

CONTRIBUTIONS TO THE BRYOPHYTE FLORA OF THE
PEŠTER PLATEAU, SW SERBIAB. PAPP¹, E. SZURDOKI¹, J. PANTOVIĆ² and M. SABOVLJEVIĆ²¹Department of Botany, Hungarian Natural History Museum

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211 bryophytes (37 liverworts and 174 mosses) were recently collected in the Pešter plateau (SW Serbia). Of these collections, five species (*Riccia canaliculata*, *Scapania praetervisa*, *Bryum canariense*, *Myurella sibirica*, *Pseudoleskeella rupestris*) were found to be new records for Serbia. Four species (*Lophozia ascendens*, *Buxbaumia viridis*, *Hamatocaulis vernicosus*, *Myurella sibirica*) are included in the Red data book of European bryophytes. An additional 19 taxa can be regarded as rare in the Balkans.

Key words: European red-listed species, liverworts, mosses, new national records, rare bryophytes, the Balkans

INTRODUCTION

Thanks to intensified field works, the exploration of the bryophyte flora of Serbia has been accelerated in the last decades. More than 100 new records were added to the national list of the bryophyte flora. While SABOVLJEVIĆ and STEVANOVIĆ (1999) cited 423 moss species for Serbia, the updated checklists (SABOVLJEVIĆ *et al.* 2008: 555 species, and ROS *et al.* 2013: 575 species) exhibit significant growth in the number of taxa. Similarly, SABOVLJEVIĆ (2000) cited 81 liverwort species and SABOVLJEVIĆ and NATCHEVA (2006) and ROS *et al.* (2007) cited 118 and 120 liverworts, respectively. The floristical results for the country are summarised in the checklists of SE Europe and the Mediterranean for liverworts (SABOVLJEVIĆ and NATCHEVA 2006, ROS *et al.* 2007) and mosses (SABOVLJEVIĆ *et al.* 2008, ROS *et al.* 2013). Some additional bryophyte species records can be found in ERZBERGER and PAPP (2011), PANTOVIĆ *et al.* (2014), PAPP and ERZBERGER (2009), PAPP *et al.* (2012a, b, c, 2013a), and SABOVLJEVIĆ *et al.* (2010). Although the last decade shows a generally better knowledge on the bryophyte flora of Serbia, many areas of the country remain bryologically poorly known. One of such areas is the Pešter plateau, which seemed to be a promising area from bryological point of view, due to its geological diversity and special microclimate, which is particularly harsh in the winter months.

MATERIAL AND METHODS

Study area

Pešter plateau (alternatively Pešterska visoravan) is a highland area situated in southwestern Serbia, in the Sandžak region. The altitude varies between 1,150 and 1,492 m, the latter figure marking the highest peak in the region named Kuljarski vrh. The plateau is located mainly in the Sjenica county, but parts are found in the Novi Pazar and Tutin counties. The plateau, surrounded by mountains named Golija (1,833 m), Hum (1,756 m), Jadovnik (1,734 m), Ozren (1,693 m), Zlatac (1,627 m), Giljeva (1,617 m), Žilindar (1,616 m), Javor (1,519 m), Ninaja (1,462 m) and Jarut (1,428 m), covers about 50 km² with the central highland named Peštersko polje. The plateau itself is the highest upland in the Balkans (and Europe) and the largest one in Serbia. It is also known as “Serbian Siberia”, due to its long and harsh winters, short cool summers, and strong winds. Since measurements are recorded in Serbia, the lowest temperature, –39 °C, was measured at Karajukića bunari village on 26 January 2006, beating the previous record of –38.4 °C measured in Sjenica in 1954.

The plateau is rich in (mainly karstic) water resources. The Uvac, Vapa, Jablanica and Grabovica rivers flow through the plateau. The plateau and its central field were once a big lake in the geological past, and as the area gradually drained through karst ruptures, marshy remnants were left in the lowest parts, and around streams. Some of the wetlands (encompassing 3,455 ha) are included in the Ramsar list of international importance. Beside karstic geology, ultramaphic rocks and soils are also characteristic features of the area.

The main settlements were developed in the edges of the fields; the area is mainly inhabited during summer time for cattle grazing.

Pešter plateau and its surroundings are home to a number of rare and endangered plant species, although the area is not officially protected by law (SEKULIĆ and ŠINŽAR-SEKULIĆ 2010).

Methods

Our collecting trip to the investigated area, shown in Figure 1, was made at the end of May to beginning of June in 2012, and in April 2014. All the important habitat types, such as wetlands, stream valleys, gorges, forests, rock formations and grasslands were investigated, and bryophytes collected from different substrates (soil, exposed and shaded rocks, tree bark, decaying wood, etc.).

The specimens are preserved in the Herbarium of the Hungarian Natural History Museum, Budapest (BP) and the Belgrade University Herbarium (BEOU).

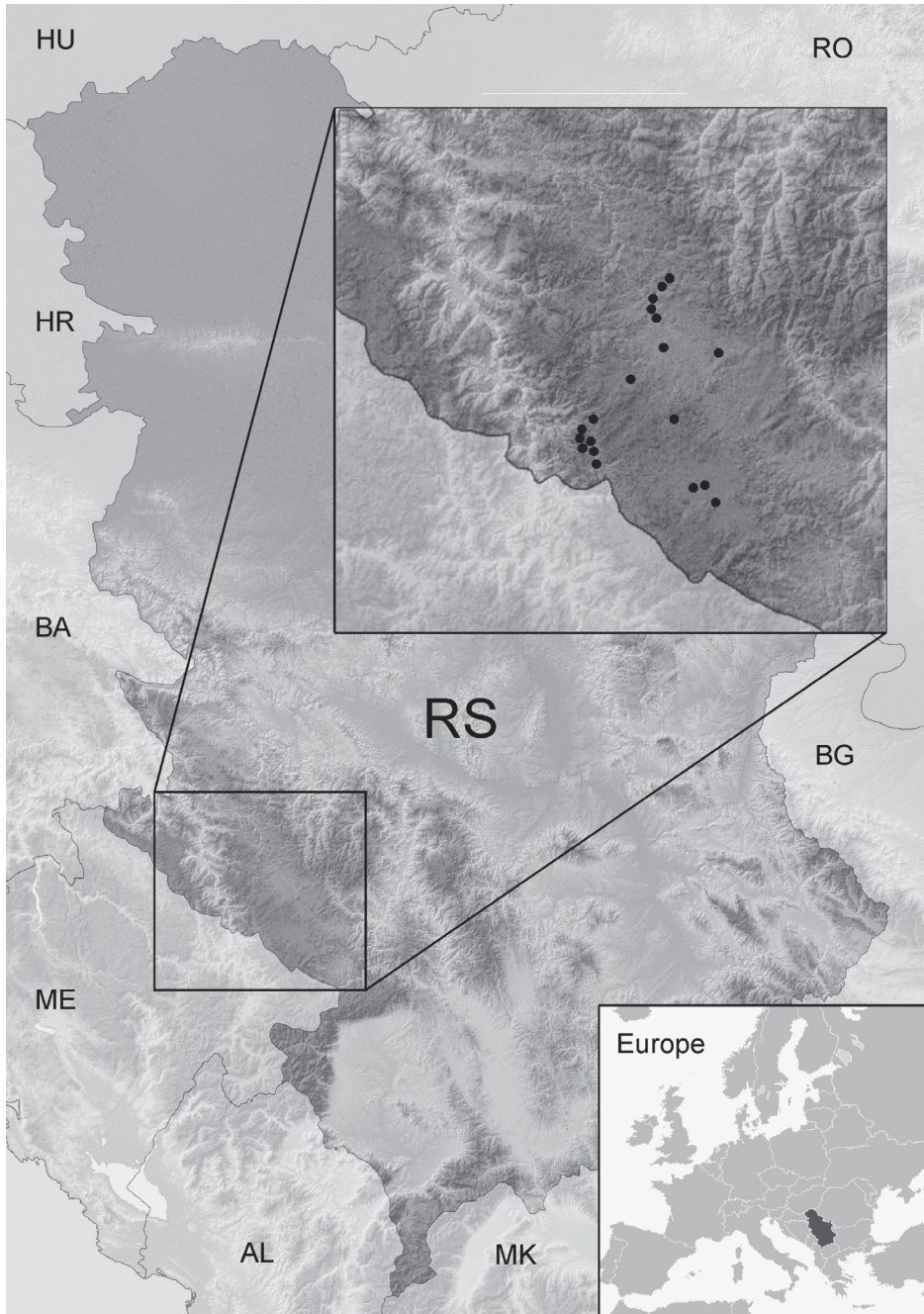


Fig. 1. Location of the study area.

Nomenclature follows GROLLE and LONG (2000) for liverworts and HILL *et al.* (2006) for mosses, except for *Polytrichum commune* var. *perigoniale*, in which case KOPERSKI *et al.* (2000) is accepted.

Site details

1. SW Serbia, Pešter plateau, S of Karajukića bunari village, 43° 04' 55.2" N, 20° 05' 04.2" E, 1,170 m, 30.05.2012.
2. SW Serbia, Pešter plateau, S of Karajukića bunari at Altunin bunar village towards Suvi do, limestone rocks in the pasture at Boroštica, 43° 03' 44.2" N, 20° 07' 10.9" E, 1,175 m, 30.05.2012.
3. SW Serbia, Pešter plateau, E of Karajukića bunari village, pasture along a stream, 43° 05' 04.1" N, 20° 06' 01.2" E, 1,160 m, 30.05.2012.
4. SW Serbia, Pešter plateau, from Karajukića bunari village to Sjenica town between Cetanoviće and Dujke, dolina along the road, 43° 10' 34.1" N, 20° 02' 33.2" E, 1,270 m, 30.05.2012.
5. SW Serbia, Pešter plateau, from Sjenica town to Crvsko village, between Bare and Goševo, serpentine bedrock, 43° 08' 20.9" N, 19° 53' 22.4" E, 1,110 m, 31.05.2012.
6. SW Serbia, Pešter plateau, at Crvsko village, limestone rocks in pasture, 43° 06' 53.3" N, 19° 54' 07.2" E, 1,140 m, 31.05.2012.
7. SW Serbia, Pešter plateau, at Goševo village, *Cerasus avium* tree, 43° 07' 44.5" N, 19° 53' 51.9" E, 1,160 m, 31.05.2012.
8. SW Serbia, Pešter plateau, between Goševo at Bare villages, *Piceo-Abietetum*, 43° 08' 08.3" N, 19° 52' 52.8" E, 1,165 m, 31.05.2012.
9. SW Serbia, Pešter plateau, near Bare village, acidic soil at roadside, 43° 09' 06.7" N, 19° 52' 20.9" E, 1,400 m, 31.05.2012.
10. SW Serbia, Pešter plateau, from Sjenica to Bare village, near Bare, limestone rock and *Piceo-Abietetum* along a stream, 43° 10' 09.5" N, 19° 53' 42.0" E, 1,290 m, 01.06.2012.
11. SW Serbia, Pešter plateau, near Bare, *Piceo-Abietetum*, 43° 08' 36.8" N, 19° 52' 20.8" E, 1,300 m, 01.06.2012.
12. SW Serbia, Pešter plateau, from Bare to Sjenica, serpentine rocks at the roadside, 43° 16' 14.6" N, 20° 01' 08.8" E, 1,380 m, 01.06.2012.
13. SW Serbia, Pešter plateau, at Sjenica ski center, limestone rocks in a dolina, 43° 13' 37.4" N, 19° 57' 40.0" E, 1,230 m, 01.06.2012.
14. SW Serbia, Pešter plateau, along the road from Sjenica to Novi Pazar at Kneževac village, 43° 15' 52.9" N, 20° 07' 20.2" E, 1,065 m, 02.06.2012 and 20.04.2014.
15. SW Serbia, Pešter plateau, along the road from Sjenica to Ivanjica, Uvac Reserve, at a lakeshore, 43° 19' 33.0" N, 20° 00' 13.5" E, 1,000 m, 02.06.2012.
16. SW Serbia, Pešter plateau, along the road from Sjenica to Ivanjica, after Uvac Reserve at the stream, limestone rock, 43° 21' 37.2" N, 20° 01' 46.7" E, 1,075 m, 02.06.2012.
17. SW Serbia, Pešter plateau, along the road from Sjenica to Ivanjica, after Uvac Reserve at a spring, *Caricetum*, 43° 21' 01.8" N, 20° 01' 0.7" E, 1,040 m, 02.06.2012.
18. SW Serbia, Pešter plateau, along the road from Sjenica to Ivanjica, Uvac Reserve, under the lake, 43° 19' 11.5" N, 20° 00' 08.8" E, 1,000 m, 02.06.2012.
19. SW Serbia, Pešter plateau, along the road from Sjenica to Ivanjica, Uvac Reserve, Uvac river near Sjenica, 43° 18' 49.1" N, 20° 00' 24.9" E, 1,005 m, 02.06.2012.

RESULTS AND DISCUSSION

Altogether 211 bryophytes (37 liverworts and 174 mosses) were collected in the Pešter plateau. The numerals following the species names refer to the collection sites described above.

Hepaticae

- Aneura pinguis* (L.) Dumort. – 14: in *Caricetum*
Apometzgeria pubescens (Schrank) Kuwah. – 10: limestone rock
Barbilophozia barbata (Schreb.) Loeske – 13: limestone rock
Cephaloziella divaricata (Sm.) Schiffn. – 1: limestone rock; 5: serpentine grassland
Conocephalum salebrosum Szweyk., Buczkowska et Odrzykoski – 5: wet meadow at the stream; 10: at a spring
Frullania dilatata (L.) Dumort. – 5: serpentine grassland and bark of *Salix caprea*; 19: *Salix* bark
Jungermannia leiantha Grolle – 11: decaying wood
Leiocolea collaris (Nees) Schljakov – 10: limestone rock
Lejeunea cavifolia (Ehrh.) Lindb. – 5: serpentine rock
Lepidozia reptans (L.) Dumort. – 11: decaying wood
Lophocolea bidentata (L.) Dumort. – 9: acidic soil at roadside
Lophocolea heterophylla (Schrad.) Dumort. – 1: in *Caricetum*; 10, 11: decaying wood
Lophocolea minor Nees – 5: serpentine rock; 9: acidic soil at roadside
Lophozia ascendens (Warnst.) R. M. Schust. – 11: decaying wood
Lophozia excisa (Dicks.) Dumort. – 12: serpentine rock
Lophozia incisa (Schrad.) Dumort. – 9: acidic soil at roadside
Lophozia obtusa (Lindb.) A. Evans – 9: acidic soil at roadside; 10: limestone rock; 12: serpentine rock
Marchantia polymorpha L. subsp. *polymorpha* – 14: in *Caricetum*
Metzgeria furcata (L.) Dumort. – 5: serpentine rock; 10: limestone rock
Nowellia curvifolia (Dicks.) Mitt. – 10, 11: decaying wood
Pellia endiviifolia (Dicks.) Dumort. – 5: wet meadow at the stream; 10: at a spring
Plagiochila asplenioides (L. emend. Taylor) Dumort. – 10: along a stream
Plagiochila porelloides (Torrey ex Nees) Lindenb. – 5, 12: serpentine rock; 9: acidic soil at roadside; 10: limestone rock
Porella cordaeana (Huebener) Moore – 5: serpentine rock; 10: limestone rock; 11: decaying wood
Preissia quadrata (Scop.) Nees – 10, 13: limestone rock
Ptilidium pulcherrimum (Weber) Vain. – 8, 10, 11: decaying wood
Radula complanata (L.) Dumort. – 2, 10: limestone rock; 5: serpentine rock and bark of *Salix caprea*; 8: bark of *Populus tremula*
Reboulia hemisphaerica (L.) Raddi – 2, 13, 18: soil among limestone rocks
Riccardia multifida (L.) Gray – 10: along a stream
Riccia canaliculata Hoffm. – 3: at the stream (conf. S. Ștefănuț) (PAPP *et al.* 2014b)
Riccia ciliifera Link ex Lindenb. – 3: in pasture
Riccia glauca L. – 3: in pasture; 15: soil at a lake
Riccia sorocarpa Bisch. var. *sorocarpa* – 3: in pasture
Riccia sorocarpa Bisch. var. *heegii* Schiffn. – 13: soil among limestone rocks
Scapania aspera M. Bernet et Bernet – 10: limestone rock

Scapania calcicola (Arnell et J. Perss.) Ingham – 10: limestone rock
Scapania praetervisa Meyl. – 12: serpentine rock (conf. S. Ștefănuț) (PAPP *et al.* 2014b)

Musci

Abietinella abietina (Hedw.) M. Fleisch. – 1: in pasture; 2: limestone rock; 5: serpentine grassland
Amblystegium confervoides (Brid.) Schimp. – 5: serpentine rock
Amblystegium serpens (Hedw.) Schimp. – 1: in pasture and *Caricetum*; 5: serpentine rock; 10: decaying wood
Amphidium mougeotii (Schimp.) Schimp. – 5: serpentine rock
Anomodon attenuatus (Hedw.) Huebener – 5: serpentine rock and bark of *Salix caprea*
Anomodon viticulosus (Hedw.) Hook. et Taylor – 2, 10, 13: limestone rock; 5: serpentine rock
Atrichum undulatum (Hedw.) P. Beauv. – 1: in pasture; 5: wet meadow at the stream
Aulacomnium palustre (Hedw.) Schwägr. – 1: in *Caricetum*; 3: in pasture
Bartramia halleriana Hedw. – 12: serpentine rock
Bartramia ithyphylla Brid. – 12: serpentine rock
Bartramia pomiformis Hedw. – 5: serpentine rock
Brachytheciastrum velutinum (Hedw.) Ignatov et Huttunen – 8, 11: decaying wood; 9: acidic soil at roadside; 10: sandstone rock
Brachythecium albicans (Hedw.) Schimp. – 1: in pasture; 2: limestone rock
Brachythecium glareosum (Spruce) Schimp. – 2: limestone rock
Brachythecium mildeanum (Schimp.) Schimp. – 3: in pasture
Brachythecium rivulare Schimp. – 5: wet meadow at the stream; 16: limestone rock at the stream
Brachythecium rutabulum (Hedw.) Schimp. – 1: in *Caricetum*; 5: wet meadow at the stream and serpentine rock; 17: at a spring
Brachythecium tommasinii (Sendtn. ex Boulay) Ignatov et Huttunen – 13: limestone rock
Bryoerythrophyllum recurvirostrum (Hedw.) P. C. Chen – 2, 4: limestone rock; 5: serpentine grassland; 19: *Salix* bark
Bryum alpinum Huds. ex With. – 1, 3: in pasture; 5: serpentine grassland
Bryum archangelicum Bruch et Schimp. – 1: in a pasture (det. W. Schröder) and *Caricetum*
Bryum argenteum Hedw. – 1: in pasture; 4: limestone rock; 5: serpentine grassland
Bryum caespiticium Hedw. – 1: in pasture; 2, 13: limestone rock; 5: serpentine grassland
Bryum canariense Brid. – 1: in pasture (conf. W. Schröder) (PAPP *et al.* 2014c)
Bryum capillare Hedw. – 11: soil
Bryum elegans Nees – 1: in pasture (conf. W. Schröder); 2: limestone rock
Bryum gemmiferum R. Wilczek et Demaret – 1: in pasture
Bryum moravicum Podp. – 2, 13: limestone rock; 5: serpentine grassland; 8: decaying wood; 19: limestone rock at the river
Bryum pseudotriquetrum (Hedw.) P. Gaertn., B. Mey. et Scherb. – 1, 14: in *Caricetum*; 3: in pasture; 5: wet meadow at the stream; 10: along a stream; 17: at a spring
Bryum uliginosum (Brid.) Bruch et Schimp. – 13: limestone rock (det. W. Schröder)
Buxbaumia viridis (Moug. ex Lam. et DC.) Brid. ex Moug. et Nestl. – 10, 11: decaying wood
Calliergon giganteum (Schimp.) Kindb. – 14: in *Caricetum*
Calliergonella cuspidata (Hedw.) Loeske – 1, 14: in *Caricetum*; 3: in pasture; 5: wet meadow at the stream; 10, 17: at a spring; 16: limestone rock at the stream
Campylium protensum (Brid.) Kindb. – 10: limestone rock
Campylophyllum calcareum (Crundw. et Nyholm) Hedenäs – 5: serpentine grassland
Ceratodon purpureus (Hedw.) Brid. – 1: in *Caricetum* and soil among limestone rocks; 5: wet meadow at the stream and serpentine grassland

- Cinclidotus fontinaloides* (Hedw.) P. Beauv. – 19: limestone rock at the river
Cinclidotus riparius (Host ex Brid.) Arn. – 19: limestone rock at the river
Cirriphyllum piliferum (Hedw.) Grout – 9: acidic soil at roadside
Climacium dendroides (Hedw.) F. Weber et D. Mohr – 1: in *Caricetum*; 5: wet meadow at the stream
Cratoneuron filicinum (Hedw.) Spruce – 4, 10: limestone rock; 5: wet meadow at the stream and serpentine rock; 10: along a stream; 16, 19: limestone rock at the stream; 17: at a spring
Ctenidium molluscum (Hedw.) Mitt. – 10, 13: limestone rock
Dicranella schreberiana (Hedw.) Dixon – 3: in pasture
Dicranum bonjeanii De Not. – 1: in pasture
Dicranum polysetum Sw. ex anon. – 8: soil
Dicranum scoparium Hedw. – 8: soil; 10, 11: decaying wood; 12: serpentine rock
Dicranum tauricum Sapjegin – 8, 10, 11: decaying wood
Didymodon fallax (Hedw.) R. H. Zander – 9: acidic soil at roadside
Didymodon ferrugineus (Besch.) M. O. Hill – 5: serpentine grassland
Didymodon rigidulus Hedw. – 2, 10, 13: limestone rock; 16: limestone rock at the stream
Didymodon vinealis (Brid.) R. H. Zander – 14: in dry grassland
Distichium capillaceum (Hedw.) Bruch et Schimp. – 10, 13: limestone rock
Ditrichum flexicaule (Schwägr.) Hampe – 3, 6, 13: limestone rock; 10: sandstone and serpentine rocks; 16: limestone rock at the stream
Ditrichum gracile (Mitt.) Kuntze – 2, 10, 13: limestone rock
Ditrichum pusillum (Hedw.) Hampe – 1: in pasture
Drepanocladus aduncus (Hedw.) Warnst. – 1, 14: in *Caricetum*; 15: soil at a lake
Drepanocladus polygamus (Schimp.) Hedenäs – 3: in pasture
Encalypta ciliata Hedw. – 12: serpentine rock
Encalypta streptocarpa Hedw. – 2, 10, 13: limestone rock; 10: sandstone rock
Encalypta vulgaris Hedw. – 2, 13: limestone rock; 5: serpentine grassland; 10: serpentine rock
Entosthodon fascicularis (Hedw.) Müll. Hal. – 14: on the soil along the road
Eurhynchiastrum pulchellum (Hedw.) Ignatov et Huttunen var. *pulchellum* – 12: serpentine rock
Eurhynchiastrum pulchellum (Hedw.) Ignatov et Huttunen var. *diversifolium* (Schimp.) Ochyra et Żarnowiec – 2: limestone rock
Eurhynchium angustirete (Broth.) T. J. Kop. – 10: along a stream; 11: soil
Fissidens adianthoides Hedw. – 3: in pasture
Fissidens dubius P. Beauv. – 10: limestone rock and at a spring
Fissidens taxifolius Hedw. – 5: serpentine rock; 9: acidic soil at roadside; 10: limestone rock
Fontinalis antipyretica Hedw. – 16, 19: limestone rock at the stream
Funaria hygrometrica Hedw. – 1: in *Caricetum*
Grimmia laevigata (Brid.) Brid. – 5: serpentine grassland
Grimmia ovalis (Hedw.) Lindb. – 5: serpentine grassland
Grimmia pulvinata (Hedw.) Sm. – 4, 6, 13: limestone rock; 5: serpentine grassland
Gymnostomum calcareum Nees et Hornsch. – 10: limestone rock
Hamatocaulis vernicosus (Mitt.) Hedenäs – 14: in *Caricetum*
Hedwigia ciliata (Hedw.) P. Beauv. var. *leucophaea* Bruch et Schimp. – 5: serpentine grassland
Herzogiella seligeri (Brid.) Z. Iwats. – 10, 11: decaying wood
Homalothecium sericeum (Hedw.) Schimp. – 2, 6, 10, 13: limestone rock; 5: serpentine rock and bark of *Salix caprea*; 10: serpentine rock; 16: limestone rock at the stream
Homomallium incurvatum (Brid.) Loeske – 5: serpentine rock
Hygrohypnum luridum (Hedw.) Jenn. – 5: serpentine rock; 16: limestone rock at the stream
Hylocomium splendens (Hedw.) Schimp. – 8: soil; 10: limestone rock

- Hypnum cupressiforme* Hedw. var. *cupressiforme* – 5: serpentine rock and bark of *Salix caprea*; 8: soil; 11: decaying wood
- Hypnum cupressiforme* Hedw. var. *lacunosum* Brid. – 5: serpentine grassland; 9: acidic soil at roadside
- Isopterygiopsis pulchella* (Hedw.) Z. Iwats. – 10: limestone rock
- Leptodictyum riparium* (Hedw.) Warnst. – 14: in *Caricetum*; 19: limestone rock at the river
- Leskea polycarpa* Hedw. – 19: limestone rock at the river and *Salix* bark
- Leucodon sciuroides* (Hedw.) Schwägr. – 5: serpentine grassland and bark of *Salix caprea*
- Mnium lycopodioides* Schwägr. – 5: serpentine rock
- Mnium marginatum* (Dicks.) P. Beauv. – 5: serpentine rock
- Mnium stellare* Hedw. – 2: limestone rock; 5: serpentine rock
- Myurella sibirica* (Müll. Hal.) Reimers – 13: limestone rock (conf. L. Meinunger) (PAPP *et al.* 2014a)
- Neckera complanata* (Hedw.) Huebener – 5: serpentine rock; 10: limestone rock
- Neckera crispa* Hedw. – 10: limestone rock
- Neckera menziesii* Drumm. – 5: serpentine rock; 10, 13: limestone rock
- Orthotrichum affine* Schrad. ex Brid. – 5: bark of *Salix caprea*; 7: bark of *Cerasus avium*; 8: bark of *Populus tremula*; 19: *Salix* bark
- Orthotrichum anomalum* Hedw. – 1, 2, 6, 13: limestone rock; 16, 19: limestone rock at the stream
- Orthotrichum cupulatum* Hoffm. ex Brid. var. *cupulatum* – 1, 2, 13: limestone rock; 16: limestone rock at the stream
- Orthotrichum cupulatum* Hoffm. ex Brid. var. *riparium* Huebener – 19: limestone rock at the river
- Orthotrichum lyellii* Hook. et Taylor – 5: bark of *Salix caprea*
- Orthotrichum obtusifolium* Brid. – 8: bark of *Populus tremula*; 19: *Salix* bark
- Orthotrichum pallens* Bruch ex Brid. – 5: bark of *Salix caprea*; 19: *Salix* bark
- Orthotrichum pumilum* Sw. ex anon. – 19: *Salix* bark
- Orthotrichum rupestre* Schleich. ex Schwägr. – 5: serpentine grassland
- Orthotrichum speciosum* Nees – 5: bark of *Salix caprea*; 7: bark of *Cerasus avium*; 8: bark of *Populus tremula*; 19: *Salix* bark
- Orthotrichum stramineum* Hornsch. ex Brid. – 7: bark of *Cerasus avium*; 19: *Salix* bark
- Orthotrichum striatum* Hedw. – 5: bark of *Salix caprea*; 7: bark of *Cerasus avium*; 8: bark of *Populus tremula*; 19: *Salix* bark
- Oxyrrhynchium hians* (Hedw.) Loeske – 10: at a spring; 13: limestone rock
- Palustriella commutata* (Hedw.) Ochyra – 5: wet meadow at the stream; 10: at a spring
- Palustriella falcata* (Brid.) Hedenäs – 10: at a spring
- Phascum cuspidatum* Hedw. – 14: in dry grassland
- Philonotis fontana* (Hedw.) Brid. – 3: at the stream
- Philonotis seriata* Mitt. – 5: wet meadow at the stream
- Physcomitrium pyriforme* (Hedw.) Bruch et Schimp. – 15: soil at a lake
- Plagiobryum zieri* (Hedw.) Lindb. – 13: limestone rock
- Plagiomnium affine* (Blandow ex Funck) T. J. Kop. – 1, 3: in pasture; 5: serpentine rock
- Plagiomnium cuspidatum* (Hedw.) T. J. Kop. – 2: limestone rock; 5: serpentine rock
- Plagiomnium elatum* (Bruch et Schimp.) T. J. Kop. – 5: wet meadow at the stream; 14: in *Caricetum*; 17: at a spring
- Plagiomnium rostratum* (Schrad.) T. J. Kop. – 2, 13: limestone rock; 5: serpentine rock; 10: along a stream
- Plagiomnium undulatum* (Hedw.) T. J. Kop. – 5: serpentine rock; 10: along a stream
- Plagiopus oederianus* (Sw.) H. A. Crum et L. E. Anderson – 10, 13: limestone rock
- Plagiothecium cavifolium* (Brid.) Z. Iwats. – 5: serpentine rock
- Platyhypnidium riparioides* (Hedw.) Dixon – 5: serpentine rock

- Pleuridium acuminatum* Lindb. – 1, 3: in pasture
Pleurozium schreberi (Willd. ex Brid.) Mitt. – 1: in pasture; 8: soil; 9: acidic soil at roadside; 11: soil
Pogonatum urnigerum (Hedw.) P. Beauv. – 9: acidic soil at roadside
Poblia cruda (Hedw.) Lindb. – 12: serpentine rock
Poblia wahlenbergii (F. Weber et D. Mohr) A. L. Andrews – 3: in pasture; 17: at a spring
Polytrichastrum alpinum (Hedw.) G. L. Sm. – 1: in pasture; 9: acidic soil at roadside; 12: serpentine rock
Polytrichum commune Hedw. var. *commune* – 1: in *Caricetum*
Polytrichum commune Hedw. var. *perigoniale* (Michx.) Hampe – 1: in pasture
Polytrichum juniperinum Hedw. – 1, 3: in pasture
Polytrichum piliferum Hedw. – 5: serpentine grassland
Pseudoleskeella catenulata (Brid. ex Schrad.) Kindb. – 2, 4, 10, 13: limestone rock; 16: limestone rock at the stream
Pseudoleskeella rupestris (Berggr.) Hedenäs et L. Söderstr. – 5: serpentine rock (PAPP *et al.* 2014b)
Pseudoscleropodium purum (Hedw.) M. Fleisch. – 10: along a stream
Pterigynandrum filiforme Hedw. – 8: decaying wood
Pylaisia polyantha (Hedw.) Schimp. – 16: limestone rock at the stream; 19: limestone rock at the stream and *Salix* bark
Racomitrium canescens (Hedw.) Brid. – 5: serpentine grassland
Racomitrium elongatum Ehrh. ex Frisvoll – 5: serpentine grassland; 11: soil
Rhizomnium punctatum (Hedw.) T. J. Kop. – 10: along a stream; 11: decaying wood
Rhynchostegium murale (Hedw.) Schimp. – 10: limestone rock
Rhytidiadelphus triquetrus (Hedw.) Warnst. – 8: soil; 9: acidic soil at roadside; 10: limestone rock; 12: serpentine rock
Rhytidium rugosum (Hedw.) Kindb. – 1: in pasture; 5: serpentine grassland; 6: limestone grassland
Saelania glaucescens (Hedw.) Broth. – 12: serpentine rock
Sanionia uncinata (Hedw.) Loeske – 11: decaying wood
Schistidium apocarpum (Hedw.) Bruch et Schimp. – 5, 12: serpentine rock
Schistidium atrofusum (Schimp.) Limpr. – 6, 13: limestone rock
Schistidium brunnescens Limpr. subsp. *brunnescens* – 2: limestone rock
Schistidium brunnescens Limpr. subsp. *griseum* (Nees et Hornsch.) H. H. Blom – 2, 3, 6, 13: limestone rock
Schistidium confertum (Funck) Bruch et Schimp. – 5: serpentine grassland
Schistidium crassipilum H. H. Blom – 1, 2, 6, 10: limestone rock; 16, 19: limestone rock at the stream
Schistidium flaccidum (De Not.) Ochyra – 5: serpentine grassland
Schistidium helveticum (Schkuhr) Deguchi – 5: serpentine grassland
Sciuro-hypnum populeum (Hedw.) Ignatov et Huttunen – 5: serpentine rock
Seligeria pusilla (Hedw.) Bruch et Schimp. – 10: limestone rock
Sphagnum palustre L. – 1: in pasture
Sphagnum subsecundum Nees – 1: in pasture
Straminergon stramineum (Dicks. ex Brid.) Hedenäs – 1: in *Caricetum*
Syntrichia calcicola J. J. Amann – 5: serpentine grassland; 13: limestone rock
Syntrichia latifolia (Bruch ex Hartm.) Huebener – 19: *Salix* bark
Syntrichia montana Nees – 3: limestone rock
Syntrichia ruralis (Hedw.) F. Weber et D. Mohr – 1: in pasture; 2, 4, 6, 10: limestone rock; 5: serpentine grassland; 19: limestone rock at the river and *Salix* bark
Taxiphyllum wissgrillii (Garov.) Wijk et Margad. – 5: serpentine rock

- Thamnobryum alopecurum* (Hedw.) Gangulee – 5: serpentine rock
Thuidium assimile (Mitt.) A. Jaeger – 5: serpentine rock
Timmia austriaca Hedw. – 10, 13: limestone rock
Tortella fragilis (Hook. et Wilson) Limpr. – 2, 3: limestone rock
Tortella inclinata (R. Hedw.) Limpr. – 3, 13: limestone rock
Tortella tortuosa (Hedw.) Limpr. – 2, 3, 6, 10, 13: limestone rock; 5: serpentine rock; 11: soil; 16: limestone rock at the stream
Tortula muralis Hedw. – 13: limestone rock
Tortula subulata Hedw. – 2: limestone rock; 5: serpentine grassland; 9: acidic soil at roadside; 10: sandstone rock; 12: serpentine rock; 16: limestone rock at the stream
Trichodon cylindricus (Hedw.) Schimp. – 1: in pasture
Warnstorfia exannulata (Schimp.) Loeske – 1: in *Caricetum*
Weissia condensata (Voit) Lindb. – 6: limestone rock
Weissia controversa Hedw. – 5: serpentine grassland

Five species were found to be first records for Serbia, and these were published in separate papers; *Bryum canariense* in PAPP *et al.* (2014c), *Myurella sibirica* (PAPP *et al.* 2014a), *Riccia canaliculata*, *Scapania praetervisa* and *Pseudoleskeella rupestris* in (PAPP *et al.* 2014b).

Riccia canaliculata is a species of the southern temperate zones of Europe (DÜLL 1983). In SE Europe it is known only from Greece and Romania (ROS *et al.* 2007). In Romania, it is included in the national red list in data-deficient (DD) category (ȘTEFĂNUȚ and GOIA 2012).

Scapania praetervisa is a rare arctic-alpine species (DÜLL 1983). Recently, it has been reported as new to Balkans, from the Republic of Macedonia (PAPP *et al.* 2011) and from Montenegro (PAPP *et al.* 2013b).

Bryum canariense is an interesting moss of austral tropical to temperate distribution (DIERSSEN 2001). It is known from all countries of SE Europe except Romania (SABOVLJEVIĆ *et al.* 2008). It is a threatened species; in Bulgaria it is classified as vulnerable (NATCHEVA *et al.* 2006) and as at low risk in Montenegro (SABOVLJEVIĆ *et al.* 2004).

Myurella sibirica is a subarctic, alpine element (DÜLL 1985). In SE Europe it is known only from Slovenia and Bosnia-Herzegovina according to SABOVLJEVIĆ *et al.* (2008) and has been only recently reported from Montenegro (PAPP *et al.* 2014a). According to the Red data book of European bryophytes (ECCB 1995) it is considered as endangered in Europe. It is known only from a few countries in Europe; in Austria it is considered as potentially endangered (GRIMS 1999), and in Slovakia as endangered (KUBINSKÁ *et al.* 2001).

Pseudoleskeella rupestris is a circumpolar, boreal, montane (SMITH 2004) species previously treated as a variety of *P. catenulata*. This moss is newly reported for the Balkans, from Montenegro (DRAGIĆEVIĆ *et al.* 2008) and Albania (PAPP *et al.* 2010).

Species red-listed in Europe

Four species are included in the Red data book of European bryophytes (ECCB 1995). These are as follows.

Lophozia ascendens is a boreal, montane liverwort (DÜLL 1983) living on decaying wood in constantly humid forests. It is rare (R) in Europe according to the Red data book of European bryophytes (ECCB 1995). Several vigorous populations can be found in Serbia (PAPP *et al.* 2009) and in some neighbouring Balkan countries, such as Croatia (PAPP *et al.* 2013c, d) and Montenegro (PAPP *et al.* 2013b, PAPP and ERZBERGER 2010, PAPP *et al.* 2014d).

Buxbaumia viridis is a boreal, montane species (DÜLL 1984). It also thrives on well-decayed wood in humid forests. This moss is included in the Bern Convention and the European Union Habitats and Species Directives (ECCB 1995), vulnerable in Europe according to the Red data book of European bryophytes (ECCB 1995). Several extant populations are known in Serbia (PAPP *et al.* 2009) and in some neighbouring Balkan countries, such as Croatia (ALEGRO *et al.* 2014, PAPP *et al.* 2013c, d), Montenegro (DRAGIĆEVIĆ *et al.* 2011), and the Republic of Macedonia (PAPP and ERZBERGER 2012).

Hamatocaulis vernicosus is a boreal element (DÜLL 1985) occurring in oligotrophic wet grasslands. It is included in the Bern Convention, the European Union Habitats and Species Directive, and as insufficiently known (K) in Europe according to the Red data book of European bryophytes (ECCB 1995). Pešter plateau is its second locality in Serbia. It has an extant population at Vlasina lake, but at that location only a few individuals were collected, intermixed with *Warnstorfia exannulata* in an *Eriophoretum* wetland (PAPP *et al.* 2012d). At the Pešter plateau, uniquely, a large population, covering ca 25 m² as an almost clear stand was found in *Caricetum*. The species is very rare in the Balkans. Its only known locality in Montenegro is at Barno jezero in the Durmitor Mts, where the existence of the population was proved in 2004 (PAPP and ERZBERGER 2010). There is a recently found population in Croatia, in Plitvička jezera National Park, which is the single known really viable population of this species in that country (ALEGRO *et al.* 2014).

Myurella sibirica is a subarctic, alpine element (DÜLL 1985) living on limestone rocks, in rock crevices in montane to high-mountain habitats. It is endangered in Europe according to the Red data book of European bryophytes (ECCB 1995). It has recently been reported for the first time from Serbia, on the basis of this record from the Pešter plateau, and from Montenegro (PAPP *et al.* 2014a). Previously, in SE Europe it was only known from Slovenia and Bosnia-Herzegovina, according to SABOVLJEVIĆ *et al.* (2008).

CONCLUSIONS

Pešter plateau maintains high bryophyte diversity due to the various habitat types and bedrocks occurring in this upland area. From the aspect of bryophyte conservation, wetlands are the most important habitat types on the Pešter plateau, because they are rare, sporadic, and of limited size in the Balkans. The wetlands of the Pešter plateau support the existence of *Sphagnum* species (*S. palustre*, *S. subsecundum*) being red-listed in Serbia, also the above mentioned species of the European Union Habitats and Species Directives, *Hamatocaulis vernicosus*, and other rarities in the Balkans, such as *Calliergon giganteum*, *Dicranum bonjeanii*, *Drepanocladus polygamus*, *Fissidens adianthoides*, and *Straminergon stramineum*. Due to the high elevation of the plateau, boreal liverworts (DÜLL 1983) rare in the Balkans also occur on acidic soils and serpentine rocks, including *Lophozia excisa*, *L. incisa*, *L. obtusa*, and *Scapania praetervisa* (reported for the first time from Serbia here). Also, moss species rare in the Balkans with subarctic, boreal character (DÜLL 1984, 1985) live on limestone rocks here, such as *Bryum uliginosum*, *Isopterygiopsis pulchella*, *Plagiobryum zierii*, *Schistidium atrofussum*, and *Tortella fragilis*. Among the latter ones we can also mention *Myurella sibirica* found for the first time in Serbia. Other boreal (and European red-listed) species that were located on decaying wood, are also additions to the list from the plateau, exemplified by *Lophozia ascendens* and *Buxbaumia viridis*. Temperate zone species of Europe (DÜLL 1983, 1984) occurring on the Pešter plateau, and rare in the Balkans, include *Riccia canaliculata* (found for the first time in Serbia here) and *Riccardia multifida* (these are living along streams), and *Syntrichia latifolia* that was found on tree bark.

* * *

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