

CONTRIBUTIONS TO THE BRYOPHYTE FLORA OF
THE VORAS (NIDŽE) MTS (GREECE AND THE
FORMER YUGOSLAV REPUBLIC OF MACEDONIA)

B. PAPP¹, P. ERZBERGER² and E. TSAKIRI³

¹*Department of Botany, Hungarian Natural History Museum,
H-1476 Budapest, Pf. 222, Hungary; pappbea@bot.nhmus.hu*

²*Belziger Str. 37, D-10823 Berlin, Germany; erzberger.peter@gmail.com*

³*Laboratory of Systematic Botany and Phytogeography, Department of Botany,
School of Biology, Aristotle University of Thessaloniki,
Thessaloniki 541 24, Greece; tsakiri@bio.auth.gr*

During a field trip carried out in 2010 in the Voras Mts 244 bryophyte taxa (53 liverworts and 191 mosses) were collected on the Greek side of the mountain and 95 taxa (24 liverworts and 71 mosses) on adjacent sites on the territory of the Former Yugoslav Republic of Macedonia. Six hepatics (*Calypogeia azurea*, *Cephaloziella rubella*, *Diplophyllum obtusifolium*, *Lophozia longidens*, *L. wenzelii*, *Tritomaria quinquedentata*) and 14 mosses (*Bryum tenuisetum*, *Ditrichum heteromallum*, *Grimmia incurva*, *G. sessitana*, *Plagiothecium platyphyllum*, *Pohlia camptotrachela*, *Pseudoleskea patens*, *Racomitrium affine*, *R. sudeticum*, *Rhabdoweisia fugax*, *Sphagnum fallax*, *S. papillosum*, *S. subnitens*, *Tortella bambergeri*) represent new records for the bryophyte flora of Greece, while 9 hepatics (*Diplophyllum obtusifolium*, *Lophocolea heterophylla*, *Lophozia incisa*, *L. longidens*, *L. wenzelii*, *Marsupella sphaecelata*, *Riccia beyrichiana*, *R. subbifurca*, *Scapania praetervisa*) and 3 mosses (*Grimmia anomala*, *G. muehlenbeckii*, *Pseudoleskea patens*) are recorded for the first time in the Former Yugoslav Republic of Macedonia. From the aspect of plant conservation it is worth mentioning the five species documented in these mountains, which are included in the Red data book of European bryophytes, namely *Brachythecium geheebi*, *Buxbaumia viridis*, *Grimmia caespiticia*, *G. sessitana*, and *Pseudoleskea saviana*.

Key words: liverworts, mosses, new national records, redlisted species in Europe, Voras Mts

INTRODUCTION

The Voras Mts is located on the border of Greece and the Former Yugoslav Republic of Macedonia (FYROM). During a brief study trip in 2005 we had an opportunity to visit *Sphagnum* habitats on the Greek part of the Voras Mts and a number of new records have been reported (TSAKIRI *et al.* 2006).

Recognising the unique nature of the Voras Mts we planned to revisit the area for extensive bryological research in various habitat types. This visit was made possible in July 2010.

Since 2006, time of the above mentioned publication that included all the data related with the Voras Mts up until 2006, a number of other reports have added new bryological data for Greece (BERGMEIER 2011, BERGMEIER *et al.* 2011, BLOCKEEL 2010, LÜTH and FRAHM 2008, ORGAZ ALVAREZ and BLOCKEEL 2010, PAPP and TSAKIRI 2011, TSAKIRI 2009). Additionally, related data have been included in the bryophyte lists published for Southeastern European countries (SABOVLJEVIĆ and NATCHEVA 2006, SABOVLJEVIĆ *et al.* 2008), as well as in the lists compiled for the European and Mediterranean bryophytes (HILL *et al.* 2006, ROS *et al.* 2007, SCHUMACKER and VÁÑA 2005, SÖDERSTRÖM *et al.* 2007).

Data on the bryophyte flora of FYROM are included in DÜLL *et al.* (1999) and in the checklists of the Southeastern European and Mediterranean countries (ROS *et al.* 2007, SABOVLJEVIĆ and NATCHEVA 2006, SABOVLJEVIĆ *et al.* 2008) and lately in MARTINČIČ (2009).

The present paper provides a complete list of bryophytes collected in the Voras Mts during this thorough investigation, and reports many new findings, that is, national new records for either (or both) countries.

MATERIALS AND METHOD

Study area

The Voras Mts, situated in Central North Greece (Central Macedonia District, Pella Prefecture), is the third highest mountain in Greece reaching 2,524 m above sea level (Kaimaktsalan peak). It has a SW–NE direction and acts as a natural border between Greece and the Former Yugoslav Republic of Macedonia.

The Greek part of the Voras Mts area is protected by means of the framework termed ‘Natura 2000’ project (‘Koryfes Orous Voras’; Dir. 92/43/EEC) (DAFIS *et al.* 1996). It covers about 39,000 hectares. The landscape is dominated by gentle slopes, with the exception of rugged gorges around the Loutraki area. The area was not affected by excessive human population and activities until almost a decade ago (around the year 2000), when a network of roads was constructed to provide access for a newly constructed ski centre.

Geologically, there is a great variety of substrates including schist, gneiss, ophiolites and limestone in some parts.

The area is densely forested, mainly covered by stands of *Fagus sylvatica* subsp. *sylvatica*, bordered by extensive pastures and deep valleys with various habitat types. Very significant for the area is the presence of relict stands of *Pinus peuce* and areas with *Quercus trojana* woods, both vegetation types occurring in a very limited range of distribution in Greece, as well as the presence of one of the two active (though very small-sized) bogs in the country, here in the 'Kali Pediada' area (DAFIS *et al.* 1996, TSAKIRI *et al.* 2006).

The general plant cover of the other side of the mountain, located in FYROM, is similar to that of the Greek side; beech forest and alpine pastures around the peaks.

Method

The collecting trip was made in July 2010. The investigated area is shown in Figure 1. All main habitat types, such as stream valleys, gorges, forests and grasslands were investigated, and bryophytes were collected from different substrates (soil, exposed and shady rocks, tree bark, decaying wood, etc.). Most of the sites were situated on the Greek side of the mountain, but there were two localities in FYROM.

The specimens have been shared between the participating parties and are preserved in the Herbarium of the Hungarian Natural History Museum, Budapest (BP), the Herbarium of the Botanical Museum Berlin-Dahlem (B), and the bryophyte collection of Dr E. Tsakiri (Laboratory of Systematic Botany and Phytogeography, School of Biology, Aristotle University, Thessaloniki, Greece).

In our account below, the nomenclature follows GROLLE and LONG (2000) for liverworts and HILL *et al.* (2006) for mosses, with the exception of *Grimmia sessitana*, where MAIER (2010) is followed. New floristical results for the countries are given according to the checklists of Southeast Europe and Mediterranean (SABOVLJEVIĆ and NATCHEVA 2006, SABOVLJEVIĆ *et al.* 2008, ROS *et al.* 2007) and the checklist of DÜLL for Greece (1995) and DÜLL *et al.* (1999) for the Former Yugoslav Republic of Macedonia, updated with all new records reported for Greece by BLOCKEEL (2010), ORGAZ ALVAREZ and BLOCKEEL (2010), BERGMIEIER (2011), BERGMIEIER *et al.* (2011), TSAKIRI (2009), PAPP and TSAKIRI (2011) and for the Former Yugoslav Republic of Macedonia by MARTINČIČ (2009).

For the distribution of bryophyte taxa in the Greek part of the study area, the floristical regions of Greece are used, according to the "Flora Hellenica" project (STRID and TAN 1997) with some modifications for bryophytes by PRESTON (1981).

Site details

Greece

1. Greece, Central Macedonia District, Voras Mts, above Orma village, N 40°56'25.1", E 21°53'57.9", 720 m, 12.07.2010.
2. Greece, Central Macedonia District, Voras Mts, at the Voras ski centre under the Kaimaktsalan peak, N 40°54'22.0", E 21°48'41.9", 2,035 m, 12.07.2010.

3. Greece, Central Macedonia District, Voras Mts, at the Voras ski centre under the Kaimaktsalan peak, N 40°54'38.6", E 21°48'48.8", 2,005 m, 12.07.2010.
4. Greece, Central Macedonia District, Voras Mts, along the road from Voras ski centre to Orma village at Korifi Travlou hill, N 40° 55' 19.9', E 21° 53' 50.1", 1,095 m, 12.07.2010.
5. Greece, Central Macedonia District, Voras Mts, at Voras ski centre, at the ski lift of Kremasi, N 40°56'02.9", E 21°47'54.2", 2,245 m, 13.07.2010.
6. Greece, Central Macedonia District, Voras Mts, Profitis Ilias peak, at the chapel, pasture with open subalpine vegetation, N 40°55'48.1", E 21°47'09.1", 2,510 m, 13.07.2010.
7. Greece, Central Macedonia District, Voras Mts, between the ski centre and Orma village, along a road N of Damaskinies and Mavro dasos, *Fagetum*, N 40°54'08.2", E 21°51'34.9", 1,515 m, 13.07.2010.
8. Greece, Central Macedonia District, Voras Mts, Nikolau stream with old *Platanus* trees at Loutra Loutrakiou (Pózar), N 40°58'20.7", E 21°54'41.6", 430 m, 14.07.2010.
9. Greece, Central Macedonia District, Voras Mts, Kapetan Garefi stream valley with old *Platanus* trees at Orma village, N 40°57'12.5", E 21°52'35.2", 610 m, 14.07.2010.
10. Greece, Central Macedonia District, Voras Mts, Kapetan Garefi stream valley at Orma village, at the upper hydroelectric installation, N 40°57'28.2", E 21°52'22.9", 635 m, 14.07.2010.
11. Greece, Central Macedonia District, Voras Mts, Kali Pediada bog, N 41°01'57.2", E 21°53'45.2", 1,720 m, 15.07.2010.
12. Greece, Central Macedonia District, Voras Mts, under Kali Pediada, *Fagetum*, N 41°01'41.2", E 21°54'02.9", 1,670 m, 15.07.2010.
13. Greece, Central Macedonia District, Voras Mts, along the road between Kali Pediada and Loutraki village at Kalivia Vasilakou, N 41°00'16.7", E 21°54'34.9", 1,335 m, 15.07.2010.
14. Greece, Central Macedonia District, Voras Mts, along the road between Kali Pediada and Loutraki village, above Loutraki village, N 40°58'40.6", E 21°55'42.2", 865 m, 15.07.2010.
15. Greece, Central Macedonia District, Voras Mts, Skliri Petra stream at Kalivia Siskou, N 40°56'45.7", E 21°51'48.1", 950 m, 16.07.2010.
16. Greece, Central Macedonia District, Voras Mts, Kremasis stream at Kotroni, N 40°55'02.3", E 21°51'17.8", 1,065 m, 16.07.2010.
17. Greece, Central Macedonia District, Voras Mts, at Ajia Paraskevi after Paliohoraki stream, *Fagetum*, N 40°55'18.3", E 21°51'39.5", 1,110 m, 16.07.2010.
18. Greece, Central Macedonia District, Voras Mts, between Ajia Paraskevi and Damaskinies, *Fagetum*, N 40°54'36.4", E 21°52'03.1", 1,370 m, 16.07.2010.

Former Yugoslav Republic of Macedonia

1. Former Yugoslav Republic of Macedonia (FYROM), Nidže (Voras) Mts, Kaimaktsalan peak, under the church, N 40°55'49.1", E 21°47'07.1", 2,505 m, 13.07.2010.

2. Former Yugoslav Republic of Macedonia (FYROM), Nidže (Voras) Mts, above Kali Pediada on the FYROM side, exposed siliceous rocks and *Fagetum*, N 41°02'27", E 21°53'53" and N 41°02'23.6", E 21°53'52.7", 1,745 m, 15.07.2010.

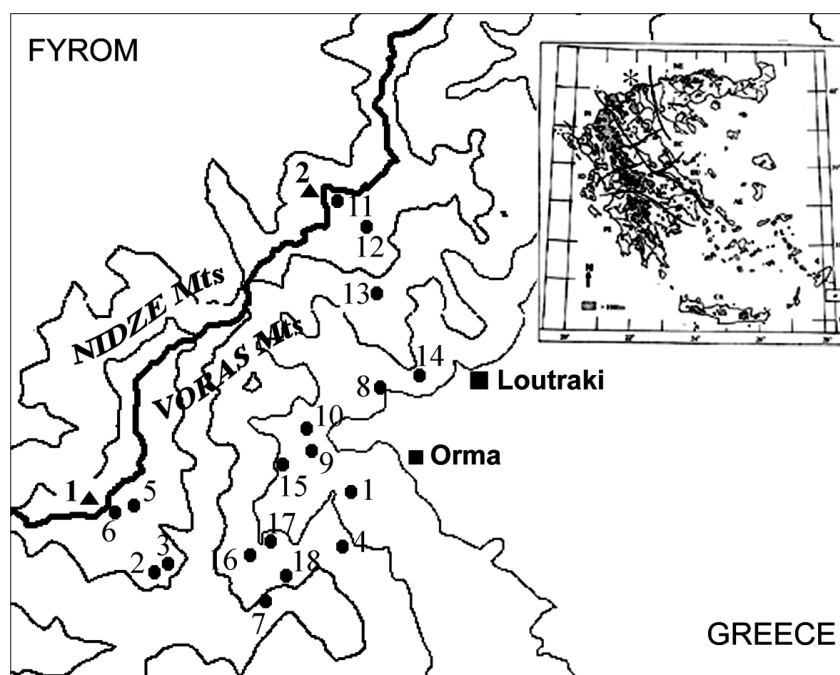


Fig. 1. The Voras Mts (Nidže Mts) area with the collection sites being indicated by: ● = sites in the Greek part (North Greece, Pella Prefecture), ▲ = sites in the FYROM side of the mountain. Numbers of collection sites are given in the text. Altitudinal lines are at 500, 1,000, 1,500 and 2,000 m a.s.l. (black). The asterisk (*) in the small map of Greece indicate the general area of collection (and the location of the Voras Mts in the map of Greece)

RESULTS

During our field trip 244 bryophyte taxa (53 liverworts and 191 mosses) were collected on the Greek side of the mountain and 95 taxa (24 liverworts and 71 mosses) on the sites situated in the Former Yugoslav Republic of Macedonia. Taxa recorded for the first time in the given country are marked by (*). The numerals following the species names refer to the collection sites described above.

Data from Greece

Hepaticae

- Barbilophozia barbata* (Schreb.) Loeske – 3: siliceous rock
Barbilophozia hatcheri (A. Evans) Loeske – 2, 3: siliceous rock
 * *Calypogeia azurea* Stotler et Crotz – 2: siliceous rock (rev. J. Váňa)
Calypogeia fissa (L.) Raddi – 2: siliceous rock; 12: bank of the stream
Cephalozia bicuspidata (L.) Dumort. – 2: soil among siliceous rocks; 5: bog (det. J. Váňa)
Cephalozia connivens (Dicks.) Lindb. – 2: bog
Cephaloziella divaricata (Sm.) Schiffn. – 2, 3: siliceous rock; 7, 17: soil
 * *Cephaloziella rubella* (Nees) Warnst. – 2: siliceous rock
Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dumort. – 3: bank of the stream
Chiloscyphus polyanthus (L.) Corda – 12, 15: bank of the stream
Conocephalum conicum (L.) Dumort. – 9: in the stream; 12: bank of the stream; 15: siliceous rock in the stream
 * *Diplophyllum obtusifolium* (Hook.) Dumort. – 3, 6: siliceous rock
Fossombronina pusilla (L.) Nees – 3: soil among siliceous rocks
Frullania dilatata (L.) Dumort. – 7, 17: *Fagus* bark; 8: *Platanus* bark
Frullania tamarisci (L.) Dumort. – 15: siliceous rock
Jungermannia atrovirens Dumort. – 3: bank of the stream; 15: siliceous rock in the stream (p.p. conf./det. J. Váňa)
Jungermannia hyalina Lyell – 2: bog (det. J. Váňa); 3: bank of the stream
Jungermannia leiantha Grolle – 12: bank of the stream
Leiocolea collaris (Nees) Schljakov – 9: limestone rock
Lejeunea cavifolia (Ehrh.) Lindb. – 9: limestone rock; 10, 15: siliceous rock
Lophocolea heterophylla (Schrad.) Dumort. – 7: bank of the stream, soil and decaying wood; 12: soil; 16: decaying wood
Lophocolea minor Nees – 7: soil
Lophozia incisa (Schrad.) Dumort. – 3: siliceous rock; 12: bank of the stream
 * *Lophozia longidens* (Lindb.) Macoun – 6: siliceous rock
Lophozia obtusa (Lindb.) A. Evans – 15: siliceous rock
Lophozia ventricosa (Dicks.) Dumort. – 3, 6: siliceous rock
 * *Lophozia wenzelii* (Nees) Steph. – 12: bank of the stream
Mannia androgyna (L.) A. Evans – 3: soil among siliceous rocks
Marchantia polymorpha L. subsp. *polymorpha* – 8: bank of the stream; 15: siliceous rock in the stream
Marchantia polymorpha L. subsp. *montivagans* Bisch. et Boisselier – 2: bog; 3: bank of the stream
Marsupella emarginata (Ehrh.) Dumort. – 2: siliceous rock; 3: siliceous rock (p.p. conf./det. J. Váňa)
Marsupella funckii (F. Weber et D. Mohr) Dumort. – 3, 6: siliceous rock; 12: bank of the stream

- Marsupella sphacelata* (Gieseke ex Lindenb.) Dumort. – 3: siliceous rock (conf. J. Váňa)
Metzgeria conjugata Lindb. – 10, 15: siliceous rock; 10: *Platanus* bark
Metzgeria furcata (L.) Dumort. – 7, 16: *Fagus* bark; 12: siliceous rock; 18: decaying wood
Nardia scalaris Gray – 3: soil among siliceous rocks; 12: bank of the stream
Nowellia curvifolia (Dicks.) Mitt. – 16: decaying wood
Pellia endiviifolia (Dicks.) Dumort. – 8, 9, 14: bank of the stream
Pellia neesiana (Gottsche) Limpr. – 2, 5: bog; 3, 15: siliceous rock in the stream
Plagiochila asplenoides (L.) Dumort. – 15: siliceous rock
Plagiochila porelloides (Torrey ex Nees) Lindenb. – 3, 10, 12, 15: siliceous rock; 7, 12: soil; 9: limestone rock; 12: bank of the stream
Porella cordaeana (Huebener) Mohr – 7: bank of the stream; 12: siliceous rock
Preissia quadrata (Scop.) Nees – 9: soil; 12: bank of the stream
Radula complanata (L.) Dumort. – 3, 15: siliceous rock; 7, 16: *Fagus* bark
Reboulia hemisphaerica (L.) Raddi – 3: siliceous rock; 12: bank of the stream
Riccia ciliifera Link ex Lindenb. – 3: soil among siliceous rocks (conf. C. Sérgio)
Riccia gougetiana Durieu et Mont. – 3: soil among siliceous rocks (conf./det. C. Sérgio)
Riccia sorocarpa Bisch. – 2, 3, 6: soil among siliceous rocks
Scapania irrigua (Nees) Nees – 2, 5: bog; 3: soil among siliceous rocks
Scapania nemorea (L.) Grolle – 7: bank of the stream
Scapania undulata (L.) Dumort. – 2, 5, 11: bog; 3, 7: bank of the stream
Southbya nigrella (De Not.) Henriq. – 8: soil
Southbya tophacea (Spruce) Spruce – 8: soil
* *Tritomaria quinquedentata* (Huds.) H. Buch – 15: siliceous rock

Musci

- Amphidium mougeotii* (Schimp.) Schimp. – 10, 15: siliceous rock
Anomodon attenuatus (Hedw.) Huebener – 9, 15: siliceous rock
Anomodon viticulosus (Hedw.) Hook. et Taylor – 4, 8: limestone rock; 9: siliceous rock and *Platanus* bark
Antitrichia curtipendula (Hedw.) Brid. – 16: *Fagus* bark and decaying wood
Atrichum undulatum (Hedw.) P. Beauv. – 13, 17: soil
Aulacomnium palustre (Hedw.) Schwägr. – 2, 5, 11: bog
Barbula convoluta Hedw. var. *sardoa* Schimp. – 4: limestone rock
Barbula unguiculata Hedw. – 8: soil
Bartramia halleriana Hedw. – 16: soil
Bartramia ithyphylla Brid. – 2, 3, 6, 11: siliceous rock; 7, 12: soil
Bartramia pomiformis Hedw. – 15: siliceous rock
Blindia acuta (Hedw.) Bruch et Schimp. – 3: bank of the stream; 5: bog
Brachytheciastrum olympicum (Jur.) Vanderp. et al. – 3: siliceous rock
Brachytheciastrum velutinum (Hedw.) Ignatov et Huttunen – 2, 3: siliceous rock; 7, 12: soil
Brachythecium glareosum (Bruch ex Spruce) Schimp. – 3, 10: siliceous rock; 9: soil

- Brachythecium rivulare* Schimp. – 2, 11: bog; 3, 7: bank of the stream; 15: siliceous rock in the stream
- Brachythecium rutabulum* (Hedw.) Schimp. – 8: bank of the stream; 9: limestone rock; 17: soil
- Bryoerythrophyllum recurvirostrum* (Hedw.) P. C. Chen – 4, 9: limestone rock; 3, 15: siliceous rock
- Bryum alpinum* Huds. ex With. – 11: on stone in bog (conf. W. Schröder)
- Bryum argenteum* Hedw. – 2, 5: bog
- Bryum caespiticium* Hedw. – 2: siliceous rock (conf./det. W. Schröder); 5: bog (det. W. Schröder)
- Bryum capillare* Hedw. – 3: siliceous rock; 4: limestone rock; 7, 8: soil
- Bryum moravicum* Podp. – 12: siliceous rock
- Bryum muehlenbeckii* Bruch et Schimp. – 3: siliceous rock (conf. W. Schröder)
- Bryum pallens* Sw. ex anon. – 2: siliceous rock (conf./det. W. Schröder); 5: bog (p.p. conf. W. Schröder)
- Bryum pallescens* Schleich. ex Schwägr. – 2: siliceous rock (rev./det. W. Schröder); 3: siliceous rock (p.p. det. W. Schröder, conf. D. T. Holyoak)
- Bryum pseudotriquetrum* (Hedw.) P. Gaertn. et al. var. *pseudotriquetrum* – 2: bog (conf./det. W. Schröder); 3: on the bank of the stream; 5: bog; 11: bog (conf. W. Schröder); 15: bank of the stream (conf. W. Schröder)
- Bryum pseudotriquetrum* (Hedw.) P. Gaertn. et al. var. *bimum* (Schreb.) Lilj. – 2: bog
- Bryum ruderales* Crundw. et Nyholm – 2: siliceous rock (det. W. Schröder)
- Bryum schleicheri* DC. – 12: bank of the stream
- * *Bryum tenuisetum* Limpr. – 2: on soil over siliceous rock (det. W. Schröder)
- Buxbaumia viridis* (Moug. ex Lam. et DC.) Brid. ex Moug. et Nestl. – 7, 18: decaying wood; 16: decaying wood (obs. E. Tsakiri)
- Calliergonella cuspidata* (Hedw.) Loeske – 2, 11: bog
- Campyliadelphus chrysophyllus* (Brid.) R. S. Chopra – 8: soil
- Campylium stellatum* (Hedw.) Lange et C. E. O. Jensen – 2, 11: bog
- Ceratodon purpureus* (Hedw.) Brid. – 2, 3, 6: siliceous rock; 5: bog
- Cirriphyllum crassinervium* (Taylor) Loeske et M. Fleisch. – 9, 10: siliceous rock; 9: concrete rock wall and limestone rock; 15: bank of the stream
- Climacium dendroides* (Hedw.) F. Weber et D. Mohr – 2, 11: bog
- Cratoneuron filicinum* (Hedw.) Spruce – 8: bank of the stream; 9: in the stream; 15: siliceous rock in the stream
- Ctenidium molluscum* (Hedw.) Mitt. – 8: limestone rock; 9: soil
- Dialytrichia mucronata* (Brid.) Broth. – 8: limestone and siliceous rock
- Dicranella heteromalla* (Hedw.) Schimp. – 12: soil
- Dicranella howei* Renauld et Cardot – 8: soil
- Dicranoweisia crispula* (Hedw.) Milde – 2, 3, 6: siliceous rock
- Dicranum bonjeanii* De Not. – 2, 11: bog
- Dicranum scoparium* Hedw. – 2, 3, 11, 12: siliceous rock; 11, 13: soil; 7: decaying wood
- Dicranum tauricum* Sapjegin – 7: decaying wood

- Didymodon fallax* (Hedw.) R. H. Zander – 8: soil; 9: limestone rock
Didymodon insulanus (De Not.) M. O. Hill – 4, 9: limestone rock; 17: soil
Didymodon luridus Hornsch. – 8: soil
Didymodon tophaceus (Brid.) Lisa – 8: bank of the stream
Didymodon vinealis (Brid.) R. H. Zander – 9: concrete rock wall and limestone rock
Diphyscium foliosum (Hedw.) D. Mohr – 12: bank of the stream
* *Ditrichum heteromallum* (Hedw.) E. Britton – 2, 3: siliceous rock
Encalypta streptocarpa Hedw. – 8, 9: limestone rock; 15: siliceous rock
Eucladium verticillatum (With.) Bruch et Schimp. – 8, 9: limestone rock
Eurhynchiastrium pulchellum (Hedw.) Ignatov et Huttunen var. *diversifolium* (Schimp.)
Ochyra et Zarnowiec – 3: siliceous rock; 17: soil
Eurhynchium striatum (Hedw.) Schimp. – 10: siliceous rock
Fissidens dubius P. Beauv. – 8, 9: limestone rock and soil; 15: siliceous rock
Fissidens kosaninii Latzel – 8: limestone rock
Fissidens rivularis (Spruce) Schimp. – 9: in the stream
Fontinalis antipyretica Hedw. – 11: bog
Funaria hygrometrica Hedw. – 2, 7, 8: bank of the stream
Grimmia alpestris (F. Weber et D. Mohr) Schleich. – 2: siliceous rock; 3: siliceous rock
(conf. E. Maier)
Grimmia anomala Hampe ex Schimp. – 3, 12: siliceous rock (p.p. conf. E. Maier)
Grimmia caespiticia (Brid.) Jur. – 3: siliceous rock (p.p. conf./rev. E. Maier); 6: siliceous rock
Grimmia hartmannii Schimp. – 7: shaded siliceous rock; 12, 15: siliceous rock (conf. E. Maier)
* *Grimmia incurva* Schwägr. – 6: siliceous rock (conf. E. Maier)
Grimmia montana Bruch et Schimp. – 3: siliceous rock (conf. E. Maier and R. Ochyra)
Grimmia muehlenbeckii Schimp. – 2, 3, 12: siliceous rock
Grimmia orbicularis Bruch ex Wilson – 14: limestone rock (conf. E. Maier)
Grimmia ovalis (Hedw.) Lindb. – 3: siliceous rock (conf. E. Maier)
Grimmia pulvinata (Hedw.) Sm. – 4, 8: limestone rock
* *Grimmia sessitana* De Not. – 3: siliceous rock (conf. R. Ochyra); 6: siliceous rock
(conf./rev. E. Maier)
Gymnostomum calcareum Nees et Hornsch. – 8, 9: limestone rock
Gymnostomum viridulum Brid. – 8: limestone rock
Gyroweisia tenuis (Hedw.) Schimp. – 8: soil
Herzogiella seligeri (Brid.) Z. Iwats. – 7, 16: decaying wood
Heterocladium dimorphum (Brid.) Schimp. – 12: soil
Homalothecium philippeanum (Spruce) Schimp. – 4: limestone rock; 10: siliceous rock; 17: soil
Homalothecium sericeum (Hedw.) Schimp. – 1, 4, 8, 9: limestone rock; 7: *Fagus* bark; 8, 9: *Platanus* bark; 9: siliceous rock; 13: rock
Hygroamblystegium tenax (Hedw.) Jenn. – 12: in the stream
Hygrohypnum duriusculum (De Not.) D. W. Jamieson – 3: bank of the stream

- Hygrohypnum luridum* (Hedw.) Jenn. – 3: bank of the stream; 9: in the stream
Hypnum cupressiforme Hedw. var. *cupressiforme* – 7: shaded siliceous rock and decaying wood; 8: limestone rock; 9, 15: siliceous rock; 9: *Platanus* bark
Hypnum cupressiforme Hedw. var. *lacunosum* Brid. – 3: siliceous rock
Isothecium alopecuroides (Lam. ex Dubois) Isov. – 7: shaded siliceous rock; 10, 12, 15: siliceous rock; 16: *Fagus* bark and decaying wood
Isothecium myosuroides Brid. – 15: siliceous rock
Leptodon smithii (Hedw.) F. Weber et D. Mohr – 8: limestone and siliceous rocks, *Platanus* bark
Leucodon sciuroides (Hedw.) Schwägr. – 4: limestone rock; 7, 13, 16: *Fagus* bark; 8: siliceous rock; 9: *Platanus* bark
Mnium stellare Hedw. – 9: soil; 10, 15: siliceous rock
Mnium thomsonii Schimp. – 6: siliceous rock
Neckera besseri (Lobarz.) Jur. – 8: limestone rock and *Platanus* bark; 8, 9: siliceous rock
Neckera complanata (Hedw.) Huebener – 9, 10, 15: siliceous rock
Neckera crispa Hedw. – 8: limestone rock; 10, 15: siliceous rock
Neckera menziesii Drumm. – 4: limestone rock
Neckera pumila Hedw. – 16: *Fagus* bark
Orthotrichum affine Schrad. ex Brid. – 8: *Platanus* bark
Orthotrichum anomalum Hedw. – 8, 9: siliceous rock
Orthotrichum cupulatum Hoffm. ex Brid. – 8: limestone rock
Orthotrichum lyellii Hook. et Taylor – 7, 13: *Fagus* bark
Orthotrichum pallens Bruch ex Brid. – 7: *Acer* bark
Orthotrichum stramineum Hornsch. ex Brid. – 7: *Fagus* bark
Orthotrichum striatum Hedw. – 7: *Fagus* bark
Oxyrrhynchium hians (Hedw.) Loeske – 3, 15: bank of the stream; 8, 9, 17: soil
Palustriella commutata (Hedw.) Ochyra – 11: bog; 12: in the stream
Palustriella decipiens (De Not.) Ochyra – 2: bog; 12: bank of the stream
Philonotis calcarea (Bruch et Schimp.) Schimp. – 8: bank of the stream
Philonotis fontana (Hedw.) Brid. – 2: bog; 8, 12: bank of the stream
Philonotis marchica (Hedw.) Brid. – 2: bog
Philonotis seriata Mitt. – 2: bog; 3, 12: bank of the stream; 5: bog
Philonotis tomentella Molendo – 11: bog
Plagiomnium cuspidatum (Hedw.) T. J. Kop. – 16: decaying wood
Plagiomnium rostratum (Schrad.) T. J. Kop. – 8: bank of the stream
Plagiomnium undulatum (Hedw.) T. J. Kop. – 9: in the stream; 10: siliceous rock; 12: bank of the stream; 15: siliceous rock in the stream
Plagiopus oederianus (Sw.) H. A. Crum et L. E. Anderson – 10, 15: siliceous rock
Plagiothecium cavifolium (Brid.) Z. Iwats. – 7: soil; 12, 15: siliceous rock
Plagiothecium denticulatum (Hedw.) Schimp. – 2, 12: siliceous rock
* *Plagiothecium platyphyllum* Mönk. – 15: siliceous rock
Plasteurhynchium striatulum (Spruce) M. Fleisch. – 8: limestone rock and *Platanus* bark; 9: siliceous rock

- Platyhypnidium riparioides* (Hedw.) Dixon – 2: bog; 3: bank of the stream; 8, 9: in the stream; 15: siliceous rock in the stream
- Pleurochaete squarrosa* (Brid.) Lindb. – 8: limestone rock
- Pogonatum aloides* (Hedw.) P. Beauv. – 2: siliceous rock
- Pogonatum urnigerum* (Hedw.) P. Beauv. – 2: siliceous rock; 7: soil; 12: soil
- Pohlia annotina* (Hedw.) Lindb. – 2, 3: soil among siliceous rocks
- * *Pohlia camptotrachela* (Renauld et Cardot) Broth. – 2, 3: soil among siliceous rocks
- Pohlia cruda* (Hedw.) Lindb. – 3, 6, 12: siliceous rock; 7: soil
- Pohlia ludwigii* (Spreng. ex Schwägr.) Broth. – 2: bog
- Pohlia melanodon* (Brid.) A. J. Shaw – 2, 15: siliceous rock; 8: bank of the stream
- Pohlia nutans* (Hedw.) Lindb. – 3, 6, 12: siliceous rock; 5: bog
- Polytrichastrum alpinum* (Hedw.) G. L. Sm. – 2: siliceous rock (conf./det. W. Schröder); 3: siliceous rock; 7, 12: soil
- Polytrichastrum formosum* (Hedw.) G. L. Sm. – 12: soil
- Polytrichum commune* Hedw. var. *commune* – 2, 11: bog
- Polytrichum commune* Hedw. var. *perigoniale* (Michx.) Hampe – 2, 5, 11: bog
- Polytrichum juniperinum* Hedw. – 2, 3, 12: soil
- Polytrichum piliferum* Hedw. – 2, 3: siliceous rock
- Pseudoleskea incurvata* (Hedw.) Loeske – 2, 3, 6: siliceous rock
- * *Pseudoleskea patens* (Lindb.) Kindb. – 3, 12: siliceous rock
- Pseudoleskea saviana* (De Not.) Latzel – 3, 12: siliceous rock; 7: shaded siliceous rock and *Fagus* bark
- Pseudoleskeella catenulata* (Brid. ex Schrad.) Kindb. – 8: limestone rock
- Pseudoleskeella nervosa* (Brid.) Nyholm – 9: *Platanus* bark
- Pseudotaxiphyllum elegans* (Brid.) Z. Iwats. – 3, 12: soil
- Pterigynandrum filiforme* Hedw. – 2, 3, 12, 15: siliceous rock; 7: shaded siliceous rock; 7, 16: *Fagus* bark
- Pterogonium gracile* (Hedw.) Sm. – 8: siliceous rock
- * *Racomitrium affine* (F. Weber et D. Mohr) Lindb. – 3: siliceous rock (conf. R. Ochya)
- Racomitrium canescens* (Hedw.) Brid. – 2, 3, 6: among siliceous rock (conf. H. Bednarek-Ochya)
- * *Racomitrium sudeticum* (Funck) Bruch et Schimp. – 6: siliceous rock (rev. R. Ochya)
- * *Rhabdoweisia fugax* (Hedw.) Bruch et Schimp. – 3: siliceous rock
- Rhizomnium punctatum* (Hedw.) T. J. Kop. – 2: bog; 7, 12: bank of the stream; 16: decaying wood
- Rhynchostegiella tenella* (Dicks.) Limpr. – 8: limestone rock
- Rhynchostegium megapolitanum* (Blandow ex F. Weber et D. Mohr) Schimp. – 8: soil
- Rhynchostegium murale* (Hedw.) Schimp. – 9: concrete rock wall
- Saelania glaucescens* (Hedw.) Broth. – 3: soil among siliceous rocks
- Schistidium apocarpum* (Hedw.) Bruch et Schimp. – 2, 15: siliceous rock (conf. W. Schröder and R. Ochya); 17: *Fagus* bark (conf. R. Ochya)
- Schistidium confertum* (Funck) Bruch et Schimp. – 2, 3, 6: siliceous rock (conf. R. Ochya); 7: shaded siliceous rock

- Schistidium crassipilum* H. H. Blom – 4, 8: limestone rock; 9: siliceous rock
Schistidium elegantulum H. H. Blom – 8: limestone rock (conf. W. Schröder) and siliceous rock (conf. R. Ochyra)
Schistidium rivulare (Brid.) Podp. – 12: siliceous rock (conf. W. Schröder)
Sciuro-hypnum populeum (Hedw.) Ignatov et Huttunen – 9: limestone rock
Scleropodium touretii (Brid.) L. F. Koch – 9: limestone rock
Scorpiurium circinatum (Bruch) M. Fleisch. et Loeske – 8: soil and limestone rock
Sphagnum angustifolium (C. E. O. Jensen ex Russow) C. E. O. Jensen – 3: at the stream; 11: bog
Sphagnum auriculatum Schimp. – 2, 11: bog
* *Sphagnum fallax* (H. Klinggr.) H. Klinggr. – 2, 11: bog
* *Sphagnum papillosum* Lindb. var. *papillosum* – 11: bog
* *Sphagnum papillosum* Lindb. var. *sublaeve* Warnst. – 11: bog
Sphagnum squarrosum Crome – 2: bog
* *Sphagnum subnitens* Russow et Warnst. – 11: bog
Sphagnum subsecundum Nees – 2, 5, 11: bog
Sphagnum teres (Schimp.) Ångstr. – 5: bog
Straminergon stramineum (Dicks. ex Brid.) Hedenäs – 2, 5: bog
Syntrichia montana Nees – 8: siliceous rock
Syntrichia ruralis (Hedw.) F. Weber et D. Mohr – 2, 3, 12: among siliceous rocks; 4: limestone rock; 7, 13: *Fagus* bark
Syntrichia virescens (De Not.) Ochyra – 3: siliceous rock
Thamnobryum alopecurum (Hedw.) Gangulee – 9: limestone rock; 10, 15: siliceous rock
Thuidium recognitum (Hedw.) Lindb. – 10: siliceous rock
Timmia austriaca Hedw. – 3: siliceous rock
* *Tortella bambergeri* (Schimp.) Broth. – 1, 8: limestone rock
Tortella inclinata (R. Hedw.) Limpr. – 8: soil
Tortella nitida (Lindb.) Broth. – 8: limestone rock
Tortella tortuosa (Hedw.) Limpr. – 4, 9: limestone rock; 10: *Platanus* bark; 15: siliceous rock
Tortula hoppeana (Schultz) Ochyra – 2, 3, 6: soil among siliceous rocks
Tortula muralis Hedw. – 8: limestone rock
Tortula schimperii M. J. Cano, O. Werner et J. Guerra – 7: soil
Tortula subulata Hedw. – 4: limestone rock
Trichodon cylindricus (Hedw.) Schimp. – 2: bog (conf./det. W. Schröder)
Trichostomum crispulum Bruch – 8, 9: soil
Warnstorfia exannulata (Schimp.) Loeske – 2, 5, 11: bog
Weissia controversa Hedw. – 17: soil
Zygodon rupestris Schimp. ex Lorentz – 9: *Platanus* bark
Zygodon viridissimus (Dicks.) Brid. – 8: *Platanus* bark

All the collection sites in the Greek part of the study area belong to the North Central floristical area of Greece. Six hepatics and 14 mosses represent new records for the bryophyte flora of Greece.

Calypogeia azurea Stotler et Crotz – This species is mentioned in DÜLL (1995) with a question mark citing an old record from the Ionian island by MAZZIARI (1851). From Greece, neither reported in the recent Southeast European hepatic checklist (SABOVLJEVIĆ and NATCHEVA 2006), nor in the Mediterranean checklist by ROS *et al.* (2007). Known from almost all SE European countries except Greece, Montenegro and the European part of Turkey (SABOVLJEVIĆ and NATCHEVA 2006).

Cephaloziella rubella (Nees) Warnst. – In SE Europe known from Bulgaria, Romania, Serbia, Slovenia and the European part of Turkey (SABOVLJEVIĆ and NATCHEVA 2006).

Diplophyllum obtusifolium (Hook.) Dumort. – In SE Europe recorded in several countries including Bosnia-Herzegovina, Bulgaria, Croatia, Romania, Serbia and Slovenia (SABOVLJEVIĆ and NATCHEVA 2006).

Lophozia longidens (Lindb.) Macoun – In SE Europe reported only from Bulgaria, Romania, Serbia (SABOVLJEVIĆ and NATCHEVA 2006), and recently discovered in Montenegro (PAPP and ERZBERGER 2010).

Lophozia wenzelii (Nees) Steph. – This species is not mentioned from Greece in DÜLL (1995), neither in ROS *et al.* (2007), but reported from Greece, probably erroneously, in SABOVLJEVIĆ and NATCHEVA (2006). In SE Europe it is known only from Bulgaria and Romania according to SABOVLJEVIĆ and NATCHEVA (2006).

Tritomaria quinquedentata (Huds.) H. Buch – Known from almost all SE European countries except Bosnia-Herzegovina, Greece, Montenegro and the European part of Turkey (SABOVLJEVIĆ and NATCHEVA 2006).

Bryum tenuisetum Limpr. – Only known from North and Central Europe (and North America), new to Southeast Europe in general and Greece in particular (DEMARET 1993, SABOVLJEVIĆ *et al.* 2008).

Ditrichum heteromallum (Hedw.) E. Britton – Known from almost all SE European countries except Albania, Greece, and the European part of Turkey (SABOVLJEVIĆ *et al.* 2008).

Grimmia incurva Schwägr. – In SE Europe known only from Bulgaria, FYROM and Romania (SABOVLJEVIĆ *et al.* 2008).

Grimmia sessitana De Not. – In SE Europe reported only from Bulgaria, FYROM, Romania and Serbia (SABOVLJEVIĆ *et al.* 2008).

Plagiothecium platyphyllum Mönk. – In SE Europe recorded in almost all countries except Albania, Bosnia-Herzegovina, Croatia and Greece (SABOVLJEVIĆ *et al.* 2008).

Pohlia camptotrachela (Renauld et Cardot) Broth. – In SE Europe known only from Bosnia-Herzegovina, Montenegro, Romania and Serbia (SABOVLJEVIĆ *et al.* 2008).

Pseudoleskea patens (Lindb.) Kindb. – Known from several SE European countries including Bosnia-Herzegovina, Montenegro, Romania, Serbia and Slovenia (SABOVLJEVIĆ *et al.* 2008).

Racomitrium affine (F. Weber et D. Mohr) Lindb. – In SE Europe reported only from Bulgaria, Romania and Serbia according to SABOVLJEVIĆ *et al.* (2008).

Racomitrium sudeticum (Funck) Bruch et Schimp. – In SE Europe known from almost all SE European countries except Albania, Croatia, Greece, and the European part of Turkey (SABOVLJEVIĆ *et al.* 2008).

Rhabdoweisia fugax (Hedw.) Bruch et Schimp. – In SE Europe known from Bulgaria, Montenegro, Romania, Serbia and Slovenia (SABOVLJEVIĆ *et al.* 2008).

Sphagnum fallax (H. Klinggr.) H. Klinggr. – Recorded in almost all SE European countries except Albania, Greece, FYROM and the European part of Turkey (SABOVLJEVIĆ *et al.* 2008).

Sphagnum papillosum Lindb. (including var. *sublaeve*) – Recorded in numerous SE European countries including Bosnia-Herzegovina, Bulgaria, Croatia, Romania, Serbia and Slovenia (SABOVLJEVIĆ *et al.* 2008).

Sphagnum subnitens Russow et Warnst. – Reported from almost all SE European countries except Albania, Bosnia-Herzegovina, Greece, and the European part of Turkey (SABOVLJEVIĆ *et al.* 2008).

Tortella bambergeri (Schimp.) Broth. – In SE Europe known only from Bulgaria, Montenegro, Romania and Slovenia according to SABOVLJEVIĆ *et al.* (2008).

For several taxa, collected in the Greek part of the mountain, only a limited number of reports are available. Details are given here for taxa that were reported in only one phytogeographical area of Greece.

Cephalozia connivens (Dicks.) Lindb.; reported only from Crete (GRADSTEIN 1970) and according to DÜLL (1995) the taxon needed verification; here verified for the North Central phytogeographical area of Greece.

Marchantia polymorpha L. subsp. *montivagans* Bisch. et Boisselier; re-collected in North Central Greece (DÜLL 1995).

Nardia scalaris Gray; reported only from East Central Greece (COPPEY 1907), here recollected after a century of its first report.

Blindia acuta (Hedw.) Bruch et Schimp.; recently reported from NE Greece (BLOCKEEL (2010): Rhodope Mts).

Dicranum bonjeanii De Not.; recently reported from NE Greece (BLOCKEEL 2010).

Fissidens kosaninii Latzel; previously reported in the Pindos area (GAMISANS and HÉBRARD 1980).

Grimmia anomala Hampe ex Schimp.; recently reported from Pindos (BLOCKEEL (2010): Mt Smolikas).

Grimmia caespiticia (Brid.) Jur.; recently reported from Pindos (BLOCKEEL (2010): Mt Smolikas).

Hygrohypnum duriusculum (De Not.) D. W. Jamieson; recently reported from NE Greece (BLOCKEEL 2010).

Plagiomnium cuspidatum (Hedw.) T. J. Kop.; reported only from NE Greece (GANIATSAS 1937, TAYLOR 1952), the taxon according to DÜLL (1995) had to be verified.

Schistidium confertum (Funck) Bruch et Schimp.; was included with question mark for North Central Greece in DÜLL (1995) (NC?, *Schistidium apocarpum* cf. var. *confertum*) and was recently reported from the Pindos area (BLOCKEEL (2010): Mt Smolikas).

Schistidium elegantulum H. H. Blom; reported from North East Greece (LÜTH 2003).

Schistidium rivulare (Brid.) Podp.; has an old report from Sterea Ellada (COPPEY 1907), and needed verification (DÜLL 1995).

Sphagnum squarrosum Crome; recollected in the same mountain area (ATHANASIADIS 1977, TSAKIRI *et al.* 2006).

Straminergon stramineum (Dicks. ex Brid.) Hedenäs; also has a very old report from the Ionian islands (MAZZIARI 1851), according to DÜLL (1995) it was doubtful and needed verification.

Tortula hoppeana (Schultz) Ochyra, reported only from Pindos phyto-geographical area (BLOCKEEL 2010, GRISEBACH 1841, 1845).

Data from the Former Yugoslav Republic of Macedonia

Hepaticae

- Anthelia juratzkana* (Limpr.) Trevis. – 1: siliceous rock
Barbilophozia floerkei (F. Weber et D. Mohr) Loeske – 1: siliceous rock
Barbilophozia hatcheri (A. Evans) Loeske – 1: siliceous rock; 2: shaded siliceous rock
Barbilophozia lycopodioides (Wallr.) Loeske – 1: siliceous rock
Cephaloziella divaricata (Sm.) Schiffn. – 2: among exposed siliceous and serpentine rocks
* *Diplophyllum obtusifolium* (Hook.) Dumort. – 1: siliceous rock
Frullania dilatata (L.) Dumort. – 2: shaded siliceous rock
* *Lophocolea heterophylla* (Schrader) Dumort. – 2: decaying wood
* *Lophozia incisa* (Schrader) Dumort. – 1: siliceous rock
* *Lophozia longidens* (Lindb.) Macoun – 1: siliceous rock
* *Lophozia wenzelii* (Nees) Steph. – 1: siliceous rock
Marsupella emarginata (Ehrh.) Dumort. – 1: siliceous rock
Marsupella funckii (F. Weber et D. Mohr) Dumort. – 1: siliceous rock
* *Marsupella sphacelata* (Gieseke ex Lindenb.) Dumort. – 1: siliceous rock
Metzgeria furcata (L.) Dumort. – 2: *Fagus* bark
Nardia scalaris Gray – 1: siliceous rock
Plagiochila porelloides (Torrey ex Nees) Lindenb. – 2: among exposed siliceous and serpentine rocks; shaded siliceous rock
Radula complanata (L.) Dumort. – 2: shaded siliceous rock
Reboulia hemisphaerica (L.) Raddi – 2: exposed siliceous and serpentine rocks
* *Riccia beyrichiana* Hampe ex Lehm. – 2: among exposed siliceous and serpentine rocks (det. C. Sérgio)
Riccia sorocarpa Bisch. – 1: siliceous rock; 2: exposed siliceous and serpentine rocks
* *Riccia subbifurca* Warnst. ex Croz. – 2: among exposed siliceous and serpentine rocks (conf. L. Meinunger)
* *Scapania praetervisa* Meyl. – 2: among exposed siliceous rocks (conf. L. Meinunger and W. Schröder)
Tritomaria quinquedentata (Huds.) H. Buch – 2: exposed siliceous and serpentine rocks

Musci

- Amphidium mougeotii* (Schimp.) Schimp. – 1: siliceous rock
Andreaea rupestris Hedw. – 1: siliceous rock
Bartramia ithyphylla Brid. – 1: siliceous rock; 2: shaded siliceous rock

- Brachytheciastrum olympicum* (Jur.) Vanderp. et al. – 2: shaded siliceous rock
Brachytheciastrum velutinum (Hedw.) Ignatov et Huttunen – 1: siliceous rock; 2: siliceous and serpentine rocks and decaying wood
Brachythecium geheebi Milde – 2: *Fagus* snag
Brachythecium salebrosum (Hoffm. ex F. Weber et D. Mohr) Schimp. – 2: siliceous and serpentine rocks
Bryoerythrophyllum recurvirostrum (Hedw.) P. C. Chen – 1: siliceous rock
Bryum alpinum Huds. ex With. – 1: siliceous rock; 2: exposed siliceous and serpentine rocks (conf. W. Schröder)
Bryum archangelicum Bruch et Schimp. – 2: exposed siliceous and serpentine rocks (det. W. Schröder)
Bryum caespiticium Hedw. – 1: siliceous rock (conf./det. W. Schröder)
Bryum moravicum Podp. – 2: shaded siliceous rock and *Fagus* snag
Bryum pallescens Schleich. ex Schwägr. – 2: exposed siliceous and serpentine rocks (det. W. Schröder, conf. D. T. Holyoak)
Bryum pseudotriquetrum (Hedw.) P. Gaertn. et al. – 2: shaded siliceous rock (conf. W. Schröder and D. T. Holyoak)
Campylium stellatum (Hedw.) Lange et C. E. O. Jensen – 2: shaded siliceous rock
Ceratodon purpureus (Hedw.) Brid. – 1: siliceous rock; 2: exposed siliceous and serpentine rocks
Cratoneuron filicinum (Hedw.) Spruce – 2: exposed siliceous and serpentine rocks
Dicranoweisia crispula (Hedw.) Milde – 1: siliceous rock
Dicranum scoparium Hedw. – 1: siliceous rock; 2: exposed siliceous and serpentine rocks; 2: shaded siliceous rock
Dicranum tauricum Sapjegin – 2: decaying wood
Distichium capillaceum (Hedw.) Bruch et Schimp. – 1: siliceous rock
Ditrichum flexicaule (Schwägr.) Hampe – 2: exposed siliceous and serpentine rocks
Ditrichum heteromallum (Hedw.) E. Britton – 1: siliceous rock
Eurhynchiastrum pulchellum (Hedw.) Ignatov et Huttunen – 1: siliceous rock
Fissidens bryoides Hedw. – 2: shaded siliceous rock
Fissidens dubius P. Beauv. – 2: exposed siliceous and serpentine rocks
Grimmia alpestris (F. Weber et D. Mohr) Schleich. – 1: siliceous rock
* *Grimmia anomala* Hampe ex Schimp. – 2: shaded siliceous rock (conf. E. Maier)
Grimmia hartmannii Schimp. – 1: siliceous rock (det. R. Ochyra); 2: shaded siliceous rock (p.p. conf. E. Maier)
Grimmia incurva Schwägr. – 1: siliceous rock (conf./p.p. rev. E. Maier)
Grimmia montana Bruch et Schimp. – 1: siliceous rock; 2: exposed siliceous and serpentine rocks (conf. E. Maier and R. Ochyra)
* *Grimmia muehlenbeckii* Schimp. – 2: exposed siliceous and serpentine rocks (p.p. conf. E. Maier)
Grimmia ovalis (Hedw.) Lindb. – 2: exposed siliceous and serpentine rocks (p.p. conf. E. Maier)

- Grimmia sessitana* De Not. – 1: siliceous rock (conf./p.p. rev. E. Maier); 2: exposed siliceous and serpentine rocks (conf. R. Ochyra)
- Herzogiella seligeri* (Brid.) Z. Iwats. – 2: decaying wood
- Heterocladium dimorphum* (Brid.) Schimp. – 1: siliceous rock; 2: shaded siliceous rock
- Homalothecium sericeum* (Hedw.) Schimp. – 2: shaded siliceous rock
- Hypnum cupressiforme* Hedw. var. *lacunosum* Brid. – 2: among exposed siliceous and serpentine rocks
- Hypnum revolutum* (Mitt.) Lindb. – 1: siliceous rock
- Leucodon sciuroides* (Hedw.) Schwägr. – 2: *Fagus* bark
- Orthotrichum rupestre* Schleich. ex Schwägr. – 2: exposed siliceous and serpentine rocks
- Orthotrichum stramineum* Hornsch. ex Brid. – 2: *Fagus* bark
- Orthotrichum striatum* Hedw. – 2: *Fagus* bark
- Plagiothecium denticulatum* (Hedw.) Schimp. – 2: *Fagus* bark and shaded siliceous rock
- Pogonatum urnigerum* (Hedw.) P. Beauv. – 2: shaded siliceous rock
- Pohlia cruda* (Hedw.) Lindb. – 1: siliceous rock; 2: shaded siliceous rock
- Pohlia elongata* Hedw. var. *greenii* (Brid.) A. J. Shaw – 1: siliceous rock (det. W. Schröder)
- Pohlia nutans* (Hedw.) Lindb. – 1: siliceous rock
- Polytrichastrum alpinum* (Hedw.) G. L. Sm. – 1: siliceous rock
- Polytrichastrum formosum* (Hedw.) G. L. Sm. – 1: siliceous rock
- Polytrichum juniperinum* Hedw. – 1, 2: among siliceous rocks
- Polytrichum piliferum* Hedw. – 1: siliceous rock
- Pseudoleskea incurvata* (Hedw.) Loeske – 1: siliceous rock
- * *Pseudoleskea patens* (Lindb.) Kindb. – 1: siliceous rock
- Pseudoleskea saviana* (De Not.) Latzel – 2: *Fagus* bark and shaded siliceous rock
- Pseudoleskeella nervosa* (Brid.) Nyholm – 2: *Fagus* bark
- Pterigynandrum filiforme* Hedw. – 2: *Fagus* bark
- Racomitrium canescens* (Hedw.) Brid. – 1: siliceous rock (conf. H. Bednarek-Ochyra)
- Racomitrium sudeticum* (Funck) Bruch et Schimp. – 1: siliceous rock (conf./rev. R. Ochyra and H. Bednarek-Ochyra)
- Rhizomnium punctatum* (Hedw.) T. J. Kop. – 2: shaded siliceous rock
- Saelania glaucescens* (Hedw.) Broth. – 2: exposed siliceous and serpentine rocks
- Sanionia uncinata* (Hedw.) Loeske – 1: siliceous rock
- Schistidium confertum* (Funck) Bruch et Schimp. – 2: exposed siliceous and serpentine rocks (conf. W. Schröder)
- Syntrichia norvegica* F. Weber – 1: siliceous rock
- Syntrichia ruralis* (Hedw.) F. Weber et D. Mohr – 1: siliceous rock; 2: *Fagus* bark
- Timmia austriaca* Hedw. – 1: siliceous rock; 2: shaded siliceous rock
- Tortella tortuosa* (Hedw.) Limpr. – 2: exposed siliceous and serpentine rocks
- Tortula hoppeana* (Schultz) Ochyra – 1: siliceous rock
- Tortula subulata* Hedw. – 2: shaded siliceous rock
- Weissia brachycarpa* (Nees et Hornsch.) Jur. – 2: exposed siliceous and serpentine rocks
- Weissia controversa* Hedw. – 2: shaded siliceous rock

Nine hepatics and 3 mosses are recorded for the first time in the Former Yugoslav Republic of Macedonia.

Diplophyllum obtusifolium (Hook.) Dumort. – In SE Europe reported from many countries including Bosnia-Herzegovina, Bulgaria, Croatia, Romania, Serbia and Slovenia according to SABOVLJEVIĆ and NATCHEVA (2006). As seen above, it is also reported for the first time from Greece.

Lophocolea heterophylla (Schrad.) Dumort. – A common species known from almost all SE European countries except FYROM and the European part of Turkey (SABOVLJEVIĆ and NATCHEVA 2006).

Lophozia incisa (Schrad.) Dumort. – It is known from almost all SE European countries except FYROM, Montenegro and the European part of Turkey according to SABOVLJEVIĆ and NATCHEVA (2006). Very recently it was discovered in Montenegro (PAPP and ERZBERGER 2010).

Lophozia longidens (Lindb.) Macoun – In SE Europe it is recorded only in Bulgaria, Romania, and Serbia (SABOVLJEVIĆ and NATCHEVA 2006). It was reported from Montenegro recently (PAPP and ERZBERGER 2010). As seen above, it is also reported for the first time from Greece.

Lophozia wenzelii (Nees) Steph. – In SE Europe known only from Bulgaria and Romania according to SABOVLJEVIĆ and NATCHEVA (2006). As seen above, it is also reported for the first time from Greece.

Marsupella sphacelata (Gieseke ex Lindenb.) Dumort. – In SE Europe recorded only in Bulgaria, Greece and Romania (SABOVLJEVIĆ and NATCHEVA 2006).

Riccia beyrichiana Hampe ex Lehm. – In SE Europe known only from Croatia and Greece (ROS *et al.* 2007, SABOVLJEVIĆ and NATCHEVA 2006). It was reported from Bulgaria recently (NATCHEVA 2011).

Riccia subbifurca Warnst. ex Croz. – In SE Europe reported only from Albania, Croatia, Greece and Montenegro according to SABOVLJEVIĆ and NATCHEVA (2006). Later on, Greece was excluded in ROS *et al.* (2007).

Scapania praetervisa Meyl. – In Europe hitherto only reported from the Northern, Western and Central parts, new to Southeast Europe (ROS *et al.* 2007, SÖDERSTRÖM *et al.* 2007, SABOVLJEVIĆ and NATCHEVA 2006) in general and to the Former Yugoslav Republic of Macedonia in particular.

Grimmia anomala Hampe ex Schimp. – In SE Europe reported only from Albania Romania and Serbia according to SABOVLJEVIĆ *et al.* (2008). It was reported recently from Greece (BLOCKEEL 2010).

Grimmia muehlenbeckii Schimp. – Recorded in almost all SE European countries except Bosnia-Herzegovina, FYROM, Montenegro and the European part of Turkey (DÜLL 1995, SABOVLJEVIĆ *et al.* 2008). Very recently it was discovered in Montenegro (PAPP and ERZBERGER 2010).

Pseudoleskea patens (Lindb.) Kindb. – Known from several SE European countries including Bosnia-Herzegovina, Montenegro, Romania, Serbia and Slovenia (SABOVLJEVIĆ *et al.* 2008). As seen above, it is also reported for the first time from Greece.

With respect for plant conservation, it is worth mentioning that five species are included in the Red data book of European bryophytes (ECCB 1995). These are as follows.

Brachythecium geheebi Milde – A subcontinental-montane element (DÜLL 1985) and European endemism (ECCB 1995), it is in the rare (R) category according to the Red data book of European bryophytes (ECCB 1995). It occurs on shaded, slightly basic rocks in the high mountains of Central Europe and Norway (DÜLL 1985, FREY *et al.* 1995). In SE Europe it was reported from several countries including Bulgaria, Croatia, Former Yugoslav Republic of Macedonia, Montenegro, Romania, Serbia and Slovenia (SABOVLJEVIĆ *et al.* 2008). In the Voras Mts it was found on a decaying *Fagus* snag on the FYROM side of the mountain.

Buxbaumia viridis (Moug. ex Lam. et DC.) Brid. ex Moug. et Nestl. – This boreal, montane species (DÜLL 1984) thrives on well-decayed wood in constantly humid forest environment, sheltered or shaded places, rarely on humus-rich acidic soil. The Red data book of European bryophytes rates it as vulnerable and it is listed in the Bern Convention and the European Union Habitats and Species Directive (ECCB 1995). It is known from all SE European countries except the European part of Turkey (SABOVLJEVIĆ *et al.* 2008). It was reported for the first time in Greece by GEISSLER (1977) from the Rodope Mts, subsequently discovered in four localities in North Central Greece (Aoos gorge and Varnous Mts in 2003, Smolikas and Timfi Mts in 2008 by Blockeel) cited in TSAKIRI *et al.* (2009). In the Voras Mts three small populations were found on the Greek side on a north-facing

slope covered by *Fagus* forest under the ski centre between 1,000–1,500 m a.s.l. This is its sixth known locality in Greece.

Grimmia caespiticia (Brid.) Jur. – A subarctic-subalpine element (DÜLL 1984), it is in the rare (R) category according to the Red data book of European bryophytes (ECCB 1995). It can be found on acidic rocks in alpine mountains of Europe, Asia and Greenland (NYHOLM 1998). In the Voras Mts it was found on exposed siliceous rocks in the upper zone above 2,000 m a.s.l. on the Greek side of the mountains. This is its second locality in Greece (see above BLOCKEEL 2010). In SE Europe it is also known from Bulgaria, Montenegro, Romania and Serbia (SABOVLJEVIĆ *et al.* 2008).

Grimmia sessitana De Not. – A subarctic, subalpine species (DÜLL 1984) that is included in the regionally threatened (RT) category according to the Red data book of European bryophytes (ECCB 1995). In SE Europe it is also known from Bulgaria, FYROM, Romania and Serbia (SABOVLJEVIĆ *et al.* 2008). In the Voras Mts it was collected from exposed siliceous rocks in the alpine zone above 2,000 m a.s.l. both on the Greek and FYROM sides. It is reported for the first time in Greece here.

Pseudoleskea saviana (De Not.) Latzel – A species of shaded volcanic rocks, but sometimes found on tree bark mainly at the base of trunks, it is in the regionally threatened (RT) category according to the Red data book of European bryophytes (ECCB 1995). It is a rare, continental-subalpine species found in the Alps and other areas towards the east (DÜLL 1985). It is known from all SE European countries except the European part of Turkey (SABOVLJEVIĆ *et al.* 2008). It does not appear to be rare in SE Europe, evidenced by several collections in Albania, Bulgaria, Montenegro and Serbia (PAPP and ERZBERGER 2009, 2010, PAPP *et al.* 2009, 2010). In the Voras Mts it was collected in the alpine zone and in *Fagus* forests from siliceous rocks and tree bark on both the Greek and FYROM sides.

DISCUSSION

The bryophyte flora of the Voras Mts is very diverse due to the wide variety of bedrocks, geological formations and the span of altitudinal range. Habitats with siliceous bedrock are rare in Greece, where mountains are mainly built up of limestone. In the upper zone of the Voras Mts many species of arctic, subarctic, alpine affinity can be found on open acidic rocky ha-

bitats, alpine grasslands, exemplified by the hepatics *Anthelia juratzkana*, *Lophozia longidens*, and the mosses *Bryum archangelicum*, *B. muehlenbeckii*, several *Grimmia* species (*G. anomala*, *G. caespiticia*, *G. incurva*, *G. sessitana*), *Hypnum revolutum*, *Mnium thomsonii*, *Pohlia ludwigii*, *Polytrichastrum alpinum*, *Pseudoleskea patens*, *Syntrichia norvegica*, *Timmia austriaca*, *Tortula hoppeana*. These species are indeed rare in Greece. Infrequent boreal, sub-boreal species are also abundant in these habitats, represented by species of *Barbilophozia* (*B. floerkei*, *B. hatcheri*, *B. lycopodioides*), *Calypogeia azurea*, *Jungermannia leiantha*, species of *Lophozia* (*L. incisa*, *L. obtusa*, *L. wenzelii*), *Scapania irrigua*, *Tritomaria quinquedentata* among hepatics, and species of *Bartramia* (*B. halleriana*, *B. ithyphylla*), *Grimmia alpestris*, *Pohlia campototrachela*, species of *Racomitrium* (*R. affine*, *R. sudeticum*), *Rhabdoweisia fugax*, *Saelania glaucescens*, *Schistidium confertum* and *S. rivulare* among mosses. In the alpine wet meadows also numerous alpine, boreal, subboreal species, rare in Greece, occur such as the hepatics *Marchantia polymorpha* subsp. *montivagans*, *Scapania irrigua*, and the mosses *Aulacomnium palustre*, *Blindia acuta*, *Bryum pallens*, *Campylium stellatum*, *Dicranum bonjeanii*, *Palustriella decipiens*, species of *Philonotis* (*P. seriata*, *P. tomentella*), *Polytrichum commune*, *P. commune* var. *perigoniale*, species of *Sphagnum* (*S. angustifolium*, *S. fallax*, *S. subsecundum*, *S. teres*), *Straminergon stramineum*, *Warnstorfia exannulata*. Some Mediterranean elements also occur at higher elevations in the alpine zone, represented by *Calypogeia fissa*, *Fossombronina pusilla*, *Mannia androgyna*, species of *Riccia* (*R. beyrichiana*, *R. ciliifera*, *R. gougetiana*, *R. subbifurca*). However, Mediterranean, sub-Mediterranean species are characteristic mainly in the lower parts of the mountain at 500–600 m a.s.l., as shown by *Southbya nigrella*, *S. tophacea* among hepatics, *Dicranella howei*, *Dialytrichia mucronata*, species of *Didymodon* (*D. insulanus*, *D. luridus*, *D. vinealis*), *Eucladium verticillatum*, *Gymnostomum calcareum*, *G. viridulum*, *Gyroweisia tenuis*, *Leptodon smithii*, *Neckera menziesii*, *Plasteurbhynchium striatulum*, *Pleurochaete squarrosa*, *Rhynchostegiella tenella*, *Rhynchostegium megapolitanum*, *Scorpiurium circinatum*, *Scleropodium tourettii*, *Syntrichia montana* and *Tortella nitida* among mosses. In the *Fagus* forests a few rare species living on decaying wood can be mentioned, such as the hepatic *Nowellia curvifolia*, and the mosses *Antitrichia curtipendula* and *Buxbaumia viridis*.

With the high number of bryophyte species rare in Greece occurring especially in the upper zones, beech forests, alpine grasslands and meadows of the Voras Mts, this mountainous habitat can be regarded as an Important Bryophyte Area in Greece. Although the area is included in the Corine Biotopes and Natura 2000 sites of Greece, the factors threatening this unique environment are more than obvious. Unfortunately, large parts of the alpine grasslands, meadows, abounding in rarities, are seriously affected by uncared human activity generated by the opening and operation of the new ski centre. The Voras Mts thus requires a much greater attention to its natural treasures.

* * *

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