

## Lichenized fungi from the Jakupica mountain range (Macedonia, FYROM)

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**Abstract:** ROHRER, A., BILOVITZ, P. O. & MAYRHOFER, H. 2012. Lichenized fungi from the Jakupica mountain range (Macedonia, FYROM). – *Herzogia* 25: 167–175.

A list of 160 taxa of lichens and a lichenicolous fungus from the Jakupica mountain range is presented, of which 20 lichens (*Buellia aethalea*, *Caloplaca aurea*, *C. cacuminum*, *Candelariella reflexa*, *Cladonia caespiticia*, *Collema subflaccidum*, *Lecanora glabrata*, *L. persimilis*, *Lecidella achristotera*, *Lepraria caesioalba*, *Melanelia disjuncta*, *Pertusaria leioplaca*, *P. leucosora*, *Physconia detera*, *Polyblastia microcarpa*, *Rhizocarpon obscuratum*, *Scoliosporum umbrinum* var. *corticolum*, *Thelidium decipiens*, *T. incavatum*, *Verrucaria macrostoma*) and the lichenicolous fungus (*Carbonea vitellinaria*) are new to Macedonia.

**Zusammenfassung:** ROHRER, A., BILOVITZ, P. O. & MAYRHOFER, H. 2012. Lichenisierte Pilze vom Jakupica Gebirgszug (Makedonien, FYROM). – *Herzogia* 25: 167–175.

Für den Jakupica Gebirgszug wird eine Liste von 160 Flechten-Taxa und einem lichenicolen Pilz vorgelegt, wovon 20 Flechten (*Buellia aethalea*, *Caloplaca aurea*, *C. cacuminum*, *Candelariella reflexa*, *Cladonia caespiticia*, *Collema subflaccidum*, *Lecanora glabrata*, *L. persimilis*, *Lecidella achristotera*, *Lepraria caesioalba*, *Melanelia disjuncta*, *Pertusaria leioplaca*, *P. leucosora*, *Physconia detera*, *Polyblastia microcarpa*, *Rhizocarpon obscuratum*, *Scoliosporum umbrinum* var. *corticolum*, *Thelidium decipiens*, *T. incavatum*, *Verrucaria macrostoma*) und der lichenicole Pilz (*Carbonea vitellinaria*) neu für Makedonien sind.

**Key words:** Ascomycetes, Balkan Peninsula, biodiversity, alpine belt.

### Introduction

Lichenological exploration of Macedonia started with ZAHLBRUCKNER (1897), who studied a small collection made by J. Dörfler in 1893. BORNMÜLLER (1929) published a list of 86 taxa based on his own collection from 1918, which was determined by Zahlbruckner. KUŠAN (1936) and SZATALA (1940) contributed records from various parts of the country, including the Šar Planina mountain range, which was later investigated intensively by PAVLETIĆ & MURATI (1977, 1978) and MURATI (1979, 1984, 1985). Other mountain ranges and regions were explored by MURATI (1986, 1993a, 1993b). Josef Poelt visited Macedonia in 1971 and again in 1977 together with his students Josef Hafellner and Helmut Mayrhofer, and the latter also made collections in 1976 and 1980. Collections from these visits were cited in various taxonomic treatments (e. g., MAYRHOFER & POELT 1979, MAYRHOFER 1984). Knowledge of the country's lichen flora has been considerably expanded due to the publication of more than 100 new taxa, mainly from material stowed away in the herbarium GZU (MAYRHOFER et al. 2012).

From the high altitudes of Jakupica mountain range there were only two records in KUŠAN (1936) based on collections from I. Horvath and several records in BORNMÜLLER (1929) from

the summit of Pepelak mountain in the Golešnica Planina, the eastern part of the Jakupica mountain range. Species from the mountain Vodno, southwest of Skopje, an outpost of Jakupica mountain range are cited in ZAHLBRUCKNER (1897), BORNMÜLLER (1929), SZATALA (1940) and PAVLETIĆ & MURATI (1980).

Although Macedonia is a rather small country (25,713 km<sup>2</sup>) it covers eight vegetation zones, due to its heterogenic topography ranging from 40 to 2764 m above sea level. The country is influenced by three climatic regions, the Mediterranean, the temperate eastern continental and the boreal alpine (FILIPOVSKI et al. 1996).

The Jakupica mountain range is situated south of Skopje, its highest peak being Solunska Glava (2538 m). It consists of three parts: Karadžica in the northwest, Golešnica in the east, and Dautica in the southwest (FLECK 2004). The Vodno mountain near Skopje is the northern outpost. The border to the east is the River Vardar valley, to the south the Babuna mountain range, and the Pelagonia valley is the border to the west. The lower altitudes are characterized by a warm continental climate and dominated by oak woodlands, and at higher altitudes with a cold continental climate, beech forests occur. *Pinus mugo* is present in the subalpine belt (FILIPOVSKI et al. 1996). The geology is very heterogeneous: Pepelak mountain consists of gneiss and mica schists, and the bedrock of both the highest peaks, Solunska Glava and Begovo (2420 m), is marble (GRIPP 1922).

The main focus of the field study was an assessment of the diversity of lichenized fungi on different rock outcrops in the subalpine and alpine belts. The forests remain under-explored due to the limited time for fieldwork. Unfortunately, marble is not a luxuriant substratum in terms of lichens and despite the high altitudes, the number of species it supports is rather low.

## Material and methods

The list is based on collections made by the first author in 2008 (Fig. 1) and an evaluation of the papers of ZAHLBRUCKNER (1897), BORNMÜLLER (1929), KUŠAN (1936), SZATALA (1940) and PAVLETIĆ & MURATI (1980). The specimens have been identified mainly with the aid of WIRTH (1995) or monographic treatments using routine light microscopic techniques. Some of the identifications required verification by using standardized thin-layer chromatography (TLC) following the protocols of WHITE & JAMES (1985) and ORANGE et al. (2001). The specimens are preserved in the herbarium of the Institute of Plant Sciences, Karl-Franzens-University Graz (GZU). The nomenclature follows NIMIS & MARTELOS (2008) or other modern treatments. New records for Macedonia are marked with an asterisk (\*).

## List of sampling locations

Macedonia, Jakupica mountain range:

- 01: Northern slope of the mountain Vodno, 41°58'21"N/21°23'48"E, 792 m, 02.VII.2008, A. Rohrer.
- 02: Summit of the mountain Vodno, 41°57'55"N/21°23'52"E, 1076 m, 02.VII.2008, A. Rohrer.
- 03: Juručica, 41°46'34"N/21°26'40"E, 1536 m, 04.VII.2008, A. Rohrer.
- 04: Krivul, 41°43'49"N/21°25'51"E, 2037 m, 05.VII.2008, A. Rohrer.
- 05: Solunska Glava, 41°42'14"N/21°24'11"E, 2519 m, 05.VII.2008, A. Rohrer.
- 06: Juručica, 41°46'33"N/21°26'52"E, 1475 m, 06.VII.2008, A. Rohrer.
- 07: Sipačan, 41°45'45"N/21°28'15"E, 1798 m, 07.VII.2008, A. Rohrer.
- 08: Sipačan, 41°45'25"N/21°27'32"E, 1560 m, 07.VII.2008, A. Rohrer.
- 09: Gorno Begovo, 41°44'03"N/21°23'52"E, 2093 m, 08.VII.2008, A. Rohrer.

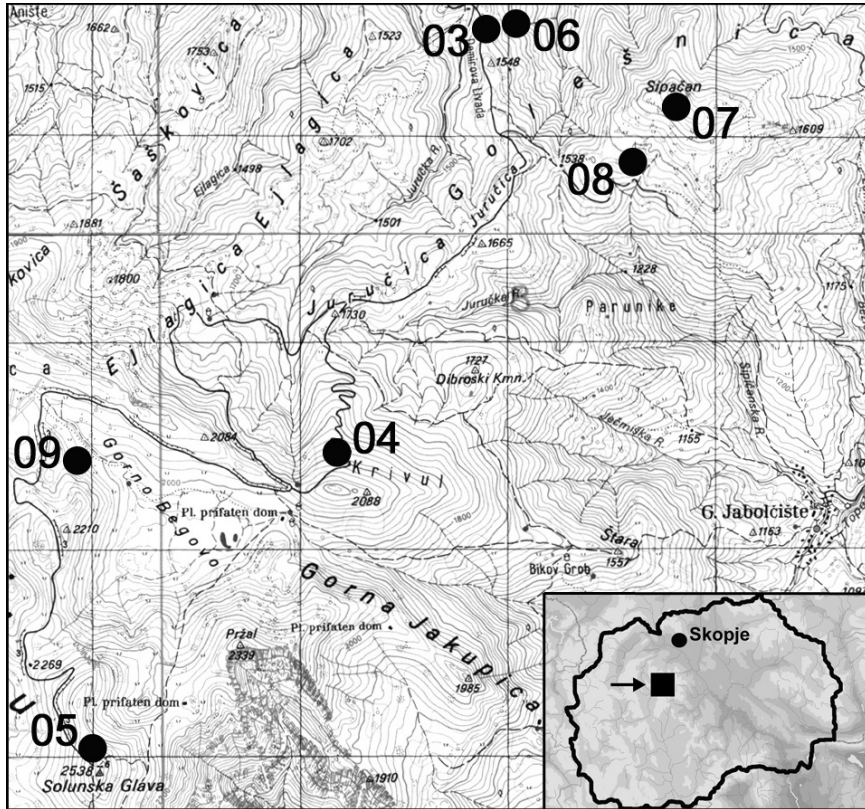


Fig. 1: Study area and sampling locations (except 01 & 02, both mountain Vodno near Skopje; map from <http://www.makpetrol.com.mk/planinari/pavelmaps.asp> – modified).

### List of substrata and their abbreviations

<i>Fraxinus ornus</i>	Fra orn
<i>Carpinus orientalis</i>	Car ori
<i>Fagus sylvatica</i>	Fag syl
on branches	bra-
on bark of trunks (corticolous)	cor-
on mossy siliceous rocks	mus-sil
on mossy marble	mus-mar
on siliceous soil	ter-sil
on calcareous soil	ter-cal
on marble	mar
on siliceous rocks	sil
on calcareous rocks (excluding marble)	cal

## Results

### Lichenized taxa

*Acarospora cervina* A.Massal.: 02 (cal)

*Acarospora fuscata* (Schrad.) Th.Fr.: 03 (sil); Zelenikovo (BORNMÜLLER 1929, as *A. rufescens*)

- Anaptychia ciliaris* (L.) Körb.: 01 (cor Fra orn), 08 (cor Fag syl); Vodno (PAVLETIĆ & MURATI 1980)
- Arthonia radiata* (Pers.) Ach.: Vodno (BORNMÜLLER 1929, as *A. astroidea*)
- Aspicilia cinerea* (L.) Körb.: 03 (sil); Vodno (BORNMÜLLER 1929)
- Aspicilia reticulata* Kremp.: Vodno (SZATALA 1940)
- Bagliettoa calciseda* (DC.) Gueidan & Cl.Roux: Vodno (BORNMÜLLER 1929, as *Verrucaria c.*)
- Brodoa intestiniformis* Goward: 07 (sil)
- Bryoria fuscescens* (Gyeln.) Brodo & D.Hawksw.: 03 (sil); Vodno (PAVLETIĆ & MURATI 1980, as *Alectoria jubata*)
- \**Buellia aethalea* (Ach.) Th.Fr.: 03 (sil)
- Buellia badia* (Fr.) A.Massal.: 07 (sil)
- Caeruleum heppii* (Nägeli ex Körb.) K.Knudsen & L.Arcadia: Zelenikovo (BORNMÜLLER 1929, as *Acarospora h.*)
- Caloplaca aurantia* (Pers.) Hellb.: Vodno (BORNMÜLLER 1929)
- \**Caloplaca aurea* (Schaer.) Zahlbr.: 09 (ter-mar)
- Caloplaca australis* (Arnold) Zahlbr.: 09 (mar)
- \**Caloplaca cacuminum* Poelt: 05 (cal) (on *Thelidium decipiens*)
- Caloplaca cerina* (Hedw.) Th.Fr.: 08 (cor Fag syl)
- Caloplaca coccinea* (Müll.Arg.) Poelt: 05 (cal)
- Caloplaca coronata* (Körb.) J.Steiner: Vodno (BORNMÜLLER 1929)
- Caloplaca crenulatella* (Nyl.) H.Olivier: 02 (cal)
- Caloplaca flavovirescens* (Wulfen) Dalla Torre & Sarnth.: Zelenikovo (BORNMÜLLER 1929)
- Caloplaca lobulata* (Flörke) Hellb.: Vodno (BORNMÜLLER 1929)
- Caloplaca pyracea* (Ach.) Th.Fr.: Vodno (BORNMÜLLER 1929)
- Caloplaca variabilis* (Pers.) Müll.Arg.: 02 (cal); Vodno (BORNMÜLLER 1929)
- Candelariella aurella* (Hoffm.) Zahlbr.: 02 (cal); Neresi (Zahlbruckner 1897, as *Caloplaca epixantha*)
- Candelariella coralliza* (Nyl.) H.Magn.: 03 (sil)
- \**Candelariella reflexa* (Nyl.) Lettau: 08 (cor Fag syl)
- Candelariella vitellina* (Ehrh.) Müll.Arg.: 03 (sil), 07 (sil); Zelenikovo (BORNMÜLLER 1929)
- Cetraria muricata* (Ach.) Eckfeldt: 03 (ter-sil), 07 (ter-sil)
- Circinaria calcarea* (L.) A.Nordin, S.Savić & Tibell: 02 (cal); Neresi (Zahlbruckner 1897, as *Lecanora c. var. concreta*), Gronje Vodna (Zahlbruckner 1897, as *Lecanora c. var. concreta f. ochracea*), Vodno (BORNMÜLLER 1929, as *Lecanora c.*)
- Circinaria contorta* (Hoffm.) A.Nordin, S.Savić & Tibell: 02 (cal); Zelenikovo (BORNMÜLLER 1929, as *Lecanora c.*)
- Circinaria gibbosa* (Ach.) A.Nordin, S.Savić & Tibell: Zelenikovo (BORNMÜLLER 1929, as *Lecanora g.*)
- \**Cladonia caespiticia* (Pers.) Flörke: 07 (ter-sil)
- Cladonia coccifera* (L.) Willd.: 03 (ter-sil)
- Cladonia convoluta* (Lam.) Anders: Vodno (BORNMÜLLER 1929, as *C. foliacea* var. *convoluta*)
- Cladonia fimbriata* (L.) Fr.: 03 (mus-sil)
- Cladonia foliacea* (Huds.) Willd.: 07 (mus-sil); Vodno (PAVLETIĆ & MURATI 1980)
- Cladonia furcata* (Huds.) Schrad.: Vodno (PAVLETIĆ & MURATI 1980)
- Cladonia pocillum* (Ach.) O.J.Rich.: 09 (mus-mar)
- Cladonia pyxidata* (L.) Hoffm.: 04 (ter-sil), 09 (mus-mar); Vodno (BORNMÜLLER 1929), Zelenikovo (BORNMÜLLER 1929), Vodno (PAVLETIĆ & MURATI 1980)

- Cladonia rangiformis* Hoffm.: Vodno (BORNMÜLLER 1929)  
*Clauzadea monticola* (Schaer.) Hafellner & Bellem.: Vodno (BORNMÜLLER 1929, as *Lecidea m.*)  
*Collema nigrescens* (Huds.) DC.: 08 (cor Fag syl)  
\**Collema subflaccidum* Degel.: 08 (cor Fag syl)  
*Collema undulatum* Laurer ex Flot.: 05 (cal)  
*Cornicularia normoerica* (Gunnerus) Du Rietz: 03 (sil); (BORNMÜLLER 1929, as *Cetraria tristis*)  
*Dimelaena oreina* (Ach.) Norman: 03 (sil) – chemotype Va according to OBERMAYER et al. (2004)  
*Diploschistes diacapsis* (Ach.) Lumbsch: Vodno (BORNMÜLLER 1929, as *D. albissimus*)  
*Diploschistes muscorum* (Scop.) R.Sant.: 03 (mus-sil)  
*Diploschistes ocellatus* (Vill.) Norman: Gornje Vodna (ZAHLEBRUCKNER 1897), Vodno (BORNMÜLLER 1929), Vodno (PAVLETIĆ & MURATI 1980)  
*Diploschistes scrupeus* (Schreb.) Norman: 03 (sil); Vodno (PAVLETIĆ & MURATI 1980)  
*Diplotomma alboatrum* (Hoffm.) Flot.: Vodno (BORNMÜLLER 1929, as *Buellia epipolia*)  
*Diplotomma venustum* Körb.: Gornje Vodna (ZAHLEBRUCKNER 1897, as *Buellia alboatra* var. *venusta*)  
*Flavocetraria nivalis* (L.) Kärnefelt & Thell: Jakupica (KUŠAN 1936, as *Cetraria n.*)  
*Fulgensia* cf. *bracteata* (Hoffm.) Räsänen subsp. *deformis* (Erichsen) Poelt: 05 (ter-cal)  
*Fulgensia fulgens* (Sw.) Elenkin: 02 (ter-cal)  
*Graphis pulverulenta* (Pers.) Ach.: Neresi (ZAHLEBRUCKNER 1897, as *G. scripta* var. *pulverulenta*)  
*Graphis scripta* (L.) Ach.: 01 (cor Car ori)  
*Heteroplacidum compactum* (A.Massal.) Gueidan & Cl.Roux: 05 (cal)  
*Lasallia pustulata* (L.) Mérat: 03 (sil)  
*Lecanora albella* (Pers.) Ach.: 06 (cor Fag syl)  
*Lecanora albescens* (Hoffm.) Branth & Rostr.: Zelenikovo (BORNMÜLLER 1929)  
*Lecanora allophana* Nyl.: 08 (cor Fag syl)  
*Lecanora argentata* (Ach.) Malme: 01 (cor Car ori), 08 (cor Fag syl); Vodno (PAVLETIĆ & MURATI 1980, as *L. subfusca*)  
*Lecanora argopholis* (Ach.) Ach.: Vodno (BORNMÜLLER 1929, as *L. frustulosa*)  
*Lecanora bicincta* Ramond: 07 (sil)  
*Lecanora campestris* (Schaer.) Hue: Vodno (BORNMÜLLER 1929)  
*Lecanora carpineae* (L.) Vain.: 06 (cor Fag syl)  
*Lecanora cenisia* Ach.: 03 (sil), 07 (sil); Pepelak (BORNMÜLLER 1929, as *L. atryneae*)  
*Lecanora chlarotera* Nyl.: 06 (cor Fag syl)  
*Lecanora crenulata* Hook.: Vodno (BORNMÜLLER 1929)  
*Lecanora dispersa* (Pers.) Röhl.: 02 (cal); Neresi (ZAHLEBRUCKNER 1897), Vodno (BORNMÜLLER 1929)  
*Lecanora dispersoareolata* (Schaer.) Lamy: 03 (sil)  
\**Lecanora glabrata* (Ach.) Malme: 06 (cor Fag syl)  
*Lecanora intricata* (Ach.) Ach.: 03 (sil), 07 (sil); Pepelak (BORNMÜLLER 1929)  
*Lecanora intumescens* (Rebent.) Rabenh.: 01 (cor Car ori)  
\**Lecanora persimilis* (Th.Fr.) Nyl.: 01 (cor Car ori)  
*Lecanora polytropae* (Ehrh.) Rabenh.: 03 (sil), 03 (ter-sil)  
*Lecanora rupicola* (L.) Zahlbr.: 03 (sil)  
*Lecanora semipallida* H.Magn.: 02 (cal)  
*Lecanora sulphurea* (Hoffm.) Ach.: 03 (sil)

- Lecidea atrobrunnea* (Lam. ex DC.) Schaer.: Pepelak (BORNMÜLLER 1929)
- Lecidea fuliginosa* Taylor: Pepelak (BORNMÜLLER 1929)
- Lecidea fuscoatra* (L.) Ach.: 03 (sil)
- \**Lecidella achristotera* (Nyl.) Hertel & Leuckert: 01 (cor Car ori)
- Lecidella elaeochroma* (Ach.) M.Choisy: 01 (Fra orn), 06 (cor Fag syl); Neresi (ZAHLBRUCKNER 1897, as *Lecidea parasema*), Vodno (BORNMÜLLER 1929, as *Lecidea parasema*), Vodno (PAVLETIĆ & MURATI 1980, as *Lecidea parasema*)
- Lecidella patavina* (A.Massal.) Knoph & Leuckert: 05 (cal)
- Lecidella stigmatea* (Ach.) Hertel & Leuckert: Neresi (ZAHLBRUCKNER 1897, as *Lecidea enteroleuca*), Zelenikovo (BORNMÜLLER 1929, as *Lecidea enteroleuca*)
- \**Lepraria caesioalba* (de Lesd.) J.R.Laundon: 07 (sil)
- Lobothallia radiosa* (Hoffm.) Hafellner: 02 (cal), 09 (mar); Vodno (BORNMÜLLER 1929, as *Lecanora circinata*)
- \**Melanelia disjuncta* (Erichsen) Essl.: 03 (sil)
- Melanelixia glabra* (Schaer.) O.Blanco et. al.: 01 (bra Car ori), 08 (cor Fag syl)
- Melanelixia glabrata* (Lamy) Sandler & Arup: 01 (cor Car ori), 06 (cor Fag syl)
- Melanelixia subaurifera* (Nyl.) O.Blanco et. al.: 08 (cor Fag syl)
- Opegrapha atra* Pers.: Gornje Vodna (ZAHLBRUCKNER 1897), Vodno (BORNMÜLLER 1929)
- Ophioparma ventosa* (L.) Norman: 07 (sil); Pepelak (BORNMÜLLER 1929, as *Haematomma ventosum*)
- Parmelia saxatilis* (L.) Ach.: 03 (ter-sil), 07 (sil); Vodno (PAVLETIĆ & MURATI 1980)
- Parmelia sulcata* Taylor: 01 (cor Car ori); Vodno (PAVLETIĆ & MURATI 1980)
- Parmelina pastillifera* (Harm.) Hale: 08 (cor Fag syl)
- Parmelina tiliacea* (Hoffm.) Hale: 01 (bra Car ori), 03 (sil)
- Peltigera canina* (L.) Willd.: Vodno (PAVLETIĆ & MURATI 1980)
- Peltigera rufescens* (Weiss) Humb.: 03 (ter-sil)
- Pertusaria albescens* (Huds.) M.Choisy & Werner: 08 (cor Fag syl)
- \**Pertusaria leioplaca* DC.: 08 (cor Fag syl)
- \**Pertusaria leucosora* Nyl.: 03 (sil), 07 (sil)
- Pertusaria pertusa* (Weigel) Tuck.: Vodno (PAVLETIĆ & MURATI 1980, as *P. communis*)
- Phlyctis argena* (Ach.) Flot.: 01 (cor Car ori)
- Physcia adscendens* H.Olivier: 01 (bra Car ori); Vodno (PAVLETIĆ & MURATI 1980)
- Physcia aipolia* (Ehrh. ex Humb.) Fürnr.: 01 (bra Car ori), 08 (cor Fag syl)
- Physcia stellaris* (L.) Nyl.: Vodno (PAVLETIĆ & MURATI 1980)
- \**Physconia detersa* (Nyl.) Poelt: 08 (cor Fag syl)
- Physconia distorta* (With.) J.R.Laundon: 01 (cor Car ori), 08 (cor Fag syl); Gornje prope Üsküb (ZAHLBRUCKNER 1897, as *Physcia pulverulenta* var. *argyphaea*), Vodno (PAVLETIĆ & MURATI 1980, as *P. pulverulenta*)
- Placocarpus schaeereri* (Fr.) Breuss: Gornje Vodna (ZAHLBRUCKNER 1897, as *Endopyrenium monstrosum*), Vodno (BORNMÜLLER 1929, as *Dermatocarpon monstrosum*)
- Placynthium nigrum* (Huds.) Gray: 02 (cal); Vodno (BORNMÜLLER 1929)
- Pleopsidium flavum* (Bellardi) Körb.: 03 (sil)
- \**Polyblastia microcarpa* (Arnold) Lettau: 05 (cal)
- Porina aenea* (Wallr.) Zahlbr.: Neresi (ZAHLBRUCKNER 1897, as *Segestria a.*)
- Protoparmelia atriseda* (Fr.) R.Sant. & V.Wirth: 07 (sil)

- Protoparmelia badia* (Hoffm.) Hafellner: 03 (sil), 07 (sil); Vodno (PAVLETIĆ & MURATI 1980, as *Lecanora b.*)
- Protoparmeliopsis muralis* (Schreb.) M.Choisy: 02 (cal), 09 (mar); Neresi (ZAHLEBRUCKNER 1897, as *Lecanora m.*), Gornje Vodna (ZAHLEBRUCKNER 1897, as *Lecanora m. var. versicolor*), Vodno (BORNMÜLLER 1929, as *Lecanora m. var. versicolor*)
- Pseudephebe pubescens* (L.) M.Choisy: 07 (sil); Pepelak (BORNMÜLLER 1929, as *Parmelia lanata*)
- Pseudevernia furfuracea* (L.) Zopf var. *furfuracea*: 07 (sil)
- Psora testacea* Hoffm.: Gornje Vodna (ZAHLEBRUCKNER 1897, as *Lecidea t.*)
- Ramalina carpathica* Körb.: Pepelak (BORNMÜLLER 1929)
- Ramalina farinacea* (L.) Ach.: 01 (cor Car ori)
- Ramalina fastigiata* (Pers.) Ach.: 01 (cor Car ori)
- Ramalina fraxinea* (L.) Ach.: 08 (cor Fag syl); Vodno (PAVLETIĆ & MURATI 1980)
- Ramalina pollinaria* (Westr.) Ach.: 06 (sil), 07 (sil)
- Rhizocarpon alpicola* (Anzi) Rabenh.: Pepelak (BORNMÜLLER 1929)
- Rhizocarpon geographicum* (L.) DC.: 03 (sil); Gornje Vodna (ZAHLEBRUCKNER 1897), Pepelak (BORNMÜLLER 1929), Vodno (PAVLETIĆ & MURATI 1980), Zelenikovo (BORNMÜLLER 1929, as *R. g. f. contiguum*)
- \**Rhizocarpon obscuratum* (Ach.) A.Massal.: 03 (sil)
- Rinodina bischoffii* (Hepp) A.Massal.: 02 (cal)
- Rinodina confragosa* (Ach.) Körb.: 03 (sil)
- Rinodina milvina* (Wahlenb.) Th.Fr.: 03 (sil)
- Rinodina oleae* Bagl.: Zelenikovo (BORNMÜLLER 1929, as *R. demissa*)
- Rinodina oxydata* (A.Massal.) A.Massal.: Zelenikovo (BORNMÜLLER 1929, as *R. discolor var. candida*)
- Sarcogyne regularis* Körb.: 02 (cal); Gornje Vodna (ZAHLEBRUCKNER 1897, as *Biatorella pruinosa*), Zelenikovo (BORNMÜLLER 1929, as *Biatorella pruinosa*)
- Schaereria fuscocinerea* (Nyl.) Clauzade & Cl.Roux: 07 (sil); Pepelak (BORNMÜLLER 1929, as *S. tenebrosa*)
- \**Scoliciosporum umbrinum* (Ach.) Arnold var. *corticolum* (Anzi) Bagl. & Carestia: 06 (cor Fag syl)
- Squamarina cartilaginea* (With.) P.James: 02 (ter-cal); Vodno (BORNMÜLLER 1929, as *Lecanora crassa*), Vodno (SZATALA 1940, as *S. crassa var. liparia f. imbricata*), Vodno (PAVLETIĆ & MURATI 1980, as *Lecanora crassa*)
- Squamarina gypsacea* (Sm.) Poelt: 09 (ter-cal)
- Squamarina lentigera* (Weber) Poelt: Dolnje Vodna (ZAHLEBRUCKNER 1897, as *Lecanora l.*)
- Tephromela atra* (Huds.) Hafellner: Neresi (ZAHLEBRUCKNER 1897, as *Lecanora a.*), Zelenikovo (BORNMÜLLER 1929, as *Lecanora a.*)
- Thamnotia vermicularis* (Sw.) Schaer.: Jakupica (KUŠAN 1936)
- \**Thelidium decipiens* (Nyl.) Kremp.: 05 (cal), 09 (mar)
- \**Thelidium incavatum* Mudd: 09 (mar)
- Toninia sedifolia* (Scop.) Timdal: 02 (ter-cal), 09 (ter-cal); Vodno (BORNMÜLLER 1929, as *T. coeruleonigricans*), Zelenikovo (BORNMÜLLER 1929, as *T. coeruleonigricans*)
- Umbilicaria crustulosa* (Ach.) Frey: 03 (sil)
- Umbilicaria cylindrica* (L.) Delise ex Duby var. *cylindrica*: 03 (sil)
- Umbilicaria cylindrica* var. *tornata* (Ach.) Nyl.: Pepelak (BORNMÜLLER 1929, as *Gyrophora tornata*)
- Umbilicaria nylanderiana* (Zahlbr.) H.Magn.: Pepelak (BORNMÜLLER 1929, as *Gyrophora corrugata*)
- Umbilicaria polyphylla* (L.) Baumg.: 03 (sil)

*Usnea hirta* (L.) F.H.Wigg.: 08 (cor Fag syl)

\**Verrucaria macrostoma* Dufour ex DC.: 02 (cal)

*Verrucaria muralis* Ach.: 09 (mar); Neresi (ZAHLEBRUCKNER 1897, as *V. rupestris* f. *confluens*)

*Verrucaria nigrescens* Pers.: 02 (cal), 09 (mar)

*Verruculopsis lecideoides* (A.Massal.) Gueidan & Cl.Roux: Vodno (BORNMÜLLER 1929, as *Verrucaria l.*)

*Xanthoparmelia pulla* (Ach.) O.Blanco et al.: Vodno (BORNMÜLLER 1929, as *Parmelia prolixa*)

*Xanthoparmelia stenophylla* (Ach.) Ahti & D.Hawksw.: 03 (sil); Vodno (BORNMÜLLER 1929, as *Parmelia conspersa* var. *stenophylla*)

*Xanthoria parietina* (L.) Beltr.: 01 (bra Car ori), 03 (sil); Zelenikovo (BORNMÜLLER 1929), Vodno (PAVLETIĆ & MURATI 1980)

### Lichenicolous fungus

\**Carbonea vitellinaria* (Nyl.) Hertel: 07 (sil) (on *Candelariella vitellina*)

### Discussion

Our investigation of the lichen mycota from the Jakupica mountain range yielded 160 lichen taxa and one lichenicolous fungus. Previously, only 82 lichen species have been mentioned for the investigated area (ZAHLEBRUCKNER 1897, BORNMÜLLER 1929, KUŠAN 1936, SZATALA 1940 and PAVLETIĆ & MURATI 1980). The main attention of this study was focused on the diversity of lichenized fungi on different rock outcrops in the subalpine and alpine belts. The epiphytic species as well as the species on soil and plant remains are under-explored due to the limited time for field work. We found 44 lichenized species on siliceous rocks (excluding literature data), most of them common at higher altitudes, e.g. *Acarospora fuscata*, *Candelariella vitellina*, *Lecanora cenisia*, *L. polytropa*, *L. sulphurea*, *Pertusaria leucosora*, *Protoparmelia badia*, *Ramalina pollinaria* and *Rhizocarpon geographicum*. Surprisingly, we could only find two species of *Rhizocarpon*, namely the frequent *R. geographicum* and *R. obscuratum*; additionally *R. alpicola* is mentioned in BORNMÜLLER (1929). We recorded 26 species on calcareous rocks (excluding literature data), including very frequent species such as *Lobothallia radiosa*, *Protoparmeliopsis muralis*, *Verrucaria nigrescens* and *Thelidium decipiens*, the latter appearing to colonize calcareous rocks at altitudes higher than 2000 m above sea level. However, only seven species were recorded from marble. Considering the current collections and the data from literature, the number of terricolous species and species colonizing plant remains is quite low. Many common species are absent at higher altitudes, e.g. *Cetraria ericetorum*, *C. islandica*, *Cladonia arbuscula*, *C. rangiferina* and *Flavocetraria cucullata* on siliceous and calcareous soil, *Alectoria nigricans* and *A. ochroleuca* on siliceous soil, *Cladonia symphylicarpa* and *Physconia muscigena* on calcareous soil, *Caloplaca ammiospila*, *C. stillicidiorum*, *C. tirolensis*, *Lecanora epibryon*, *L. hagenii* var. *fallax* and *Megaspora verrucosa* on plant remains over calcareous soil. Further investigation of lichens with these ecological demands will surely bring to light at least some of the mentioned species.

### Acknowledgements

We are most grateful to Othmar Breuss (Vienna), Jiří Malíček (Praha), Walter Obermayer (Graz) and Jan Vondrák (Průhonice near Praha) for the determination of critical specimens, Peter Kosnik (Graz) for his technical support with TLC of selected specimens, Mitko Karadelev (Skopje) for providing accommodation in Skopje and supplying transport to the field sites, Vladimir Matevski and Tose Tokov (both Skopje) for their ongoing support during the fieldwork, Pramodhandra Harvey (Graz) and an anonymous reviewer for correcting and improving the English and to the Karl-Franzens-University Graz for giving a grant to cover the travel expenses for Alexander Rohrer.



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Manuscript accepted: 2 October 2012.

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