CONTRIBUTIONS TO THE BRYOPHYTE FLORA OF WESTERN STARA PLANINA MTS (E SERBIA)

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During the bryophyte investigation carried out in July 2005 in Western Stara Planina Mts (E Serbia) altogether 322 bryophytes (62 liverworts and 260 mosses) were recorded. Among them 27 are reported for the first time in Serbia (Gymnocolea inflata, Gymnomitrion concinnatum, Jungermannia pumila, Marsupella emarginata, Radula lindenbargiana, Riccia gougetiana, Tritomaria exsecta, Bryum neodamense, Cynodontium gracilescens, C. strumiferum, Dicranum spadiceum, Encalypta microstoma, Grimmia elatior, G. torquata, G. unicolor, Hypnum cupressiforme var. subjulaceum, H. kamulosum, Lescuraea saxicola, Orthotrichum urnigerum, Paraleucobryum sauteri, Philonotis arnelii, Poblia bulbifera, P. longicolla, P. nutans var. schimperi, Racomitrium lanuginosum, Schistidium papillosum, Timmia bavarica); one species (Cynodontium tenellum) collected on the Bulgarian side of Midzor peak is new record for Bulgaria. 7 species from the Western Stara Planina Mts are included in the Red data book of European bryophytes (ECCB 1995), i.e. Brachythecium geheebii, Bryum neodamense, Encalypta microstoma, Grimmia caespiticia, Lophozia ascendens, Paraleucobryum sauteri, Pseudoleskea saviana. All of these but the last one (being in the regionally threatened (RT) category) are rare (R). Furthermore, 12 liverwort and 34 moss species are of national conservation and protection interest in Serbia or Bulgaria.

Key words: bryophyte flora, Bulgaria, new and redlisted species, Serbia, Western Stara Planina Mts

INTRODUCTION

Although the checklists of the bryophytes of Serbia (SABOVIJEVIĆ 2000a, SABOVIJEVIĆ and STEVANOVIĆ 1999) were published only very recently, thanks to intensive field work conducted in the country, mainly in protected areas, many new records have been revealed (e.g. SABOVIJEVIĆ 2000b, 2003a, b, 2006, SABOVIJEVIĆ and STEVANOVIĆ 2000, BLOCKEEL et al. 2003, PAPP and SABOVIJEVIĆ 2001, 2002, PAPP and ERZBERGER 2005, PAPP et al. 2004, 2006, SABOVIJEVIĆ and CVETIĆ 2001, 2003, VELJIĆ et al. 2001, PÓCS et al. 2004, CVETIĆ and SABOVIJEVIĆ 2005). As to the present
knowledge, the bryophyte flora of Serbia comprises 118 hepatics and 527 mosses. 36 species of the European red list occur in the country (ECCB 1995, PAPP et al. in press).

Following is a new contribution based on comprehensive work done in the Western Stara Planina Mts (E Serbia) with the aim of the better knowledge of the Serbian bryoflora and provide new data on European redlisted species.

MATERIALS AND METHODS

The investigated area

Stara Planina Mts (“Old Mountain” or the Balkan mountain range) are an extension of the Carpathian mountain range, separated from the latter by the Danube River. It runs 560 km from eastern Serbia eastward through central Bulgaria to the Black Sea.

In Serbia, Stara Planina Mts cover 1,800 km of mountainous region; 150 km along the border of Serbia and Bulgaria. The highest peak of this western part of the range, situated on the borderline between Serbia and Bulgaria, is Midzor at 2,168 m a.s.l.

The overall climate is continental with clear montane characteristics above 1000 m on the northern and above 1,500 m on the southern slopes. The mean temperature in January is −2, −9 °C depending on altitude and exposure, whereas the mean temperature in July is 10–22 °C. The precipitation reaches its maximum in May–June, and the minimum is in February, with the mean annual precipitation 1,300 mm. The snow cover lasts for 7–8 months in the areas above 2,000 m, and 120–130 days at 1,500–2,000 m a.s.l. (VOYNIKOV 1989).

The bedrock consists mostly of Paleozoic, weakly metamorphic and intrusive siliceous rocks and mainly Permian red sandstone in the surroundings of Midzor peak. The soils are brown-forest soils in the forested areas, which form a relatively thick layer, and dark peaty mountainous soils at higher elevations (VOYNIKOV 1989).

The vegetation consists mainly of beech forests (Fagus sylvatica) with scattered remnants of spruce (Picea abies) on the northeastern slopes.
The timberline runs at about 1,550–1,600 m a.s.l. and is formed by beech. As a result of human influence in the past, the timberline is lower than would naturally be. The higher altitudes, formerly covered by dwarfed subalpine spruce stands, are presently dominated by Juniperus communis subsp. saxatilis and subalpine pastures with Poa media, Poa alpina, Sesleria coerulea, Festuca valida, Phleum alpinum, etc. Small fragments of orophytic subalpine vegetation on bare rocks and “stone rivers” are found just below Midžor peak, dominated by Saxifraga spp. (S. pedemontana, S. paniculata, S. bryoides), Cerastium alpinum, Juncus trifidus, Sedum alpestre (BONDEV 1966).

On the proposal of the Institute of Nature Protection of Serbia, in 1997 Stara Planina was placed under strict protection as “natural merit of first class” and a strategy for ecotourism development was developed.

METHODS

The collecting trip to the investigated area shown in Figure 1 was made in July 2005. Most collecting places are situated in Serbia, but one locality lies on the eastern side of Midžor peak on the territory of Bulgaria. All main habitat types, such as forests, grasslands, stream valleys and fens were visited, and bryophytes were collected from different substrates (soil, exposed and shady rocks, tree barks and decaying wood).

The specimens are deposited in the Hungarian Natural History Museum, Budapest (BP) and in the Botanical Museum, Berlin Dahlem (B).

Nomenclature of the species follows GROLLE and LONG (2000) and HILL et al. (2006). New floristical results for Serbia are analysed according to the checklists of Serbia-Montenegro (SABOVLJEVIĆ 2000a, SABOVLJEVIĆ and STEVANOVIC 1999) and updated by the new records (see the citations in introduction), while for Bulgaria according to the checklists of Bulgaria (GANEVA and NATCHEVA 2003, NATCHEVA and GANEVA 2005).

Site details

1. Serbia, Stara Planina Mts, Babin Zub, at great rock walls in Fagetum, boulder scree and crevices of great rocks,Permian red sandstone, 1,581 m, 43° 22' 28.8" N, 22° 36' 59.1” E, 25.06.2005.
2. Serbia, Stara Planina Mts, Babin Zub, open subalpine grassland and rock outcrops, Permian red sandstone, 1,751 m, 43° 22' 16.8" N, 22° 36' 45.7" E, 25.06.2005.

3. Serbia, Stara Planina Mts, Babin Zub, Zubska reka stream, Permian red sandstone rocks in Fagetum, 1,536 m, 43° 22' 28.8" N, 22° 36' 59.1" E, 26.06.2005.

4. Serbia, Stara Planina Mts, valley of Zubska reka stream, wet meadows, 1,361 m, 43° 22' 42.7" N, 22° 37' 11.8" E, 26.06.2005.

5. Serbia, Stara Planina Mts, Babin Zub, road to Jabučko ravniste, sandstone rocks, Fagetum, 1,581 m, 43° 22' 28.8" N, 22° 36' 59.1" E, 27.06.2005.

6. Serbia, Stara Planina Mts, valley of Crnovrska reka stream, above Balta Berilovac, black schistose sandstone rocks, 488 m, 43° 24' 03.3" N, 22° 29' 44.0" E, 27.06.2005.

7. Serbia, Stara Planina Mts, valley of Crnovrska reka stream, above Balta Berilovac, 510 m, 43° 24' 07.0" N, 22° 30' 34.9" E, 27.06.2005.

8. Serbia, Stara Planina Mts, valley of Crnovrska reka stream above Mezдрeja village, 643 m, 43° 24' 55.8" N, 22° 33' 04.4" E, 27.06.2005.

9. Serbia, Stara Planina Mts, valley of Crnovrska reka stream at Zubska reka stream at Kozarnica village above Golema reka village, wet meadow, 1,003 m, 43° 23' 42.9" N, 22° 36' 17.4" E, 27.06.2005.

10. Serbia, Stara Planina Mts, between Babin Zub and Midžor peak, subalpine grassland with sandstone rock outcrops and small temporary streams, 1,593 m, 43° 22' 45.1" N, 22° 37' 39.5" E, 28.06.2005.

11. Serbia, Stara Planina Mts, between Babin Zub and Midžor peak, sandstone rock outcrops at wind-swept mountain ridge, 1,812 m, 43° 23' 59.4" N, 22° 38' 00.4" E, 28.06.2005.

12. Serbia, Stara Planina Mts, between Babin Zub and Midžor peak, at the peak of Tupanar, subalpine grassland with sandstone rock outcrops, 1,693 m, 43° 23' 59.4" N, 22° 39' 21.0" E, 28.06.2005.

13. Serbia, Stara Planina Mts, valley between Babin Zub and the village Topli Do, Rekitska gora, sandstone rocks, Fagetum, 1,396 m, 43° 22' 05.6" N, 22° 37' 50.3" E, 29.06.2005.

14. Serbia, Stara Planina Mts, valley between Babin Zub and the village Topli Do, Rekitska reka stream, Permian red sandstone rocks, 1,100 m, 43° 22' 16.9" N, 22° 38' 39.1" E, 29.06.2005.

15. Serbia, Stara Planina Mts, between Babin Zub and Midžor peak, at the peak of Tupanar, temporary small pool in subalpine grassland, 1,903–1,933 m, 43° 24' 00.9" N, 22° 38' 55.5" E and 43° 24' 03.5" N, 22° 39' 30.4" E, 30.06.2005.


17. Serbia, Stara Planina Mts, valley of Temstica reka stream above Temska village, at Bukovački do stream, Permian red sandstone schist, 457 m, 43° 16' 44.5" N, 22° 34' 18.1" E, 01.07.2005.

18. Serbia, Stara Planina Mts, valley of Temstica reka stream at Temska village, wet Permian red sandstone rock wall, 507 m, 43° 17' 36.7" N, 22° 35' 23.6" E, 01.07.2005.
19. Serbia, Stara Planina Mts, valley of Temstica reka stream between Temska and Topli Do villages, 525 m, 43° 17' 47.7" N, 22° 36' 23.6" E, 01.07.2005.

20. Bulgaria, Stara Planina Mts, Midzor peak, Permian red sandstone rocks and rock cervices, 2,169 m, 43° 23' 42.7" N, 22° 40' 39.4" E, 30.06.2005.

RESULTS AND DISCUSSION

Altogether 322 bryophyte taxa (62 liverworts and 260 mosses) were collected during our field trip. The following 27 taxa are recorded for the first time in Serbia: Gymnocolea inflata, Gymnomitrion concinnatum, Jungermannia pumila, Marsupella emarginata, Radula lindenbergiana, Riccia gougetiana, Tritomaria exsecta, Bryum neodamense, Cynodontium gracilescens, C strumiferum, Dicranum spadiceum, Encalypta microstoma, Grimmia elatior, G. torquata, G. unicolor, Hypnum cupressiforme var. subjulaceum, H. hamulosum, Lescuraea saxicola, Orthotrichum urnigerum, Paraleucobryum sauteri, Philonotis arnellii, Pohlia bulbifera, P. longicolla, P. nutans var. schimperi, Racomitrium lanuginosum, Schistidium papillosum, Timmia bavarica.

Gymnocolea inflata (Huds.) Dumort. is a northern sub-Atlantic species (DÜLL 1983). It was recorded in SE Europe from Bulgaria, Greece, Macedonia, Romania and Slovenia (SABOVLJEVIĆ and NATCHEVA 2006).

Gymnomitrion concinnatum (Lightf.) Corda is a subarctic, alpine species (DÜLL 1983). It is known in SE Europe only from Romania, Slovenia and Bulgaria (from adjacent Western Stara Planina) (SABOVLJEVIĆ and NATCHEVA 2006, GANEVA and NATCHEVA 2003).

Jungermannia pumila With. is a montane species of the European temperate zone (DÜLL 1983). It was reported in SE Europe from Bulgaria, Bosnia-Herzegovina, Romania and Slovenia (SABOVLJEVIĆ and NATCHEVA 2006).

Marsupella emarginata (Ehrh.) Dumort. is a montane species of the European temperate zone (DÜLL 1983). It was reported in SE Europe from Greece, Bulgaria, Romania, Bosnia-Herzegovina, Macedonia, Croatia and Slovenia (SABOVLJEVIĆ and NATCHEVA 2006).

Radula lindenbergiana Gottsche ex C. Hartm. is a montane element of the sub-Mediterranean zone (DÜLL 1983). This species is known from all SE European countries except Macedonia (SABOVLJEVIĆ and NATCHEVA 2006).
Riccia gougetiana Durieu et Mont. is a sub-Mediterranean species (DÜLL 1983). It is recorded in several SE European countries as Bosnia-Herzegovina, Bulgaria, Croatia, Greece, Macedonia, Romania (SABOVLIJEVIĆ and NATCHEVA 2006).

Tritomaria exsecta (Schmidel) Loeske is a montane species of the European temperate zone (DÜLL 1983). It was reported in SE Europe in Bulgaria, Bosnia-Herzegovina, Croatia, Romania and Slovenia (SABOVLIJEVIĆ and NATCHEVA 2006). In Bulgaria it was known only from Pirin Mts (GANEVA and NATCHEVA 2003), now it was also collected on the Bulgarian side of Midžor peak.

Fig. 1. Location of the investigated area. (H = Hungary, RO = Romania, HR = Croatia, BiH = Bosnia-Herzegovina, MO = Montenegro, SE = Serbia, BG = Bulgaria, MK = FYR Macedonia, Al = Albania)
Bryum neodamense Itzigs. is a subarctic element (DÜLL 1985). In SE Europe it is known from Romania (SABOVIJEVIĆ et al. in press), Croatia, Slovenia (DÜLL et al. 1999) and Bulgaria (NATCHEVA and GANEVA 2005). In Bulgaria it is known only from the Vitosha Mts.

Cynodontium gracilescens (F. Weber et D. Mohr) Schimp. is a subarctic, subalpine species (DÜLL 1984). In SE Europe this species is only known from Romania (SABOVIJEVIĆ et al. in press).

Cynodontium strumiferum (Hedw.) Lindb. is a boreal, montane element (DÜLL 1984). In SE Europe it is known from Romania (SABOVIJEVIĆ et al. in press), Bulgaria (Rila Mts) (NATCHEVA and GANEVA 2005) and Slovenia (MARTINČIČ 2003).

Dicranum spadiceum E. Zetterst. is a subarctic, alpine element (DÜLL 1984). In SE Europe it is recorded only in Bulgaria (Rila Mts) (NATCHEVA and GANEVA 2005) and Slovenia (Juljske Alpe) (MARTINČIČ 2003).

Encalypta microstoma Bals.-Criv. et De Not. is a subarctic, subalpine species (DÜLL 1984). In SE Europe it is known only from Bulgaria (Rila Mts) (NATCHEVA and GANEVA 2005). According to NYHOLM (1998) it is a very rare species occurring in the higher mountains of Europe.

Grimmia elatior Bruch ex Bals.-Criv. et De Not. is a subarctic, subalpine element (DÜLL 1984). In SE Europe it is reported from Romania (SABOVIJEVIĆ et al. in press), Bulgaria (Western Stara Planina) (NATCHEVA and GANEVA 2005), Bosnia-Herzegovina and Slovenia (DÜLL et al. 1999, MARTINČIČ 2003).

Grimmia torquata Drumm. is a subarctic, subalpine moss (DÜLL 1984). It is recorded in SE Europe from Romania (SABOVIJEVIĆ et al. in press), Bulgaria (Central Stara Planina, Rila Mts) (NATCHEVA and GANEVA 2005) and Greece (DÜLL 1995).

Grimmia unicolor Hook. is a subarctic, alpine species (DÜLL 1984). It is known in SE Europe from Romania (SABOVIJEVIĆ et al. in press), Bulgaria (Central Stara Planina, Rila Mts) (NATCHEVA and GANEVA 2005) and Bosnia-Herzegovina (DÜLL et al. 1999).

Hypnum cupressiforme Hedw. var. subjulaceum Molendo is a boreal, montane taxon. In SE Europe it is known from Bulgaria (DÜLL 1985), Bosnia-Herzegovina, Montenegro, and Slovenia (PAVLETIĆ 1955).

Hypnum hamulosum Schimp. is a subarctic, subalpine moss (DÜLL 1985).
In SE Europe it is mentioned only from Romania (SABOVLJEVIĆ et al. in press) and Slovenia (MARTINČIČ 2003).

Lescuraea saxicola (Schimp.) Molendo is a subarctic, subalpine moss (DÜLL 1985). It is reported by MARTINČIČ (2006) from Prokletije Mts (Serbia, Montenegro), but it is not clear, whether it was found on the territory of Serbia or Montenegro. In SE Europe it is reported from Romania (SABOVLJEVIĆ et al. in press), Bulgaria (NATCHEVA and GANEVA 2005) and Slovenia (MARTINČIČ 2003).

Orthotrichum urnigerum Myrin is an Atlantic, montane species (DÜLL 1985). In SE Europe it is reported from Romania (SABOVLJEVIĆ et al. in press), Bulgaria, where it has only a pre-1956 literature record from the Vitosha Mts (NATCHEVA and GANEVA 2005), and from Greece (DÜLL 1995).

Paraleucobryum sauteri (Bruch et Schimp.) Loeske is a sub-Atlantic, montane moss (DÜLL 1984). In SE Europe it is reported from Bulgaria, where it has only a pre-1956 literature record from the Vitosha Mts (NATCHEVA and GANEVA 2005), and from almost all former Yugoslavian countries such as Bosnia-Herzegovina, Montenegro, Croatia, Slovenia (DÜLL et al. 1999, MARTINČIČ 2003).

Philonotis arnellii Husn. is a sub-Atlantic, montane moss (DÜLL 1985). In SE Europe it is reported from Bulgaria (NATCHEVA and GANEVA 2005), Romania (SABOVLJEVIĆ et al. in press) and from almost all former Yugoslavian countries (DÜLL et al. 1999, MARTINČIČ 2003).

Pohlia bulbifera (Warnst.) Warnst. is a sub-Atlantic species (DÜLL 1985). In SE Europe it is mentioned as doubtfully recorded from Croatia (DÜLL et al. 1999), and it is reported from Romania (SABOVLJEVIĆ et al. in press) and Slovenia (MARTINČIČ 2003).

Pohlia longicolla (Hedw.) Lindb. is a subarctic, subalpine moss (DÜLL 1985). In SE Europe it is reported from Bulgaria, where it has only a pre-1956 literature record from the Vitosha Mts (NATCHEVA and GANEVA 2005), and from Montenegro and Slovenia (DÜLL et al. 1999, MARTINČIČ 2003). It is also doubtfully recorded from Greece (DÜLL 1995).

Pohlia nutans (Hedw.) Lindb. subsp. schimperi (Müll. Hal.) Nyholm was a neglected taxon in Central Europe, but has recently been published from Poland, Czech Republic and Austria (KÖCKINGER et al. 2005). Being new to the Balkan Peninsula, it represents a considerable extension of its range of distribution.
Racomitrium lanuginosum (Hedw.) Brid. is a boreal, montane species (DÜLL 1984). In SE Europe it is known from Bulgaria, Greece, Bosnia-Herzegovina, Montenegro, Slovenia (NATCHEVA and GANEVA 2005, DÜLL 1995, DÜLL et al. 1999, MARTINČIČ 2003).

Schistidium papillosum Culm. is a boreo-arctic, montane species (SMITH 2004). Apart from a doubtful record in Slovenia (MARTINČIČ 2003), in SE Europe it is known from Romania (SABOVLJEVIĆ et al. in press) and Bulgaria (Rila Mts) (BLOM 1996).

Timmia bavarica Hessl. is a subcontinental, dealpine element (DÜLL 1984). It is reported by MARTINČIČ (2006) from Prokletije Mts (Serbia, Montenegro), but it is not clear, whether it was found on the territory of Serbia or Montenegro. It is known from many SE European countries such as Albania (COLACINO and SABOVLJEVIĆ 2006), Bulgaria (NATCHEVA and GANEVA 2005), Greece (DÜLL 1995), Bosnia-Herzegovina, Montenegro, Croatia, Macedonia, Slovenia (DÜLL et al. 1999, MARTINČIČ 2003).

One species, Cynodontium tenellum (Schimp.) Limpr., collected on the Bulgarian side of Midzor peak is a new record for Bulgaria (NATCHEVA and GANEVA 2005). It is a boreal, montane species (DÜLL 1984). In SE Europe it is reported from Bosnia-Herzegovina (DÜLL et al. 1999) and Slovenia (MARTINČIČ 2003). It was reported by us (PAPP and ERZBERGER 2005) for the first time in Serbia from the Golija-Studenica Biosphere Reserve.

List of taxa collected in the Serbian side of the Stara Planina Mts

Species names are followed by the locality numbers and the substrates.

**Hepaticae**

*Anastrophyllum minutum* (Schreb.) R. M. Schust. – 1, 2, 11, 12: sandstone rocks, rock crevices

*Aneura pinguis* (L.) Dumort. – 9: on wet soil

*Apometzgeria pubescens* (Schrank) Kuwah. – 1, 3, 12: sandstone rocks, rock crevices

*Barbilophozia floerkei* (F. Weber et D. Mohr) Loeske – 1, 15: sandstone rocks, rock crevices

*Barbilophozia batcheri* (A. Evans) Loeske – 1, 2, 10, 11: sandstone rocks, rock crevices; 4: at the edge of the forest
Barbilophozia lycopodioides (Wallr.) Loeske – 11, 15: sandstone rocks, rock crevices
Bazzania tricrenata (Wahlenb.) Lindb. – 1, 12: sandstone rocks, rock crevices
Blepharostoma trichophyllum (L.) Dumort. – 11, 12: sandstone rocks, rock crevices
Cephaloziella divaricata (Sm.) Schiffn. – 2, 6, 10, 12: sandstone rocks, rock crevices; 4: at the edge of the forest; 15: on soil
Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dumort. – 4: on wet soil; 19: sandstone rocks at the stream
Chiloscyphus polyanthus (L.) Corda – 3: wet sandstone rocks; 8: at the stream
Conocephalum conicum (L.) Dumort. – 1: sandstone rocks, rock crevices; 3, 19: wet sandstone rocks; 8: at the stream
Diplophyllum albicans (L.) Dumort. – 1: sandstone rocks, rock crevices
Frullania dilatata (L.) Dumort. – 1, 3, 5: on the bark of Fagus; 7: on the bark of Juglans; 8: on the bark of Quercus; 16: on the bark of Populus
Frullania tamarisci (L.) Dumort. – 1: sandstone rocks, rock crevices
Gymnocalyce inflata (Huds.) Dumort. – 1: sandstone rocks, rock crevices (det. Váha)
Gymnomitrium concinnatum (Lightf.) Corda – 1, 2: sandstone rocks, rock crevices
Jungermannia hyalina Lyell – 17: on soil near waterfall (det. Váha)
Jungermannia pumila With. – 3: wet sandstone rocks (det. Váha)
Leiocolea badensis (Gotische) Jörg. – 16: limestone rocks (det./conf. Váha)
Leiocolea collaris (Nees) Schljakov – 1, 3: sandstone rocks, rock crevices
Leiocolea heterocolpos (Thed. ex Hartm.) H. Buch – 1, 3, 11: sandstone rocks, rock crevices (det./conf. Váha)
Lepiodes cavifolia (Ehrh.) Lindb. – 1, 3, 10, 12: sandstone rocks, rock crevices
Lophocolea bidentata (L.) Dumort. var. bidentata – 18: wet sandstone rocks
Lophocolea heterophylla (Schrad.) Dumort. – 1: sandstone rocks, rock crevices; 1, 3: on the bark of Fagus; 1, 3: on decaying wood; 13: on soil; 16: limestone rocks at the stream
Lophocolea minor Nees – 1, 3: sandstone rocks, rock crevices; 16: limestone rocks; 17: on soil
Lophozia ascendens (Warnst.) R. M. Schust. – 3: on decaying wood
Lophozia bicrenata (Schmidel ex Hoffm.) Dumort. – 17: on soil (conf. Váha)
Lophozia excisa (Dicks.) Dumort. – 10: sandstone rocks, rock crevices (det. Váha)
Lophozia incisa (Schrad.) Dumort. – 12: sandstone rocks, rock crevices
Lophozia longidens (Lindb.) Macoun – 1, 2, 12: sandstone rocks, rock crevices
Lophozia obtusa (Lindb.) A. Evans – 10: sandstone rocks, rock crevices
Lophozia sudetica (Nees ex Huebener) Grolle – 1, 15: sandstone rocks, rock crevices (det./conf. Váha)
Lophozia ventricosa (Dicks.) Dumort. – 1, 10, 11, 12: sandstone rocks, rock crevices; 18: wet sandstone rocks (det./conf. Váha)
Marchantia polymorpha L. subsp. polymorpha – 4, 7: at the stream; 9: on wet soil; 19: sandstone rocks at the stream
Marchantia polymorpha L. subsp. montivagans Bisch. et Boisselier – 3: wet sandstone rocks; 4, 9: on wet soil
Marchantia polymorpha L. subsp. ruderalis Bisch. et Boisselier – 3, 4: on wet soil

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Marsupella emarginata (Ehrh.) Dumort. – 18: wet sandstone rocks (det. Váňa)
Marsupella junckii (F. Weber et D. Mohr) Dumort. – 1: sandstone rocks, rock crevices (det. Váňa)
Metzgeria conjugata Lindb. – 1, 3: sandstone rocks, rock crevices
Metzgeria furcata (L.) Dumort. – 1, 10, 14: sandstone rocks, rock crevices; 3: on the bark of Fagus
Peltia endiviifolia (Dicks.) Dumort. – 4: bank of stream; 6: sandstone rocks, rock crevices; 8: at the stream; 16: limestone rocks at a waterfall; 17, 19: sandstone rocks at the stream
Plagiochila porelloides (Torrey ex Nees) Lindenb. – 1, 2, 3, 10, 11, 16: sandstone rocks, rock crevices; 5: on the bark of Fagus; 17, 18: sandstone rocks at the stream
Porella cordaeana (Huebner) Mohr – 1, 10: sandstone rocks, rock crevices; 3, 14: wet sandstone rocks, 3, 5: on the bark of Fagus; 19: on the bark of Salix
Porella platyphylla (L.) Pfeiff. – 3: shaded sandstone rock
Preissia quadrata (Scop.) Nees – 1, 3: sandstone rocks, rock crevices
Radula complanata (L.) Dumort. – 1, 3, 10, 11, 12: sandstone rocks, rock crevices; 3: on the bark of Fagus
Radula lindenbergiana Gottsch. ex C. Hartm. – 1: sandstone rocks, rock crevices (conf. Váňa)
Reboulia hemisphaerica (L.) Raddi – 6: sandstone rocks, rock crevices
Riccia glauca L. – 17: on soil
Riccia gougetiana Durieu et Mont. – 10: sandstone rocks, rock crevices (det./conf. Váňa)
Riccia sororcarpa Bisch. – 10: sandstone rocks, rock crevices
Scapania aequiloba (Schwägr.) Dumort. – 1, 3: sandstone rocks, rock crevices (conf. Váňa)
Scapania lingulata H. Buch – 17: sandstone rocks at the stream (conf. Váňa)
Scapania nemorea (L.) Grolle – 18: wet sandstone rocks
Scapania undulata (L.) Dumort. – 3: wet sandstone rocks
Tritomaria exsecta (Schmidel) Loeske – 1, 2, 11: sandstone rocks, rock crevices
Tritomaria quinquedentata (Huds.) H. Buch – 1, 2, 11, 12: sandstone rocks, rock crevices; 18: wet sandstone rocks

Musci

Abietinella abietina (Hedw.) M. Fleisch. – 4: on soil at the edge of forest, 16: on soil
Aloina aloides (Koch ex Schultz) Kindb. – 6: on basic soil over black schistose rock
Aloina rigida (Hedw.) Limpr. – 6: sandstone rocks, rock crevices
Amblystegium serpens (Hedw.) Schimp. – 3: at the base of Fagus; 16, 17: limestone rocks at the stream; 19: on the bark of Salix
Amblystegium subtile (Hedw.) Schimp. – 3: on the bark of Fagus (conf. Klawitter)
Amphidium mougeotii (Schimp.) Schimp. – 1, 3, 5, 10, 11, 12: sandstone rocks, rock crevices
Andreae rupestris Hedw. – 1, 2: sandstone rocks, rock crevices
Anomodon attenuatus (Hedw.) Huebener – 3, 13: sandstone rocks, rock crevices

Anomodon longifolius (Schleicher ex Brid.) Hartm. – 3: sandstone rocks, rock crevices

Anomodon rugelii (Müll. Hal.) Keissl. – 1, 3: sandstone rocks, rock crevices

Anomodon viticulosus (Hedw.) Hook. et Taylor – 16: limestone rocks at the stream; 19: on the bark of Salix

Antitrichia curtipendula (Hedw.) Brid. – 1, 3: sandstone rocks, rock crevices

Atrichum undulatum (Hedw.) P. Beauv. – 1: sandstone rocks, rock crevices; 3: wet sandstone rocks; 17: on soil

Aulacomnium palustre (Hedw.) Schwägr. – 15: on soil

Barbula unguiculata Hedw. – 6: sandstone rocks, rock crevices, 16: calcareous soil

Bartramia walleriana Hedw. – 1, 2, 3, 11: sandstone rocks, rock crevices

Bartramia ithyphylla Brid. – 1, 2, 5, 10, 11, 12, 18: sandstone rocks, rock crevices

Bartramia pomiformis Hedw. – 5, 17: sandstone rocks, rock crevices; 18: wet sandstone rocks

Brachytheciastrum velutinum (Hedw.) Ignatov et Huttunen – 1, 3, 5, 10, 14: sandstone rocks, rock crevices, soil, base of Fagus

Brachythecium albicans (Hedw.) Schimp. – 8: at the stream; 12: sandstone rocks, rock crevices

Brachythecium geheebii Mild – 1, 10: sandstone rocks, rock crevices

Brachythecium glareosum (Bruch ex Spruce) Schimp. – 1, 3: sandstone rocks, rock crevices; 4: on soil at the edge of forest; 16: limestone rocks at the stream

Brachythecium rivulare Schimp. – 1: sandstone rocks, rock crevices; 3, 14, 19: wet sandstone rocks; 4: on wet soil; 8: at the stream; 16: on wet calcareous rock

Brachythecium rutabulum (Hedw.) Schimp. – 14: sandstone rocks, rock crevices; 17: on soil and sandstone rocks at the stream; 19: on the bark of Salix

Brachythecium salebrosum (Hoffm. ex F. Weber et D. Mohr) Schimp. – 3: shaded boulder

Brachythecium tommasinii (Sendtn. ex Boulay) Ignatov et Huttunen – 3: sandstone rocks, rock crevices

Bryoerythrophyllum recurvirostrum (Hedw.) P. C. Chen – 3, 10, 12: sandstone rocks, rock crevices; 6: on basic soil over black schistose rock; 17: sandstone rocks at the stream; 19: on the bark of Salix

Bryum alpinum Huds. ex With. – 2, 6, 10: sandstone rocks, rock crevices

Bryum argenteum Hedw. – 6: sandstone rocks, rock crevices

Bryum caespiticium Hedw. – 1: on soil; 6, 12: sandstone rock crevices

Bryum capillare Hedw. – 1, 6: on base-rich soil; 16: limestone rocks; 18: on wet rocks

Bryum dichotomum Hedw. – 5, 6: on soil

Bryum elegans Nees – 1: sandstone rock crevices

Bryum moravicum Podp. – 1, 3, 5, 10, 14: sandstone rocks, rock crevices; 1, 3, 4, 5: on the bark of Fagus; 16: limestone rocks at the stream

Bryum neodamense Itzigs. – 15: on soil

Bryum pallens Sw. ex anon. – 4: on wet soil; 6: sandstone rocks, rock crevices

Bryum pallescens Schleicher ex Schwägr. – 3: sandstone rock crevices (det. Schröder)
Bryum pseudotriquetrum (Hedw.) P. Gaertn. et al. – 4, 9: on wet soil; 6, 10: sandstone rocks, rock crevices; 7: at the stream; 16: limestone rocks at the stream

Bryum rubens Mitt. – 9: on wet soil

Bryum schleicheri DC. – 4: on wet soil

Calliergonella cuspidata (Hedw.) Loeske – 4, 8, 9: on wet soil; 6: sandstone rocks, rock crevices; 16: on moist calcareous soil

Campyliadelphus chrysophyllus (Brid.) R. S. Chopra – 10, 12: sandstone rocks, rock crevices

Campylium stellatum (Hedw.) Lange et C. E. O. Jensen – 1, 3: sandstone rocks, rock crevices; 4: on wet soil

Campylophyllum calcareum (Crundw. et Nyholm) Hedenäs – 17: sandstone rocks at the stream

Ceratodon purpureus (Hedw.) Brid. – 1, 2, 10: sandstone rocks, rock crevices; 4: at the edge of the forest; 5, 6, 15: on soil; 8: at the stream

Cinclidotus fontinaloides (Hedw.) P. Beauv. – 19: sandstone rocks at the stream

Cirriphyllum crassinervium (Taylor) Loeske et M. Fleisch. – 14: sandstone rocks, rock crevices

Climacium dendroides (Hedw.) F. Weber et D. Möhr – 7: at the stream; 9: on wet soil; 17: on soil

Coscinodon cribrosus (Hedw.) Spruce – 6: schistose rock (conf. E. Maier)

Cratoneuron filicinum (Hedw.) Spruce – 3, 6: sandstone rocks, rock crevices; 16: moist calcareous rock; 17: sandstone rocks at the stream

Crossidium squamiferum (Viv.) Jur. – 6: sandstone rocks, rock crevices

Ctenidium molluscum (Hedw.) Mitt. – 1, 3: sandstone rocks, rock crevices; 16: limestone rocks

Cynodontium bruntonii (Sm.) Bruch et Schimp. – 18: wet sandstone rocks

Cynodontium gracilescens (F. Weber et D. Mohr) Schimp. – 5: sandstone rocks, rock crevices

Cynodontium polycarpon (Hedw.) Schimp. – 11: sandstone rocks

Cynodontium struniferum (Hedw.) Lindb. – 1, 11: sandstone rocks

Cynodontium tenellum (Schimp.) Limpr. – 5, 10: sandstone rocks, rock crevices

Dichodontium pellucidum (Hedw.) Schimp. – 3: wet sandstone rocks, rock crevices

Dicranella heteromalla (Hedw.) Schimp. – 1: sandstone rocks, rock crevices; 18: wet sandstone rocks

Dicranella schreberiana (Hedw.) Dixon – 9: on wet soil

Dicranella staphylina H. Whitehouse – 17: on soil

Dicranella varia (Hedw.) Schimp. – 16: limestone rocks

Dicranodontium denudatum (Brid.) E. Britton – 18: wet sandstone rocks

Dicranoweisia crispula (Hedw.) Mildc – 1, 2, 3, 5, 11, 12, 15: sandstone rocks, rock crevices

Dicranum scoparium Hedw. – 1, 2, 3, 10, 11, 12, 18: sandstone rocks, rock crevices

Dicranum spadiceum J. E. Zetterst. – 11: sandstone rocks, rock crevices

Didymodon fallax (Hedw.) R. H. Zander – 16: on soil; 17: sandstone rocks at the stream

Didymodon luridus Hornsch. – 6: sandstone rocks, rock crevices; 17: sandstone rocks at the stream
Didymodon rigidulus Hedw. - 6: sandstone rocks, rock crevices; 16: limestone rocks at the stream

Didymodon tophaceus (Brid.) Lisa - 6: sandstone rocks, rock crevices

Didymodon vinealis (Brid.) R. H. Zander - 17: sandstone rocks at the stream

Distichium capillaceum (Hedw.) Bruch et Schimp. - 1, 3, 12: sandstone rocks, rock crevices

Distichium flexicaule (Schwägr.) Hampe - 12: sandstone rocks, rock crevices, 16: on soil

Distichium gracile (Mitt.) Kuntze - 3, 11, 12: sandstone rocks, rock crevices

Distichium heteromallum (Hedw.) E. Britton - 1: sandstone rocks, rock crevices

Distichium pusillum (Hedw.) Hampe - 1, 2: sandstone rocks, rock crevices

Drepanoclados aduncus (Hedw.) Warnst. - 15: on soil

Encalypta ciliata Hedw. - 3, 5, 10: sandstone rocks, rock crevices

Encalypta microstoma Bals.-Criv. et De Not. - 10, 11: sandstone rocks, rock crevices

Encalypta rhaptocarpa Schwägr. - 12: sandstone rocks, rock crevices

Encalypta streptocarpa Hedw. - 3, 6, 10: sandstone rocks, rock crevices; 16: limestone rocks

Encalypta vulgaris Hedw. - 6: sandstone rocks, rock crevices

Eucladium verticillatum (With.) Bruch et Schimp. - 1, 6: sandstone rocks, rock crevices; 16, 17: limestone rocks at waterfalls

Eurhynchiastrum pulchellum (Hedw.) Ignatov et Huttunen var. diversifolium (Schimp.) Ochyra et Zarnowiec - 1, 10, 15: sandstone rocks, rock crevices

Fissidens crassipes Wilson ex Bruch et Schimp. subsp. warnstorffii (M. Fleisch.) Brugg.-Nann. - 17: sandstone rocks at the stream

Fissidens dubius P. Beauv. - 1: sandstone rocks, rock crevices; 16: limestone rocks at the stream

Fissidens gracilifolius Brugg.-Nann. et Nyholm - 16: limestone rocks at the stream

Fissidens pusillum (Wilson) Mildé - 19: sandstone rocks at the stream

Fissidens taxifolius Hedw. - 9: on wet soil; 17: on soil

Fontinalis antipyretica Hedw. - 8: at the stream

Funaria hygrometrica Hedw. - 5: sandstone rocks, rock crevices

Grimmia alpestris (F. Weber et D. Mohr) Schleich. - 2, 6, 10, 15: sandstone rocks, rock crevices (conf. E. Maier)

Grimmia caespiticia (Brid.) Jur. - 6, 15: sandstone rocks, rock crevices

Grimmia elatior Bruch ex Bals.-Criv. et De Not. - 1, 2, 10, 11: sandstone rocks, rock crevices (conf. E. Maier)

Grimmia funalis (Schwägr.) Bruch et Schimp. - 1, 2, 3, 11: sandstone rocks, rock crevices (conf. E. Maier)

Grimmia hartmannii Schimp. - 1, 2, 3, 5, 10, 14: sandstone rocks, rock crevices (conf. E. Maier)

Grimmia laevigata (Brid.) Brid. - 6, 10, 18: sandstone rocks, rock crevices (conf. E. Maier)

Grimmia longirostris Hook. - 5: sandstone rock outcrops (det. E. Maier)

Grimmia muehlenbeckii Schimp. - 1, 2, 10: sandstone rocks, rock crevices (conf. E. Maier)

Grimmia ovalis (Hedw.) Lindb. - 2, 5, 10, 11, 18: sandstone rocks, rock crevices (conf. E. Maier)

Grimmia pulvinata (Hedw.) Sm. - 6, 18: sandstone rocks, rock crevices; 16: limestone rocks

Grimmia tergestina Tomm. ex Bruch et Schimp. - 6: on basic rocks (rev. E. Maier)
Grimmia torquata Drumm. – 1: sandstone rocks, rock crevices
Grimmia unicolor Hook. – 12: sandstone rocks, rock crevices
Gymnostomum calceareum Nees et Hornsch. – 3, 6: sandstone rocks, rock crevices; 16: limestone rocks
Hedwigia ciliata (Hedw.) P. Beauv. var. ciliata – 1, 5, 7, 9, 10, 11: sandstone rocks, rock crevices
Hedwigia ciliata (Hedw.) P. Beauv. var. leucophaea Bruch et Schimp. – 5, 10, 14: sandstone rocks, rock crevices
Herzogiella seligeri (Brid.) Z. Iwats. – 1: sandstone rocks, rock crevices; 1, 3: on decaying wood
Heterocladium dimorphum (Brid.) Schimp. – 1, 10, 11, 12: sandstone rocks, rock crevices
Homalia trichomanoides (Hedw.) Brid. – 1: sandstone rocks, rock crevices
Homalothecium lutescens (Hedw.) H. Rob. – 1, 10, 16, 17: on soil
Homalothecium philippeanum (Spruce) Schimp. – 1, 2, 3, 10, 14: sandstone rocks, rock crevices
Homalothecium sericeum (Hedw.) Schimp. – 6, 10: sandstone rocks, rock crevices; 16: limestone rocks; 19: on the bark of Salix
Hygroamblystegium fluviatile (Hedw.) Loeske – 8: at the stream; 19: sandstone rocks at the stream
Hygroamblystegium tenax (Hedw.) Jenn. – 3, 14, 17: wet sandstone rocks
Hygroamblystegium varium (Hedw.) Mönk. – 16: limestone rocks at the stream
Hygrohypnum luridum (Hedw.) Jenn. – 17: sandstone rocks at the stream
Hylocomiastrum pyrenaicum (Spruce) M. Fleisch. – 2: sandstone rocks, rock crevices
Hylocomium splendens (Hedw.) Schimp. – 1: sandstone rocks, rock crevices; 9: on wet soil; 10, 11, 17, 18: on soil
Hyphnum cupressiforme Hedw. var. cupressiforme – 1, 2, 10, 11, 12, 14: sandstone rocks, rock crevices; 7: on the bark of Juglans; 16, 17: on soil; 18: wet sandstone rocks; 19: on the bark of Salix
Hyphnum cupressiforme Hedw. var. lacunosum Brid. – 1, 2, 6, 10: sandstone rocks, rock crevices
Hyphnum cupressiforme Hedw. var. subjulaceum Molendo – 1, 11: sandstone rocks, rock crevices
Hyphnum hamulosum Schimp. – 11: sandstone rocks, rock crevices
Hyphnum revolutum (Mitt.) Lindb. – 11: sandstone rocks, rock crevices
Isopterygiopsis pulchella (Hedw.) Z. Iwats. – 3, 12: sandstone rocks, rock crevices
Isothecium alopecuroides (Lam. ex Dubois) Isov. – 1, 2, 3, 11, 14: sandstone rocks, rock crevices; 5: on the bark of Fagus
Isothecium myosuroides Brid. subsp. myosuroides – 11: sandstone rocks, rock crevices
Leptobryum pyriforme (Hedw.) Wilson – 17: on soil
Leptodictyum riparium (Hedw.) Warnst. – 7: at the stream
Lescuraea saxicola (Schimp.) Molendo – 1: sandstone rocks, rock crevices; 5: on the bark of Fagus
Leskea polycarpa Hedw. – 16: on the bark of Populus and Juglans

Leucodon sciuroides (Hedw.) Schwägr. – 3, 4, 5: on the bark of Fagus; 7: on the bark of Juglans; 10, 14: sandstone rocks, rock crevices; 16: on the bark of Populus and Prunus cerasus

Mnium lycopedioides Schwägr. – 1, 3: sandstone rocks, rock crevices
Mnium marginatum (Dicks.) P. Beauv. – 1: sandstone rocks, rock crevices
Mnium spinosum (Voit) Schwägr. – 1, 11: sandstone rocks, rock crevices
Mnium spinulosum Bruch et Schimp. – 12: sandstone rocks, rock crevices
Mnium stellare Hedw. – 1, 3, 11, 12, 18: sandstone rocks, rock crevices; 17: sandstone rocks at the stream
Mnium thomsonii Schimp. – 1, 11, 12: sandstone rocks, rock crevices
Myurella julacea (Schwägr.) Schimp. – 12: sandstone rocks, rock crevices
Neckera besseri (Lobarz.) Jur. – 1, 14: sandstone rocks, rock crevices; 16: limestone rocks at the stream
Neckera complanata (Hedw.) Huebener – 1: sandstone rocks, rock crevices; 16: limestone rocks
Neckera crispa Hedw. – 1: sandstone rocks, rock crevices; 16: limestone rocks
Neckera menziesii Drumm. – 1: sandstone rocks, rock crevices
Orthothecium intricatum (Hartm.) Schimp. – 1, 3: sandstone rocks, rock crevices
Orthotrichum affine Schrad. ex Brid. – 7: on the bark of Juglans; 16: on the bark of Juglans, Populus and Prunus cerasus; 8, 19: on the bark of Salix
Orthotrichum anomalum Hedw. – 6, 10: sandstone rocks, rock crevices; 16: limestone rocks
Orthotrichum cupulatum Hoffm. ex Brid. var. cupulatum – 6: black schistose rocks; 10, 13, 14: sandstone rocks, rock crevices; 16: limestone rocks
Orthotrichum obtusifolium Brid. – 5: on the bark of Fagus; 13: on the bark of Sambucus
Orthotrichum pallens Bruch ex Brid. – 3, 4, 5: on the bark of Fagus; 13: on the bark of Sambucus
Orthotrichum rupestre Schleich. ex Schwägr. – 10, 11: sandstone rocks, rock crevices
Orthotrichum stramineum Hornsch. ex Brid. – 3, 5, 13: on the bark of Fagus
Orthotrichum striatum Hedw. – 5, 13: on the bark of Fagus; 16: on the bark of Prunus cerasus; 19: on the bark of Salix
Orthotrichum urnigerum Myrin – 10: sandstone rocks, rock crevices; 14: sandstone rocks at the stream
Oxyrrhynchium hians (Hedw.) Loeske – 16: limestone rocks at the stream
Oxystegus tenuirostris (Hook. et Taylor) A. J. E. Sm. – 3: sandstone rocks at the stream (det. Klawitter)
Palustriella commutata (Hedw.) Ochyra – 16, 17: limestone rocks at waterfalls
Palustriella decipiens (De Not.) Ochyra – 4: on wet soil
Paraleucobryum longifolium (Hedw.) Loeske – 1: sandstone rocks, rock crevices and at base of Fagus; 3: at base of Fagus
Paraleucobryum sauteri (Bruch et Schimp.) Loeske – 1: sandstone rocks

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Philonotis arnellii Husn. - 17: on soil
Philonotis calcarea (Bruch et Schimp.) Schimp. - 4, 9, 10: on wet soil
Philonotis fontana (Hedw.) Brid. - 1, 10, 12: sandstone rocks, rock crevices; 4, 9: on wet soil; 7: at the stream
Philonotis marchica (Hedw.) Brid. - 6: sandstone rocks, rock crevices; 16: near waterfall
Philonotis seriata Mitt. - 4: on wet soil
Plagiobryum zierii (Hedw.) Lindb. - 1, 2, 10, 11: sandstone rocks, rock crevices
Plagiomnium affine (Blandow ex Funck) T. J. Kop. - 4, 13: on soil
Plagiomnium elatum (Bruch et Schimp.) T. J. Kop. - 4, 9: on wet soil
Plagiomnium ellipticum (Brid.) T. J. Kop. - 16: limestone rocks at a waterfall
Plagiomnium rostratum (Schrad.) T. J. Kop. - 3: wet sandstone rocks; 8: at the stream; 16: limestone rocks at the stream
Plagiomnium undulatum (Hedw.) T. J. Kop. - 1, 3, 6: wet sandstone rocks; 8: at the stream; 17, 18, 19: sandstone rocks at the stream
Plagiothecium cavifolium (Brid.) Z. Iwats. - 1, 10, 12: sandstone rocks, rock crevices
Plagiothecium denticulatum (Hedw.) Schimp. var. denticulatum - 1, 3, 10: sandstone rocks, rock crevices
Plagiothecium denticulatum (Hedw.) Schimp. var. obtusifolium (Turner) Moore - 1, 3: sandstone rocks, rock crevices
Plagiothecium laetum Schimp. - 3: at the stream
Plagiothecium nemorale (Mitt.) A. Jaeger - 1: sandstone rocks, rock crevices
Plagiothecium succulentum (Wilson) Lindb. - 1, 3: sandstone rocks, rock crevices
Plasteurhynchium striatulum (Spruce) M. Fleisch. - 1: sandstone rocks, rock crevices; 16: limestone rocks at the stream
Platyhypnidium riparioides (Hedw.) Dixon - 3, 6, 8: at the stream, 14, 17, 19: wet sandstone rocks; 16: limestone rocks at a waterfall
Pleuridium acuminatum Lindb. - 5: on soil
Pleurochaete squarrosa (Brid.) Lindb. - 6: sandstone rocks, rock crevices
Pleurozium schreberi (Willd. ex Brid.) Mitt. - 1, 10: sandstone rocks, rock crevices, 16: on soil; 18: wet sandstone rocks
Pogonatum aloides (Hedw.) P. Beauv. - 1: on soil; 18: wet sandstone rocks
Pogonatum nanum (Hedw.) P. Beauv. - 5: on soil
Pogonatum urnigerum (Hedw.) P. Beauv. - 1: on soil over sandstone rocks, in rock crevices
Pobbia andalusica (Höhn.) Broth. - 10, 12: on soil over sandstone rocks, rock crevices
Pobbia bulbifera (Warnst.) Warnst. - 10: on soil
Pobbia cruda (Hedw.) Lindb. - 1, 2, 5, 10, 11: sandstone rocks, rock crevices
Pobbia elongata Hedw. - 5: on soil
Pobbia longicolla (Hedw.) Lindb. - 1, 11, 12, 15: sandstone rocks, rock crevices
Pobbia lutescens (Limpr.) H. Lindb. - 1: sandstone rocks, rock crevices; 5, 13, 17: on soil
Pobbia melanodon (Brid.) A. J. Shaw - 16: on soil

Contributions to the Bryophytes of Western Stara Planina Mts
Pohlia nutans (Hedw.) Lindb. subsp. nutans – 1, 2, 10, 11: sandstone rocks, rock crevices
Pohlia nutans (Hedw.) Lindb. subsp. schimperi (Müll. Hal.) Nyholm – 1, 10, 11: sandstone rocks, rock crevices; 15: on soil
Pohlia wahlenbergii (F. Weber et D. Mohr) A. L. Andrews – 16, 17: limestone rocks at a waterfall
Polytrichastrum alpinum (Hedw.) G. L. Sm. – 1, 2, 5, 11, 12, 18: sandstone rocks, rock crevices
Polytrichastrum formosum (Hedw.) G. L. Sm. – 1, 2: sandstone rocks, rock crevices; 15, 17: on soil
Polytrichum commune Hedw. – 18: wet sandstone rocks
Polytrichum juniperinum Hedw. – 2, 4, 10: sandstone rocks, rock crevices
Polytrichum piliferum Hedw. – 1, 2, 6, 10, 12, 18: sandstone rocks, rock crevices
Pseudoleskea incurvata (Hedw.) Loeske – 1, 11, 15: sandstone rocks, rock crevices
Pseudoleskea patens (Lindb.) Kindb. – 1, 3: sandstone rocks, rock crevices
Pseudoleskea radicosa (Mitt.) Macoun et Kindb. – 1, 3, 5, 15: sandstone rocks, rock crevices
Pseudoleskea saviana (De Not.) Latzel – 3: on the bark of Fagus (conf. H. Köckinger)
Pseudoleskeella catenulata (Brid. ex Schrad.) Kindb. – 10, 12: sandstone rocks, rock crevices
Pseudoleskeella nervosa (Brid.) Nyholm – 1, 2, 10, 14: sandstone rocks, rock crevices; 1: on decaying wood; 3, 4, 5: on the bark of Fagus
Pseudoscleropodium purum (Hedw.) M. Fleisch. – 16: on soil
Pseudotaxiphyllum elegans (Brid.) Z. Iwats. – 18: wet sandstone rocks
Pterigynandrum filiforme Hedw. – 1, 2, 3, 10, 12, 14: sandstone rocks, rock crevices; 1, 4, 5: on the bark of Fagus, 1: on decaying wood
Racomitrium aciculare (Hedw.) Brid. – 3, 18: wet sandstone rocks
Racomitrium affine (F. Weber et D. Mohr) Lindb. – 1: exposed sandstone rocks; 2: sandstone rocks, rock crevices; 17, 18: wet sandstone rocks (det./conf. F. Müller)
Racomitrium aquaticum (Brid. ex Schrad.) Brid. – 1: sandstone rocks, rock crevices
Racomitrium canescens (Hedw.) Brid. – 2, 10: sandstone rocks, rock crevices; 8: at the stream
Racomitrium ericoides (Brid.) Brid. – 12: sandstone rocks, rock crevices
Racomitrium heterostichum (Hedw.) Brid. – 1, 2: sandstone rocks, rock crevices; 17, 18: wet sandstone rocks (rev./conf. F. Müller)
Racomitrium lanuginosum (Hedw.) Brid. – 1, 2, 11: sandstone rocks, rock crevices
Racomitrium sudeticum (Funck) Bruch et Schimp. – 2: sandstone rocks, rock crevices; 18: wet sandstone rocks (rev./conf. F. Müller)
Rhabdoweisia fugax (Hedw.) Bruch et Schimp. – 18: wet sandstone rocks
Rhizomnium punctatum (Hedw.) T. J. Kop. – 1, 3, 5: sandstone rocks, rock crevices; 1: on decaying wood; 18: wet sandstone rocks
Rhytidiadelphus squarrosus (Hedw.) Warnst. – 9: on wet soil
Rhytidiadelphus triquetrus (Hedw.) Warnst. – 1, 11: sandstone rocks, rock crevices; 18: wet sandstone rocks
Rhytidium rugosum (Hedw.) Kindb. – 10: sandstone rocks, rock crevices
Saelania glaucescens (Hedw.) Broth. – 11: sandstone rocks, rock crevices
Sanionia uncinata (Hedw.) Loeske – 1, 2, 3, 11, 15: sandstone rocks, rock crevices; 3: on the bark of Fagus; 18: wet sandstone rocks
Schistidium apocarpum (Hedw.) Bruch et Schimp. – 3, 7, 10, 14: sandstone rocks; 16: on soil over calcareous rock (conf./det. W. Schröder)
Schistidium confor tum (Funck) Bruch et Schimp. – 2, 10: sandstone rocks, rock crevices (conf. W. Schröder)
Schistidium flaccidum (De Not.) Ochyra – 10: sandstone rocks, rock crevices (conf. W. Schröder)
Schistidium papillosum Culm. – 1, 5, 10, 11, 12: sandstone rocks, rock crevices (conf. W. Schröder)
Schistidium Pruinosum (Wilson ex Schimp.) G. Roth – 10, 12: sandstone rocks, rock crevices (conf./det. W. Schröder)
Sciuro-hypnum populeum (Hedw.) Ignatov et Huttunen – 1, 10: sandstone rocks, rock crevices; 3, 19: sandstone rocks at the stream
Sciuro-hypnum reflexum (Starke) Ignatov et Huttunen – 1, 3, 11, 15: sandstone rocks, rock crevices
Sciuro-hypnum starkei (Brid.) Ignatov et Huttunen – 1: sandstone rocks, rock crevices
Syntrichia laevipila Brid. – 16: calcareous soil near waterfall
Syntrichia montana Nees – 10: sandstone rocks, rock crevices
Syntrichia ruralis (Hedw.) F. Weber et D. Mohr – 1, 3, 6, 10, 14, 18: sandstone rocks, rock crevices; 3: on the bark of Fagus; 16: on calcareous soil
Syntrichia virescens (De Not.) Ochyra – 10: sandstone rocks, rock crevices
Taxiphyllum wissgrillii (Garov.) Wijk et Margad. – 1, 3: sandstone rocks, rock crevices
Thuidium assimile (Mitt.) A. Jaeger – 16: on soil
Thuidium recognitum (Hedw.) Lindb. – 9, 17: on soil
Thuidium tamariscinum (Hedw.) Schimp. – 18: wet sandstone rocks
Timmia austriaca Hedw. – 1, 11: sandstone rocks, rock crevices
Timmia bavarica Hessl. – 1, 3: sandstone rocks, rock crevices
Tortella fragilis (Hook. et Wilson) Limpr. – 12: sandstone rocks, rock crevices
Tortella tortuosa (Hedw.) Limpr. – 1, 10, 12: sandstone rocks, rock crevices; 16: on soil
Tortula atrovirens (Sm.) Lindb. – 6: soil in crevices of schistose rocks
Tortula inermis (Brid.) Mont. – 6: sandstone rocks, rock crevices
Tortula lanceola R. H. Zander – 6: sandstone rocks, rock crevices
Tortula hoppeana (Schultz) Ochyra – 10, 12: sandstone rocks, rock crevices
Tortula muralis Hedw. – 6: sandstone rocks, rock crevices; 16: limestone rocks; 17: sandstone rocks at the stream
Tortula schimperi M. J. Cano, O. Werner et J. Guerra – 10, 14: sandstone rocks, rock crevices
Tortula subulata Hedw. – 10, 14, 18: sandstone rocks, rock crevices
Trichodon cylindricus (Hedw.) Schimp. – 2: sandstone rocks, rock crevices
Trichostomum brachydontium Bruch – 1, 6: sandstone rocks, rock crevices
Warnstorfia exannulata (Schimp.) Loeske – 15: on soil
Weissia condensa (Voit) Lindb. – 6, 10, 12: sandstone rocks, rock crevices
Weissia controversa Hedw. var. controversa – 10: sandstone rocks, rock crevices
Weissia controversa Hedw. var. crispata (Nees et Hornsch.) Nyholm – 10: sandstone rocks, rock crevices

List of the species collected in the Bulgarian side of the Stara Planina Mts

Locality: Midzor peak, Permian red sandstone rocks and rock crevices, 2,169 m, 43° 23' 42.7" N, 22° 40' 39.4" E, 30.06.2005.

Hepaticae

Anastrophyllum minutum (Schreb.) R. M. Schust.
Apometzgeriapubescens (Schrank) Kuwah.
Barbilophozia floerkei (F. Weber et D. Mohr) Loeske
Bazzania tricrenata (Wahlenb.) Lindb.
Fossmbronia busnotti Corb. (conf. Vána)
Frullania jackii Gottsch.
Jamesoniella autumnalis (DC.) Steph.
Jungermannia sphaerocarpa Hook. (det. Vána)
Lejeunea cavifolia (Ehrh.) Lindb.
Lophozia excisa (Dicks.) Dumort.
Lophozia incisa (Schrad.) Dumort.
Plagiochila porelloides (Torrey ex Nees) Lindemb.
Tritomaria exsecta (Schmidel) Loeske
Tritomaria quinquedentata (Huds.) H. Buch

Musci

Amphidium lapponicum (Hedw.) Schimp.
Amphidium mougeotii (Schimp.) Schimp.
Bartramia ithyphylla Brid.
Cynodontium tenellum (Schimp.) Limpr.
Dicranoweisia crispula (Hedw.) Mild

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Dicranum spadiceum J. E. Zetterst.
Distichium capillaceum (Hedw.) Bruch et Schimp.
Ditrichum gracile (Mitt.) Kuntze
Encalypt a alp ina Sm.
Encalypta ciliata Hedw.
Encalypta microstoma Bals.-Criv. et De Not.
Eurhynchias trum pulchellum (Hedw.) Ignatov et Huttunen
Grimmia alpestris (F. Weber et D. Mohr) Schleich. (conf. E. Maier)
Grimmia elatior Bruch ex Bals.-Criv. et De Not. (conf. E. Maier)
Grimmia funalis (Schwägr.) Bruch et Schimp. (conf. E. Maier)
Grimmia ovalis (Hedw.) Lindb.
Hedwigia ciliata (Hedw.) P. Beauv. var. leuco phaea Bruch et Schimp.
Heterocladium dimorphum (Brid.) Schimp.
Hylocomium splendens (Hedw.) Schimp.
Lescuraea saxicola (Schimp.) Molendo
Mnium thomsonii Schimp.
Plagiothecium laetum Schimp.
Pohlia cruda (Hedw.) Lindb.
Pohlia elongata Hedw.
Pohlia longicolla (Hedw.) Lindb.
Polytrichastrum alpinum (Hedw.) G. L. Sm.
Polytrichastrum formosum (Hedw.) G. L. Sm.
Racomitrium canescens (Hedw.) Brid.
Saelania glaucescens (Hedw.) Broth.
Schistidium confertum (Funck) Bruch et Schimp. (conf. W. Schröder)
Syntrichia ruralis (Hedw.) F. Weber et D. Mohr
Tortella tortuosa (Hedw.) Limpr.

Conservation value of the bryophyte flora
of the Stara Planina Mts

According to present knowledge, 36 species redlisted in Europe occur in Serbia (Red data book of European bryophytes, ECCB 1995, PAPP et al. in press). Of these, the following 7 species were found in the Western Stara Planina Mts: Brachythecium geheebii, Bryum neodamense, Encalypta microstoma, Grimmia caespiticia, Lophozia ascendens, Paraleucobryum sauteri, Pseudoleskea saviana. Except the last one, which is in the regionally threatened (RT) category, all of them are placed in the rare (R) category.
Part of the data concerning the populations of European redlisted species in Serbian Stara Planina were published also in PAPP et al. (in press).

**Brachythecium geheebii** Milde

A moss species listed in the rare (R) category of the Red data book of European bryophytes (ECCB 1995), it is a subcontinental-montane element (DÜLL 1985) and a European endemism (ECCB 1995). It occurs on shaded, slightly basic rocks in the high mountains of Central Europe and Norway (FREY et al. 1995, DÜLL 1985). We found it under Babin Zub, on a boulder scree and the basis of great, Permian red sandstone rocks and under Midžor peak on sandstone rock outcrops in subalpine grassland.

The species was first recorded in Serbia from the Golija-Studenica Biosphere Reserve (PAPP and ERZBERGER 2005) thus this is the second locality in Serbia. It was reported earlier from Montenegro (SABOVLJEVIĆ and STEVANOVIĆ 1999). In SE Europe it has records from Bulgaria, Romania (DÜLL 1985), Montenegro and Slovenia (PAVLETIĆ and PULEVIĆ 1975, ECCB, 1995).

**Bryum neodamense** Itzigs.

It is in the rare (R) category according to the Red data book of European bryophytes (ECCB 1995) and is regarded as a subarctic element (DÜLL 1985). It is reported for the first time from Serbia; in SE Europe it is known from Croatia, Slovenia (DÜLL et al. 1999) and Bulgaria (NATCHEVA and GANEVA 2005), in the latter only from the Vitosha Mts.

**Encalypta microstoma** Bals.-Criv. et De Not.

In the rare (R) category according to the Red data book of European bryophytes (ECCB 1995), this is a subarctic, subalpine species (DÜLL 1984). According to NYHOLM (1998) it is very rare, confined to the higher mountains of Europe. In the western Stara Planina Mts we found it under Midžor peak, at the peak of Tupanar on sandstone rocks in subalpine...
grassland; also found it on the Bulgarian side of Mižor peak. This is the first record in Serbia and also a new locality of this redlisted species for Bulgaria. Formerly, in SE Europe it was only known from Bulgaria, only from the Rila Mts (NATCHEVA and GANEVA 2005).

**Grimmia caespiticia** (Brid.) Jur.

It is in the rare (R) category according to the Red data book of European bryophytes (ECCB 1995). Regarded as a subarctic-subalpine element (DÜLL 1984) it occurs on acidic rocks in the alpine belts of mountains of Europe, Asia and Greenland (NYHOLM 1998). In the western Stara Planina Mts it was found at Crnovrska reka (stream) near Baltraberilovac village, on exposed, black schistose sandstone rocks and under Midžor peak, at the peak of Tupanar, on sandstone rocks at a temporary small pool in subalpine grassland. This is its second occurrence in Serbia, after the first record in Serbia is from the Golija-Studenica Biosphere Reserve (PAPP and ERZBERGER 2005). Previous records are from Montenegro (SABOVLJEVIĆ and STEVANOVIC 1999), from Bulgaria and Romania (DÜLL 1984). It is also recorded in Turkey (DÜLL 1984).

**Lophozia ascendens** (Warnst.) R. M. Schust.

It is in the rare (R) category according to the Red data book of European bryophytes (ECCB 1995). As a boreal, montane leafy hepatic (DÜLL 1983, 1984) it lives on large, well-decayed logs in constantly humid forests; therefore, it is considered an indicator of old-growth forests. We collected it on decaying wood at Zubska reka (stream) below the hotel of Babin Zub.

*Lophozia ascendens* was found in Serbia for the first time in the Tara Mts (PAPP and SABOVLJEVIĆ 2002); later we collected it also in Kopaonik National Park (PAPP *et al.* 2004), and Golija-Studenica Biosphere Reserve is its third locality in Serbia (PAPP and ERZBERGER 2005). In SE Europe it was also reported from Bulgaria, Romania (DÜLL 1983).
Paraleucobryum sauteri (Bruch et Schimp.) Loeske

It is in the rare (R) category according to the Red data book of European bryophytes (ECCB 1995) known as a subcontinental, montane element (DÜLL 1984). We found it, as a first record in Serbia, under Babin Zub on a sandstone boulder in block scree under Fagus. In SE Europe it is reported from Bulgaria, but it has only a pre-1956 literature record from the Vitosha Mts (NATCHEVA and GANEVA 2005) and it is known from almost all former Yugoslavian countries as Bosnia-Herzegovina, Montenegro, Croatia, Slovenia (DÜLL et al. 1999, MARTINČIČ 2003).

Pseudoleskea saviana (De Not.) Latzel

It is in the regionally threatened (RT) category according to the Red data book of European bryophytes (ECCB 1995). A species of shaded volcanic rocks, it is sometimes found on tree bark mainly at the base of trunks. Regarded as a rare, continental-subalpine species, it can be found in the Alps and towards the east in Romania, Bulgaria, Greece and Turkey (DÜLL 1985). From Slovenia it is reported by MARTINČIČ (2003). In the western Stara Planina Mts we collected it on the bark of Fagus at Zubska reka (stream) below the hotel of Babin Zub. Previously, it was also collected by us in the Kopaonik Mts (PAPP et al. 2004) and in the Golija-Studenica Biosphere Reserve (PAPP and ERZBERGER 2005).

Two species of Schistidium (S. papillosum, S. pruinoseum) are in the insufficiently known (K) category in the Red data book of European bryophytes (ECCB 1995). We found them on exposed sandstone rocks in subalpine grassland area. Their records from the western Stara Planina Mts are an important contribution to establish their range of distribution and conservation status.

According to the preliminary national red list of bryophytes of Serbia and Montenegro (SABOVLJEVIĆ et al. 2004) this mountainous area is very rich in species of national conservation interest. Two hepatics (Bazzania tricrenata, Scapania aequiloba) and two mosses (Anomodon rugelii, Pohlia longicolla) are in the endangered (EN) category. 4 hepatics (Lophozia
ascendens, Lophozia badensis, L. heterocolpos, L. collaris) and 8 mosses (Amphidium mougeotii, Cynodontium bruntonii, Encalypta ciliata, Grimmia caespiticia, Orthotrichum obtusifolium, Paraleucobryum sauteri, Pseudoleskea saviana, Timmia bavarica) are vulnerable (VU). Three hepatics (Anastrophyllum minutum, Barbilophozia floerkei, Barbilophozia hatcheri) and 13 mosses (Andraea rupestris, Brachyteci um geheebii, Hygroamblystegium tenax, Ditrichum pusillum, Isopterygiopsis pulchella, Leptobryum pyriforme, Myurella julacea, Plagio bryum zierii, Pseudoleskea radicosa, Racomitrium sudeticum, Syntrichia virescens, Timmia austriaca) were placed in the category of lower risk (LR) in the national red list of bryophytes. Four mosses (Brachythecium reflexum, B. starkei, Dicranella schreberiana, Philonotis arnellii) are data deficient (DD). It is hoped that the new data presented here are going to improve the knowledge about their distribution.

Although our exploration on the Bulgarian side of Midžor peak was very short, 10 species were collected, which are included in the national red list of bryophytes of Bulgaria (NATCHEVA et al. 2006). Of the liverworts, Fossombronia husnotii is critically endangered (CR), and Frullania jackii is endangered (EN). Another liverwort species, Tritomaria exsecta and 5 mosses (Amphidium lapponicum, Encalypta microstoma, Grimmia elatior, Grimmia funalis, Lescuraea saxicola) are vulnerable (VU). Schistidium confertum is in the near threatened or lower risk (LR) and Pohlia longicolla in the data deficient (DD) category.

**CONCLUSION**

Though our investigation on the Western Stara Planina Mts covered a relatively small area (surroundings of Midžor peak), we found several redlisted species. The impressive species diversity can be attributed to the special circumstances provided by the bedrock (Permian red sandstone) and climate. Several species, characterized by boreal or arctic-alpine distribution, occur here extrazonally, supported by the special micro- and meso-climate with high precipitation coupled with the high elevations and the fact that the Stara Planina Mts is connected to the Carpathians, and hence it forms a natural pathway for northern species to reach areas.
further south. The species newly reported for Serbia are also mainly montane species known as subarctic, alpine elements, or boreal, montane taxa. The base of Babin Zub with vertical faces of shaded, moist, sandstone rocks and fissures, the sandstone outcrops in the alpine meadows and wind-swept ridges of sandstone rock maintain a very special bryoflora. Mainly these are the substrates for the mosses discussed here as new records and redlisted species. Conservationally, it is very important to preserve the forests and montane habitats by leaving them intact around Babin Zub and down to the eastern slope towards Topli Do village. Because the shaded, moist microhabitats, essential for the bryophyte flora living there, can be sustained only this way. Unfortunately, we observed active forestry operations in the area, in spite that it is a nature reserve well marked with signs.

The survival of this truly valuable bryoflora requires more effective and very strict protection. The Midžor region should be considered as a hot-spot of bryophyte diversity on the Balkans and it would deserve declaration of a trans-border Important Bryophyte Area.

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