

CONTRIBUTIONS TO THE BRYOPHYTE FLORA OF SOUTHEASTERN SERBIA: SUVA PLANINA MTS AND ITS SURROUNDINGS

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Altogether 229 bryophyte taxa (25 liverworts and 204 mosses) were collected during a field trip made in 2006 in SE Serbia. The following 11 taxa (3 liverworts and 8 mosses) are recorded for the first time in Serbia: *Cephaloziella varians*, *Conocephalum salebrosum*, *Scapania cuspiduligera*, *Bryum algovicum* var. *compactum*, *B. lonchocaulon*, *Cynodontium fallax*, *Dicranella howei*, *Grimmia dissimulata*, *Hypnum procerrimum*, *Seligeria acutifolia*, *Zygodon viridissimus*. Two species occurring in the investigated area (*Pseudoleskea saviana*, *Taxiphyllum densifolium*) are red-listed in Europe and 19 species are included in the preliminary national red list of Serbia.

Key words: bryophyte flora, Jerma gorge, new and red-listed species, Sićevačka gorge, Suva Planina Mts

INTRODUCTION

After the publication of the checklists of bryophytes of Serbia (SABOVLJEVIĆ 2000, SABOVLJEVIĆ and STEVANOVIĆ 1999), thanks to intensive fieldwork in recent years, many new species have been recorded, which increased the number of the known species by almost 20%. The more recent state of the knowledge on the bryophyte flora of the country is summarised in the southeastern European checklists (SABOVLJEVIĆ and NATCHEVA 2006, SABOVLJEVIĆ *et al.* 2008).

With the present paper about the material collected in Suva Planina Mts and its surroundings we continue to publish the results of our collecting trips organised by the Hungarian Natural History Museum in collaboration with the Institute for the Protection of Nature of Serbia.

MATERIALS AND METHODS

The investigated area

Suva Planina Mts are situated in southeastern Serbia near the town of Niš, its range extending along a curve from Niška Banja to Bela Palanka towns. Its highest point is Trem peak with 1,808 m a.s.l. Phytogeographically, Suva Planina Mts and their surroundings have a transitional character, which coupled with the highly varied terrain, results in a rich diversity of flora and vegetation with several preserved Tertiary relicts and relict plant communities (MIŠIĆ 1981).

The bedrock of this region consists mainly of limestone with a very complex dissected relief, typical karst formations, numerous deep gorges and canyons (MIŠIĆ 1981). One of the largest gorges in Serbia is Sićevačka klisura in the valley of Nišava river, which is situated at the northern foot of Suva Planina Mts. Another huge limestone gorge in the surrounding area is the Jerma gorge situated near the Bulgarian border at Dimitrovgrad.

The region of Suva Planina Mts, as is reflected by its name (suva – dry), is one of the warmest highlands in Serbia with 11.6 °C annual main temperature. The warmest month is July with 22.7 °C, while the coldest is January with –0.6 °C mean temperature. The mean yearly temperature fluctuation of 23.3 °C is considerable. The precipitation maximum is in May and the minimum is in February, with average annual precipitation of 580 mm. The summers in Suva Planina Mts are usually very dry, with the occurrence of at least four dry months. The climate is moderate continental to continental (JOVANOVIĆ 1980).

There are only few springs in the whole mountain. The two most important sources are Bojanine vode at 860 m (under Sokolov kamen, the second highest peak) and Rakoš česma (at the Bela Palanka side of the mountain).

The main vegetation types in Suva Planina Mts are montane and submontane beech forests (*Fagetum montanum*, *Fagetum submontanum*, *Luzulo-Fagetum*). In the lower parts of the mountain, on rugged karst terrains, in the oak and beech forest contact zones *Quercetum frainetto-cerris-carpinetosum orientalis* and *Carpinetum orientalis* forests are predominant. In the south facing sites of the large gorges thermophilous shrub communities (e.g. *Syringo-Carpinetum orientalis*) are characteristic, while the northern slopes are covered by mesophilous polydominant forest communities (*Carpino orientalis-Quercetum mixtum*, *Fraxino-Colurnetum mixtum*, *Syringo-Colurnetum mixtum*). Several Tertiary relict species are preserved in these gorges, including *Acer monspessulanum*, *Berberis vulgaris*, *Coronilla emerus*, *Corylus colurna*, *Cotinus coggygia*, *Cotoneaster tomentosa*, *Crataegus nigra*, *Euonymus verrucosus*, *Fraxinus ornus*, *Juglans regia*, *Padus avium*, *Paliurus spinachristi*, *Prunus mahaleb*, *Pyrus amygdaliformis*, *Rhamnus tinctoria*, *Quercus pubescens*, *Sorbus aria*, *Syringa vulgaris*, *Tilia tomentosa* (MIŠIĆ 1981).

Methods

The collecting trip was made in July 2006. The investigated area is shown by Fig. 1. The presumably best sites of all main habitat types such as stream valleys, gorges, forests

and grasslands were visited, and bryophytes were collected from different substrates (soil, exposed and shady rocks, tree bark and decaying wood).

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

Nomenclature of the bryophyte species follows GROLLE and LONG (2000) and HILL *et al.* (2006). New floristical results for the country are given according to the checklists of southeastern Europe (SABOVLJEVIĆ and NATCHEVA 2006, SABOVLJEVIĆ *et al.* 2008). The conservation value of the bryoflora was analysed on the basis of the Red data book of European bryophytes (ECCB 1995) and the preliminary national red list of bryophytes (SABOVLJEVIĆ *et al.* 2004).

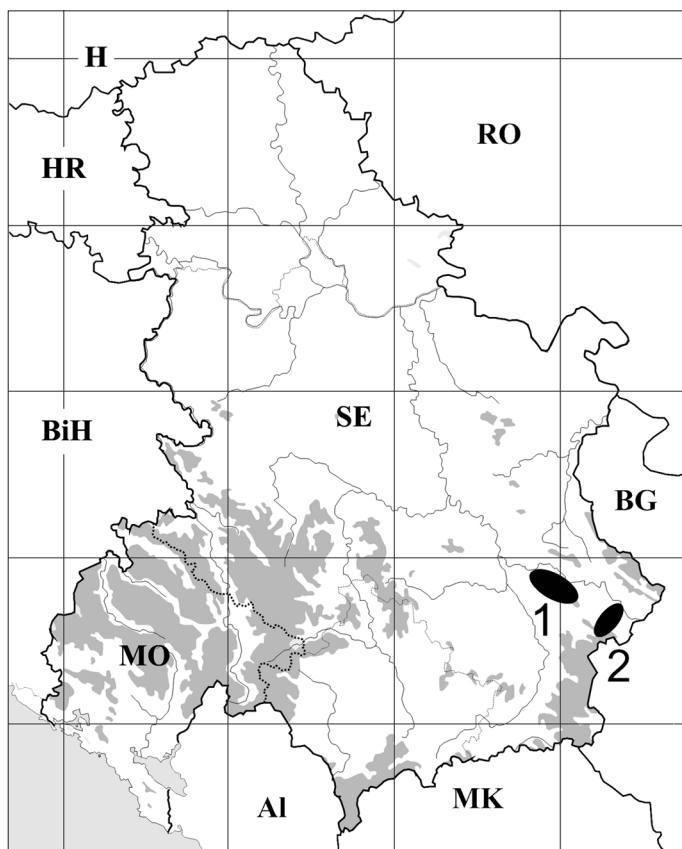


Fig. 1. Location of the investigated areas. (●) 1 = Suva Planina Mts, 2 = Jerma Gorge (H = Hungary, RO = Romania, HR = Croatia, BiH = Bosnia-Herzegovina, MO = Montenegro, SE = Serbia, BG = Bulgaria, MK = FYR Macedonia, Al = Albania)

Site details

1. Serbia, Suva Planina Mts, Gornja Studena village, Bojanine vode, 865–965 m, N 43° 13' 16.8", E 22° 06' 42.4" and N 43° 13' 02.5", E 22° 07' 08.2", 10.07.2006.
2. Serbia, Suva Planina Mts, Gornja Studena village, road from Bojanine vode towards Trem peak, 1,000 m, N 43° 11' 57.5", E 22° 09' 11.8", 10.07.2006.
3. Serbia, Suva Planina Mts, Gornja Studena village, tourist path from Bojanine vode to Trem peak, Fagetum, 1,072 m, N 43° 12' 38.2", E 22° 07' 45.2", 11.07.2006.
4. Serbia, Suva Planina Mts, Gornja Studena village, from Bojanine vode to Trem peak, Devojački grob, grassland, 1,315 m, N 43° 11' 48.6", E 22° 08' 42.0", 11.07.2006.
5. Serbia, Suva Planina Mts, Gornja Studena village, under Trem peak, between Devojački grob and Trem, grassland, 1,530 m, N 43° 11' 19.4", E 22° 09' 33.6", 11.07.2006.
6. Serbia, Suva Planina Mts, Gornja Studena village, Trem peak, 1,824 m, N 43° 11' 00.4", E 22° 10' 16.9", 11.07.2006.
7. Serbia, Suva Planina Mts, Čukljenik village, 334 m, N 43° 16' 25.0", E 22° 04' 22.7", 12.07.2006.
8. Serbia, Suva Planina Mts, Gornja Studena village, from Bojanine vode to Sokolov kamen peak, under Sokolov kamen, 1,200 m, N 43° 12' 53.6", E 22° 06' 45.1", 12.07.2006.
9. Serbia, Suva Planina Mts, Gornja Studena village, Sokolov kamen peak, grassland, 1,431 m, N 43° 12' 45.2", E 22° 06' 40.4", 12.07.2006.
10. Serbia, Suva Planina Mts, Jelašnica village, Jelašnička klisura gorge, 317 m, N 43° 16' 35.5", E 22° 04' 06.3", 13.07.2006.
11. Serbia, Suva Planina Mts, Siće vačka klisura, opposite to Sićevo village, on the left side of Nišava river, above Sv. Bogorodica monastery, 350 m, N 43° 19' 44.6", E 22° 04' 32.1", 15.07.2006.
12. Serbia, Suva Planina Mts, Siće vačka klisura, Nišava river at Sv. Bogorodica monastery, 220 m, N 43° 19' 52.0", E 22° 04' 01.9", 15.07.2006.
13. Serbia, Suva Planina Mts, Siće vačka klisura at Sićevo village, on the right side of Nišava river, 340 m, N 43° 20' 11.8", E 22° 04' 33.8", 15.07.2006.
14. Serbia, Niška Banja, hot spring, 250 m, N 43° 17' 37.0", E 22° 00' 26.9", 15.07.2006.
15. Serbia, Jerma gorge between Pirot and Dimitrovgrad, Zvonačka Banja, at Hotel Mir, 650 m, N 42° 55' 54.6", E 22° 36' 01.0", 14.07.2006.
16. Serbia, Jerma gorge between Pirot and Dimitrovgrad, from Trnsko Odorovce to Poganovo monastery, 528 m, N 42° 57' 34.4", E 22° 37' 02.2", 14.07.2006.
17. Serbia, Jerma gorge between Pirot and Dimitrovgrad, at Poganovo monastery, 495 m, N 42° 58' 43.1", E 22° 38' 11.7", 14.07.2006.
18. Serbia, Jerma gorge between Pirot and Dimitrovgrad, at Vlasi village, 499 m, N 42° 59' 38.3", E 22° 38' 02.7", 14.07.2006.

RESULTS AND DISCUSSION

Altogether 229 bryophyte taxa (25 liverworts and 204 mosses) were collected during our field trip. The following 11 taxa (10 species, 1 variety) are recorded for the first time in Serbia.

Cephaloziella varians (Gottsche) Steph. (syn. *C. arctica* Bryhn et Douin – see GROLLE and LONG (2000)) – This member of the notoriously difficult genus *Cephaloziella* has only recently been brought to the attention of Central European bryologists by the results of the bryophyte mapping of Germany (MEINUNGER and SCHRÖDER 2007), where it turned out to be one of the rather widespread species of the genus, occurring in nearly all regions from the lowlands to the alps. The circumscription of this species is based on the works of SCHUSTER (1980) and DAMSHOLT (2002), who consider it to be related to *C. grimsulana* (J. B. Jack ex Gottsche et Rabenh.) Lacout., whereas MEINUNGER and SCHRÖDER (2007) place it close to *C. hampeana* (Nees) Schiffn. Keys, descriptions and illustrations can be found in DAMSHOLT (2002) and MEINUNGER and SCHRÖDER (2007). Salient features of *C. varians* include the presence of underleaves, small leaf cells and gemmae and its autoicous condition. It grows exclusively on base-rich or calcareous substrates. In Suva Planina Mts it was collected on the grassland of the second highest peak (Sokolov kamen) of the mountain.

The species had been reported previously from arctic regions and from Central European Mountains, from the French Pyrenees to Slovakia. No reports from the Balkan Peninsula are known up to date (SABOVLJEVIĆ and NATCHEVA 2006). Our record is therefore new to SE Europe.

Conocephalum salebrosum Szweykowski, Buczkowska et Odrzykoski – This thalloid liverwort was recently described by SZWEYKOWSKI *et al.* (2005). It is closely related to *C. conocephalum*, but on the basis of morphological, anatomical and genetic characters it can be separated with certainty. Our specimens in Suva Planina Mts were collected at the base of large shaded limestone rockwalls. The *Conocephalum* specimens collected earlier in the Balkan region should be revised in order to establish the correct distribution of the two species.

Scapania cuspiduligera (Nees) Müll. Frib. – It is a subarctic, subalpine species (DÜLL 1983). In SE Europe it is known only from Romania and Slovenia (SABOVLJEVIĆ and NATCHEVA 2006). In Suva Planina Mts it was collected in the grassland of Sokolov kamen peak.

Bryum algovicum Sendtn. ex Müll. Hal. var. *compactum* (Hornsch.) Duell – This is the less common autoicous form of *B. algovicum* (CRUNDWELL 1970). According to unpublished studies of Holyoak these autoicous plants occur mainly on high elevations in the Alps, whereas synoicous plants occur throughout the lowlands. It might merit treatment as a separate species according to HILL *et al.* (2006). In Suva Planina Mts it was collected just below the summit (Trem peak) of the mountain at 1,800 m a.s.l.

Bryum lonchocaulon Müll. Hal. – This species was included in *B. pallescens* according to HILL *et al.* (2006), but treated separately by ZOLOTOV (2000), who considered the polyoicous (partly synoicous) *B. lonchocaulon* to be a species distinct from the autoicous *B. pallescens*. This is also the opinion of MEINUNGER and SCHRÖDER (2007), who suggest it might be of hybrid origin. Our specimen was also collected on the highest peak of Suva Planina Mts.

Cynodontium fallax Limpr. – It is a subarctic, subalpine, species (DÜLL 1984). In SE Europe it is known only from Bulgaria, Romania and Slovenia (SABOVLJEVIĆ *et al.* 2008). In Suva Planina Mts it was collected from shaded limestone rocks on a steep slope under the second highest peak (Sokolov kamen) of the mountain.

Dicranella howei Renauld et Cardot – This is an Atlantic, Mediterranean species (DÜLL 1984). It was collected in a large, long gorge (Sićevačka klisura) at the foot of Suva Planina Mts. In SE Europe it is known from Bosnia-Herzegovina, Croatia, Greece, Montenegro and the European part of Turkey (SABOVLJEVIĆ *et al.* 2008).

Grimmia dissimulata E. Maier – This species was recently described by MAIER (2002). It occurs on exposed calcareous rocks. Its presently known distribution is as follows: Africa: Morocco; Asia: Syria, Turkey; Europe: Austria, Belgium, Cyprus, France, Germany, Great Britain, Greece, Hungary, Italy, Montenegro, Spain, Switzerland (MAIER 2002, PORLEY 2004, ERZBERGER and PAPP 2004, PAPP and ERZBERGER 2007b). In SE Europe it is already known from Greece and Montenegro (SABOVLJEVIĆ *et al.* 2008). In Suva Planina Mts it was collected from exposed limestone rocks in a valley at the foot of the mountain.

Hypnum procerrimum Molendo – This is a sub-Atlantic, alpine species (DÜLL 1985). In SE Europe it is reported from Bosnia-Herzegovina, Bulgaria, Croatia, Romania and Slovenia (SABOVLJEVIĆ *et al.* 2008). It was

collected on calcareous grasslands around the highest peak of Suva Planina Mts.

Seligeria acutifolia Lindb. – This is a sub-Mediterranean, montane taxon (DÜLL 1984). In SE Europe it is recorded in Bulgaria, Croatia, Greece and Romania (SABOVLJEVIĆ *et al.* 2008). In Suva Planina Mts it was collected from shaded limestone rocks on a steep slope under the second highest peak (Sokolov kamen) of the mountain.

Zygodon viridissimus (Dicks.) Brid. – It is an Atlantic species (DÜLL 1984) reported from numerous SE European countries, *e.g.* Bulgaria, Bosnia-Herzegovina, Croatia, Greece, Macedonia, Montenegro, Romania and Slovenia (SABOVLJEVIĆ *et al.* 2008). In Suva Planina Mts it was collected from the bark of *Fagus* around Bojanine vode at *ca* 900 m a.s.l.

List of the species

Following the species name, the numbers indicating the localities, and the substrates are given.

Hepaticae

- Apometzgeria pubescens* (Schrank) Kuwah. – 1, 8: on shaded limestone rock
Barbilophozia hatcheri (A. Evans) Loeske – 8: on shaded limestone rock
Cephaloziella varians (Gottsche) Steph. – 9: on soil (det. L. Meinunger)
Cololejeunea calcarea (Lib.) Schiffn. – 8: on shaded limestone rock
Cololejeunea rossettiana (C. Massal.) Schiffn. – 1: on shaded limestone rock
Conocephalum salebrosum Szweykowski, Buczkowska et Odrzykoski – 8, 10: on shaded limestone rock
Frullania dilatata (L.) Dumort. – 3: on the base of a *Fagus*; 11: on the bark of *Tilia*; 16: on the bark of *Salix*; 17: on the bark of *Alnus*
Leiocolea collaris (Nees) Schljakov – 5, 8, 10: on shaded limestone rock
Lophocolea heterophylla (Schrad.) Dumort. – 1: on soil
Lophocolea minor Nees – 11: on soil
Marchantia polymorpha L. subsp. *polymorpha* – 10: on limestone rock in and near the stream
Marchantia polymorpha L. subsp. *ruderalis* Bisch. et Boisselier – 2: on limestone rock in the stream
Metzgeria furcata (L.) Dumort. – 1: on shaded limestone rock and on the base of *Fagus*; 11: on shaded limestone rock
Pedinophyllum interruptum (Nees) Kaal. – 5, 8, 10: on shaded limestone rock

- Pellia endiviifolia* (Dicks.) Dumort. – 10: on limestone rock in the stream; 17: on rock at the river
- Plagiochila porelloides* (Torrey ex Nees) Lindenb. – 1, 5, 6, 8, 10, 11, 17: on shaded limestone rock; 5: on the bark of *Sorbus*
- Porella cordaeana* (Huebener) Mohr – 1: on limestone rock in the stream; 8: on shaded limestone rock and on the bark of *Fagus*
- Porella platyphylla* (L.) Pfeiff. – 2: on limestone rock; 11, 17: on shaded limestone rock; 17: on decaying wood
- Preissia quadrata* (Scop.) Nees – 4, 8: on shaded limestone rock
- Radula complanata* (L.) Dumort. – 1, 3, 8: on shaded limestone rock; 1: on the bark of *Fagus*, 11: on exposed limestone rock and on the bark of *Acer*; 16: on the bark of *Salix*; 17: on the bark of *Alnus*
- Reboulia hemisphaerica* (L.) Raddi – 3: on limestone rock
- Riccia gougetiana* Durieu et Mont. – 6: on soil
- Riccia sorocarpa* Bisch. – 6, 9: on soil (det. Meinunger)
- Scapania calcicola* (Arnell et J. Perss.) Ingham – 5, 6, 8: on shaded limestone rock and on calcareous soil (pp. conf. Meinunger)
- Scapania cuspiduligera* (Nees) Müll. Frib. – 9: on soil

Musci

- Abietinella abietina* (Hedw.) M. Fleisch. – 10, 11, 16: on soil
- Aloina ambigua* (Bruch et Schimp.) Limpr. – 16: on soil
- Amblystegium confervoides* (Brid.) Schimp. – 2, 8: on small shaded limestone rocks
- Amblystegium serpens* (Hedw.) Schimp. – 1, 10: on limestone rock in the stream; 11: on the bark of *Acer*; 14: on limestone rocks in the water; 16: on the bark of *Salix*; 17: on rock at the river and on decaying wood
- Amblystegium subtile* (Hedw.) Schimp. – 2: on the bark of *Fagus*
- Anomodon attenuatus* (Hedw.) Huebener – 1, 10, 11, 17: on shaded limestone rock
- Anomodon longifolius* (Schleich. ex Brid.) Hartm. – 1, 8: on shaded limestone rock
- Anomodon viticulosus* (Hedw.) Hook. et Taylor – 1, 2, 8, 10, 11, 16: on shaded limestone rock; 17: on the bark of *Alnus*
- Atrichum undulatum* (Hedw.) P. Beauv. – 1: on soil
- Barbula convoluta* Hedw. var. *convoluta* – 6, 10, 16: on soil
- Barbula convoluta* Hedw. var. *sardoa* Schimp. – 1: on shaded limestone rock
- Barbula unguiculata* Hedw. – 1, 3, 4, 11: on soil; 1: on shaded limestone rock; 13, 15: on exposed limestone rock
- Bartramia halleriana* Hedw. – 8: on shaded limestone rock
- Brachytheciastrum velutinum* (Hedw.) Ignatov et Huttunen – 1, 2, 8, 10, 17: on limestone rock; 2: on the bark of *Fagus*; 11: on soil
- Brachythecium albicans* (Hedw.) Schimp. – 16: on soil
- Brachythecium glareosum* (Bruch ex Spruce) Schimp. – 1, 11: on soil

- Brachythecium rivulare* Schimp. – 1, 2: on limestone rock in the stream; 10, 17: on rock at the river
- Brachythecium rutabulum* (Hedw.) Schimp. – 1: on soil; 1, 10, 17: on shaded limestone rock; 10: on limestone rock in the stream; 12, 18: on rock at the river
- Brachythecium salebrosum* (Hoffm. ex F. Weber et D. Mohr) Schimp. – 11: on the bark of *Acer campestre*
- Brachythecium tommasinii* (Sendtn. ex Boulay) Ignatov et Huttunen – 1, 8, 11: on shaded limestone rock
- Bryoerythrophyllum recurvirostrum* (Hedw.) P. C. Chen – 2, 4, 6, 8, 9, 11, 17: on soil
- Bryum algovicum* Sendtn. ex Müll. Hal. var. *compactum* (Hornsch.) Duell – 6: on soil (det. W. Schröder)
- Bryum argenteum* Hedw. – 4, 9: on soil; 13: on exposed limestone rock
- Bryum caespiticium* Hedw. – 4, 6, 9: on soil
- Bryum capillare* Hedw. – 1, 2, 6: on soil; 10: on exposed limestone rock; 11: on shaded limestone rock; 17: on rock at the river
- Bryum elegans* Nees – 1: on shaded limestone rock; 6: on soil
- Bryum lonchocaulon* Müll. Hal. – 6: on soil (det. W. Schröder)
- Bryum moravicum* Podp. – 1, 2, 17: on shaded limestone rock; 11 on exposed limestone rock; 17: on the bark of *Tilia*
- Bryum pallens* Sw. ex anon. – 6: on soil (det. L. Meinunger)
- Bryum pseudotriquetrum* (Hedw.) P. Gaertn. *et al.* – 5, 9, 16: on soil near the stream
- Bryum rubens* Mitt. – 1: on soil
- Bryum torquescens* Bruch et Schimp. – 3: on calcareous soil (conf. W. Schröder); 11: among exposed limestone rocks
- Campyliadelphus chrysophyllus* (Brid.) R. S. Chopra – 6, 11: on soil in calcareous grassland
- Campylophyllum calcareum* (Crundw. et Nyholm) Hedenäs – 1, 11: on soil; 17: on shaded limestone rock
- Campylophyllum halleri* (Hedw.) M. Fleisch. – 5, 8: on shaded limestone rock
- Ceratodon purpureus* (Hedw.) Brid. – 1, 4, 9, 11: on soil
- Cinclidotus fontinaloides* (Hedw.) P. Beauv. – 12, 18: on rock at the river
- Cinclidotus riparius* (Host ex Brid.) Arn. – 12: on rock at the river
- Cirriphyllum crassinervium* (Taylor) Loeske et M. Fleisch. – 1, 10, 11, 17: on shaded limestone rock; 12, 18: on rock at the river
- Cratoneuron flicinum* (Hedw.) Spruce – 1, 2, 10: on limestone rock in the stream; 11: on soil; 17: on rock at the river and in a spring
- Crossidium squamiferum* (Viv.) Jur. – 7: on exposed conglomerate rock; 10, 13: on exposed limestone rock
- Ctenidium molluscum* (Hedw.) Mitt. – 1, 5, 6, 8, 9, 10, 11: on shaded limestone rock; 10: on exposed limestone rock; 18: on rock at the river
- Cynodontium fallax* Limpr. – 8: on shaded limestone rock
- Dicranella heteromalla* (Hedw.) Schimp. – 1: on soil
- Dicranella howei* Renauld et Cardot – 11: on soil
- Dicranella schreberiana* (Hedw.) Dixon – 3: on soil

- Dicranella varia* (Hedw.) Schimp. – 1: on shaded limestone rock; 16: on soil
- Dicranum scoparium* Hedw. – 1, 8: on shaded limestone rock
- Didymodon acutus* (Brid.) K. Saito – 13: on exposed limestone rock; 16: on soil
- Didymodon fallax* (Hedw.) R. H. Zander – 1: on shaded limestone rock; 2, 10: on limestone rock in the stream; 10: on exposed limestone rock; 11: on soil
- Didymodon insulanus* (De Not.) M. O. Hill – 10, 17: on exposed and shaded limestone rock
- Didymodon luridus* Hornsch. – 1: on shaded limestone rock; 1, 10: on limestone rock in the stream; 7: on exposed conglomerate rock; 10: on exposed limestone rock; 12, 17: on rock at the river
- Didymodon rigidulus* Hedw. – 1: on shaded limestone rock; 1: on limestone rock in the stream; 4, 6, 9, 10, 15: on exposed limestone rock; 17, 18: on rock at the river
- Didymodon sinuosus* (Mitt.) Delogne – 1: on shaded limestone rock; 1: on limestone rock in the stream; 12, 17: on rock at the river
- Didymodon tophaceus* (Brid.) Lisa – 14: limestone rocks in the water
- Didymodon vinealis* (Brid.) R. H. Zander – 10: on shaded limestone rock; 12: on rock at the river; 17: on soil near the river
- Distichium capillaceum* (Hedw.) Bruch et Schimp. – 5, 6, 8, 9: on shaded limestone rock
- Ditrichum flexicaule* (Schwägr.) Hampe – 4, 6, 9: on soil; 8, 10, 11: on exposed limestone rock
- Ditrichum gracile* (Mitt.) Kuntze – 5, 6, 11: on exposed limestone rock; 8: on shaded limestone rock
- Encalypta rhaptocarpa* Schwägr. – 5, 9: on soil
- Encalypta spathulata* Müll. Hal. – 9: on soil (conf. L. Meinunger)
- Encalypta streptocarpa* Hedw. – 1, 8, 10, 11, 17: on shaded limestone rock; 4, 5, 6, 9: on soil; 16, 17: on rock at the river
- Encalypta vulgaris* Hedw. – 5: on soil; 6, 10, 11: on exposed limestone rock
- Entodon concinnus* (De Not.) Paris – 5, 11: on soil
- Eucladium verticillatum* (With.) Bruch et Schimp. – 10: on shaded limestone rock
- Eurhynchiastrum pulchellum* (Hedw.) Ignatov et Huttunen – 6: on soil; 2, 8, 10: on shaded limestone rock
- Eurhynchium angustirete* (Broth.) T. J. Kop. – 1: on soil; 8: on shaded limestone rock
- Fissidens bryoides* Hedw. – 1: on shaded limestone rock; 11: on soil
- Fissidens crassipes* Wilson ex Bruch et Schimp. subsp. *warnstorffii* (M. Fleisch.) Brugg.-Nann. – 10: on limestone rock in the stream; 12: on rock at the river
- Fissidens dubius* P. Beauv. – 1, 6, 8, 9, 10, 17: on shaded limestone rock; 5, 6, 9, 11: on soil; 18: on rock at the river
- Fissidens gracilifolius* Brugg.-Nann. et Nyholm – 1, 2, 3, 8, 10: on shaded limestone rock
- Fissidens pusillus* (Wilson) Milde – 10: on moist vertical limestone rock face near the stream
- Fissidens taxifolius* Hedw. – 1, 10: on shaded limestone rock; 1: on the base of *Fagus*; 3, 10, 11: on soil
- Fontinalis antipyretica* Hedw. – 12: on rock at the river

- Funaria hygrometrica* Hedw. – 1, 3, 11: on soil; 2: on limestone rock in the stream
- Grimmia anodon* Bruch et Schimp. – 6, 9: on exposed limestone rock
- Grimmia dissimulata* E. Maier – 10: on exposed limestone rock (conf. E. Maier)
- Grimmia orbicularis* Bruch ex Wilson – 10, 11: on exposed limestone rock
- Grimmia pulvinata* (Hedw.) Sm. – 4, 10, 11, 13, 15, 16: on exposed limestone rock; 7: on exposed conglomerate rock
- Grimmia tergestina* Tomm. ex Bruch et Schimp. – 5, 9, 10, 11: on exposed limestone rock
- Gymnostomum aeruginosum* Sm. – 5, 8: on shaded limestone rock
- Gymnostomum calcareum* Nees et Hornsch. – 10: on shaded limestone rock; 17: on rock at the river
- Gyroweisia tenuis* (Hedw.) Schimp. – 10: on shaded limestone rock
- Herzogiella seligeri* (Brid.) Z. Iwats. – 3: on the base of a *Fagus*
- Homalothecium lutescens* (Hedw.) H. Rob. – 1, 5, 11, 16: on soil; 10, 11: on exposed limestone rock
- Homalothecium philippeanum* (Spruce) Schimp. – 1, 6, 8, 17: on shaded limestone rock
- Homalothecium sericeum* (Hedw.) Schimp. – 1, 10, 11, 17: on shaded limestone rock; 5, 6, 9: on exposed limestone rock; 1: on the bark of *Fagus*; 11: on the bark of *Acer campestre*; 16: on the bark of *Salix*; 16, 17, 18: on rock at the river
- Homomallium incurvatum* (Schröd. ex Brid.) Loeske – 1, 3, 8, 11, 17: on limestone rock
- Hygroamblystegium fluviatile* (Hedw.) Loeske – 12: on rock at the river
- Hygroamblystegium humile* (P. Beauv.) Vanderp., Goffinet et Hedenäs – 10, 17: on rock at the river
- Hygroamblystegium tenax* (Hedw.) Jenn. – 10, 12, 16, 17: on rock at the stream or river
- Hygroamblystegium varium* (Hedw.) Mönk. – 17: on shaded limestone rock
- Hygrohypnum luridum* (Hedw.) Jenn. – 10: on limestone rock in the stream; 17, 18: on rock at the river
- Hylocomium splendens* (Hedw.) Schimp. – 5, 8: on shaded limestone rock
- Hypnum cupressiforme* Hedw. var. *cupressiforme* – 1, 9, 10, 11: on shaded limestone rock; 2: on the bark of *Fagus*; 5: on the bark of *Sorbus*; 11: on soil; 16: on the bark of *Salix*
- Hypnum cupressiforme* Hedw. var. *lacunosum* Brid. – 1, 6, 10: on exposed limestone rock
- Hypnum procerrimum* Molendo – 5, 6: on calcareous soil in grassland (conf. W. Schröder)
- Hypnum revolutum* (Mitt.) Lindb. – 6: on exposed limestone rock (conf. W. Schröder, det. L. Meinunger)
- Hypnum vaucheri* Lesq. – 4, 6, 11: on exposed limestone rock
- Isoetecium alopecuroides* (Lam. ex Dubois) Isov. – 1: on soil; 1: on shaded limestone rock; 1: on the bark of *Fagus*
- Leptobryum pyriforme* (Hedw.) Wilson – 10: on shaded limestone rock
- Leptodictyum riparium* (Hedw.) Warnst. – 12, 17: on rock at the river; 14: limestone rocks in the water
- Leskea polycarpa* Hedw. – 10, 11, 16, 17: on shaded limestone rock; 7: on the bark of *Juglans regia*; 11: on the bark of *Salix* and of *Acer campestre*; 12: on rock at the river; 17: on the bark of *Alnus*

- Leucodon sciuroides* (Hedw.) Schwägr. – 3: on the base of a *Fagus*; 4: on exposed limestone rock; 2, 11, 17: on shaded limestone rock; 11: on the bark of *Tilia*; 16: on the bark of *Salix*; 17: on the bark of *Alnus*
- Mnium marginatum* (Dicks.) P. Beauv. – 1, 8, 17: on shaded limestone rock
- Mnium stellare* Hedw. – 10: on shaded limestone rock
- Mnium thomsonii* Schimp. – 5, 8: on shaded limestone rock; 6: on calcareous soil
- Myurella julacea* (Schwägr.) Schimp. – 8: on shaded limestone rock; 5, 9: on calcareous soil
- Neckera besseri* (Lobarz.) Jur. – 1, 8, 10, 11, 17: on shaded limestone rock
- Neckera complanata* (Hedw.) Huebener – 1, 8, 10, 16, 17: on shaded limestone rock
- Neckera crispa* Hedw. – 1, 5, 8, 10: on shaded limestone rock
- Neckera menziesii* Drumm. – 1: on shaded limestone rock
- Neckera pumila* Hedw. – 8: on shaded limestone rock
- Orthothecium intricatum* (Hartm.) Schimp. – 8: on shaded limestone rock
- Orthotrichum affine* Schrad. ex Brid. – 3: on the base of a *Fagus*; 10, 16: on the bark of *Salix*; 11: on the bark of *Tilia*
- Orthotrichum anomalum* Hedw. – 1, 2: on shaded limestone rock; 1: on limestone rock in the stream; 7: on the bark of *Juglans regia*; 9, 10, 11, 13, 15: on exposed limestone rock; 13: on roots and stem of *Ailanthus altissima*; 16, 17: on rock at the river
- Orthotrichum cupulatum* Hoffm. ex Brid. var. *cupulatum* – 1: on shaded limestone rock; 4, 15: on exposed limestone rock; 7: on exposed conglomerate rock; 16: on rock near the river
- Orthotrichum cupulatum* Hoffm. ex Brid. var. *riparium* Huebener – 1: on limestone rock in the stream; 17, 18: on rock at the river
- Orthotrichum diaphanum* Schrad. ex Brid. – 7: on the bark of *Juglans regia*; 10: on the bark of *Tilia*; 13: on roots and stem of *Ailanthus altissima*; 16: on the bark of *Salix*
- Orthotrichum lyellii* Hook. et Taylor – 17: on the bark of *Tilia*
- Orthotrichum obtusifolium* Brid. – 7: on the bark of *Juglans regia*; 10, 16: on the bark of *Salix*
- Orthotrichum pallens* Bruch ex Brid. – 1: on the bark of *Fagus*; 5: on the bark of *Sorbus*; 7: on the bark of *Juglans regia*; 8, 11: on the bark of *Acer*; 11: on the bark of *Tilia*; 10, 16: on the bark of *Salix*; 17: on the bark of *Alnus*
- Orthotrichum pumilum* Sw. – 10: on the bark of *Tilia*
- Orthotrichum speciosum* Nees – 17: on the bark of *Alnus*
- Orthotrichum stramineum* Hornsch. ex Brid. – 3, 4: on the base of a *Fagus*; 13: on the bark of *Acer pseudoplatanus*
- Orthotrichum striatum* Hedw. – 17: on the bark of *Alnus*
- Oxyrrhynchium bians* (Hedw.) Loeske – 1, 3, 11, 16: on soil; 1, 10, 17: on shaded limestone rock; 1, 2: on limestone rock in the stream; 10: on exposed limestone rock
- Oxyrrhynchium schleicheri* (R. Hedw.) Röhl – 8: on shaded limestone rock; 11: on soil
- Oxystegus tenuirostris* (Hook. et Taylor) A. J. E. Sm. – 17: on shaded limestone rock
- Palustriella commutata* (Hedw.) Ochyra – 1: on limestone rock in the stream
- Phascum cuspidatum* Hedw. var. *piliferum* (Hedw.) Hook. et Taylor – 4: on soil

- Philonotis marchica* (Hedw.) Brid. – 10: on limestone rock in the stream
- Plagiomnium affine* (Blandow ex Funck) T. J. Kop. – 10: on shaded limestone rock; 11: on soil; 12: on rock at the river
- Plagiomnium cuspidatum* (Hedw.) T. J. Kop. – 1: on shaded limestone rock; 17: on decaying wood
- Plagiomnium rostratum* (Schrad.) T. J. Kop. – 1, 2, 5, 8, 10, 16, 17: on shaded limestone rock
- Plagiomnium undulatum* (Hedw.) T. J. Kop. – 1: on shaded limestone rock; 10: on soil; 16, 17: on rock at the river
- Plagiopus oederianus* (Sw.) H. A. Crum et L. E. Anderson – 8: on shaded limestone rock
- Plagiothecium laetum* Schimp. – 8: on shaded limestone rock
- Plasteurhynchium striatulum* (Spruce) M. Fleisch. – 1, 8, 10, 11, 16, 17: on shaded limestone rock; 10: on exposed limestone rock
- Platyhypnidium riparioides* (Hedw.) Dixon – 1, 10: on limestone rock in the stream; 12, 16, 17, 18: on rock at the river
- Pleurochaete squarrosa* (Brid.) Lindb. – 10, 11: among exposed limestone rock
- Pohlia cruda* (Hedw.) Lindb. – 6, 8: on shaded limestone rock
- Pohlia melanodon* (Brid.) A. J. Shaw – 1: on soil; 10: on shaded limestone rock and limestone rock in the stream
- Pohlia nutans* (Hedw.) Lindb. – 6: on soil
- Pohlia wahlenbergii* (F. Weber et D. Mohr) A. L. Andrews var. *wahlenbergii* – 1: on soil; 10: on limestone rock in the stream
- Pohlia wahlenbergii* (F. Weber et D. Mohr) A. L. Andrews var. *calcareae* (Warnst.) E. F. Warb. – 17: on rock at the river
- Polytrichastrum formosum* (Hedw.) G. L. Sm. – 2: on limestone rock; 6, 8: on soil
- Polytrichum juniperinum* Hedw. – 6: on soil
- Pseudocrossidium hornschruchianum* (Schultz) R. H. Zander – 10: on soil
- Pseudoleskea incurvata* (Hedw.) Loeske – 1, 3, 5, 8: on shaded limestone rock; 5: on the bark of *Sorbus*; 6: on exposed limestone rock; 8: on the bark of *Fagus*
- Pseudoleskea saviana* (De Not.) Latzel – 5: on shaded limestone rock
- Pseudoleskeella catenulata* (Brid. ex Schrad.) Kindb. – 1, 8, 11, 17: on shaded limestone rock; 4, 5, 6: on exposed limestone rock
- Pseudoleskeella nervosa* (Brid.) Nyholm – 1, 8, 11: on shaded limestone rock; 1, 3: on the base of *Fagus*; 11: on the bark of *Acer campestre*; 17: on rock at the river; 17: on the bark of *Alnus*
- Pterigynandrum filiforme* Hedw. – 1, 3: on the base of a *Fagus*; 2: on shaded limestone near spring; 8: on the bark of *Fagus*
- Pterygoneurum ovatum* (Hedw.) Dixon – 9, 10: on soil in calcareous grassland
- Ptychodium plicatum* (Schleich. ex F. Weber et D. Mohr) Schimp. – 6: on exposed limestone rock
- Pylaisia polyantha* (Hedw.) Schimp. – 16, 17: on shaded limestone rock and on the bark of *Alnus*
- Rhizomnium punctatum* (Hedw.) T. J. Kop. – 3: on soil; 10: on shaded limestone rock

- Rhodobryum ontariense* (Kindb.) Kindb. – 11: on shaded limestone rock
- Rhynchostegiella tenella* (Dicks.) Limpr. – 10: on shaded limestone rock
- Rhynchostegium megapolitanum* (Blandow ex F. Weber et D. Mohr) Schimp. – 11: on soil
- Rhynchostegium murale* (Hedw.) Schimp. – 1, 8, 10, 17: on shaded limestone rock; 3: on soil; 17: on rock at the river
- Rhytidiadelphus triquetrus* (Hedw.) Warnst. – 5, 6: on soil
- Schistidium apocarpum* (Hedw.) Bruch et Schimp. – 16: on rock near the river
- Schistidium atrofusum* (Schimp.) Limpr. – 6: on exposed limestone rock
- Schistidium brunnescens* Hedw. subsp. *brunnescens* – 5, 10, 13: on exposed limestone rock
- Schistidium brunnescens* Hedw. subsp. *griseum* (Nees et Hornsch.) H. H. Blom – 10: on exposed limestone rock
- Schistidium crassipilum* H. H. Blom – 1, 6, 8, 10, 11: on shaded limestone rock; 1: on limestone rock in the stream; 4, 9, 11, 15: on exposed limestone rock; 16, 17: on rock at the river
- Schistidium elegantulum* H. H. Blom – 1: on shaded limestone rock
- Schistidium helveticum* (Schkuhr) Deguchi – 4, 10: on exposed limestone rock
- Schistidium robustum* (Nees et Hornsch.) H. H. Blom – 5, 6: on exposed limestone rock
- Sciuro-hypnum populeum* (Hedw.) Ignatov et Huttunen – 1: on shaded limestone rock
- Sciuro-hypnum flotowianum* (Sendtn.) Ignatov et Huttunen – 1: on shaded limestone rock
- Seligeria acutifolia* Lindb. – 8: on shaded limestone rock
- Seligeria donniana* (Sm.) Müll. Hal. – 8: on shaded limestone rock
- Seligeria pusilla* (Hedw.) Bruch et Schimp. – 1, 8, 10: on shaded limestone rock
- Syntrichia calcicola* J. J. Amann – 4: on exposed limestone rock
- Syntrichia laevipila* Brid. – 13: on soil
- Syntrichia montana* Nees var. *montana* – 7: on exposed conglomerate rock; 10, 11, 15: on exposed limestone rock
- Syntrichia montana* Nees var. *calva* (Durieu et Sagot ex Bruch et Schimp.) J. J. Amann – 7: on exposed conglomerate rock
- Syntrichia papillosa* (Wilson) Jur. – 10: the bark of *Salix* and *Tilia*
- Syntrichia princeps* (De Not.) Mitt. – 11: on exposed limestone rock
- Syntrichia ruralis* (Hedw.) F. Weber et D. Mohr – 1, 6: on soil; 3: on the base of a *Fagus*; 8: on shaded limestone rock; 17: on rock near the river
- Syntrichia virescens* (De Not.) Ochyra – 1: on shaded limestone rock
- Taxiphyllum densifolium* (Lindb. ex Broth.) Reimers – 1: on shaded limestone rock
- Taxiphyllum wissgrillii* (Garov.) Wijk et Margad. – 1, 8, 10: on shaded limestone rock
- Thamnobryum alopecurum* (Hedw.) Gangulee – 1, 10: on shaded limestone rock
- Thuidium assimile* (Mitt.) A. Jaeger – 11, 16: on soil
- Timmia austriaca* Hedw. – 5, 6, 8: on shaded limestone rock
- Tortella inclinata* (R. Hedw.) Limpr. – 9, 10: among exposed limestone rock
- Tortella tortuosa* (Hedw.) Limpr. – 1, 3, 8: on shaded limestone rock; 4, 5, 6, 9, 10, 11: on exposed limestone rock
- Tortula inermis* (Brid.) Mont. – 10, 13, 15: on exposed limestone rock

- Tortula muralis* Hedw. var. *muralis* – 1: on shaded limestone rock; 7: on exposed conglomerate rock; 10, 13, 15: on exposed limestone rock; 16, 17: on rock at the river
- Tortula muralis* Hedw. var. *aestiva* Hedw. – 1, 10: on shaded limestone rock
- Tortula schimperi* M. J. Cano, O. Werner et J. Guerra – 1: on shaded limestone rock
- Tortula subulata* Hedw. – 1, 9: on soil; 1: on shaded limestone rock
- Trichodon cylindricus* (Hedw.) Schimp. – 1: on soil
- Trichostomum brachydontium* Bruch – 5, 8: on shaded limestone rock
- Trichostomum crispulum* Bruch – 5, 8, 9, 10: on exposed and shaded limestone rock
- Weissia brachycarpa* (Nees et Hornsch.) Jur. – 4: on exposed limestone rock; 9 on soil
- Weissia condensa* (Voit) Lindb. – 7: on exposed conglomerate rock; 10, 11, 13, 15: on exposed limestone rock
- Weissia controversa* Hedw. var. *controversa* – 1, 11: on soil
- Weissia controversa* Hedw. var. *crispata* (Nees et Hornsch.) Nyholm (= *W. fallax* Sehm.) – 1, 10: on soil among limestone rocks
- Zygodon viridissimus* (Dicks.) Brid. – 1: on the bark of *Fagus*

Conservation value of the bryoflora

Two species are red-listed in Europe.

Pseudoleskea saviana is in the regionally threatened (RT) category according to the Red data book of European bryophytes (ECCB 1995). It is a species of shaded volcanic rocks, but sometimes it is found on tree bark mainly at the base of trunks. It is a rare, continental-subalpine species. It can be found in the Alps and also more towards the east in Romania, Bulgaria, Greece and Turkey (DÜLL 1985). From Slovenia it is reported by MARTINČIČ (2003). In Suva Planina Mts it was collected from a shaded limestone rock near the summit of the mountain at 1,800 m a.s.l. It was also collected by the authors in several other mountains of Serbia, e.g. Kopaonik Mts (PAPP *et al.* 2004), Golija-Studenica Biosphere Reserve (PAPP and ERZBERGER 2005), Western Stara Planina (PAPP and ERZBERGER 2007a).

Taxiphyllum densifolium is rare (R) in Europe (ECCB 1995). It is a Pontic, montane element according to DÜLL (1985). It is sporadically found in the Czech Republic, Poland, Hungary and Russia. In SE Europe it was reported only from Romania and Serbia (SABOVLJEVIĆ *et al.* 2008). In Serbia it was discovered recently by the authors in Djerdap National Park (PAPP *et al.* 2006). It was also reported earlier from Turkey in the Asian part of Black Sea coast (PAPP 2004). In Suva Planina Mts it was found on shaded rocks at Bojanine vode at 850 m a.s.l.

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 (*Cololejeunea rossettiana*, *Scapania calcicola*) and four mosses (*Orthotrichum obtusifolium*, *Pseudoleskea saviana*, *Pterygoneurum ovatum*, *Seligeria pusilla*) are vulnerable (VU). Nine mosses (*Hygroamblystegium fluviatile*, *H. humile*, *H. tenax*, *Leptobryum pyriforme*, *Myurella julacea*, *Rhodobryum ontariense*, *Timmia austriaca*, *Syntrichia papillosa*, *S. virescens*) were placed in the category of lower risk (LR) in the national red list of bryophytes. Four mosses (*Amblystegium confervoides*, *Anomodon longifolius*, *Dicranella schreberiana*, *Neckera pumila*) were marked as data deficient (DD). The new data on these species improve the knowledge about their distribution and contribute towards a better understanding of their bryogeographical and ecological profile.

CONCLUSION

The bryophyte flora of the investigated region is very diverse. In the montane area the high number of boreal and subboreal species is characteristic besides the predominance of species of temperate zones of Europe. While around the high peaks several species with even alpine, subalpine-subarctic character (e.g. *Scapania cuspiduligera*, *Cynodontium fallax*, *Encalypta rhaptocarpa*, *E. spathulata*, *Hypnum procerrimum*, *H. revolutum*, *Mnium thomsonii*, *Myurella julacea*, *Ptychodium plicatum*, *Schistidium atrofuscum*, *Timmia austriaca*) can be found, on the lower parts of the mountain and in the gorges at the foothills numerous sub-Mediterranean, sub-Atlantic taxa occur like the aquatic-riparian *Cinclidotus fontinaloides*, *C. riparius*, *Didymodon sinuosus*, *Eucladium verticillatum*, *Fissidens crassipes* subsp. *warnstorffii*, *Hygroamblystegium fluviatile*, *Philonotis marchica*, *Pohlia wahlenbergii* var. *calcareae*, or species of dry grasslands and open places such as *Aloina ambigua*, *Bryum torquescens*, *Crossidium squamiferum*, *Dicranella howei*, *Didymodon acutus*, *D. vinealis*, *Grimmia orbicularis*, *Gymnostomum calcareum*, *Gyroweisia tenuis*, *Pleurochaete squarrosa*, *Pseudocrossidium hornschruchianum*, *Syntrichia princeps*, *Tortula inermis*.

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