# New and noteworthy bryophyte records from Montenegro and Serbia

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## Abstract

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During investigations into four regions of Montenegro (Rumija Mts, Lovčen Mts, the coastal area around Kotor, Durmitor National Park) and one of Serbia (Stara Planina Mts) carried out in 2003-2005, 28 bryophyte taxa new to Montenegro and 22 new to Serbia were collected. Two of these, *Cynodontium gracilescens* and *Pohlia nutans* subsp. *schimperi,* are new to the Balkan peninsula and four additional species were not known to occur in the whole territory of former Yugoslavia: *Encalypta microstoma, Grimmia dissimulata, G. torquata,* and *Orthotrichum urnigerum.* An annotated catalogue of the new records is presented, including notes on substrates and associated bryophytes. Bryogeographic relations are discussed with reference to some ecological characteristics of the regions investigated.


Key words: *Musci, Hepaticae,* Balkan peninsula, bryoflora, bryophyte ecology, bryogeography.

## Introduction

Within the last decades, former Yugoslavia has undergone a process of political transformation, which resulted in the formation of several new entities within the former federal territory. As a consequence of these changes, recent bryofloras have now to bear reference to these smaller geographical units, whereas formerly such works treated the whole of Yugoslavia (e.g. Pavletić 1955). As far as Montenegro and Serbia are concerned, Sabovljević & Stevanović (1999) and Sabovljević (2000a) have achieved the task of compiling first checklists of bryophytes on the basis of records published between 1923 and 1998. Since these regions were not in the focus of bryologists, the species catalogue in these compilations must necessarily be rather incomplete. This is clearly demonstrated by the large numbers of taxa new to Montenegro and Serbia that were published recently on the basis of field research (Sabovljević 1998, 1999, 2000b, 2002, 2003a-b, Sabovljević & Stevanović 2000a-b, Sabovljević & al. 1999, Milikić & al. 2001, Papp & Sabovljević 2001, 2002, Papp & al. 2004, Papp & Erzberger 2005, Pócs & al. 2004, Sabovljević & Cvetić 2001, 2003, Cvetić & Sabovljević 2005, Grdović 2005, Dragicević 2004, Dragicević & al. 2001, 2003, Veljić & al. 2001, Martinčič 2006). Parts of these records have been incorporated into more recent checklists (Dragićević & Veljić 2006, Sabovljević & Natcheva 2006).

The present paper represents another contribution towards the knowledge of the bryophyte floras of Montenegro and Serbia. Resulting from field work organized by the Hungarian Natural History Museum in Budapest and, in part, jointly with the Institute for Protection of Nature in Serbia, 28 taxa new to Montenegro and 22 new to Serbia are enumerated and discussed.

## Study area

The Rumija Mts, as well as the Lovčen Mts, form part of the Dinaric range and are made up of Triassic and Jurassic limestone. The Rumija Mts are situated between the Mediterranean coast and Lake Skadar near the border to Albania. Maximum elevation is 1593 m.

The Lovčen Mts are protected as a national park, covering 64 km$^2$. They extend from 985 m to 1749 m altitude. In these mountain ranges, Mediterranean climate meets the moderately continental climate of the mountain belt. The carboniferous rocks of the Lovčen Mts give rise to many karst formations.

The coastal area of Kotor Bay is on the UNESCO List of Cultural and Natural Heritage. It covers the narrow strip between the sea and the adjacent mountain belt. The climate is Mediterranean with dry, sunny summers and high levels of precipitation during winter.

Durmitor National Park (established in 1978, and also on the UNESCO List of World Natural Heritage) is situated in the NE of Montenegro near Žabljak, the highest town of the Balkan peninsula at 1450 m. It covers an area of 320 km$^2$ and comprises the central part of the Durmitor massif as well as part of the canyon of the river Tara. The bedrock is made of Triassic and Jurassic limestone deposits over 2000 m thick in the western part of the massif, giving rise to ragged peaks (highest elevation Bobotov Kuk, 2523 m), and of Cretaceous limestone in the northern and eastern part, there forming a landscape of rounded domes and broader valleys. The climate is characterized by winters with much snow and cool summers (average monthly temperatures of January: -5.4 °C, of July: 13.2 °C), and annual precipitation varying between 1500 mm and 1750 mm according to elevation (Cerović 1986).

The Stara Planina Mts in SE Serbia at the border to Bulgaria are made up mostly of Permian red sandstone and schists, and Mt Midžor (2169 m) is one of the highest elevations of Serbia. They are the westernmost extension of the Balkan mountain range and the area of a planned nature park and a biosphere reserve. They are also the object of an agreement of cooperation between ministries of Bulgaria and Serbia for the formation of a transboundary protected area (Mandić 1999).

## Material and methods

The field excursions on which the present paper is based were carried out in October 2003 (Montenegro: Rumija Mts, Lovčen Mts and Bay of Kotor), October 2004 (Montenegro: Durmitor Mts and Tara Canyon) and July 2005 (Serbia: Stara Planina). The complete floristic results of these investigations will be published elsewhere. The data were evaluated on the basis of the checklists and reports on new records mentioned in the introduction. Concerning distribution in former Yugoslavia, Düll & al. (1999) was also consulted.

Nomenclature of liverworts follows Söderström & al. (2002), that of mosses Hill & al. (2006). Specimens collected by the first author are kept in the herbarium Berlin-Dahlem (B), those collected by the second author are deposited in the herbarium of the Hungarian Natural History Museum in Budapest (BP).

The map shows the location of the areas investigated (Fig. 1).

Site details

03-03. Montenegro, between Nikšič and Podgorica, 1-2 km before the road to Zagorak, 275 m, 42°37'50.9"N, 19°00'34.1"E, 7.10.2003.

03-04. Montenegro, Rumija Mts, at Lake Skadar, at Vučedabici village near Virpazar, 458 m, 42°07'40.1"N, 19°13'28,7"E, 8.10.2003.

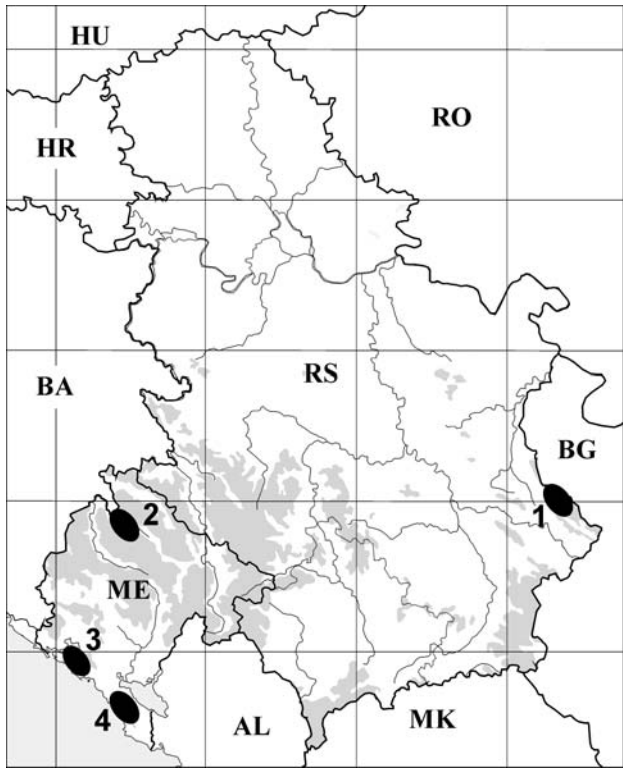


Fig. 1. Locations of the investigated areas (●) – 1 = Stara Planina, 2 = Durmitor, 3 = Lovčen and Kotor Bay, 4 = Rumija. – Abbreviations (ISO 3166-1): HU = Hungary, RO = Romania, HR = Croatia, BA = Bosnia, Herzegovina, ME = Montenegro, RS = Serbia, BG = Bulgaria, MK = FYR Macedonia, AL = Albania.

03-07. Montenegro, Rumija Mts, at Vladimir village near Šasko jezero, maquis, 28 m, 41°59'12.4"N, 19°19'29.4"E, 8.10.2003.

03-08. Montenegro, Rumija Mts, near Limljani village, at a stream, 557 m, 42°10'14.4"N, 19°06'17.7"E, 9.10.2003.

03-09. Montenegro, Rumija Mts, at the mountain pass along the road from Virpazar to Bar, around the ruins of a castle, and at mountains above, 910-1164 m, 42°09'27.8"N, 19°06' 37.3"E, and 42°09'33.7"N, 19°06'42.4"E, 9.10.2003.

03-11. Montenegro, at the northwestern part of Lake Skadar, near Mihaljevići village, 110-135 m, 42°18'13.6"N, 19°02'56.6"E and 42°19'05.9"N, 19°02'59.4"E, 10.10.2003.

03-13. Montenegro, at the northwestern part of Lake Skadar, at Rijeka Crnojevića village, 10 m, 42°21'10,1"N, 19°02'07.9"E, 10.10.2003.

03-14. Montenegro, Lovčen Mts, near Njeguši village, along the road to the Mausoleum of Njegoš, Fagetum, 1030 m, 42°25'18.2"N, 18°48'20.8"E,11.10.2003.

03-16. Montenegro, Lovčen Mts, along the road from Njeguši village to the Mausoleum of Njegoš, at a stream, 1300 m, 42°22'50.8"N, 18°49'37.0"E, 11.10.2003.

03-17. Montenegro, Lovčen Mts, near Dolovi village, 1255 m, 42°22'17.5"N, 18°49'24.1"E, 11.10.2003.

03-19. Montenegro, on the peninsula west of Kotor, near Trojica fortress, maquis at a southwest facing slope, 290 m, 42°24'23.5"N, 18°45'22.8"E, 12.10.2003.

03-20. Montenegro, Lovčen Mts, along the road from Njeguši village to Kotor, 350-370 m, 42°23'57.6"N, 18°46'12.5"E and 42°23'50.1"N, 18°45'59.6"E, 13.10.2003.

03-23. Montenegro, along the road from Kotor to Perast, at the pension Stari Mlini before Perast, stream, 0-10 m, 14.10.2003.
04-01. Montenegro, Durmitor Mts, Durmitor NP, Žabljak, between Crno jezero and Poljana, Piceo-Abietum, limestone, 1421 m, 43°08'52.0"N, 19°05'48.0"E, 5.10.2004.
04-02. Montenegro, Durmitor Mts, Durmitor NP, Žabljak, between Crno jezero and Poljana after the path to Međed, grasslands, limestone, 1566 m, 43°07'59.0"N, 19°06'00.8"E, 5.10.2004.
04-06. Montenegro, Durmitor Mts, Durmitor NP, Žabljak, on the bank of Crno jezero and rivulet from Ivan do, 1430 m, 43°08'56.6"N, 19°05'41.5"E, 7.10.2004.
04-07. Montenegro, Durmitor Mts, Durmitor NP, Žabljak, Mlinski potok, 1434 m, 43°08' 58.2"N, 19°05'23.8"E, 7.10.2004.
04-09. Montenegro, Durmitor Mts, Durmitor NP, Žabljak, between Momčilov grad restoran and Jablan bara, limestone, 1808 m, 43°10'06.4"N, 19°04'11.1"E, and acidic rocks, 1867 m, 43°10'00.0"N, 19°03'51.3"E, 8.10.2004.
04-12. Montenegro, Durmitor Mts, Durmitor NP, Žabljak, Barno jezero, peat wetland, 1506 m, 43°09'19.6"N, 19°05'25.8"E, 10.10.2004.
04-17. Montenegro, Durmitor Mts, Durmitor NP, Žabljak, on the bank of Malo jezero of Crno jezero and Titova peć, 1449 m, 43°08'31.7"N, 19°05'07.7"E, 10.10.2004 & 12.10.2004.
04-22. Montenegro, Durmitor NP, Tara canyon, between Dobrilovina and Splavište, Česma spring, 677 m, 11.10.2004.
05-01. Serbia, Stara Planina, Babin Zub, Fagetum at the basis of great rocks, Permian red sandstone, 1581 m, 43°22'28.8"N, 22°36'59.1"E, 25.6.2005.
05-02. Serbia, Stara Planina, Babin Zub, boulder scree and crevices of great rocks, Permian red sandstone, 1581 m, 43°22'28.8"N, 22°36'59.1"E, 25.6.2005.
05-03. Serbia, Stara Planina, Babin Zub, open subalpine grassland and rock outcrops, Permian red sandstone, 1741 m, 43°22'16.8"N, 22°36'46.5"E, 25.6.2005.
05-04. Serbia, Stara Planina, Babin Zub, small stream Zubska reka, Fagetum, 1536 m, 26.6. 2005.
05-06. Serbia, Stara Planina, Babin Zub, Fagetum, road to Jabučko ravnište, 1581 m, 43°22'28.8"N, 22°36'59.1"E, 27.6.2005.
05-07. Serbia, Stara Planina, valley of Crnovrska reka, above Balta Berilovac, black schistose sandstone, 488 m, 43°24'03.3"N, 22°29'44.0"E, 27.6.2005.
05-11. Serbia, Stara Planina, between Babin Zub and Midžor, subalpine grassland with sandstone rock outcrops and small temporary streams, 1593 m, 43°22'45.1"N, 22°37'39.5"E, 28.6. 2005.
05-12. Serbia, Stara Planina, between Babin Zub and Midžor, 1812 m, 43°23'27.5"N, 22°38' 00.4"E, 28.6.2005.
05-13. Serbia, Stara Planina Mts, between Babin Zub and Midžor peak, at the peak of Tupanar, subalpine grassland with sandstone rock outcrops, 1693 m, 43°23'59.4"N, 22°39'21.0"E, 28.6.2005.
05-14. Serbia, Stara Planina, valley between Babin Zub and the village Topli Dol, Rekitska gora, Fagetum, 1396 m, 43°22'05.6"N, 22°37'50.3"E, 29.6.2005.
05-16. Serbia, Stara Planina, between Babin Zub and Midžor, at the peak of Tupanar, temporary small pool in subalpine grassland, 1903 m, 43°24'00.9"N, 22°38'55.5"E, 30.6.2005.

## Results and discussion

Fifty bryophyte taxa representing new national records to Montenegro or Serbia were collected.

Two taxa are new to the Balkans: *Cynodontium gracilescens* and *Pohlia nutans* subsp. *schimperi*. Another four species are new to the whole territory of former Yugoslavia, but do occur in Bulgaria or Greece. These are *Encalypta microstoma, Grimmia dissimulata, G. torquata* and *Orthotrichum urnigerum.* 28 records are new to Montenegro and 22 records new to Serbia. An additional four records could be new records to Serbia as well, but due to ambiguities or

doubtful records in the literature, this is not evident at present. In any case, our results contribute to clarifying the situation.

Although a bryogeographical evaluation of our floristic inventory will be published elsewhere, some remarks on the geographical relations of the new records seem to be appropriate.

Not unexpectedly, bryophytes of (sub)Mediterranean affinity were collected in Montenegro, in the coastal area between Kotor and Herceg-Novi *(Scorpiurium deflexifolium, S. sendtneri, Weissia longifolia* var. *angustifolia),* or in the Rumija and Lovčen Mts not far inland *(Fossombronia pusilla, Frullania inflata* var. *illyrica*, *Dicranella howei, Schistidium brunnescens* subsp. *griseum, Syntrichia handelii).* On the other hand, shaded calcareous rocks in karstic depressions (dolinas) of the Lovčen Mts are home to some boreal-montane species such as *Barbilophozia barbata, Scapania nemorea, Ditrichum gracile* and *Orthothecium intricatum*. With the exception of *Scapania nemorea*, these were also collected in Durmitor.

The number of new records resulting from our first Montenegrine excursion is exceeded by that of our collecting trip to Durmitor National Park, Montenegro. Diversity of bryophytes, especially taxa of boreal and montane affinities, is very high in this area due to the presence of a great number of suitable biotopes. The rich fen vegetation of Barno jezero deserves special mention, with noteworthy records of *Riccardia multifida*, six species of *Sphagnum (S. fallax, S. inundatum, S. russowii, S. subsecundum, S. subnitens, S. teres), Tomentypnum nitens, Scorpidium cossonii* (the latter probably recorded earlier as *S.* (= *Drepanocladus*) *revolvens*) and *Straminergon stramineum*. Other bryophytes we observed at this fascinating site, such as *Pseudocalliergon trifarium, Dicranum bonjeanii, Hamatocaulis vernicosus, Scorpidium scorpioides, Sphagnum subnitens*, had already been reported by Birks & Walters (1972) in their study of the vegetation of Barno jezero. Under the prevailing climate, montane coniferous forest with a high proportion of rotting wood is a different type of biotope rich in bryophytes, among them three species hitherto undetected: *Cephalozia lunulifolia, Lophozia incisa, Fissidens gymnandrus.* Another epixylic species with strong populations in Durmitor, *Buxbaumia viridis,* is of special conservation interest. Climate, and obviously microclimate, in the vicinity of lakes (Crno jezero) and streams create optimal conditions for the development of epiphytic vegetation on coniferous and broad-leaved trees, especially old beech and sycamore, with *Antitrichia curtipendula, Ulota crispa* and many species of *Orthotrichum; Frullania fragilifolia* (on *Abies*) was not previously recorded. Of the rich bryoflora of calcareous rocks and soils, the dominant type of substrate in Durmitor massif and Tara canyon, the following species (five of them representing new records) deserve special mention: *Leicolea bantriensis, Barbula crocea, Campylophyllum calcareum, C. halleri, Ditrichum gracile, Eurhynchium angustirete, Orthothecium intricatum, Schistidium robustum, Seligeria pusilla, Timmia austriaca, T. bavarica*. The rare occurrence of subneutral soils enables the growth of some bulbilliferous species of *Pohlia: P. andalusica, P. annotina, P. camptotrachela, P. proligera*, a group of species obviously neglected in the region.

Nearly one half of our new records comes from the Stara Planina Mts in S Serbia. Since this area is one of the highest mountain regions of Serbia, it is not surprising that many taxa of (sub)alpine affinities were found: *Gymnomitrion concinnatum, Leiocolea heterocolpos, Cynodontium gracilescens, Dicranum spadiceum, Encalypta microstoma, Grimmia elatior, G. unicolor, Hypnum hamulosum, Pohlia longicolla, P. nutans* subsp. *schimperi, Timmia bavarica*.

Even more taxa belong to boreal and montane elements: *Tritomaria exsecta, Bryum neodamense, Cynodontium strumiferum, Grimmia torquata, Hypnum cupressiforme* var. *subjulaceum, Lescuraea saxicola, Orthotrichum urnigerum, Paraleucobryum sauteri, Racomitrium lanuginosum, Schistidium confertum, S. papillosum*. *Gymnocolea inflata* and *Radula lindenbergiana* represent the northern or montane suboceanic element. Sub-Mediterranean species were collected in the subalpine region *(Riccia gougetiana)* or in a valley *(Tortula atrovirens),* together with other species of similar geographical affinities, e.g. *Crossidium squamiferum*.

Our records from Stara Planina show a high proportion of taxa not previously known from Serbia, some are even new to the whole territory of former Yugoslavia or the Balkans. This fact underlines the importance of this bryologically rich area as a meeting point of southern and northern elements and emphasizes the necessity of preferably international conservation measures.

**Catalogue of bryophytes new to Montenegro or Serbia**

Liverworts and mosses are listed separately, each in alphabetical order. Numbers in brackets following the number of the locality are the authors' collection numbers (the second author's numbers are preceded by "BP"). After the data on substrates and associate bryophytes, information on the distribution of the taxa in surrounding countries is quoted from Düll & al. (1999) for former Yugoslavia and from Ganeva & Natcheva (2003) and Natcheva & Ganeva (2005) for Bulgaria (only for the records from Stara Planina). For distribution in Montenegro and Serbia, Sabovljević & Stevanović (1999) and Sabovljević (2000a) and more recent reports (see introduction) are also consulted. Flora element and general distribution are given according to Hill & Preston (1998) or other sources (Blom 1996, Düll 1983, 1984, 1985, Düll & al. 1999, Nyholm 1998, Smith 2004).

Records new to Montenegro or Serbia are denoted by ME or RS, respectively; brackets indicate that there have been previous doubtful reports or that the literature is not unequivocal. Geographical abbreviations (according to ISO 3166-1): BG = Bulgaria, BA = Bosnia and Herzegovina, ME = Montenegro, HR = Croatia, MK = Macedonia, RS = Serbia, SI = Slovenia.

***Hepaticae***

ME – ***Barbilophozia barbata*** (Schreb.) Loeske – Lovčen 03-14 *(BP48951/H, 9791, 9808)* on soil and on calcareous stones at the edge of beech forest, with *Hypnum cupressiforme, Pseudoscleropodium purum, Ctenidium molluscum, Campyliadelphus chrysophyllus, Fissidens dubius, Homalothecium lutescens;* Durmitor 04-01 *(10424a),* 04-17 *(10718)* on soil at banks of lakes Crno Jezero and Mali Crno Jezero, with *Bartramia ithyphylla, Brachytheciastrum velutinum, Saelania glaucescens;* BA, HR, MK, RS, SI; boreal-montane circumpolar

ME – ***Cephalozia lunulifolia*** (Dumort.) Dumort. – Durmitor 04-01 *(10357)* on rotten wood, with *Plagiothecium laetum* var. *curvifolium, Nowellia curvifolia, Riccardia palmata, Scapania umbrosa, Blepharostoma trichophyllum* subsp. *trichophyllum;* BA, HR, RS, SI; in Serbia only recently found in the Golija Mts (Papp & Erzberger 2005); boreo-temperate circumpolar

ME – ***Cephaloziella divaricata*** (Sm.) Schiffn. – Rumija 03-07 *(BP48952/H),* 03-19 *(9853, BP48953/H)* on soil in maquis; Durmitor 04-09 *(10542)* on soil overlying siliceous rock, with *Pogonatum aloides, Pohlia annotina, Ditrichum heteromallum, Ceratodon purpureus;* BA, HR, MK, RS, SI; in Serbia only recently found in the Golija Mts (Papp & Erzberger 2005); boreo-temperate circumpolar

ME – ***Fossombronia pusilla*** (L.) Nees – Rumija 03-04 *(9712)* on soil at the edge of *Quercus* forest, with *Reboulia hemisphaerica, Entosthodon pulchellus;* HR, RS, SI; Mediterranean suboceanic

ME – ***Frullania fragilifolia*** (Taylor) Gottsche & al. – Durmitor 04-12 *(10588)* conf. Váňa, on the bark of young *Abies,* with *Ptilidium pulcherrimum;* BA, HR, RS, SI; temperate suboceanic

ME – ***Frullania inflata*** var. ***illyrica*** (Grolle) R. M. Schust. – Rumija 03-09 *(BP48954/H),* Lovčen 03-20 *(9861)* conf. Váňa, on calcareous rock near temporary creek; Düll (1983): relictual Mediterranean-montane; var. *inflata*: relictual sub-Mediterranean-montane. *Frullania inflata* var. *illyrica* was known as an Albanian endemic (Bisang & al. 1988) and differs from the typical variety by fewer and larger oil bodies, but this character was considered by Grolle & Long (2000) to be variable and therefore var. *illyrica* was synonymized with var. *inflata*. Our material shows the characteristics of var. *illyrica* and we prefer this name pending further research. In Europe, *F. inflata* is known from seven countries (Albania, Austria, Czech Republic, Hungary, Italy, Slovenia). It was rated vulnerable (Schumacker & Martigny 1995), but is presently considered near threatened only, since about 15 recent localities are known from Austria (Váňa 2001) and a new locality has also been detected in Hungary (Papp & Erzberger 2006). The present record is therefore very significant on a European scale.

RS – ***Gymnocolea inflata*** (Huds.) Dumort. – Stara Planina 05-03 *(10922d)* det. Váňa, on outcrops of sandstone in open subalpine grassland, with *Grimmia funalis* and *G. hartmanii;* SI; northern-suboceanic disjunct holarctic

RS – ***Gymnomitrion concinnatum*** (Lightf.) Corda – Stara Planina 05-02 *(BP48945/H, 10907, 10919)* conf. Váňa, 05-03 *(BP48946/H)* on vertical faces of shaded, moist sandstone rock in fissures and between boulders in block scree, with *Heterocladium dimorphum, Andreaea rupestris, Pseudoleskea radicosa, Sciuro-hypnum reflexum, Marsupella* sp.; BG (from adjacent W Stara Planina), SI; arctic-montane circumpolar

ME – ***Jungermannia gracillima*** Sm. – Durmitor 04-02 *(10423)* conf. Váňa, on soil, with *Pohlia andalusica;* BA, HR, RS, SI; boreo-temperate European

RS – ***Jungermannia pumila*** With. – Stara Planina 05-04 *(10952)* det. Váňa, on irrigated sandstone in stream, with *Radula complanata, Lejeunea cavifolia* and *Platyhypnidium riparioides*; BG, BA, ME, SI; western-temperate montane disjunct holarctic

ME – ***Lophocolea minor*** Nees – Lovčen 03-17 *(BP48955/H)* on soil among limestone rocks; reported from all other SE European countries except of the European part of Turkey (Sabovljević & Natcheva 2006); subcontinental disjunct-holarctic (-bipolar)

ME – ***Lophozia incisa*** (Schrad.) Dumort. – Durmitor 04-06 *(10472),* 04-17 *(10635)* on rotten wood, with *Blepharostoma trichophyllum* subsp. *trichophyllum, Lepidozia reptans, Herzogiella seligeri, Leiocolea heterocolpos;* BA, HR, RS, SI; boreal-montane circumpolar

RS – ***Radula lindenbergiana*** Gottsche ex C. Hartm. – Stara Planina 05-02 *(BP48949/H)* conf. Váňa, on vertical faces of shaded, moist, sandstone rock; BG, HR, ME, SI; suboceanic (-sub-Mediterranean)-montane holarctic-African

ME – ***Riccardia multifida*** (L.) Gray – Durmitor 04-12 *(10597)* conf. Váňa, in calcareous rich fen, with *Pseudocalliergon trifarium, Bryum pseudotriquetrum, Scorpidium cossonii, Campylium stellatum* var. *stellatum;* BA, HR, RS, SI; boreo-temperate circumpolar

RS – ***Riccia gougetiana*** Durieu & Mont. – Stara Planina 05-11 *(BP48950/H, 11022)* conf. Váňa; on soil between sandstone rock outcrops in subalpine grassland, with *Polytrichum juniperinum, Ceratodon purpureus;* BG, HR, MK; sub-Mediterranean European W Central Asian African

RS – ***Tritomaria exsecta*** (Schmidel) Loeske – Stara Planina 05-02 *(10918/II, 10918b)* conf. Váňa, on shaded sandstone rock, with *Scapania aspera, Plagiobryum zierii, Anomodon rugelii, Ctenidium molluscum, Fissidens dubius, Grimmia funalis, G. torquata, Radula complanata, Lejeunea cavifolia, Distichium capillaceum, Campylium stellatum* var. *stellatum,* 05-03 *(10928, 10929)* on sandstone rock outcrops in alpine meadow, with *T. quinquedentata, Dicranum scoparium, Racomitrium lanuginosum, Pohlia nutans* subsp. *nutans, Polytrichastrum formosum*, 05-12 *(11043, 11055)* on wind-swept ridge of sandstone rock, with *T. quinquedentata, Anastrophyllum minutum, Hypnum cupressiforme, Plagiochila porelloides, Ditrichum gracile, Isothecium alopecuroides, Polytrichastrum alpinum, Pohlia nutans* subsp. *schimperi, Cynodontium strumiferum, Amphidium mougeotii,* also collected in Bulgaria near the Serbian border *(11077)* in similar habitat and with similar associates; BG (Pirin Mts), BA, HR, SI; boreal-montane circumpolar

***Musci***

ME – ***Barbula crocea*** (Brid.) F. Weber & D. Mohr – Durmitor 04-22 *(10688)* on wet calcareous rocks in Tara canyon close to the river, with *Preissia quadrata, Leiocolea alpestris, Campylophyllum calcareum;* BA, HR, RS, SI; sub-oceanic pre-alpine; European N African

RS – ***Bryum neodamense*** Itzigs. – Stara Planina 05-16 *(BP173098)* on the bank of a small pool with *Warnstorfia exannulata, Aulacomnium palustre, Polytrichastrum formosum* and *Ceratodon purpureus;* in Bulgaria known only from the Vitosha Mts (Natcheva & Ganeva 2005); HR, SI; boreal-montane circumpolar

RS – ***Cynodontium gracilescens*** (F. Weber & D. Mohr) Schimp. – Stara Planina 05-06 *(BP173099)* on shaded sandstone rock with *Cynodontium tenellum, Encalypta ciliata, Dicra-*

*noweisia crispula* and *Brachytheciastrum velutinum;* not known from Bulgaria (Natcheva & Ganeva 2005); not known in former Yugoslavia (Düll & al. 1999); arctic-alpine (Nyholm 1987). New to the Balkan Peninsula (Düll 1984).

RS – ***Cynodontium strumiferum*** (Hedw.) Lindb. – Stara Planina 05-12 *(11045, 11048, 11055, 11067)* all c. spg., on siliceous rock at wind-swept ridge, with *Mnium thomsonii, Plagiochila porelloides, Barbilophozia hatcheri, Dicranum scoparium, Sanionia uncinata, Tritomaria exsecta, T. quinquedentata, Amphidium mougeotii, Pohlia nutans* subsp. *nutans, Blepharostoma trichophyllum* subsp. *trichophyllum;* BG (Rila Mts), SI; boreo-arctic montane circumpolar

RS – ***Dicranum spadiceum*** J. E. Zetterst. – Stara Planina 05-12 *(11050, 11058a)* on siliceous rocks at wind-swept ridge, with *Barbilophozia lycopodioides, Plagiochila porelloides, Tritomaria quinquedentata, Sciuro-hypnum reflexum, Heterocladium dimorphum, Hylocomium splendens, Polytrichastrum alpinum, Pseudoleskea incurvata;* also near the border at Mt Midžor in Bulgaria *(11081)* in similar habitat and with similar accompanying bryophytes, additional associates are *Pohlia cruda, Anastrophyllum minutum, Mnium thomsonii, Plagiothecium laetum;* BG (Rila Mts), SI (Julijske Alpe); subarctic alpine; holarctic

RS – ***Encalypta microstoma*** Bals.-Criv. & De Not. – Stara Planina 05-11 *(BP173100, 11004, 11016, 11017),* 05-12 *(11052)* always c. spg., on flat rock outcrops in subalpine pastures, with *Barbilophozia hatcheri, Metzgeria furcata, Radula complanata, Pohlia cruda, P. nutans, Pterigynandrum filiforme, Plagiothecium cavifolium, Hypnum cupressiforme;* BG (Rila Mts), not known from former Yugoslavia (Düll & al. 1999); very rare in higher mountains of Europe (Nyholm 1998)

ME – ***Fissidens gymnandrus*** Büse – Durmitor 04-01 *(10412)* on moist soil near spring, with *F. taxifolius*, 04-09 (*10526* c. spg.), on subneutral soil, with *Weissia brachcarpa,* 04-17 *(10637, 10640)* on rotten wood and on tree root under overhanging rock, with *Chiloscyphus pallescens, Bryoerythrophyllum recurvirostrum;* BA, HR, SI (Pavletić 1955), subcontinental; European E Asian North American

ME – ***Grimmia dissimulata*** E. Maier – Rumija 03-04 (9713a) on calcareous rock, with *Tortella nitida, Syntrichia laevipila*, 03-08 *(9737b,c),* 03-09 *(9776),* 03-13 *(9788)* on calcareous rock, with *G. pulvinata, Tortella tortuosa, Schistidium* sp., *Orthotrichum anomalum, Bryum capillare, Syntrichia montana, Pterogonium gracile;* all det./conf. E. Maier; described recently (Maier 2002), distribution (E. Maier, in litt.): Africa: Marocco; Asia: Syria, Turkey; Europe: Austria, Belgium, Cyprus, France, Germany, Great Britain, Greece, Hungary, Italy, Spain, Switzerland; see also Porley (2004) and Erzberger & Papp (2004).

RS – ***Grimmia elatior*** Bruch ex Bals.-Criv. & De Not. – Stara Planina 05-02 *(10912),* 05-03 *(BP173101, 10921, 10926),* 05-11 *(11033),* 05-12 *(11051, 11061)* all conf. E. Maier, on rock outcrops in subalpine pastures, with *Syntrichia ruralis, G. funalis, Ceratodon purpureus, Homalothecium philippeanum, Racomitrium lanuginosum, R. canescens,* also collected in Bulgaria near the border at Mt Midžor *(11090)* in similar habitat; BG (W Stara Planina), BA, SI; boreal-montane circumpolar

RS – ***Grimmia torquata*** Drumm. – Stara Planina 05-02 *(10913a, 10918/VIII)* at the base of Babin Zub sandstone rock in fissures, with *G. funalis, Amphidium mougeotii, Bartramia pomiformis, Dicranum scoparium, Scapania aequiloba, Tritomaria exsecta, Plagiobryum zierii, Anomodon rugelii, Ctenidium molluscum, Fissidens dubius;* BG (central Stara Planina, Rila Mts), not known from former Yugoslavia (Düll & al. 1999); boreo-arctic montane European

RS – ***Grimmia unicolor*** Hook. – Stara Planina 05-13 *(BP173102)* on rock outcrops in subalpine pastures; BG (central Stara Planina, Rila Mts), BA; subarctic-alpine, holarctic

RS – ***Hypnum cupressiforme*** Hedw. var. ***subjulaceum*** Molendo – Stara Planina 05-02 *(BP173103),* 05-12 *(11052)* sandstone rock outcrops at wind-swept ledge, with *H. cupressiforme* var. *cupressiforme, Radula complanata, Schistidium papillosum, Encalypta microstoma, Isothecium alopecuroides, I. myosuroides* var. *myosuroides, Tortella tortuosa;* also collected in Montenegro

recently: Durmitor 04-17 *(10702)* on calcareous rock with *Encalypta ciliata;* BG (Düll 1985), BA, ME, SI (Pavletič 1955); boreal-montane; holarctic (-bipolar)

RS – ***Hypnum hamulosum*** Schimp. – Stara Planina 05-12 *(11054a)* on sandstone rock at wind-swept ridge, with *H. revolutum* var. *revolutum;* Düll & al. (1999): "SI?; has to be verified"; arctic-montane circumpolar

(RS) – ***Lescuraea saxicola*** (Schimp.) Molendo – Stara Planina 05-01 *(BP173104)* at the base of Babin Zub on a sandstone rock in Fagetum, 05-06 *(BP173105)* on bark at the base of a *Fagus* tree; BG; it is not clear, whether the record from the Prokletije Mts published in Martinčič (2006) refers to RS or ME; not known from other regions of former Yugoslavia (Düll & al. 1999); boreal-montane circumpolar

RS – ***Orthotrichum urnigerum*** Myrin – Stara Planina 05-11 *(11034)* c. spg., in clefts of sandstone rock outcrops in subalpine greenlands, with *Encalypta streptocarpa, Tortula hoppeana, Pseudoleskeella catenulata, Leucodon sciuroides*, 05-14 *(11071)* c. spg., on rock near creek, with *Schistidium apocarpum, Cirriphyllum crassinervium, Platyhypnidium riparioides;* BG (only a pre-1956 literature record from the Vitosha Mts), not known from former Yugoslavia (Düll & al. 1999); oceanic-montane (Düll 1985)

RS – ***Paraleucobryum sauteri*** (Bruch & Schimp.) Loeske – Stara Planina 05-02 *(10891)* on sandstone boulder in block scree under *Fagus;* BG (only a pre-1956 literature record from the Vitosha Mts), BA, ME, HR, SI; sub-continental montane; European W Asian North American

ME – ***Pohlia andalusica*** (Höhn.) Brot. – Durmitor 04-02 *(10423),* 04-09 *(10524, 10548)* on subneutral soil, with *Jungermannia gracillima, P. camptotrachela, P. proligera, Ditrichum heteromallum;* missing in Düll & al. (1999); recent records from Serbia are from the Kopaonik Mts (Papp & al. 2004) and the Golija Mts (Papp & Erzberger 2005), also collected in Stara Planina 05-11 *(11042, BP173120)* on open soil in subalpine pasture, with *P. bulbifera;* boreal-montane suboceanic

ME – ***Pohlia annotina*** (Hedw.) Lindb. – Durmitor 04-09 *(10542)* on soil overlying siliceous rock, with *Pogonatum aloides, Ditrichum heteromallum, Ceratodon purpureus, Cephaloziella divaricata;* BA, RS, SI; boreo-temperate European

RS – ***Pohlia bulbifera*** (Warnst.) Warnst. – Stara Planina 05-11 *(11042)* on open soil in subalpine pasture, with *P. andalusica;* ?HR, SI; boreo-temperate circumpolar

ME – ***Pohlia camptotrachela*** (Renauld & Cardot) Broth. – Durmitor 04-09 *(10524)* on open soil, with *P. andalusica, P. proligera;* BA, RS, SI; boreal-montane suboceanic

RS – ***Pohlia longicolla*** (Hedw.) Lindb. – Stara Planina 05-02 *(BP173106),* 05-12 *(BP173107, 11053, 11060)* on wind-swept sandstone rock, with *P. cruda, Bartramia* sp., conf. H. Köckinger, 05-16 *(BP173108)* on sandstone rock at a temporary small pool; BG (only a pre-1956 literature record from the Vitosha Mts), ME, SI, subarctic subalpine; holarctic (?-bipolar)

RS – ***Pohlia nutans*** subsp. ***schimperi*** (Müll. Hal.) Nyholm – Stara Planina 05-02 *(BP173109),* 05-11 *(BP173110, 11040)* on sandstone outcrops in subalpine pastures, 05-12 *(11043, 11046)* on sandstone rock at wind-swept mountain ridge, with *Anastrophyllum minutum, Tritomaria exsecta, T. quinquedentata, Plagiochila porelloides, Ditrichum gracile, Hypnum cupressiforme, Isothecium alopecuroides, Polytrichastrum alpinum,* conf. H. Köckinger, 05-16 *(BP173119)* on sandstone rock at a temporary small pool. This taxon was neglected in Central Europe, but has recently been published from Poland, Czech Republic and Austria (Köckinger & al. 2005). The present record represents a considerable extension of its area. New to the Balkan Peninsula.

ME – ***Pohlia proligera*** (Kindb.) Lindb. ex Broth. – Durmitor 04-09 *(10524, 10548),* 04-17 *(10636)* on open soil, with *P. andalusica, P. camptotrachela, Ditrichum heteromallum;* SI; boreal-montane European

ME – ***Polytrichum commune*** var. ***perigoniale*** (Michx.) Hampe – Durmitor 04-12 *(10630)* in rich fen, with *Aulacomnium palustre, Straminergon stramineum, Sphagnum subnitens;* re-

cent record from Serbia in Papp & Erzberger (2005); HR, MK, RS, SI, subboreal; holarctic (-bipolar)

RS – ***Racomitrium lanuginosum*** (Hedw.) Brid. – Stara Planina 05-02 *(BP173111, 10904)* in block scree, 05-03 *(10928)* on sandstone rock outcrops in alpine meadow, with *Dicranum scoparium, Tritomaria exsecta, T. quinquedentata,* 05-12 *(11061b)* on wind-swept ridge of sandstone rock, with *Grimmia elatior, G. funalis;* BG, BA, SI; boreo-arctic montane circumpolar

ME – ***Schistidium brunnescens*** subsp. ***griseum*** (Nees & Hornsch.) H. H. Blom – Lovčen 03-16 *(9822)* det. Schröder, on calcareous rock near a stream; BA, BG, HR, GR (Blom 1996); distribution imperfectly known, from S Scandinavia to S Europe and Turkey (Blom 1996)

(RS) – ***Schistidium confertum*** (Funck) Bruch & Schimp. – Stara Planina 05-03 *(BP173112),* 05-11 *(BP173113, 10995, 10998, 11005, 11009, 11021)* conf. Schröder, on sandstone rock outcrops and small stones in subalpine grassland, with *Hypnum lacunosum, Homalothecium lutescens, Pseudoleskeella nervosa, Bartramia ithyphylla, Pterigynandrum filiforme;* BG (Rhodope Mts (Blom 1996), western Stara Planina), ME (Dragićević & Veljić 2006); according to Düll & al. (1999) also in BA, HR, MK, RS, SI, these data are, however, open to question, since they obviously refer to records made before Blom's revision (Blom 1996); circumpolar boreo-temperate (Smith 2004)

ME – ***Schistidium helveticum*** (Schkuhr) Deguchi – Nikšič 03-03 *(BP173210),* conf. Schröder, on exposed conglomerate rock; in SE Europe it is known from Greece (Düll 1995) and Serbia (Sabovljević 2003b); Mediterranean (Blom 1996)

(RS) – ***Schistidium papillosum*** Culm. – Stara Planina 05-02 *(10905)* on insolated sandstone boulder in block scree, 05-06 *(BP173114)* on shaded sandstone rock, 05-11 *(BP173115, 11039),* 05-13 *(BP173116)* conf. Schröder, on sandstone rock outcrops in subalpine greenlands, with *Polytrichum piliferum, Ceratodon purpureus, Pohlia nutans* subsp. *nutans*, 05-12 *(11052, 11065)* on wind-swept ridge of sandstone rock, with *Radula complanata, Encalypta microstoma, Isothecium alopecuroides, I. myosuroides* var. *myosuroides, Hypnum cupressiforme* var. *subjulaceum, H. cupressiforme* var. *cupressiforme, Tortella tortuosa;* BG (Rila Mts only (Blom 1996)), not known from former Yugoslavia (Düll & al. 1999, Sabovljević 2003b) apart from a doubtful record in Slovenia (Martinčič 2003); circumpolar boreo-arctic montane (Smith 2004)

ME – ***Schistidium robustum*** (Nees & Hornsch.) H. H. Blom – Durmitor 04-01 *(10348)* conf. Schröder, on flat calcareous stone, shaded by *Abies,* 04-07 *(10503)* conf. Schröder, on concrete near mill at creek; HR (Blom 1996); European boreal-montane (Smith 2004)

ME – ***Scorpiurium deflexifolium*** (Solms) M. Fleisch. & Loeske – Lake Skadar 03-11 *(BP173211),* 03-13 *(BP173212),* Kotor Bay 03-23 *(BP173213)* on irrigated calcareous rock; BA, SI; Mediterranean-S European W Asian African

ME – ***Seligeria pusilla*** (Hedw.) Bruch & Schimp. – Durmitor 04-17 *(10643)* on calcareous rock; BA, HR, RS, SI; in Serbia only recently found in the Petnica region (Papp & Sabovljević 2001) and the Kopaonik Mts (Papp & al. 2004); boreo-temperate European

ME – ***Sphagnum inundatum*** Russow – Durmitor 04-12 *(10593)* in rich fen, with *Dicranum bonjeanii, Straminergon stramineum;* only recently discovered in Serbia in the Kopaonik Mts (Papp & al. 2004), and the Golija Mts (Papp & Erzberger 2005); BA, HR, RS, SI; boreo-temperate European

ME – ***Sphagnum russowii*** Warnst. – Durmitor 04-12 *(10608, 10610)* in rich fen, with *Calliergon stramineum;* BA, HR, MK, RS, SI; boreo-arctic montane circumpolar

ME – ***Sphagnum subsecundum*** Nees – Durmitor 04-12 *(10611)* in rich fen; BA, HR, MK, RS, SI; boreal-montane circumpolar

ME – ***Syntrichia handelii*** (Schiffn.) S. Agnew & Vondr. – Lovčen 03-17 *(BP173214)* conf. Kučera, on calcareous rock; within SE Europe reported from Greece only (Düll 1995); E Mediterranean continental (Düll 1984)

(RS) – ***Timmia bavarica*** Hessl. – Stara Planina 05-02 *(BP173117, 10914b)* on sandstone rock, with *Dicranum scoparium, Pohlia nutans* subsp. *nutans*, 05-04 *(BP173118)* on shaded

sandstone rocks in Fagetum; according to Martinčič (1995, 2006) in Prokletije Mts, but it is not evident, if these records refer to Serbia as well as to Montenegro; found also in Durmitor 04-17 *(10725* c. spg., *10731)* on calcareous rock, with *Distichium capillaceum, Leiocolea bantriensis, Brachythecium tommasinii, Metaneckera menziesii;* BG, BA, ME, HR, MK, SI; northern-subcontinental pre-alpine; holarctic (-bipolar)

ME – ***Tomentypnum nitens*** (Hedw.) Loeske – Durmitor 04-12 *(10594, 10595, 10601, 10607, 10609, 10613)* in rich fen, with *Dicranum bonjeanii, Calliergon giganteum, Straminergon stramineum, Sphagnum teres, S. fallax, Bryum pseudotriquetrum, Campylium stellatum* var. *stellatum, Riccardia multifida, Aulacomnium palustre, Climacium dendroides, Calliergonella cuspidata, Plagiomnium ellipticum;* BA, RS, SI; boreo-arctic montane circumpolar

ME – ***Weissia longifolia*** var. ***angustifolia*** (Baumgartner) Crundw. & Nyholm – Kotor 04-19 *(9849)* c. spg. on soil in scrub, with *Scorpiurium circinatum;* HR; oceanic sub-Mediterranean; European

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