

Contribution to the bryophyte flora of Mt Boranja (West Serbia)

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Received: October 11, 2012 ▷ Accepted: February 26, 2013

Abstract. The study offers an insight into the bryophyte flora of Mt Boranja (West Serbia). This region comprises 94 bryophyte taxa (namely, 19 liverworts and 75 mosses), which account for about 13.97% of the total number of bryophytes recorded in Serbia. Of the recorded species, three are red-listed for the country. It is expected that further investigation will contribute to increasing the number of taxa.

Key words: bryophyte flora, Mt Boranja, red-listed species, Serbia

Introduction

In spite of the recent progress in investigation of the bryophyte flora of Serbia, bryophytes of this area are still poorly known and many species records are still being published (Cvetić & Sabovljević 2005; Sabovljević & Grdović 2009; Papp & Sabovljević 2010; Sabovljević & al. 2010; Ellis & al. 2011a,b, 2012; Papp & al. 2012).

Mt Boranja (UTM 34T CQ61) is situated in the western part of Serbia (Fig. 1), between the cities of Krupanj and Zvornik. Geomorphologically, the massif is traversed by several rivers, such as the Borinska, Radaljska and Velika, and many other streams and rivulets. The highest peak of Mt Boranja is Crni Vrh (856 m) (Ćirković 2003). Geologically, granodiorite is the most typical bedrock. The granodiorite massif stretches over a surface of 55 km². Northwards and southwards of it there are limestone rocks, and some sandstone, quartzite and phyllite rocks in the west (Mojsilović & al. 1977). All soil types in this region (parapodzols, rankers and brown acid soils) are due to the low acid reaction of its geological substrate: pH between 5.06 and 5.45 (Mišić 1956).

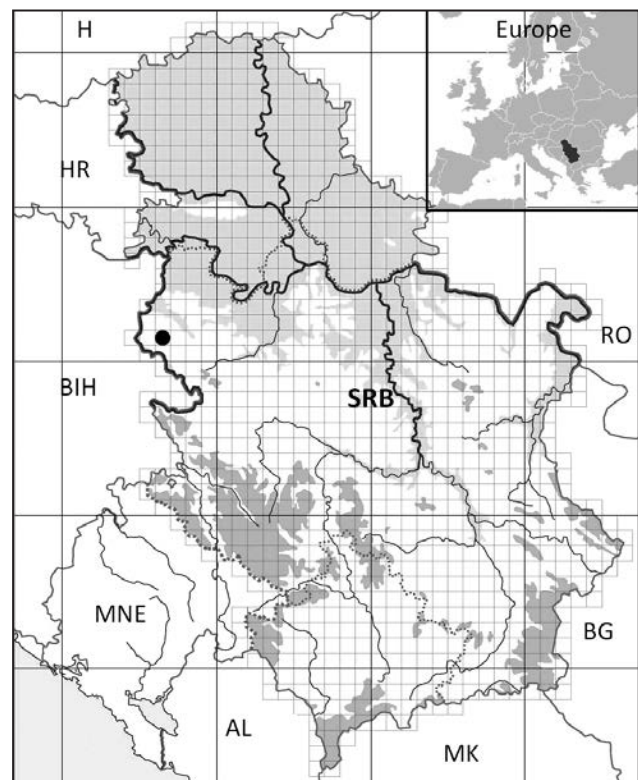


Fig. 1. Location of the investigated area. The black circle indicates the position of Mt Boranja in Serbia. (AL – Albania, BG – Bulgaria, BIH – Bosnia-Herzegovina, H – Hungary, HR – Croatia, MK – Macedonia (FYR), MNE – Montenegro, RO – Romania, SRB – Serbia).

The climate of this region is mountain continental in type, with influence of the humid Atlantic climate from the west (Stevanović & Stevanović 1995). The annual average precipitation is 988 mm, with the heaviest rainfall average in May (94 mm), June (126 mm) and July (98 mm), and the least rainfall in January (54 mm). The average air humidity is 81 %. The annual average temperature is 9.9 °C, with July as the warmest month (19.5 °C), and January as the coolest (0.1 °C). The lowest and highest temperatures recorded ever since were -22.3 °C and 41.5 °C, respectively.

Vegetation of this area is poorly investigated and has been neglected for a long time. The main type of vegetation is the well preserved beech forests. According to Mišić (1956), the main communities are *Fagetum montanum serbicum* Rudski 1949, *Abieto-Fagetum serbicum* Jov. 1959 and *Fagetum-Muscetum* Jov. 1953.

The bryophyte flora of Mt Boranja has not been investigated so far, therefore this study represents the first insight into the bryophyte flora of this area.

Material and methods

Field trips were made in April and July of 2011. All main habitat types were visited and bryophytes were collected from various substrates, namely rocks, soil, tree bark, logs, etc. The so called transect method was applied, while collecting the bryophytes.

The collecting sites were:

1. Serbia, Mt Boranja, Crni Vrh, N 44°22'30.03", E 19°15'15.06", 854 m
2. Serbia, Mt Boranja, Crkvine, N 44°22'41.71", E 19°18'29.91", 504 m
3. Serbia, Mt Boranja, Debelo Osoje, N 44°22'12.14", E 19°15'40.80", 815 m
4. Serbia, Mt Boranja, Gajići, N 44°23'50.50", E 19°17'56.62", 699 m
5. Serbia, Mt Boranja, Gornja Mala, 44°24'34.10", E 19°18'43.98", 491 m
6. Serbia, Mt Boranja, Orašac, N 44°21'23.89", E 19°16'11.81", 823 m
7. Serbia, Mt Boranja, Poljanska Kosa, N 44°23'3.12", E 19°16'41.53", 734 m
8. Serbia, Mt Boranja, Radaljsko Jezero, N 44°23'40.33", E 19°14'17.18", 494 m
9. Serbia, Mt Boranja, Veliki Radalj, N 44°23'27.91", E 19°15'19.24", 606 m
10. Serbia, Mt Boranja, Smiljanića Kosa, N 44°22'37.81", E 19°16'22.22", 710 m
11. Serbia, Mt Boranja, Stolice, N 44°24'14.98", E 19°19'21.90", 483 m
12. Serbia, Mt Boranja, Vrletni Osojac, N 44°23'57.26", E 19°17'10.12", 729 m
13. Serbia, Mt Boranja, Urlovačka Kosa, N 44°23'31.22", E 19°16'53.65", 700 m

Nomenclature follows Sabovljević & Natcheva (2006) for liverworts and Sabovljević & al. (2008) for mosses. The specimens were deposited in the bryophyte collection of the Belgrade University Herbarium (BEOU).

Results

A total of 94 bryophyte taxa were collected, of which 75 moss species and 19 liverworts. In the following list, the species name is followed by the site number(s) and substrate(s).

Liverworts

14. *Bazzania trilobata* (L.) Gray – 2: on soil in beech forest
15. *Calypogeia muelleriana* (Schiffn.) Müll. Frib. – 5: on soil in beech forest
16. *Conocephalum conicum* (L.) Dumort – 8: on soil by the lake, 11: on soil by the road
17. *Conocephalum salebrosum* Szweykowsky, Buczkowska & Odrzykoski - 9: on rock by the stream
18. *Diplophyllum albicans* (L.) Dumort – 2: on soil in beech forest
19. *Frullania dilatata* (L.) Dumort – 1: on tree bark (beech forest)
20. *Lophocolea bidentata* (L.) Dumort – 6: on tree bark
21. *Lophocolea heterophylla* (Schrad.) Dumort – 1: on soil in beech forest, 6, 9: on tree bark
22. *Metzgeria conjugata* Lindb. – 9: on rock in the stream
23. *Metzgeria furcata* (L.) Dumort – 1, 7, 10: on tree bark (beech forest), 8: on rock by the lake, 9: on rock by the stream, 11: on soil by the stream (beech forest)
24. *Microlejeunea ulcina* (Taylor.) A. Evans – 11: on soil by the stream (beech forest)

25. *Nardia scalaris* Gray – 9: on rock by the stream
 26. *Pedinophyllum interruptum* (Nees) Kaal – 1: on soil in beech forest
 27. *Pellia endivifolia* (Dicks.) Dumort – 5, 9: on humid soil
 28. *Plagiochila porelloides* (Ness.) Lindenb. – 7: on rock by the stream, 9, 11: on soil by the stream
 29. *Porella platyphylla* (L.) Pfeiff. – 5: on rock in beech forest
 30. *Radula complanata* (L.) Dumort – 10: on tree bark
 31. *Scapania nemorea* (L.) Grolle – 11: on soil in beech forest
 32. *Scapania undulata* (L.) Dumort – 9: on rock by the stream

Mosses

33. *Amblystegium serpens* (Hedw.) Schimp. – 10: on decaying wood (log)
 34. *Anomodon attenuatus* (Hedw.) Huebener – 11: on rock in beech forest, 9: on rock by the stream
 35. *Anomodon viticulosus* (Hedw.) Hook&Taylor – 11: on rock in beech forest
 36. *Antitrichia curtipendula* (Hedw.) Brid. – 11: on rock in beech forest
 37. *Atrichum angustatum* (Brid.) Bruch & Schimp. – 7: on soil in beech forest
 38. *Barbula convoluta* Hedw. – 8: on soil by the lake
 39. *Barbula unguiculata* Hedw. – 11: on exposed rocks
 40. *Bartramia ithyphylla* Brid. – 2: on soil in beech forest
 41. *Brachytheciastrum velutinum* (Hedw.) Ignatov & Huttunen – 6: on rock, 7: on tree bark (beech forest), 10: /, 13: in beech forest
 42. *Brachythecium albicans* (Hedw.) Schimp – 13: in meadow
 43. *Brachythecium salebrosum* (Hoffm ex F. Weber & D. Mohr) Schimp. – 7: on tree bark, 13: in beech forest
 44. *Bryum argenteum* Hedw. – 5: on rock, 11: on exposed rocks
 45. *Bryum capillare* Hedw. – 6: on rock, 8: on soil
 46. *Bryum weigellii* Spreng – 9: on soil
 47. *Calliergonella cuspidata* (Hedw.) Loeske – 12: /
 48. *Ceratodon purpureus* (Hedw.) Brid – 2: on exposed rocks 3, 8, 12: on soil
 49. *Dicranella heteromalla* (Hedw.) Schimp. – 7, 11, 12: on soil in beech forest
 50. *Dicranella varia* (Hedw.) Schimp. – 3, 10: on soil
 51. *Dicranum scoparium* Hedw. – 2: on soil in beech forest, 10: on soil
 52. *Diphyscium foliosum* (Hedw.) D. Mohr. – 11: on soil in beech forest
 53. *Ditrichum lineare* (Sw.) Lindb. – 12: on soil
 54. *Encalypta streptocarpa* Hedw. – 10: on soil
 55. *Encalypta vulgaris* Hedw. – 11: on exposed rock
 56. *Fissidens bryoides* Hedw. – 5: on soil
 57. *Fissidens taxifolius* Hedw. – 5: on soil by the road, 11: on humid rock wall by the road
 58. *Funaria hygrometrica* Hedw. – 3: on dry soil, 10: on sandy soil
 59. *Gyroweisia tenuis* (Hedw.) Schimp. – 11: on soil in beech forest
 60. *Homomallium incurvatum* (Schrader ex Brid.) Loeske – 10: on decaying wood (log)
 61. *Hygroamblystegium fluviatile* (Hedw.) Loeske – 7: on rock by the stream
 62. *Hypnum andoi* A.J.E. Sm – 2: on soil in beech forest
 63. *Hypnum cupressiforme* Hedw. – 1: on soil in beech forest, 6, 7: on tree bark, 10: on decaying wood (log)
 64. *Isothecium alopecuroides* (Lam. Ex Dubois.) Isov. – 7: on rock by the stream
 65. *Kindbergia praelonga* (Hedw.) Ochyra – 10: on tree bark
 66. *Leptodictyum riparium* (Hedw.) Schimp – 8: on soil
 67. *Leucobryum glaucum* (Hedw.) Angstr – 2, 10: on soil in beech forest
 68. *Leucodon sciuroides* (Hedw.) Schwägr. – 6: on tree bark
 69. *Mnium stellare* Hedw. – 5: on rock in beech forest
 70. *Nardia scalaris* S. F. Gray – 5: on soil
 71. *Neckera besseri* (Lobarz.) Jur. – 5: on rock in beech forest
 72. *Neckera complanata* (Hedw.) Huebener – 11: on rock in beech forest
 73. *Orthotrichum stramineum* Hornsch. Ex Brid – 7: on tree bark
 74. *Oxyrrhynchium schleicheri* (R. Hedw.) Röhl – 9: /
 75. *Oxyrrhynchium speciosum* (Brid.) Warnst. – 12: on soil by the road
 76. *Plagiomnium cuspidatum* (Hedw.) T. J. Kop – 10: on humid soil 11: on humid rock wall by the road
 77. *Plagiomnium ellipticum* (Brid.) T. J. Kop – 8: /
 78. *Plagiomnium rostratum* (Schrader) T. J. Kop 8: /

79. *Plagiomnium undulatum* (Hedw.) T. J. Kop – 9: on soil by the stream 13: on rock by the stream
80. *Plagiothecium curvifolium* Schlieph. ex Limpr. – 5: on soil, 11: on soil by the stream (beech forest)
81. *Plagiothecium denticulatum* (Hedw.) Schimp. – 1: on soil in beech forest, 7: on soil by the stream
82. *Plagiothecium nemorale* (Mitt.) A. Jaeger – 5, 12: on soil, 7: on tree bark and decaying wood, 9: on soil by the stream (beech forest)
83. *Pogonatum aloides* (Hedw.) P. Beauv. – 3: on dry soil
84. *Pogonatum nanum* (Hedw.) P. Beauv. – 10: on soil
85. *Pogonatum urnigerum* (Hedw.) P. Beauv. – 10: on soil
86. *Pohlia nutans* (Hedw.) Lindb. – 10: on sandy soil, 12: on soil by the road
87. *Pohlia wahlenbergii* (F.Weber & D.Mohr) A. L. Andrews – 7, 10: on soil
88. *Polytrichastrum formosum* (Hedw.) G. L. Sm. – 2: on exposed rock 5: in humid meadow, 7: on soil in beech forest, 8: on soil
89. *Polytrichum commune* Hedw. – 5: in humid meadow
90. *Polytrichum juniperinum* Hedw. – 10, 13: on soil
91. *Polytrichum piliferum* Hedw. – 2: on exposed rocks, 4: on soil, 7: on dry soil
92. *Pseudocrossidium hornschuchianum* (Schultz) R. H. Zander – 4, 7: on dry soil
93. *Pseudoscleropodium purum* (Hedw.) M. Fleisch – 5: in humid meadow, 8: /
94. *Racomitrium elongatum* Ehrh. Ex Frisvoll – 5: on soil
95. *Rhizomnium punctatum* (Hedw.) T. J. Kop – 8: on humid soil, 9: on rock by the stream, 13: on tree bark
96. *Rhodobryum roseum* (Hedw.) Limpr. – 12: on decaying wood in beech forest
97. *Schistidium crassipilum* H. H. Blom – 8: on concrete bridge
98. *Schistidium helvaticum* (Schkuhr) Deguchi – 3: on rock
99. *Syntrichia ruraliformis* (Besch.) Düll – 4: on exposed soil
100. *Taxiphyllum wissgrillii* (Garov.) Wijk & Margad – 9: on rock by the stream
101. *Thamnobryum alopecurum* (Hedw.) Gangulee – 9, 13: on rock in the stream
102. *Thuidium delicatulum* (Hedw.) Schimp. – 13: on rock in the stream
103. *Thuidium tamariscinum* (Hedw.) Schimp. – 7: on soil by the stream

104. *Tortella nitida* (Lindb.) Broth. – 11: on exposed rock
105. *Tortula muralis* Hedw. – 11: on exposed rock
106. *Tortula subulata* Hedw. – 10: on soil
107. *Trichostomum crispulum* Bruch – 1: on soil in beech forest, 3: on exposed soil

Discussion

In total, 94 taxa were recorded, accounting for about 13.97% of the Serbian bryophyte flora (Sabovljević & Natcheva 2006; Sabovljević & al. 2008). The relatively high number of liverwort species (16.1%) can be explained by the numerous watercourses and humid microhabitats next to streams and rivulets. According to Sabovljević & Natcheva (2006) and Sabovljević & al. (2008), no new species records can be listed for Serbia. Nevertheless, since this area has not been investigated earlier, all records are new for Mt Boranja. In the investigated area, as expected, temperate elements are prevailing among the bryophytes.

Three species are included in the *Bryophyte Red List of Serbia and Montenegro* (Sabovljević & al. 2004). Of these, one moss is Vulnerable (VU): *Hypnum andoi*; and two other liverworts are Endangered (EN): *Bazzania trilobata*, and Critically Endangered (CR): *Calyptogeia muelleriana*. Yet, the threat to the above-mentioned red-listed species cannot be defined, owing to lack of the population status examination and the fact that the national threat category should be revised according to the new level of knowledge about the national bryophyte flora accumulated in the past ten years since the *Red List* publication. However, the region is bryologically interesting because of the occurrence of some nationally scarcely distributed bryophyte species (e.g. *Diphyscium foliosum*) and as a region with an acidic geological substrate which covers a relatively small area in Serbia and hosts a rather diverse bryophyte flora, as compared to the basic substrate.

It is expected that with further investigation of this area more bryophyte species will be recorded.

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