

# CONTRIBUTIONS TO THE BRYOPHYTE FLORA OF REPUBLIC OF MACEDONIA

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## Abstract

The author presents the results of his own research of bryophyte flora carried out in years 1962–1972 in R. Macedonia. He mentioned 269 bryophyte taxa (41 liverworts and 228 mosses), among them 75 taxa (18 liverworts and 57 mosses) are reported for the first time in Republic of Macedonia. Six species are included in the Red data book of European bryophytes (ECCB 1995).

**Key words:** bryophyte flora, *Bryophyta*, *Marchantiophyta*, Republic of Macedonia, chorological analysis, red-listed species.

## Izvleček

Avtor predstavlja rezultate lastnih raziskovanj flore mahov (*Bryophyta*), ki jih je opravil v letih 1962–1972. Za R. Makedonijo navaja skupaj 269 taksonov mahov (41 jetrenjakov in 228 listnatih mahov), med njimi je 75 taksonov (18 jetrenjakov in 57 listnatih mahov) prvič zabeleženih v Republiki Makedoniji. V evropski Rdeči seznam (ECCB 1995) je vključenih 6 vrst.

**Ključne besede:** mahovna flora, *Bryophyta*, *Marchantiophyta*, Makedonija, horološka analiza, vrste na Rdečem seznamu.

## 1. INTRODUCTION

Bryofloristically speaking, Macedonia is the least investigated republic of former Yugoslavia. This is clearly evident from the Lists published so far (Düll et al. 1999, Cekova 2005, Sabovljević & Natcheva 2006, Ross et al. 2007, Sabovljević et al. 2008). The smaller number of recorded liverworts and musci is not due to the scarcity of bryoflora, however, but to the relatively limited number of floristic investigations. This is most clearly illustrated by the fact that the last bryofloristic paper published came out in 1992 and that 56 % of the liverworts and 28 % of the mosses are known from only one locality (Cekova 2005).

Until now, only little information on the bryophyte flora has been available for the areas mentioned in this article except for Šar planina. These data were contributed by Herzog (1919), Soška (1939), Zabijakin (1960, 1963), Szepesfalvy in Csiki, Javorka & Kümmerle (1926).

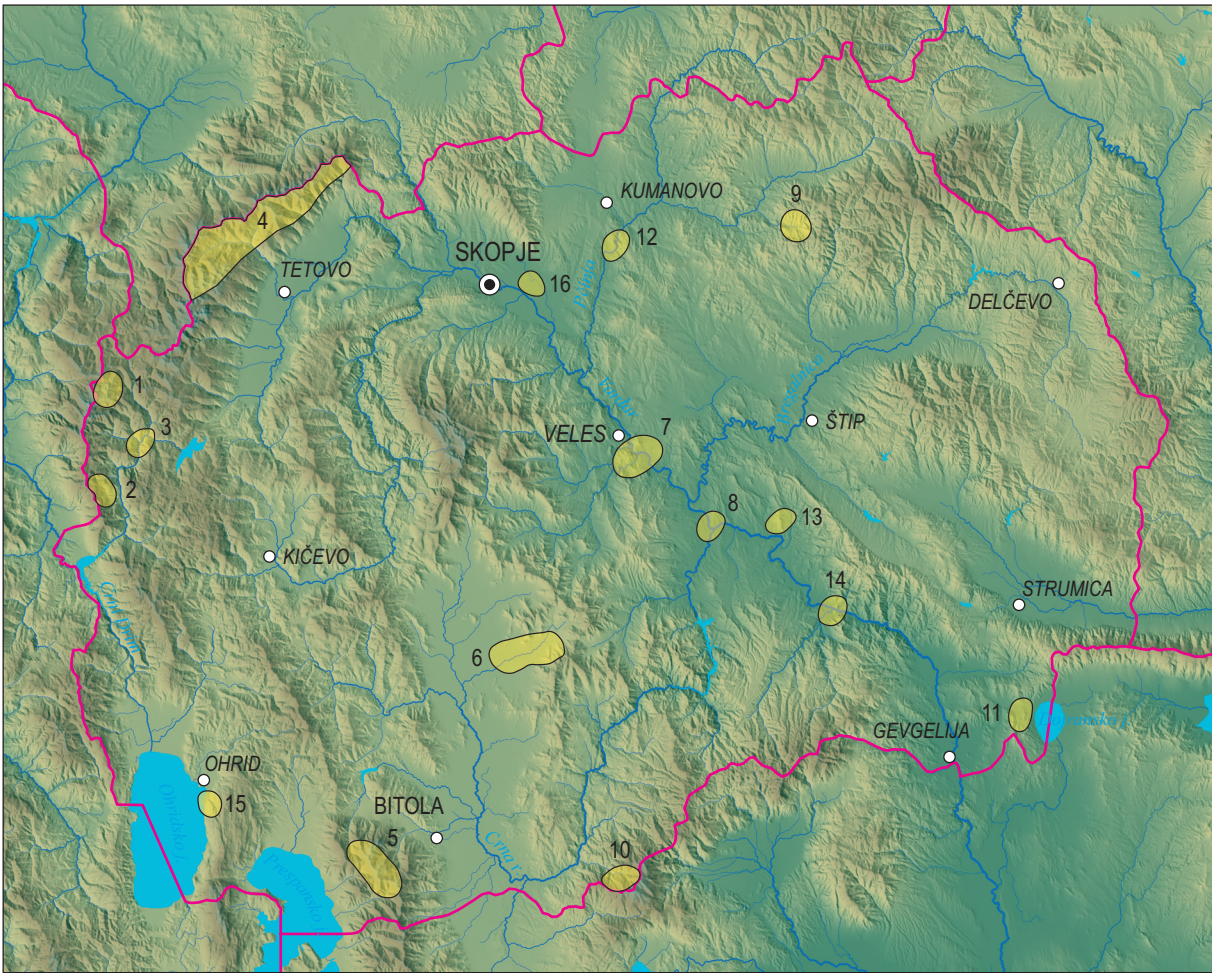
In the period 1962 – 1972 the author intensively collected bryophyte material in different parts of Macedonia, especially in the higher regions. However, he only published the material (*Musci*) from Šar planina (Martinčič 1980). This article presents the data also for other regions out of Macedonia. The high number of the species that are recorded in this article for Macedonia for the first time demonstrates that the poor presence of bryophytic flora is in fact the result of its being poorly investigated.

## 2. MATERIAL AND METHODS

### THE STUDY AREA

The localities in which bryophyte material was collected can be arranged in three groups. The first is composed of the localities in the mountain ranges of Korab and Dešat and the valley of

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**Figure 1:** Location of the investigated areas. For details about numbers see the List of collecting localities.  
**Slika 1:** Lega raziskanih območij. Za podrobnosti glej Seznam nahajališč.

the River Radika below them, the localities in Šar planina and Mt. Pelister. Most of the collected bryophytes are from the subalpine and alpine belt, and only a smaller part is from the montane belt at altitudes between 1000 and 1500 m. The other group comprises the localities from the vicinity of Prilep (No. 6–8) – these are mostly in the montane belt at altitudes between 1000–1300 m. The third group consists of the localities (No. 9–17) from the lowland and colline belts, mostly at altitudes of 150–500 m. They are scattered around different parts of Macedonia.

### COLLECTING LOCALITIES

Localities are equipped with the position in the UTM network system (34 T world part), and for subdivision we applied the grid of 10 × 10 km. Re-

grettfully, ecological denotation of particular localities remains highly inadequate. Altitude sometimes indicates only the belt in which the bryophyte material on a certain locality was collected.

- 1–1. Korab Mts, alpine grassland and rock crevices, silicate, 2100–2500 m (DM62).
- 1–2. Korab Mts, peak, alpine grassland and rock crevices, silicate, 2600–2700 m (DM 62).
- 1–3. Village Nistrovo under Korab Mts, silicate, 1200 m (DM62).
- 2–1. Dešat Mts, Veliki Krčin, subalpine and alpine grassland, rock crevices, springs, 1500–2200 m, silicate, limestone (DM60).
- 3–1. Valley of river Radika between Mavrovo and Žirovnica village, 900 m, limestone (DM71).
- 3–2. Valley of river Radika near Mavrovo, 1200 m, limestone (DM71).



- 4-1. Šar planina Mts, Ljuboten, 1000 m, 1300 m, 1500 m, 2000 m, silicate (EM17).
- 4-2. Šar planina Mts, Kule near Ljuboten, alpine grasslands, rock crevices, 2200–2300 m, silicate (EM07).
- 4-3. Šar planina Mts, Livadica, above lake Livadičko jezero, alpine grasslands, 2200 m, 2300 m, silicate (EM07).
- 4-4. Šar planina Mts, Bistra, alpine grassland, rock crevices, 1900 m, 2000 m, 2200–2400 m, 2500–2600 m, silicate (EM06).
- 4-5. Šar planina Mts, between Bistra and Crni vrv, alpine grasslands, 2200 m, silicate (DM96).
- 4-6. Šar planina Mts, Kobilica above the village of Brodec, subalpine and alpine grasslands, rock crevices, 1500 m, 2000 m, 2500 m, limestone (DM95–96).
- 4-7. Šar planina Mts, Piribeg, 1300 m, 1500 m, 1900 m, 2300 m, silicate (EM06–07).
- 4-8. Šar planina Mts, Lešnica, forests, sub-alpine grasslands, springs, 1500 m, 1600 m, 1700 m, silicate (DM95).
- 4-9. Šar planina Mts, Ceripašino, alpine grasslands, 1800 m, 2000 m, silicate, limestone (DM95).
- 4-10. Šar planina Mts, Titov vrv, alpine grasslands, rock crevices, springs, 1800 m, 1900 m, 2200–2500 m, limestone (DM85).
- 4-11. Šar planina Mts, Smreka (Rudoka), alpine grassland, 2000 m, silicate (DM84).
- 4-12. Šar planina Mts, Šutman (Rudoka), alpine wetland, 2200 m, silicate (DM74).
- 4-13. Šar planina Mts, Borislajec (Rudoka), alpine grasslands, rock crevices, 2000 m, 2400 m, silicate (DM84).
- 4-14. Šar planina Mts, Borislajec (Rudoka) above lake Belo ezero, 2000–2300 m silicate (DM84).
- 5-1. Pelister Mts, alpine grasslands, rock crevices, bog near alpine house, 1700 m, 2000 m, 2200–2400 m, silicate (EL14).
- 5-2. Pelister Mts, above the village of Niže pole, 1400–1600 m, silicate (EL14).
- 5-3. Pelister Mts, northern slope, forest, 1500–1600 m, silicate (EL14).
- 5-4. Pelister Mts, at the lake Malo ezero, alpine grasslands, moist rocks, 2200 m, silicate (EL13).
- 5-5. Pelister Mts, kota 1905, subalpine grasslands, 1700 m, silicate (EL23).
- 6-1. Markova kula above Prilep town, 750 m, silicate (EL47).
- 6-2. Zagradski kamen above Prilep town, 950 m, 1000–1200 m, silicate (EL48).
- 6-3. The mountain pass Pletvar above Prilep town, fagetum, grassland, silicate, 900 m (EL58).
- 6-4. Baba near Pletvar, forest, moist forest soil, 1200–1300 m (EL58).
- 6-5. Babuna (Kozjak) above Prilep town, 1000 m, silicate ((EL58).
- 7-1. Valley of Topolka river near the Veles town, 200 m, silicate (EM61).
- 7-2. Town Veles, slope above Vardar river, 250 m, silicate (EM61).
- 8-1. Gradsko near Veles town, 200 m, limestone, silicate (EM70).
- 9-1. Kratovo, 700 m (EM95).
- 10-1. Near the village of Skočivir under Kajmakčalan Mts, 650 m, 20. 7. 1962 (EL53).
- 11-1. Dojran at the lake Dojran, 150 m (FL46).
- 12-1. At the village of Pčinja near the town Skopje, 200 m (EM65).
- 13-1. Orlovo brdo at Krivolak, 200–500 m (EL99).
- 14-1. Demir Kapija, 100 m, limestone (FL08).
- 15-1. Ohrid, on the bank of the lake Ohridsko ezero, at Hydrobiological institute, 720 m (DL84).
- 15-2. Ljubanište, on the bank of the lake Ohridsko ezero, 720 m (DL84).
- 16-1. Petrovac near the town Skopje, 230 m (EM54).

## METHODS

The field excursions on which the present paper is based were carried out in the period 1962 – 1972. The data were evaluated according the checklist of R. Macedonia (Cekova 2005), the new checklists of SE Europe (Sabovljević & Natcheva 2006, Sabovljević et al. 2008) and of the Mediterranean (Ross et al. 2007).

Nomenclature of liverworts follows Schumacker & Vaňa (2005), that of mosses Hill et al. (2006). Floral elements are given according to Düll et al. (1999), Martinčić (1966, 2006) and Hill & Preston (1998). The specimens are preserved in the Herbarium of Department of Biology (Biotechnical faculty) University of Ljubljana.

## 3. RESULTS AND DISCUSSION

Altogether 269 bryophyte taxa (41 liverworts and 228 mosses) have been recorded, of which 75 (18 liverworts and 57 mosses) are reported for

the first time in R. Macedonia (marked with \* in List of taxa). *Blepharostoma trichophyllum* subsp. *brevirete* is a new taxon for the Balkan peninsula, *Aloina brevirostris*, *Cephalozia ambigua* and *Andreea alpestris* are new species for the territory of former Yugoslavia.

LIST OF TAXA:

Hepaticae

*Aneura pinguis* (L.) Dumort. – valley of Topolka river near Veles, 200 m.

Cekova (2005) does not mention this species, it is reported for Macedonia by Sabovljević & Natcheva (2006) and by Ros et al. (2007).

*Barbilophozia floerkei* (F. Weber & D. Mohr) Loeske – Šar planina: Bistra, 2500–2600 m.

*Barbilophozia barbata* (Schmidel ex Schreb.) Loeske – Markova kula above Prilep, 750 m; Zagradski kamen above Prilep, 1200 m.

*Barbilophozia hatcheri* (A. Evans) Loeske – V. Krčin, 2000 m; Pelister, 1900–2200 m, 2400 m; Pelister, at lake Malo ezero, 2200 m; Pelister, kota 1905, 1700 m; Šar planina: Kule near Ljuboten, 2200–2300 m; Ceripašino, 2000 m; Kobilica, 2000 m; Piribeg, 1900 m; Šutman, 2200 m; Borislajec, 2400 m.

*Barbilophozia lycopodioides* (Wallr.) Loeske – Šar planina: Borislajec, 2400 m.

\**Blepharostoma trichophyllum* (L.) Dumort. subsp. *trichophyllum* – Šar planina: Kobilica, 2500 m.

*Subboreal element*. A taxon, generally distributed in both Central and northern Europe. It occurs in all of the countries in SE Europe except in Albania and R. Macedonia (Sabovljević & Natcheva 2006).

\**Blepharostoma trichophyllum* (L.) Dumort. subsp. *brevirete* Bryhn & Kaal. – Šar planina: Kule near Ljuboten, 2200–2300 m.

*Arctic-alpine element* (Damsholt 2002). The southernmost locality in Europe so far was in Slovenia (the Julian Alps: Mangart). The discovery of this taxon on Šar planina is surprising because it is the only locality of this subspecies in the Balkan Peninsula. It should nevertheless be taken into consideration that Macedonian mountains, in addition to Prokletije, are an important diversity centre of arctic-alpine (subarctic-subalpine) bryophyte species (Martinčić 1966, 2006).

*Calypogeia azurea* Stotler & Crotz – Pelister, bog at alpine house, 2000 m.

\**Cephalozia ambigua* C. Massal. – Korab, 2500 m. *Subarctic-alpine element*. In SE Europe it is known only from Bulgaria and Romania (Sabovljević & Natcheva 2006).

\**Cephalozia lunulifolia* (Dumort.) Dumort. – Šar planina: Šutman, 2200 m.

*Boreal-montane element*. It has been reported from all other SE European countries except Albania, and R. Macedonia (Sabovljević & Natcheva 2006, Erzberger & Papp 2007).

\**Chiloscyphus coadunatus* (Sw.) J.J. Engel & R.M. Schust. var. *rivularis* Loeske – Baba near Pletvar, 1200–1300 m; Šar planina: Ljuboten, 1000 m.

*Temperate element*. It was reported from all other SE European countries except R. Macedonia (Sabovljević & Natcheva 2006).

\**Chiloscyphus pallescens* (Ehrh. ex Hoffm.) Dumort. – Šar planina: Ljuboten, 1500 m; Lešnica, 1500 m.

*Subboreal element*. After Sabovljević & Natcheva (2006) and Ros et al. (2007) it was reported from all other SE European countries except Albania and R. Macedonia.

*Frullania dilatata* (L.) Dumort. var. *dilatata* – Zagradski kamen above Prilep, 1000–1200 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Veles, 250 m; Skočivir, 650 m; Šar planina: Kobilica, 1500 m.

*Frullania tamarisci* (L.) Dumort. – Markova kula above Prilep, 750 m.

\**Gymnomitrium concinnatum* (Lightf.) Corda – Šar planina: Bistra, 1900 m.

*Subarctic-subalpine (alpine) element*. Until very recently it was known in SE Europe only from Slovenia and Bulgaria, but has been found also in Serbia (Erzberger & Papp 2007) and in Montenegro (Erzberger et al. 2008).

*Jungermannia atrovirens* Dumort. – valley of river Radika between Mavrovo and Žirovnica village, 900 m.

\**Jungermannia pumila* With. – valley of river Radika between Mavrovo and Žirovnica village, 900 m.

*Subboreal element*. This species has been very much overlooked in the Balkan Peninsula where it occurs on isolated, scarce localities in Bulgaria, Rumania, Bosnia and Herzegovina, Montenegro and Serbia.

*Jungermannia sphaerocarpa* Hook. – Šar planina: Livadica, 2200 m.

- Lophozia collaris* (Nees) Dumort. – Šar planina: Bistra, 2200–2400 m; Kobilica, 2500 m; Šutman, 2200 m.
- \**Lophozia heterocolpos* (Thed. ex C. Hartm.) M. Howe var. *heterocolpos* – Šar planina: Lešnica, 1700 m.  
*Subarctic-subalpine element*. On the territory of former Yugoslavia it was recorded from Slovenia, Montenegro and Serbia (Sabovljević & Natcheva 2006).
- Lophozia sudetica* (Nees ex Huebener) Grolle – Korab, 2500 m.  
*Boreal-montane element*. Although Cekova (2005) does not mention this species, it is mentioned for R. Macedonia by Sabovljević & Natcheva (2006) and Ros et al. (2007). In the territory of former Yugoslavia it is recorded also from Montenegro (Papp et al. 2008), Serbia and Slovenia.
- Lophozia ventricosa* (Dicks.) Dumort. var. *ventricosa* – Pelister, 2000 m; Pelister, at the lake Malo ezero, 2200 m.
- Mannia fragrans* (Balbis) Frye & L. Clark – Veles, 250 m; Gradsko near Veles, 200 m.
- Mannia triandra* (Scop.) Grolle – Šar planina: Ljuboten, 2000 m.
- \**Marchantia polymorpha* L. subsp. *ruderalis* Bischl. & Boisselier – Nistrovo village under Korab, 1200 m.  
*Boreal-temperate element*. *M. polymorpha* is a common species in R. Macedonia (Cekova 2005), but there have not yet been any data on the differentiation of its subspecies.
- \**Marsupella funckii* (F. Weber & D. Mohr) Dumort. – Pelister, 2000 m; Šar planina: Bistra, 1900 m.  
*Boreal-temperate element*. On the territory of former Yugoslavia it is known from Slovenia, Croatia and Serbia (Ros et al. 2007).
- \**Nardia scalaris* Gray – Pelister, at the lake Malo ezero, 2200 m.  
*Boreal-temperate element*. While it is a relatively common species in Slovenia, it has only isolated localities towards the south of the Balkan Peninsula. In the territory of former Yugoslavia it has been recorded also from Serbia and Croatia.
- Pedinophyllum interruptum* (Nees) Kaal. – Šar planina: Lešnica, 1800 m.
- Pellia endiviifolia* (Dicks.) Dumort. – valley of Topolka river near Veles, 200 m; Nistrovo village under Korab, 1200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Šar planina: Livadica, 2200 m.
- \**Plagiochila porelloides* (Torrey ex Nees) Lindb. – Pletvar above Prilep, 900 m; Korab, 2300–2500 m; V. Krčin, 2200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Šar planina: Lešnica, 1500 m; Ceripašino, 1800 m; Livadica, 2300 m; Borislajec, above the lake Belo ezero, 2300 m; Piribeg, 1300 m, Šutman, 2200 m.  
*Subboreale element*. The data available so far for R. Macedonia have referred to the former common species *P. asplenioides*. These data do not allow clear differentiation between the identity of *P. asplenioides* as we understand it today and *P. porelloides*.
- Porella cordaeana* (Huebener) Moore – V. Krčin, 1500 m; Pelister, 1900–2200 m.
- Preissia quadrata* (Scop.) Nees – Šar planina: Lešnica, 1600 m.
- Radula complanata* (L.) Dumort. – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m.
- Reboulia hemisphaerica* (L.) Raddi – Skočivir, 650 m.
- \**Riccardia palmata* (Hedw.) Carruth. – Pelister, northern slope, 1500–1700 m.  
*Boreal-montane element*. In SE Europe it is reported from all countries except Greece and R. Macedonia (Sabovljević & Natcheva 2006, Ros et al. 2007).
- \**Scapania aequiloba* (Schwägr.) Dumort. – V. Krčin, 2000 m; Šar planina: Lešnica, 1600 m; Kule at Ljuboten, 2200–2300 m; Šutman, 2200 m.  
*Boreal-montane element*. It is recorded in all other SE European countries except R. Macedonia (Sabovljević & Natcheva 2006, Ros et al. 2007).
- \**Scapania aspera* Bernet & M. Bernet – V. Krčin, 2000 m.  
*Boreal-temperate element*. In SE Europe it is reported from all countries except R. Macedonia (Sabovljević & Natcheva 2006, Ros et al. 2007).
- \**Scapania helvetica* Gottsche – Korab, 2500 m.  
*Alpine-subalpine element*. This species was reported in SE Europe only from Slovenia, Bulgaria and Romania (Sabovljević & Natcheva 2006).
- Scapania irrigua* (Nees) Nees var. *irrigua* – valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- \**Tritomaria exectiformis* (Breidl.) Loeske subsp. *exectiformis* – Šar planina: Ceripašino, 1800 m.

*Boreal-montane element.* After Sabovljević & Natcheva (2006) and Ros et al. (2007) it is known in SE Europe from Slovenia, Croatia, Bosnia and Herzegovina, Bulgaria and Romania.

***Tritomaria quinquedentata*** (Huds.) H. Buch subsp. *quinquedentata* – Šar planina: Šutman, 2200 m.

Musci

***Abietinella abietina*** (Hedw.) M. Fleisch. var. *abietina* – valley of river Radika between Mavrovo and Žirovnica village, 900 m; valley of river Radika near Mavrovo, 1200 m; Baba near Pletvar, 1200–1300 m.

***Aloina aloides*** (Koch ex Schultz) Kindb. – Gradsko near Veles, 200 m.

\****Aloina brevirostris*** (Hook. & Grev.) Kindb. – valley of river Radika between Mavrovo and Žirovnica village, 900 m.

*Boreal-montane element.* So far, this species has been recorded in SE Europe only for Greece (Sabovljević et al. 2008). The closest localities are as far as Hungary and Austria.

\****Amblystegium radicale*** (P. Beauv.) Grout – Baba near Pletvar, 1200–1300 m.

*Temperate element.* Widely distributed across SE Europe (Sabovljević et al. 2008). Cekova (2005) and Sabovljević et al. (2008) do not mention this species for R. Macedonia, although it has been found on Šar planina (Martinčič 1980).

***Amblystegium serpens*** (Hedw.) Schimp. – Baba near Pletvar, 1200–1300 m; Dojran, 150 m.

***Amblystegium subtile*** (Hedw.) Schimp. – Kratovo, 700 m.

***Amblystegium varium*** (Hedw.) Lindb. – Pelister, northern slope, 1500–1600 m; Pelister, 2200–2400 m.

***Amphidium mougeotii*** (Schimp.) Schimp. – Korab, 2500 m.

\****Andreaea alpestris*** (Thed.) Schimp. – Šar planina: Livadica, at the lake Malo zero 2200 m; Bistra, 1900 m.

*Arctic-alpine element.* In SE Europe it is known only from Bulgaria and Romania (Sabovljević & Natcheva 2006).

***Anomodon viticulosus*** (Hedw.) Hook. & Tayl. – valley of river Radika between Mavrovo and Žirovnica village, 900 m.

***Antitrichia californica*** Sull. – Markova kula above Prilep, 750 m.

***Antitrichia curtispindula*** (Hedw.) Brid. – Šar planina: Piribeg, 1500 m.

***Atrichum tenellum*** (Röhl.) Bruch & Schimp. – Pelister, northern slope, 1500–1600 m.

***Atrichum undulatum*** (Hedw.) P. Beauv. – Pletvar above Prilep, 900 m; Skočivir, 650 m.

\****Aulacomnium androgynum*** (Hedw.) Schwägr. – Skočivir, 650 m.

*Temperate element.* It has been reported from all other SE countries except Albania, R. Macedonia, Montenegro, Slovenia and Turkey in Europe (Sabovljević et al. 2008).

***Aulacomnium palustre*** (Hedw.) Schwägr. – Pelister, near alpine house, 2200 m; Pelister, northern slope, 1700 m.

***Barbula unguiculata*** Hedw. – Markova kula above Prilep, 750 m; valley of Topolka river near Veles, 200 m; Kratovo, 700 m.

***Bartramia ithyphylla*** Brid. – Korab, 2100 m; Korab, 2500 m; V. Krčin, 2000 m; Pletvar above Prilep, 900 m.

***Bartramia pomiformis*** Hedw. – Pelister, 2200 m; Pelister above the village of Niže Pole, 1400–1600 m; Markova kula above Prilep, 750 m; Zagradski kamen above Prilep, 1000–1200 m; Skočivir, 650 m.

***Brachythecium olympicum*** (Jur.) Vanderp. et al. – Veles, 250 m.

***Brachythecium velutinum*** (Hedw.) Ignatov & Huttunen – V. Krčin, 1500–1800 m; Veles, 250 m; Kratovo, 700 m; Skočivir, 650 m; Šar planina: Lešnica, 1600 m; Ljuboten, 1500 m; Kobilica, 1500 m; Piribeg, 2300 m.

\****Brachythecium campestre*** (Müll. Hal.) Schimp. – Kratovo, 700 m; Pelister, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Šar planina: Ljuboten, 1500 m.

*Temperate (subcontinental) element.* The number of its sites indicates that it is widely distributed in R. Macedonia, but has probably been frequently confused with *B. rutabulum*.

***Brachythecium geheebii*** Milde – Šar planina: Ljuboten, 1300 m; Piribeg, 1500 m; Kobilica 1500 m; Ceripašino, 2000 m.

\****Brachythecium glareosum*** (Bruch ex Spruce) Schimp. – Šar planina: Lešnica, 1700 m; Piribeg, 1900 m; Ceripašino, 2000 m; Smreka, 2000 m.

*Boreal-temperate element.* It has been reported from all other SE European countries except Albania, R. Macedonia and Turkey in Europe (Sabovljević et al. 2008).



- Brachythecium rivulare* Schimp. – valley of river Radika between Mavrovo and Žirovnica village, 900 m; Pelister, 1900–2200 m; Šar planina: Titov vrv, 2400 m; Ceripašino, 2000 m.
- Brachythecium rutabulum* (Hedw.) Schimp. – Pčinja near Skopje 200 m; Petrovac near Skopje, 200 m; Šar planina: Piribeg, 1300 m; Titov vrv, 1800 m; Kobilica, 1500 m; Šutman, 2200 m.
- Brachythecium salebrosum* (Hoffm. ex F. Weber & D. Mohr) Schimp. – Babuna above Prilep, 1000 m; Kratovo, 700 m; Skočivir, 650 m; village Nistrovo under Korab, 1200 m; Korab, 2300 m; Pelister, at the lake Malo ezero, 2200 m; Pelister, 1900–2200 m; Šar planina: Titov vrv, 2300 m; Bistra, 2000 m; Borislajec, 2400 m.
- Bryoerythrophyllum recurvirostrum* (Hedw.) P.C. Chen – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Kratovo, 700 m; Dojran, 150 m; Demir Kapija, 100 m; Korab, 2100 m; V. Krčin, 2200 m.
- Bryum alpinum* Huds. ex With. – Markova kula above Prilep, 750 m; Zagradski kamen above Prilep, 1000–1200 m; Baba near Pletvar, 1100–1300 m; Skočivir, 650 m; village Nistrovo under Korab, 1200 m.
- Bryum argenteum* Hedw. – Zagradski kamen above Prilep, 1000–1200 m; valley of Topolka river near Veles, 200 m.
- Bryum capillare* Hedw. – Veles, 250 m Pelister, 2000 m.
- Bryum creberrimum* Taylor – Zagradski kamen above Prilep, 1000–1200 m; Pelister, above the village of Niže Pole, 1400–1600 m.
- Bryum elegans* Nees – valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Bryum imbricatum* (Schwägr.) Bruch & Schimp. – Pelister, kota 1905, 1700 m; Korab, peak, 2700 m; V. Krčin, 1500–1800 m.
- \**Bryum intermedium* (Brid.) Blandow – V. Krčin, 2200 m.  
*Subboreal element.* It has been reported from all other SE European countries except Albania, Bosnia-Herzegovina, Croatia and R. Macedonia (Sabovljević et al., 2008).
- Bryum pseudotriquetrum* (Hedw.) P. Gaertn. et al. var. *pseudotriquetrum* – Zagradski kamen above Prilep, 950 m; Baba near Pletvar, 1100–1300 m; Pelister, 2200–2400 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; V. Krčin, 1800 m.
- Bryum schleicheri* DC. – V. Krčin, 2000 m.
- Calliergonella cuspidata* (Hedw.) Loeske – Zagradski kamen above Prilep, 950 m; Baba near Pletvar, 1200–1300 m; Babuna above Prilep, 1000 m; Kratovo, 700 m; V. Krčin, 1800 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Pelister, kota 1905, 1700 m; Pelister, above the village Niže Pole, 1400–1600 m.
- Campyliadelphus chrysophyllus* (Brid.) R.S. Chopra – Pletvar above Prilep, 900 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- \**Campyliadelphus elodes* (Lindb.) Kanda – village Nistrovo under Korab, 1200 m.  
*Temperate element.* It has been reported from all other SE European countries except Albania, Bosnia-Herzegovina, R. Macedonia and Turkey in Europe (Sabovljević et al., 2008).
- \**Campylium protensum* (Brid.) Kindb. – Pelister, 2200 m; Pelister, at the lake Malo ezero, 2200 m; Pelister, kota 1905, 1700 m.  
*Boreal-temperate element.* This species has already been recorded for R. Macedonia (Martinčić 1968, 1980; Düll et al. 1999). However, because of a misinterpretation of synonymics, Cekova (2005) classified this taxon as a synonym into the species *C. longicuspis* (Lindb. & H. Arnell) Hedenäs, which is an arctic element (Hedenäs 1988). Sabovljević et al. (2008) mention *C. protensum* only for Albania, Bulgaria and Romania, but it is recorded also from Slovenia, Croatia, Bosnia and Herzegovina, Serbia and Montenegro (Pavletić 1955, Martinčić 1968, Düll et al. 1999).
- Campylium stellatum* (Hedw.) Lange & C.E.O. Jens. – Pelister, 2200 m.  
*Boreal-temperate element.* This species has already been mentioned for R. Macedonia (Martinčić 1968, 1980, Düll et al. 1999), but Cekova (2005) classified the taxon as a synonym into the species *C. longicuspis* (Lindb. & H. Arnell) Hedenäs, which is an arctic element and definitely does not grow in SE Europe.
- Campylophyllum calcareum* (Crundw. & Nyholm) Hedenäs – valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Campylophyllum halleri* (Hedw.) M. Fleisch. – V. Krčin, 2000 m.
- Ceratodon purpureus* (Hedw.) Brid. – Pelister, kota 1905, 1700 m; Pelister, northern slope, 1700 m.
- Cinclidotus fontinaloides* (Hedw.) P. Beauv. –

- valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Cinclidotus riparius*** (Host ex Brid.) Arn. – valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Cirriphyllum crassinervium*** (Taylor) Loeske & M. Fleisch. – Kratovo, 700 m; V. Krčin, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- \****Cirriphyllum piliferum*** (Hedw.) Grout – Pelister, 2100–2200 m.  
*Boreal-temperate element.* It has been reported from all other SE European countries except Albania, Greece, R. Macedonia and Turkey in Europe (Sabovljević et al., 2008).
- Cratoneuron filicinum*** (Hedw.) Spruce var. ***filicinum*** – village of Nistrovo under Korab, 1200 m; V. Krčin, 1800 m, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Baba near Pletvar, 1200–1300 m; valley of Topolka river near Veles, 200 m; Veles, 250 m; Kratovo, 700 m; Dojran, 150 m.
- Crossidium squamiferum*** (Viv.) Jur. var. ***squamiferum*** – Veles, 250 m.
- Ctenidium molluscum*** (Hedw.) Mitt. – V. Krčin, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Cynodontium bruntonii*** (Sm.) Bruch & Schimp. – Zagradski kamen above Prilep, 950 m.
- Dichodontium pellucidum*** (Hedw.) Schimp. – Šar planina: Šutman, 2200 m.
- \****Dicranum bonjeanii*** De Not. – Pelister, 2200 m.  
*Boreal-temperate element.* It has been reported from all other SE European countries except Albania, Greece, R. Macedonia and Turkey in Europe (Sabovljević et al. 2008).
- Dicranum scoparium*** Hedw. – Markova kula above Prilep, 750 m; Zagradski kamen above Prilep, 1000–1200 m.
- Didymodon acutus*** (Brid.) K. Saito – valley of Topolka river near Veles, 200 m; Orlovo brdo at Krivolak, 200–500 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Didymodon fallax*** (Hedw.) R. H. Zander – Gradsko near Veles, 200 m.
- Didymodon luridus*** Hornsch. – Veles, 250 m.
- Didymodon tophaceus*** (Brid.) Lisa – valley of Topolka river near Veles, 200 m; Veles, 250 m; Gradsko near Veles, 200 m.
- Distichium capillaceum*** (Hedw.) Bruch & Schimp. – Pletvar above Prilep, 900 m; Korab, peak, 2700 m; V. Krčin, 2200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Distichium inclinatum*** (Hedw.) Bruch & Schimp. – V. Krčin, 2000 m.
- Ditrichum flexicaule*** (Schwägr.) Hampe – Pletvar above Prilep, 900 m; V. Krčin, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Drepanocladus aduncus*** (Hedw.) Warnst. – Pelister, bog near alpine house, 2200 m.
- \****Drepanocladus polygamus*** (Schimp.) Hedenäs – bank of the lake Ohridsko ezero, near the Hydrobiological institute, 720 m.  
*Boreal-temperate element.* In SE Europe it was reported from Bulgaria, Montenegro, Romania, Slovenia and Serbia (Sabovljević et al. 2008).
- Encalypta alpina*** Sm. – V. Krčin, 2200 m.
- Encalypta ciliata*** Hedw. – Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; V. Krčin, 2200 m.
- \****Encalypta microstoma*** Bals.-Criv. & De Not. – Šar planina: Smreka, 2000 m.  
*Alpine element.* In SE it was reported from Bulgaria and Serbia (Sabovljević et al. 2008). It was reported, as *E. ciliata* Hedw. var. *microstoma* (Bals. & De Not.) Schimp. also from Šar planina: Smreka, 2000 m (Martinčić 1980).
- Encalypta streptocarpa*** Hedw. – Baba near Pletvar, 1200–1300 m; Veles, 250 m; V. Krčin, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Encalypta vulgaris*** Hedw. – V. Krčin, 2200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Veles, 250 m; Gradsko near Veles, 200 m; Dojran, 150 m; Pčinja near Skopje 200 m; Demir Kapija, 100 m.
- Entosthodon muehlenbergii*** (Turner) Fife – Pletvar above Prilep, 900 m; Gradsko near Veles, 200 m; Demir Kapija, 100 m.
- \****Entosthodon pulchellus*** (H. Philib.) Brugués – valley of Topolka river near Veles, 200 m; Veles, 250 m; Demir Kapija, 100 m.  
*Subatlantic-submediterranean element.* In SE Europe it was reported from regions with more warm climate: Albania, Bosnia and Herzegovina, Greece, Montenegro, Slovenia and Serbia (Sabovljević et al. 2008).
- Eucladium verticillatum*** (With.) Bruch & Schimp.



– valley of Topolka river near Veles, 200 m; Veles, 250 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.

*Eurhynchiastrum pulchellum* (Hedw.) Ignatov & Huttunen var. *diversifolium* (Schimp.) Ochyra & Żarnowiec – Zagradoski kamen above Prilep, 1000–1200 m; V. Krčin, 2200 m; Pelister, 2200–2400 m; Šar planina: Kobilica, 2000 m.

\**Eurhynchiastrum pulchellum* (Hedw.) Ignatov & Huttunen var. *praecox* (Hedw.) Ochyra & Żarnowiec – Pletvar above Prilep, 900 m; Veles, 250 m; Demir Kapija, 100 m; Pelister, 1900–2200 m; Pelister, at the lake Malo ezero, 2200 m.

Two out of three varieties that species *E. pulchellum* comprises in Europe – var. *pulchellum* (Martinčić 1980) and var. *diversifolium* (Herzog 1919) – have already been recorded for R. Macedonia. In the territory of former Yugoslavia, the var. *praecox*, which is a taxon new to R. Macedonia, has so far been known only from Slovenia, Bosnia and Herzegovina and Serbia.

*Eurhynchiastrum pulchellum* (Hedw.) Ignatov & Huttunen var. *pulchellum* – Baba near Pletvar, 1200–1300 m; V. Krčin, 2000 m; Pelister, 2200 m, 2200–2400 m.

*Fissidens dubius* P. Beauv. – Pletvar above Prilep, 900 m; Demir Kapija, 100 m; V. Krčin, 2200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.

*Fissidens taxifolius* Hedw. subsp. *taxifolius* – Pletvar above Prilep, 900 m; V. Krčin, 2000 m.

\**Fontinalis antipyretica* Hedw. subsp. *gracilis* (Lindb.) Kindb. – Pelister, bog near alpine house, 2200 m.

*Boreal-temperate element.* A polymorphic species, distributed across the entire SE Europe. There are only older data on the distribution of subspecies (Pavletić 1955, Martinčić 1968, Düll et al. 1999). The subspecies *gracilis* grows mainly in colder streams of the montane belt in Slovenia, Croatia and Bosnia and Herzegovina.

*Funaria hygrometrica* Hedw. – Dojran, 150 m.

\**Grimmia caespiticia* (Brid.) Jur. – Korab, 2300 m; Pelister, 1900–2300 m.

*Subarctic-subalpine (alpine) element.* This species is reported in SE Europe only from Bulgaria, Montenegro, Romania and Serbia (Sabovljević et al. 2008).

\**Grimmia donniana* Sm. – Šar planina: Livadica, at lake, 2200 m; Smreka, 2000 m.

*Subarctic-subalpine (alpine) element.* This species is reported in SE Europe from Slovenia, Croatia, Serbia, Bulgaria and Romania. Martinčić (1968) mentioned the species also for R. Macedonia, but this was based on his misinterpretation of the synonymics, which was later followed by Düll et al. (1999).

*Grimmia hartmanii* Schimp. – Pelister, above the village of Niže Pole, 1400–1600 m.

*Grimmia laevigata* (Brid.) Brid. – Zagradoski kamen above Prilep, 950 m; Demir Kapija, 100 m.

\**Grimmia longirostris* Hook. – Pelister, northern slope, 1500–1600 m.

*Boreal-temperate element.* This species is reported in SE Europe only from Bulgaria, Greece and Serbia (Sabovljević et al. 2008).

*Grimmia orbicularis* Bruch ex Wilson – Demir Kapija, 100 m.

*Grimmia ovalis* (Hedw.) Lindb. – Zagradoski kamen above Prilep, 1000–1200 m; Baba near Pletvar, 1200–1300 m.

*Grimmia pulvinata* (Hedw.) Sm. var. *pulvinata* – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Veles, 250 m; Gradosko near Veles, 200 m; Dojran, 150 m; Pčinja near Skopje 200 m; Orlovo brdo at Krivolak, 200–500 m; Demir Kapija, 100 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.

\**Grimmia pulvinata* (Hedw.) Sm. var. *africana* (Hedw.) Hook. f. & Wils. – Pletvar above Prilep, 900 m; valley of Topolka river near Veles, 200 m; Veles, 250 m.

On the territory of former Yugoslavia this taxon was reported only from Slovenia and Bosnia and Herzegovina (Pavletić 1955).

*Grimmia ramondii* (Lam. & DC.) Margad. – Pelister, at the lake Malo ezero, 2200 m.

*Hedwigia ciliata* (Hedw.) P. Beauv. var. *ciliata* – Markova kula above Prilep, 750 m; Zagradoski kamen above Prilep, 1000–1200 m; Baba near Pletvar, 1200–1300 m.

\**Hedwigia ciliata* (Hedw.) P. Beauv. var. *leucophaea* Bruch & Schimp. – Markova kula above Prilep, 750 m; Šar planina: Smreka, 2000 m (det. P. Erzberger).

*Hedwigia stellata* Hedenäs – Pelister, above Niže Pole village, 1400–1600 m (det. P. Erzberger). *Subatlantic-submediterranean element.* Cekova (2005) and Sabovljević et al. (2008) do not mention this species for R. Macedonia. But

after Erzberger (1996) it was recorded from three localities.

***Heterocladium dimorphum*** (Brid.) Schimp. – Pletvar above Prilep, 900 m; Korab, 2300 m; Korab, peak, 2700 m.

\****Homalothecium aureum*** (Spruce) H. Rob. – Veles, 250 m; Dojran, 150 m.

*Meridional element (Mediterranean-submediterranean element)*. In the continental parts of SE Europe it has so far been found only in Serbia – south Banat (Sabovljević 2003). The two localities in R. Macedonia demonstrate that in the south of the Balkan Peninsula the species has been more widely distributed than we have thought. Düll (Düll et al. 1999) characterises this species as a Mediterranean montane element, but the definition meridional element (mediterranean-submediterranean) is more appropriate, at least for SE Europe.

***Homalothecium lutescens*** (Hedw.) H. Rob. – Orlovo brdo at Krivolak, 200–500 m.

***Homalothecium philippeanum*** (Spruce) Schimp. – Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Veles, 250 m; Gradsko near Veles, 200 m; Kratovo, 700 m; Pčinja near Skopje 200 m; Petrovac near Skopje, 200 m; V. Krčin, 1500 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; valley of river Radika near Mavrovo, 1200 m.

***Homalothecium sericeum*** (Hedw.) Schimp. – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; valley of Topolka river near Veles 200 m; Veles, 250 m; Kratovo, 700 m; Dojran, 150 m; Pčinja near Skopje 200 m; Orlovo brdo at Krivolak, 200–500 m; Demir Kapija, 100 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.

***Hygroamblystegium varium*** (Hedw.) Mönkm. – Dojran, 150 m.

***Hygrohypnum luridum*** (Hedw.) Jenn. var. *luridum* – Pelister, kota 1905, 1700 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Šar planina: Šutman, 2200 m.

\****Hygrohypnum duriusculum*** (De Not.) Jamieson – Pelister, bog near the alpine house, 2200 m. *Subarctic-subalpine (alpine) element*. Cekova (2005) and Sabovljević et al. (2008) do not mention this species for Macedonia, although it has been found on Šar planina: between Bistra and Crni vrh (Martinčić 1980).

***Hylacomium splendens*** (Hedw.) Schimp. – V. Krčin, 2000 m; valley of river Radika between

Mavrovo and Žirovnica village, 900 m; Pelister, above Niže Pole village, 1400 m.

\****Hypnum andoi*** A.J.E. Smith – valley of river Radika between Mavrovo and Žirovnica village, 900 m.

*Temperate-(subatlantic) element*. The knowledge of the distribution of the taxa from the complex *H. cupressiforme* is entirely insufficient because more often than not, the classification stopped at the level of the common species. A revision of the herbarium material is therefore necessary. Our assessment of the taxa followed the solution as described in Hill et al. (2006). In the territory of former Yugoslavia, the *H. andoi*, which is a taxon new to R. Macedonia, has so far been known only from Slovenia, Bosnia and Herzegovina, Serbia.

***Hypnum cupressiforme*** Hedw. var. *cupressiforme* – Markova kula above Prilep, 750 m; Zagradski kamen above Prilep, 1000–1200 m; Pletvar above Prilep, 900 m; Babuna near Pletvar, 1000 m; valley of Topolka river near Veles, 200 m; Veles, 250 m; Kratovo, 700 m; Pčinja near Skopje 200 m; Orlovo brdo at Krivolak, 200–500 m; Demir Kapija, 100 m; V. Krčin, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; valley of river Radika near Mavrovo, 1200 m; Pelister, above Niže Pole village, 1400–1600 m; Pelister, 1900–2200 m.

***Hypnum cupressiforme*** Hedw. var. *filiforme* Brid. – Markova kula above Prilep, 750 m.

\****Hypnum cupressiforme*** Hedw. var. *lacunosum* Brid. – Zagradski kamen above Prilep, 1000–1200 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Babuna above Prilep, 1000 m; Pelister, above Niže Pole village, 1400–1600 m; Pelister, kota 1905, 1700 m.

*Temperate element*. Cekova (2005) and Sabovljević et al. (2008) do not mention this taxon (as species) for R. Macedonia, although it has been found on Šar planina: Piribeg (Martinčić 1968, 1980).

\****Hypnum cupressiforme*** Hedw. var. *resupinatum* (Taylor) Schimp. – Zagradski kamen above Prilep, 1000–1200 m.

\****Hypnum cupressiforme*** Hedw. var. *subjulaceum* Molendo – Babuna above Prilep, 1000 m.

\****Hypnum imponens*** Hedw. – Pletvar above Prilep, 900 m; Pelister, above Niže Pole village, 1600 m.

*Temperate element*. For the territory of former Yugoslavia it is reported for all countries except

- Montenegro and R. Macedonia (Sabovljević et al. 2008).
- \**Hypnum jutlandicum* Holmen & E. Warncke – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Veles, 250 m; Pčinja near Skopje 200 m.  
*Temperate(-subatlantic) element.* For the territory of former Yugoslavia it is reported for all countries except Montenegro and R. Macedonia (Sabovljević et al. 2008).
- Hypnum revolutum* (Mitt.) Lindb. – Korab, peak, 2700 m.
- \**Hypnum sauteri* Schimp. – Šar planina: Kobilica, 2000 m; Lešnica, 1700 m.  
*Subarctic-subalpine (alpine) element.* The species has already been recorded for R. Macedonia – on two localities on Šar planina: Lešnica, 1700 m; Kobilica, 2000 m. (Martinčić 1980). Cekova, (2005) however, did not take this information into consideration. Sabovljević et al. (2008) also mention this species in SE Europe only for Bulgaria and Slovenia.
- Hypnum vaucheri* Lesq. – village Nistrovo under Korab, 1200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; valley of river Radika near Mavrovo, 1200 m.
- \**Isopterigyopsis pulchella* (Hedw.) Z. Iwats. – Pelister, at the lake Malo ezero, 2200 m.  
*Boreal-montane element.* The species has been mentioned for R. Macedonia already by Martinčić (1968), but this information was overlooked by both Cekova (2005) and Sabovljević et al. (2008). For the territory of former Yugoslavia it is reported for all countries except R. Macedonia.
- Isothecium alopecuroides* (Lam. ex Dubois) Isov. – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Pelister, above Niže Pole village, 1400–1600 m.
- Kindbergia praelonga* (Hedw.) Ochyra var. *praelonga* – Kratovo, 700 m.
- Leptodictyum riparium* (Hedw.) Warnst. – Dojran, 150 m.
- Leptodon smithii* (Hedw.) F. Weber & D. Mohr – Markova kula above Prilep, 750 m.
- Lescuraea mutabilis* (Brid.) Lindb. ex I. Hagen – V. Krčin, 1500 m; Pelister, above Niže Pole village, 1400–1600 m; Pelister, at the lake Malo ezero, 2200 m.
- \**Lescuraea saxicola* (Schimp.) Molendo – Pelister, above Niže Pole village, 1400–1600 m.
- Boreal-montane element.* For the territory of former Yugoslavia it is reported for Slovenia, Montenegro and Serbia.
- Leskea polycarpa* Hedw. – Pelister, 2200 m.
- Leucodon sciuroides* (Hedw.) Schwägr. – Markova kula above Prilep, 750 m; Baba near Pletvar, 1200–1300 m; Dojran, 150 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- \**Leucodon sciuroides* (Hedw.) Schwägr. var. *morensis* (Schwägr.) De Not. – valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Mnium lycopodioides* Schwägr. – Korab, 2500 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Mnium marginatum* (Dicks.) P. Beauv. – valley of river Radika near Mavrovo, 1200 m.
- Mnium stellare* Hedw. – V. Krčin, 1500 m, 2200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Pelister, at the lake Malo ezero, 2200 m.
- Mnium thomsonii* Schimp. – Korab, 2500 m – V. Krčin, 2000 m; Pelister, 2200–2400 m; Pelister, at the lake Malo ezero, 2200 m; Pelister, kota 1905, 1700 m.
- \**Molendoa sendtneriana* (Bruch & Schimp.) Limpr. – Korab, 2300–2500 m.  
*Alpine-subalpine element.* Cekova (2005) and Sabovljević et al. (2008) do not mention this species, although it has been reported from R. Macedonia (Martinčić 1966, 1968, Düll et al. 1999).
- Myurella julacea* (Schwägr.) Schimp. – V. Krčin, 2200 m.
- Neckera besserii* (Lobarz.) Jur. – Markova kula above Prilep, 750 m.
- Neckera complanata* (Hedw.) Huebener – Zagradski kamen above Prilep, 1000–1200 m; Kratovo, 700 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Neckera crispa* Hedw. – valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Neckera menziesii* Drumm. – valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- \**Neckera pumila* Hedw. – Zagradski kamen above Prilep, 1000–1200 m.  
*Temperate(-subatlantic) element.* It is reported on the territory of former Yugoslavia from all countries except R. Macedonia and Serbia (Sabovljević et al. 2008).
- Orthothecium intricatum* (Hartm.) Schimp. – V.



- Krčin, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Orthotrichum affine* Schrad. ex Brid. – Pletvar above Prilep, 900 m; Babuna above Prilep, 1000 m; Kratovo, 700 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Orthotrichum anomalum* Hedw. – Pletvar above Prilep, 900 m; Veles, 250 m; Dojran, 150 m.
- Orthotrichum cupulatum* Hoffm. ex Brid. – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Veles, 250 m; valley of river Radika near Mavrovo, 1200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.; Pelister, 2000 m.
- Orthotrichum rupestre* Schleich. ex Schwägr. – Baba near Pletvar, 1200–1300 m.
- \**Oxyrrhynchium hians* (Hedw.) Loeske – Babuna above Prilep, 1000 m; Pčinja near Skopje, 200 m; Petrovac near Skopje; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Šar planina: Lešnica, 1800 m.  
*Temperate element.* It is reported from all SE European countries except R. Macedonia (Sabovljević et al., 2008).
- Oxyrrhynchium schleicheri* (R. Hedw.) Röhl. – valley of river Radika between Mavrovo and Žirovnica village, 900 m; Šar planina: Lešnica, 1500 m.
- Palustriella commutata* (Hedw.) Ochyra var. *commutata* – Baba near Pletvar, 1200–1300 m; Korab, 2100 m; Korab, peak, 2700 m; V. Krčin, 1800 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Palustriella decipiens* (De Not.) Ochyra – Korab, 2100 m, 2600 m; V. Krčin, 1800 m
- Philonotis caespitosa* Jur. – Korab, 2300 m.
- Philonotis calcarea* (Bruch & Schimp.) Schimp. – Baba near Pletvar, 1200–1300 m; Ljubanište, at the lake Ohridsko ezero, 720 m.
- Philonotis fontana* (Hedw.) Brid. – Zagradski kamen above Prilep, 1000 m; Babuna above Prilep, 1000 m; village Nistrovo under Korab, 1200 m; V. Krčin, 1800 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Philonotis seriata* Mitt. – Korab, 2300–2500 m.
- Philonotis tomentella* Molendo – Korab, 2300–2500 m; Korab, peak, 2700 m; V. Krčin, 2000 m; Pelister, kota 1905, 1700 m; Pelister, northern slope, 1500–1600 m.
- Plagiomnium affine* (Blandow ex Funck) T.J. Kop. – village of Nistrovo under Korab, 1200 m.
- Plagiomnium cuspidatum* (Hedw.) T.J. Kop. – village of Nistrovo under Korab, 1200 m.
- \**Plagiomnium elatum* (Bruch & Schimp.) T.J. Kop. – Pelister, above the village of Niže Pole, 1600 m.  
*Boreal-temperate element.* It is known in SE Europe from all countries except Albania, R. Macedonia and the European part of Turkey (Sabovljević et al., 2008).
- Plagiomnium rostratum* (Schrad.) T.J. Kop. – Kratovo, 700 m; village of Nistrovo under Korab, 1200 m; V. Krčin, 1800 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Plagiomnium undulatum* (Hedw.) T.J. Kop. – village of Nistrovo under Korab, 1200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Plagiopus oederianus* (Sw.) A.H. Crum & L.E. Anderson – V. Krčin, 2000 m.
- Plagiothecium cavifolium* (Brid.) Z. Iwats. – Pletvar above Prilep, 900 m.
- Plagiothecium denticulatum* (Hedw.) Schimp. – Pelister, at the lake Malo ezero, 2200 m.
- Plagiothecium nemorale* (Mitt.) A. Jaeger – Zagradski kamen above Prilep, 1000–1200 m; Pletvar above Prilep, 900 m.
- \**Plasteurhynchium striatulum* (Spruce) M. Fleisch. – Demir Kapija, 100 m.  
*Meridional-temperate element (Submediterranean-temperate element).* Cekova (2005) does not mention it in her Review of bryophyte flora of Macedonia (Pregled brioflore Makedonije). According to Sabovljević & Natcheva (2006), however, it is distributed in all countries of SE Europe.
- Platyhypnidium riparioides* (Hedw.) Dixon – Veles, 250 m; Kratovo, 700 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Pelister, 1900–2200 m; Šar planina: Titov vrh, 1800 m; Lešnica, 1800 m.
- Pleurochaete squarrosa* (Brid.) Lindb. – valley of Topolka river near the town of Veles, 200 m; Veles, 250 m; Gradsko near Veles, 200 m; Dojran, 150 m; Pčinja near Skopje 200 m; Orlovo brdo at Krivolak, 200–500 m.
- Pogonatum aloides* (Hedw.) P. Beauv. – Pletvar above Prilep, 900 m.
- Pohlia cruda* (Hedw.) Lindb. – valley of river Radika near Mavrovo, 1200 m; Pelister, 2200–2400 m; Pelister, at the lake Malo ezero, 2200 m.
- Pohlia elongata* Hedw. var. *elongata* – Pelister, 2200 m.

- Pohlia elongata* Hedw. var. *polymorpha* (Hoppe & Hornsch.) Nyholm – Korab, 2500 m.
- Pohlia nutans* (Hedw.) Lindb. – Pelister, 2200 m; Pelister, at the lake Malo ezero, 2200 m.
- Polytrichastrum alpinum* (Hedw.) G.L. Sm. – Pelister, 2200 m; Pelister, at the lake Malo ezero, 2200 m.
- Polytrichastrum formosum* (Hedw.) G.L. Sm. – Pletvar above Prilep, 900 m; Pelister, 2400 m.
- Polytrichastrum sexangulare* (Brid.) G.L. Sm. – Korab, 2300 m.
- Polytrichum juniperinum* Hedw. – Markova kula above Prilep, 750 m; Baba near Pletvar, 1200–1300 m; Babuna above Prilep, 1000 m; Skočivir, 650 m; Korab, 2100–2300 m; Korab, 2500 m; V. Krčin, 1800 m.
- Polytrichum piliferum* Hedw. – Markova kula above Prilep, 750 m; Zagradski kamen above Prilep, 1000–1200 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m.
- \**Polytrichum piliferum* Hedw. var. *hoppei* (Hornsch.) Rabenh. – Korab, peak, 2700 m; Pelister, 1700 m, 2000 m.
- Pseudoleskea incurvata* (Hedw.) Loeske – Korab, peak, 2700 m.
- Pseudoleskeella catenulata* (Brid. ex Schrad.) Kindb. – V. Krčin, 2200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Pseudoleskeella nervosa* (Brid.) Nyholm – V. Krčin, 2000 m.
- Pseudoscleropodium purum* (Hedw.) M. Fleisch. – Pletvar above Prilep, 900 m.
- Pterigynandrum filiforme* Hedw. – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; village of Nistrovo under Korab, 1200 m; Pelister, 1900–2200 m, 2400 m.
- Pterogonium gracile* (Hedw.) Sm. – Baba near Pletvar, 1200–1300 m; valley of Topolka river near Veles, 200 m; Veles, 250 m; Demir Kapija, 100 m.
- \**Pterygoneurum ovatum* (Hedw.) Dixon – Veles, 250 m; Pčinja near Skopje 200 m.  
*Meridional-temperate element (Submediterranean-temperate element)*. It is reported on the territory of former Yugoslavia from all countries except R. Macedonia and Montenegro (Sabovljević et al. 2008).
- Ptychodium plicatum* (Schleich. ex F. Web. & D. Mohr) Schimp. – V. Krčin, 2200 m.
- \**Pylaisia polyantha* (Hedw.) Schimp. – Korab, 2300 m.  
*Subtemperate element*. It is reported from all SE European countries except Albania, and R. Macedonia (Sabovljević et al., 2008).
- Racomitrium aciculare* (Brid. ex Schrad.) Brid. – Pelister, kota 1905, 1700 m.
- Racomitrium canescens* (Hedw.) Brid. – Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; Babuna above Prilep, 1000 m; Korab 2100–2300 m; Pelister, above Niže Pole village, 1400–1600 m.
- \**Racomitrium ericoides* (Brid.) Brid. – Pelister, at the lake Malo ezero, 2200 m.  
*Subboreal element*. It has been mentioned for R. Macedonia (Šar planina: Piribeg) already by Martinčić (1968), but this record was overlooked by both Cekova (2005) and Sabovljević et al. (2008).
- Rhynchostegium megapolitanum* (Blandow ex F. Web. & D. Mohr) Schimp. – Kratovo, 700 m; Dojran, 150 m; Pčinja near Skopje 200 m; Demir Kapija, 100 m.
- \**Rhynchostegium murale* (Hedw.) Schimp. – Korab, 2500 m.  
*Temperate element*. After Sabovljević et al. (2008) it is reported from all SE European countries except R. Macedonia.
- Rhytidiadelphus triquetrus* (Hedw.) Warnst. – V. Krčin, 2000 m; Pelister, kota 1905, 1700 m.
- Saellania glaucescens* (Hedw.) Broth. – Pelister, 1900–2200 m, 2200–2400 m.
- Sanionia uncinata* (Hedw.) Loeske – Korab, peak, 2700 m.
- \**Sciuro-hypnum oedipodium* (Mitt.) Ignatov & Huttunen – Šar planina: between Bistra and Crni vrv, 2200 m.  
*Temperate element*. This species is reported in SE Europe only from Greece, Romania and Slovenia. This distribution pattern clearly demonstrates that the species has frequently been overlooked because of its similarity with *B. rutabulum* and *B. starkei*.
- \**Sciuro-hypnum populeum* (Hedw.) Ignatov & Huttunen – V. Krčin, 1500 m; Pelister, 1900–2200 m.  
*Temperate element*. It was reported from all other SE European countries except Albania and R. Macedonia (Sabovljević et al., 2008).
- \**Sciuro-hypnum starkei* (Brid.) Ignatov & Huttunen – Pelister, at the lake Malo ezero, 2200 m; Šar planina: Bistra, 1900 m; Lešnica, 1600 m; Šutman, 2200 m.  
*Boreal-montane element*. In SE Europe it is known from all countries except Albania, R. Macedonia and Turkey (Sabovljević et al., 2008).

- \**Scorpidium cossonii* (Schimp.) Hedenäs – Pelister, bog near alpine house, 2200 m.  
*Boreal-montane element.* Zabijakin (1963), and later also Martinčič (1966, 1968), mention *S. revolvens* for the Pelister mountains. Recently, this information has been mentioned by both Cekova (2005) and Sabovljević et al. (2008). Revision of our own material, which was determined on the basis of Hedenäs (1989) and Blockeel's (2000) taxonomic processing, on the other hand, showed that this was in fact the species *S. cossonii*, which is generally much more widely distributed. Both species differ not only in their anatomic features, but also in their ecology. It is therefore very likely that the specimens collected by Zabijakin also belong to the species *S. cossonii*. Düll (Düll et al. 1999) has already expressed his doubt in the occurrence of *S. revolvens* in the territory of former Yugoslavia. This is consistent with the revision of abundant material in Slovenia which established that *S. revolvens* grows only on the raised bog Veliko Blejsko barje on Pokljuka-Plateau (Martinčič 2003).
- Scorpiurium circinatum* (Bruch) M. Fleisch. & Loeske – Veles, 250 m, Demir Kapija, 100 m, Dojran, 150 m.
- Sphagnum capillifolium* (Ehrh.) Hedw. – Pelister, bog near alpine house, 2200 m.
- Sphagnum compactum* Lam. & DC. – Pelister, bog near alpine house, 2200 m.
- Sphagnum contortum* Schultz – Pelister, above Niže Pole village, 1600 m; Pelister, bog near alpine house, 2200 m.
- \**Sphagnum inundatum* Russow – Pelister, bog near alpine house, 2200 m.  
*Boreal-montane element.* It is reported on the territory of former Yugoslavia from all countries except R. Macedonia (Sabovljević et al. 2008).
- Sphagnum platyphyllum* (Lindb. ex Braithw.) Warnst. – Pelister, bog, near alpine house, 2200 m.
- Sphagnum teres* (Schimp.) Ångstr. – Pelister, bog near alpine house, 2200 m.
- Stegonia latifolia* (Schwägr.) Venturii ex Broth. – Korab, peak, 2700 m.
- Straminergon stramineum* (Dicks. ex Brid.) Hedenäs – Pelister, bog near alpine house, 2200 m; Šar planina: between Bistra and Crni vrv, 2200 m.
- Syntrichia montana* Nees var. *montana* – Markova kula above Prilep, 750 m; Baba near Pletvar, 1200–1300 m; Veles, 250 m; Dojran, 150 m.
- \**Syntrichia norvegica* F. Weber – V. Krčin, 2000 m; Šar planina: Titov vrv 2500–2700 m; Borislajec, 2400 m.  
*Subarctic-subalpine (alpine) element.* Cekova (2005) and Sabovljević et al. (2008) do not mention this species, although it has been reported as *S. ruralis* var. *alpina* Wahlenb. from Šar planina: Borislajec (Martinčič 1980).
- Syntrichia ruralis* (Hedw.) F. Web. & D. Mohr subsp. *ruralis* – Markova kula above Prilep, 750 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m; valley of Topolka river near Veles, 200 m; Veles, 250 m; Gradsko near Veles, 200 m; Kratovo, 700 m; Dojran, 150 m; Pčinja near Skopje 200 m; Orlovo brdo at Krivolak, 200–500 m; village of Nistrovo under Korab, 1200 m; V. Krčin, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; valley of river Radika near Mavrovo, 1200 m; Pelister, northern slope, 1500–1600 m; Pelister, above Niže Pole village, 1400–1600 m.
- \**Syntrichia ruraliformis* (Besch.) Düll – Šar planina: Ljuboten, 1300 m.  
*Meridional-temperate element.* Cekova (2005) and Sabovljević et al. (2008) do not mention this species, although it has been reported as *S. ruralis* var. *ruraliformis* from Šar planina: Ljuboten, 1300 m (Martinčič 1980).
- Thamnobryum alopecurum* (Hedw.) Gangulee – Pelister, kota 1905, 1700 m.
- \**Thuidium assimile* (Mitt.) A. Jaeger – village of Nistrovo under Korab, 1200 m; valley of river Radika near Mavrovo, 1200 m.  
*Temperate element.* Cekova (2005) does not mention this species, it is reported for Macedonia by Sabovljević et al. (2008).
- Timmia austriaca* Hedw. – V. Krčin, 2200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Pelister, at the lake Malo ezero, 2200 m.
- Timmia bavarica* Hessl. – V. Krčin, 2000 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m.
- Tortella inclinata* (R. Hedw.) Limpr. – Gradsko near Veles, 200 m.
- Tortella tortuosa* (Hedw.) Limpr. – Markova kula above Prilep, 750 m; Zagradski kamen above Prilep, 1000–1200 m; Pletvar above Prilep, 900 m; Veles, 250 m; Korab, peak, 2700 m; V. Krčin, 1500 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Pelister, 2400 m.



- \**Tortula atrovirens* (Sm.) Lindb. – village Nistrovo under Korab, 1200 m; valley of Topolka river near the town of Veles, 200 m.  
*Meridional-temperate element.* For the territory of former Yugoslavia it is reported for all countries except Bosnia and Herzegovina and R. Macedonia (Sabovljević et al. 2008).
- Tortula hoppeana* (Schultz) Ochyra – Korab, 2300–2500 m; Korab, peak, 2700 m; V. Krčin, 2000 m.
- Tortula inermis* (Brid.) Mont. – Pletvar above Prilep, 900 m; Baba near Pletvar, 1200–1300 m.
- \**Tortula lanceolata* R. H. Zander – valley of Topolka river near Veles, 200 m; Veles, 250 m; Orlovo brdo at Krivolak, 200–500 m; Demir Kapija, 100 m.  
*Meridional-temperate element.* It was reported from all other SE European countries except R. Macedonia (Sabovljević et al., 2008).
- Tortula leucostoma* (R. Br.) Hook. & Grev. – Korab, 2300–2500 m.
- Tortula muralis* Hedw. var. *muralis* – Markova kula above Prilep, 750 m; Baba near Pletvar, 1200–1300 m; Veles, 250 m; Gradsko near Veles, 200 m; Kratovo, 700 m; Dojran, 150 m.
- \**Tortula muralis* Hedw. var. *aestiva* Hedw. – Markova kula above Prilep, 750 m.
- Tortula obtusifolia* (Schwägr.) Mathieu – valley of river Radika between Mavrovo and Žirovnica village, 900 m.  
*Temperate element.* Cekova (2005) does not mention this species for Macedonia, although it had already been mentioned by Herzog (1919) and later by Martinčić (1968) and Düll et al. (1999). This record has been taken into consideration also by Sabovljević et al. (2008).
- Tortula subulata* Hedw. – Babuna above Prilep, 1000 m; Veles, 250 m; Skočivir, 650 m; Pčinja near Skopje 200 m; village of Nistrovo under Korab, 1200 m; V. Krčin, 2200 m; valley of river Radika between Mavrovo and Žirovnica village, 900 m; Pelister, 1900–2200 m.
- Tortula subulata* Hedw. var. *subulata* – Zagradski kamen above Prilep, 950 m; Pletvar above Prilep, 900 m; Baba near Pletvar, 1100–1300 m; Veles, 250 m; Pčinja near Skopje, 200 m.
- \**Tortula subulata* Hedw. var. *graeffii* Warnst – Pelister, above the village of Niže Pole, 1400–1600 m.
- \**Tortula subulata* Hedw. var. *subinermis* (Brid.) Wilson – Veles, 250 m.
- Warnstorfia exannulata* (Schimp.) Loeske – Korab, 2500 m; Pelister, bog near alpine house, 2200 m.
- Weisia brachycarpa* (Nees & Hornsch.) Jur. – Nevrokop above Pletvar, 1000 m; Veles, 250 m; Pčinja near Skopje 200 m.
- Weisia condensata* (Voit) Lindb. – Babuna above Prilep, 1000 m; Veles, 250 m; Dojran, 150 m; Pčinja near Skopje 200 m; Demir Kapija, 100 m.
- Weisia controversa* Hedw. var. *controversa* – Babuna near Pletvar, 1200–1300 m.
- \**Weisia longifolia* Mitt. – Veles, 250 m.  
*Temperate element.* It was reported from all other SE European countries except Albania, Bosnia and Herzegovina and R. Macedonia (Sabovljević et al., 2008).

The most important group among the species new to R. Macedonia comprises frigidophilous species that grow in the subalpine and alpine belt of the mountain ranges of Šar planina, Korab-Dešat and Pelister. Phytogeographically they belong to the arctic-alpine, subarctic-subalpine (alpine), alpine and boreal-montane geoelement.

To the arctic-alpine geoelement (arctic-alpine, subarctic-subalpine/alpine) belong: *Blepharostoma trichophyllum* subsp. *brevirete*, *Cephalozia ambigua*, *Gymnomitrium concinatum*, *Lophozia heterocolpos* var. *heterocolpos*, *Andreaea alpestris*, *Grimmia caespiticia*, *Grimmia donniana*, *Hygrohypnum duriusculum*, *Hypnum sauteri* and *Syntrichia norvegica*. The largest part of them are the subarctic-subalpine species, i.e. the species which do not reach into the real Arctic within Europe. The denotation “subalpine” is not the most suitable, as these species grow mostly in the alpine belt on the Balkan Peninsula e.g. in Macedonian mountains (Martinčić 1966). In the western parts of the Balkan Peninsula some of them exhibit a characteristic disjunct distribution or part of it: the Alps (Slovenia) – Vranica (Bosnia) – Prokletije – Macedonian mountains: *Blepharostoma trichophyllum* subsp. *brevirete* (Slovenia – Šar planina), *Gymnomitrium concinatum* (Slovenia – Montenegro – Šar planina), *Scapania helvetica* (Slovenia – Korab), *Hypnum sauteri* (Slovenia – Šar planina). Three species belong to the alpine element: *Scapania helvetica*, *Encalypta microstoma* and *Molendia sendtneriana*.

The boreal-montane element is represented with the following taxa: *Cephalozia lunulifolia*, *Riccardia palmata*, *Tritomaria exectiformis* subsp.

*exectiformis*, *Aloina brevirostris*, *Isopterigyopsis pulchella*, *Lescuraea saxicola*, *Sciuro-hypnum starkei*, *Scorpidium cossonii*, *Sphagnum inundatum*.

The largest among the taxa new to Macedonia is the group of boreal-temperate and temperate species. To the first we attribute the taxa distributed in the boreal zonobiome of coniferous forests and in the temperate zonobiome of deciduous forests. *Aneura pinguis*, *Marchantia polymorpha* subsp. *ruderalis*, *Marsupella funckii*, *Nardia scalaris*, *Scapania aspera*, *Brachythecium glareosum*, *Campyllum protensum*, *Campyllum stellatum*, *Cirriphyllum piliferum*, *Dicranum bonjeanii*, *Drepanocladus polygamus*, *Fontinalis antipyretica* subsp. *gracilis*, *Grimmia longirostris*, *Plagiomnium elatum*, *Polytrichum piliferum* var. *hoppei*.

Temperate species are limited to the temperate zonobiome, to the belt of deciduous vegetation. This belt comprises also the larger part of the Balkan Peninsula with the exception of the Mediterranean-Submediterranean regions and areas above the timberline. These comprise the following species: *Chiloscyphus coadunatus* var. *riularis*, *Amblystegium radicale*, *Aulacomnium androgynum*, *Brachythecium campestre*, *Campyliadelphus elodes*, *Hypnum imponens*, *Hypnum cupressiforme* var. *lacunosum*, *Oxyrrhynchium hians*, *Rhynchostegium murale*, *Sciuro-hypnum populeum*, *Thuidium assimile*, *Tortula obtusifolia*, *Weisia longifolia*. Species *Hypnum andoi*, *Hypnum jutlandicum*, *Neckera pumila* are most common in the western parts of European temperate zonobiome and can be characterised as the temperate-(Subatlantic) element.

There are relatively few thermophilous species among the new taxa found mostly in the lowland parts of Macedonia. They only comprise the meridional (Mediterranean-Submediterranean) species *Homalothecium aureum*, a Subatlantic-Submediterranean species *Entosthodon pulchellus*, *Hedwigia stellata*, *Leucodon sciuroides* var. *morensis* and meridional-temperate (Submediterranean-temperate, southern-temperate sensu Hill & Preston 1998) species *Plasteurhynchium striatulum*, *Pterygoneurum ovatum*, *Syntrichia ruraliformis*, *Tortula atrovirens* and *Tortula lanceolata*.

Six species from the List are included in the Red Data Book of the European Bryophytes (ECCB 1995). Among them four species are in the category rare (R): *Mannia triandra*, *Amblystegium radicale*, *Brachythecium geheebii*, *Grimmia caespiticia*; *Campyliadelphus elodes* is regionally threatened (RT) and *Bryum intermedium* is in the category insufficiently known (K).

#### 4. ACKNOWLEDGEMENT

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#### 5. POVZETEK

Makedonija je v brioflorističnem pogledu najslabše raziskana republika nekdanje Jugoslavije. To je jasno razvidno na podlagi Seznamov, ki so bili objavljeni (Düll et al. 1999, Cekova 2005, Sabovljević & Natcheva 2006, Ross et al. 2007, Sabovljević et al. 2008). Vendar manjše število zabeleženih vrst jetrenjakov in listnatih mahov ni posledica revnosti briofitske flore, temveč razmeroma skromnih florističnih raziskav. To dejstvo najlepše ponazarjata podatka, da je zadnji briofloristični prispevek izšel leta 1992, ter da je 56 odstotkov jetrenjakov in 28 odstotkov listnatih mahov poznanih samo iz ene lokalitete (Cekova 2005).

Avtor je v obdobju od leta 1962 do 1972 intenzivno nabiral mahovni material v različnih, zlasti v višjih predelih Makedonije. Vendar je objavil le material (*Musci*) iz Šar planine (Martinčič 1980). V pričujočem prispevku objavlja podatke še za druge predele.

Nahajališča (razvidne so v angleškem besedilu), na katerih smo nabirali mahovni material, lahko združimo v tri skupine. Prvo skupino predstavljajo nahajališča v gorskih sklopih Korab, Dešat in dolina reke Radike pod njima, Šar planina ter Pelister. Večina nabranih mahov izvira iz subalpinskega in alpinskega pasu, le manjši del iz montanskega, iz nadmorskih višin od 1000 do 1500 m. Drugo skupino sestavljajo nahajališča iz okolice Prilepa (štev. 6–8) – večinoma so v montanskem pasu, na nadmorski višini od 1000 do 1300 m. Tretjo skupino tvorijo nahajališča (štev. 9–17), ki so v nižinskem in kolinskem pasu, predvsem na nadmorskih višinah od 150 do 500 m. Raztresene so po različnih predelih Makedonije. Nahajališča so opremljene z oznako, ki prikazuje lego v UTM mreži (34T) in podrazdelitvijo na mrežo 10 × 10 km.

Podatke smo ovrednotili s podatki, zbranimi v »Pregledu brioflore republike Makedonije« (Cekova 2005), z Listo jetrenjakov JV Evrope (Sabovljević & Natcheva 2006), z Listo mahov JV Evrope (Sabovljević et al. 2008) in Listo jetrenjakov Mediterana (Ros et al. 2007).

V delu je navedeno 269 taksonov (41 jetrenjakov in 228 listnatih mahov), med katerimi je 75

taksonov (18 jetrenjakov in 57 listnatih mahov) novih za Makedonijo (v seznamu opremljenih z zvezdico). Pri nekaterih novih taksonih je dodan tudi kratek komentar.

Med vrstami, novimi za Makedonijo predstavljajo najpomembnejšo skupino tiste, ki pripadajo arktično-alpinskemu, alpinskemu in borealno-montanskemu geoelementu. Arktično-alpinski geoelement (arktično-alpinski, subarktično-subalpinski/alpinski) je zastopan z naslednjimi vrstami: *Blepharostoma trichophyllum* subsp. *brevirete*, *Cephalozia ambigua*, *Gymnomitrium concinnatum*, *Lophozia heterocolpos* var. *heterocolpos*, *Andreaea alpestris*, *Grimmia caespiticia*, *Grimmia donniana*, *Hygrohypnum duriusculum*, *Hypnum sauteri* in *Syntrichia norvegica*. Največji del med njimi so subarktično-subalpinske vrste, to so vrste, ki v Evropi ne sežejo v pravo Arktiko. Oznaka »subalpinski« ni najbolj ustrezna, kajti te vrste na Balkanskem polotoku, npr. v makedonskih gorstvih uspevajo v alpskem pasu (Martinčič 1966). Nekateri od teh vrst imajo v zahodnih predelih Balkanskega polotoka značilno disjunktno razširjenost: *Blepharostoma trichophyllum* subsp. *brevirete* (Julijske Alpe – Šar planina), *Gymnomitrium concinnatum* (Slovenija – Črna Gora – Šar planina), *Scapania helvetica* (Slovenija – Korab), *Hypnum sauteri* (Slovenija – Šar planina).

Borealno-montanski element je zastopan z naslednjimi vrstami: *Cephalozia lunulifolia*, *Riccardia palmata*, *Tritomaria exectiformis* subsp. *exectiformis*, *Aloina brevirostris*, *Isopterigyopsis pulchella*, *Lescurea saxicola*, *Sciurohypnum starkei*, *Scorpidium cossonii*, *Sphagnum inundatum*. Tudi pri teh vrstah opažamo, tako kot pri arktično - alpskih, da uspevajo na jugu Balkanskega polotoka na višjih nadmorskih višinah kot v Alpah.

Številčno največja skupina med taksoni, novimi za Makedonijo, predstavljajo borealno-temperatne in temperatne vrste. K prvim štejemo taksone, ki so razširjeni v borealnem zonobiomu iglastih gozdov ter v temperatnem zonobiomu listopadnih listavskih gozdov. Temperatne vrste so vezane na temperatni zonobion, na pas listopadne listavske vegetacije. Ta obsega med drugim večji del Balkanskega polotoka razen mediteransko-submediteranskih območij in predelov nad gozdno mejo.

Med novimi taksoni, ki so bili najdeni v nižinskih predelih Makedonije, je razmeroma majhno število termofilnih vrst. Sem uvrščamo le mediteransko-submediteransko (=meridionalna) vrsto *Homalothecium aureum*, subatlantsko-submedite-

ranski vrsti *Entosthodon pulchellus*, *Hedwigia stellata* in submediteransko-temperatne (meridionalno-temperatne; southern-temperate sensu Hill & Preston 1998) vrste *Plasteurhynchium striatulum*, *Pterygoneurum ovatum*, *Tortula atrovirens* in *Tortula lanceolata*.

Šest vrst iz Seznama je vključenih v Rdečo knjigo ogroženih evropskih mahov (ECCB 1995). Štiri med njimi sodijo v kategorijo redke (R): *Mannia triandra*, *Amblystegium radicale*, *Brachythecium geheebii*, *Grimmia caespiticia*; *Campyliadelphus elodes* je regionalno ogrožena vrsta (RT), *Bryum intermedium* pa je v kategoriji nezadostno poznanih vrst (K).

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