruralis* (Hedw.) F. Weber et D. Mohr – 9: decaying wood in deciduous forest; 10: limestone rock and bark of *Fagus sylvatica*  
*Syntrichia virescens* (De Not.) Ochyra – 10: bark of *Fagus sylvatica*  
*Thuidium assimile* (Mitt.) A. Jaeger – 2: soil  
*Timmia austriaca* Hedw. – 8: soil in mixed forest; 10: limestone rock; 11: soil among limestone rocks  
*Timmia bavarica* Hessel. – 6: soil and limestone rock; 11: limestone rock  
*Tortella bambergi* (Schimp.) Broth. – 10: limestone rock  
*Tortella inclinata* (R. Hedw.) Limpr. – 10: limestone rocky grassland  
*Tortella tortuosa* (Hedw.) Limpr. var. *tortuosa* – 1: limestone rock in deciduous forest; 3, 9: limestone rock; 2, 6, 8: limestone rock in mixed forest; 10: bark of *Fagus sylvatica*; 10, 11: limestone rock  
*Tortella tortuosa* (Hedw.) Limpr. var. *fragilifolia* (Jur.) Limpr. – 2: limestone rock  
*Tortula hoppeana* (Schultz) Ochyra – 2, 10: soil among limestone rocks  
*Tortula subulata* Hedw. – 6: soil; 11: soil among limestone rocks  
*Trichostomum crispulum* Bruch – 2, 6: soil; 11: limestone rock  
*Weissia controversa* Hedw. var. *contraversa* – 11: limestone rock  
*Weissia controversa* Hedw. var. *crispata* (Nees et Hornsch.) Nyholm – 10: soil

Four moss species are reported for the first time in Montenegro.

*Campylopus pyriformis* is a sub-Atlantic species (DÜLL 1984). In SE Europe it is known only from Croatia, Romania and Slovenia (SABOVLJEVIĆ *et al.* 2008). Recently it has been also reported from the Former Yugoslav Republic of Macedonia (PAPP and ERZBERGER 2012). According to the red lists it is regionally extinct (RE) in Slovenia (MARTINČIČ 1992) and near threatened (NT) in Romania (ȘTEFĂNUȚ and GOIA 2012).

*Didymodon nicholsonii* is a sub-Atlantic, sub-Mediterranean species (DÜLL 1984). In SE Europe it is known only from Greece (SABOVLJEVIĆ *et al.* 2008).

*Hypnum procerrimum* is a northern sub-Atlantic, alpine element (DÜLL 1985). In SE Europe it is known only from Bosnia-Herzegovina, Bulgaria, Croatia, Romania, Serbia and Slovenia (SABOVLJEVIĆ *et al.* 2008). According to the red lists it is critically endangered (CR) in Bulgaria (NATCHEVA *et al.* 2006) and data-deficient (DD) in Slovenia (MARTINČIČ 1992).

*Rhynchostegiella tenuicaulis* is a montane species of temperate zone of Europe (DÜLL 1985). In SE Europe it is known only from Bulgaria, Greece and Romania (SABOVLJEVIĆ *et al.* 2008). Recently it has been also reported from Croatia (PAPP *et al.* 2013b). According to the red lists it is data-deficient (DD) in Bulgaria (NATCHEVA *et al.* 2006) and vulnerable (VU) in Romania (ȘTEFĂNUȚ and GOIA 2012).

Eight species (*Jungermannia hyalina*, *Nardia scalaris*, *Scapania mucronata*, *Dichodontium palustre*, *Grimmia anomala*, *Schistidium dupretii*, *S. pruinosum*, *Syntrichia virescens*) have been reported recently from the Bjelasica Mts (PAPP *et al.* 2013a) and their records from the Komovi Mts represent the second locality in the country.

*Pellia neesiana* had only a very old doubtful record from Montenegro according to DRAGIĆEVIĆ and VELJIĆ (2006), then it has recently been reported from the Bjelasica Mts (PAPP *et al.* 2013a). Its record from the Komovi Mts represents the third locality in the country.

*Scapania cuspiduligera* has been recently reported from the Durmitor Mts (PAPP and ERZBERGER 2010) and its record from the Komovi Mts represents the second locality in the country.

*Anoetangium aestivum* has been recently reported from the Tara canyon (PAPP and ERZBERGER 2011) and its record from the Komovi Mts represents the second locality in the country.

*Rhizomnium punctatum* was reported for the first time in Montenegro by MARTINČIČ (2006) from the Prokletije Mts and its record from the Komovi Mts represents the second locality in the country.

#### Nature conservation merit of the bryophyte flora

Six species are included in the Red data book of European bryophytes (ECCB 1995).

*Lophozia ascendens* – It is known from the Bjelasica Mts (ERZBERGER *et al.* 2008, PAPP *et al.* 2013a) and from the Durmitor Mts (PAPP and ERZBERGER 2010). Threat status: R in the Red data book of European bryophytes.

*Brachythecium geheebi* – There are recent records from the Durmitor Mts (DRAGIĆEVIĆ and VELJIĆ 2006) and the Bjelasica Mts (PAPP *et al.* 2013a). Threat status: R in the Red data book of European bryophytes, LR in Montenegro.

*Buxbaumia viridis* – Recently, several extant populations have been discovered in Montenegro (DRAGIĆEVIĆ *et al.* 2011). Threat status: listed in the Bern Convention and the European Union Habitats and Species Directive (ECCB 1995), VU in the Red data book of European bryophytes, CR in Montenegro.

*Grimmia caespiticia* – It was collected in several localities in the Bjelasica Mts (PAPP *et al.* 2013a) and also known from the Prokletije Mts (MARTINČIĆ 2006). Threat status: R in the Red data book of European bryophytes, VU in Montenegro.

*Paraleucobryum sauteri* – It has a recent record from the Bjelasica Mts (PAPP *et al.* 2013a). Threat status: R in the Red data book of European bryophytes, VU in Montenegro.

*Pseudoleskea saviana* – Not rare in Montenegro evidenced by several records (MARTINČIĆ 2006, PAPP and ERZBERGER 2010, 2011). Threat status: RT in the Red data book of European bryophytes, VU in Montenegro.

The following 12 species are also included in the red list of Montenegro (SABOVLJEVIĆ *et al.* 2004).

*Athalamia hyalina* – From Montenegro there are two old records from the Orjen Mts collected at the beginning of the last century (DRAGIĆEVIĆ and VELJIĆ 2006). Recently recorded in the Durmitor Mts (PAPP and ERZBERGER 2010) and the Bjelasica Mts (PAPP *et al.* 2013a). Threat status: CR in Montenegro.

*Jungermannia gracillima* – Known from the Durmitor Mts (ERZBERGER and PAPP 2007, PAPP and ERZBERGER 2010) and the Bjelasica Mts (PAPP *et al.* 2013a). Threat status: EN in Montenegro.

*Leiocolea collaris* – In spite of the red list status in Montenegro it is apparently not rare in the country as evidenced by several records (PAPP and ERZBERGER 2007, 2010, PAPP *et al.* 2008, 2013a). Threat status: VU in Montenegro.

*Leiocolea heterocolpos* – In Durmitor and in Bjelasica Mts it is found in several localities (PAPP and ERZBERGER 2010, PAPP *et al.* 2013a). Threat status: VU in Montenegro.

*Amblystegium confervoides* – From Montenegro it has an old and a recent record (DRAGIĆEVIĆ and VELJIĆ 2006). Threat status: DD in Montenegro.

*Anomodon rugelii* – From Montenegro there are two old and one recent records (DRAGIĆEVIĆ and VELJIĆ 2006). Threat status: EN in Montenegro.

*Bryum creberrimum* – From Montenegro it has one recent and four old records (DRAGIĆEVIĆ and VELJIĆ 2006). Threat status: DD in Montenegro.

*Encalypta ciliata* – In Montenegro it has two recent records from the Durmitor Mts (PAPP and ERZBERGER 2010) and the Bjelasica Mts (PAPP *et al.* 2013a). Threat status: VU in Montenegro.

*Meesia uliginosa* – In Montenegro it has two old records from the Durmitor Mts (DRAGIĆEVIĆ and VELJIĆ 2006). Threat status: VU in Montenegro.

*Philonotis arnellii* – In Montenegro it has one recent and three old records from the surroundings of Herceg Novi (DRAGIĆEVIĆ and VELJIĆ 2006, PAPP and ERZBERGER 2007) and two recent records from the Lovćen Mts (PAPP and ERZBERGER 2007) and the Durmitor Mts (PAPP and ERZBERGER 2010). Threat status: DD in Montenegro.

*Racomitrium elongatum* – Seems to be not rare in Montenegro with several recent records from the Durmitor, Prokletije and Bjelasica Mts (DRAGIĆEVIĆ and VELJIĆ 2006, MARTINČIĆ 2006, PAPP and ERZBERGER 2010, PAPP *et al.* 2013a). Threat status: DD in Montenegro.

*Timmia bavarica* – It has several records from the Prokletije Mts (MARTINČIĆ 2006) and two records from the Durmitor Mts (PAPP and ERZBERGER 2010). Threat status: VU in Montenegro.

## CONCLUSIONS

The geological diversity and other favourable environmental factors of the Komovi Mts help maintain a rich bryophyte flora. The mountains of Montenegro are mostly composed of limestone, acidic bedrock is rather rare. Therefore, parts of the Komovi Mts with acidic bedrocks are of special importance for the bryophyte diversity of the country. This is documented by the occurrences of rare liverworts, such as *Lophozia sudetica*, *Marsupella funckii*, *Nardia scalaris*, *Pellia neesiana*, and rare mosses, like *Grimmia anomala*, *G. caespiticia*, and *Schistidium pruinosum*. Due to the high elevation and mountain climate, the bryophyte flora of the forests and alpine grasslands contain numerous boreal, subalpine and alpine elements, among them several rarities, including *Athalamia hyalina*, *Jungermannia confertissima*, *Leiocolea bantriensis*, *L. heterocolpos*, *Scapania cuspiduligera*, *S. mucronata*, *Anoetangium aestivum*, *Brachythecium geheebi*, *Bryum schleicheri*, *Dichodontium palustre*, *Distichium inclinatum*, *Drepanocladus polygamus*, *Encalypta ciliata*, *Hypnum procerrimum*, *Isopterygiopsis pulchella*, *Lescuraea saxicola*, *Meesia uliginosa*, *Orthothecium rufescens*, *Palustriella decipiens*, *Philonotis tomentella*, *Platydictya jungermannioides*, *Pohlia drummondii*, *Rhizomnium pseudopunctatum*, *Syntrichia norvegica*, and *Timmia bavarica*. Most of these are calciphilous species. Decaying wood in old growth forests also support populations of many rarities like *Cephalozia connivens*, *Lophozia ascendens*, *L. longiflora*, *Scapania umbrosa*, *Buxbaumia viridis* and *Paraleucobryum sauteri*.

\* \* \*

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