

# DISTRIBUTION OF *LETHARIA VULPINA* (LICHENIZED ASCOMYCETES) IN THE SUBALPINE LARCH STANDS (*RHODOTHAMNO- LARICETUM*) IN THE EASTERN JULIAN ALPS (SLOVENIA)

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## Abstract

The article provides the list of localities of *Letharia vulpina* in the eastern Julian Alps (northwestern Slovenia) that were recorded by the authors in 2010. Prior to this year the knowledge on the occurrence of this lichenized fungus in Slovenia was insignificant (only one known locality, recorded already in the 19<sup>th</sup> century). With a phytosociological table we present the species composition and structure of natural subalpine larch stands (*Rhodothamno-Laricetum deciduae*) in which the species *Letharia vulpina* grows as an epiphyte on old and thick trees. It can also be expected in other Alpine regions in Slovenia where similar natural larch stands are preserved and the air is not over polluted.

**Key words:** *Letharia vulpina*, *Larix decidua*, *Rhodothamno-Laricetum*, subalpine forests, biodiversity, the Julian Alps, Slovenia.

## Izvešček

Članek podaja seznam nahajališč vrste *Letharia vulpina* v vzhodnih Julijskih Alpah (severozahodna Slovenija), ki so jih avtorji popisali v letu 2010. Pred tem letom je bila vednost o pojavljanju te lihenizirane glive v Sloveniji zelo majhna (eno samo znano nahajališče, opaženo že v 19. stoletju). S fitocenološko tabelo prikazujemo vrstno sestavo in zgradbo naravnih subalpinskih macesnovih sestojev (*Rhodothamno-Laricetum deciduae*) v katerih vrsta *Letharia vulpina* raste kot epifit na starih in debelih drevesih. Pričakujemo jo lahko tudi v drugih alpskih območjih v Sloveniji, kjer so ohranjeni podobni naravni macesnovi sestoji in kjer ozračje ni preveč onesnaženo.

**Ključne besede:** *Letharia vulpina*, *Larix decidua*, *Rhodothamno-Laricetum*, subalpski gozdovi, biodiverziteteta, Julijske Alpe, Slovenija.

## 1. INTRODUCTION

*Letharia vulpina* is a fruticose lichenized fungus from the family *Parmeliaceae*. Its distribution area comprises Europe (Scandinavia, the Alps and other central- and south-European mountains), North Africa, Asia Minor, Cyprus, Caucasus and boreal part of North America (Schade 1954: 122, Gams 1955: 30, Mayrhofer, in litt., ht-

tp://en.wikipedia.org/wiki/Letharia\_vulpina). It usually grows on tree trunks and branches of conifers, in central and southern Europe and in the mountains surrounding the Mediterranean, especially on *Larix decidua*, *Pinus cembra* (on this two tree species for example in Switzerland, there only in the Alps – Bolliger & al. 2007: 287, in the Italian Alps – Nascimbene & al. 2008, in Upper Austria, also there only in the Alps – Berger & al.

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2009: 150 and in Carinthia –Türk & al. 2004: 70: very rare in eastern edges of the Alps, with one new locality, 9156/1, published in Hafellner 2008: 72), *Pinus peuce* (on the latter see data for Montenegro – Medjedović 1971, Bilovitz & al. 2008: 22, B. Surina, in litt., H. Mayrhofer, in litt.), *Pinus pinaster*, *Juniperus excelsa* and *Cedrus atlantica*.

Traditionally it was used as a pigment source for dyes and paints and in folk medicine for relieving digestive problems as a highly diluted infusion. It was also used to hunt foxes and wolves with a mixture of meat, lichens and broken glass. It is toxic to carnivores. The knowledge of its occurrence in Slovenia until 2010 was insignificant. Schade (1954: 121) published the information on its growth on a larch tree near Belo (=Velo) polje – 9649/1, UTM 33T VM13 (where it was supposedly collected in 1876 by E. H. from Innsbruck and where it most likely still grows today, as it was found on 14.10. 2010 above the nearby alp Planina Pod Mišelj vrhom). The same information is quoted also in the Catalogue of the lichenized and lichenicolous fungi of Slovenia (Suppan

& al. 2000: 81). Later processing of lichens of the Julian Alps (Batič & al. 2003, Mrak & al. 2004) did not produce any new findings as this species was not even recorded at the time, with the research being limited to the lower-lying forests. In our research of natural larch forests in Slovenia (Daskobler & al. 2010) it was first noticed at the end of August 2010 above the Mala Pišnica valley and was subsequently recorded on several other localities in the eastern part of the Julian Alps. This article presents these localities and forest stands with larch trees on which this epiphytic lichen grows.

## 2. METHODS

Vegetation in natural larch stands in the Julian Alps was studied according to the central-European method (Braun-Blanquet 1964). The relevés were entered into the FloVegSi database (Seliškar & al. 2003). The same application was used to make the distribution map (Figure 1).

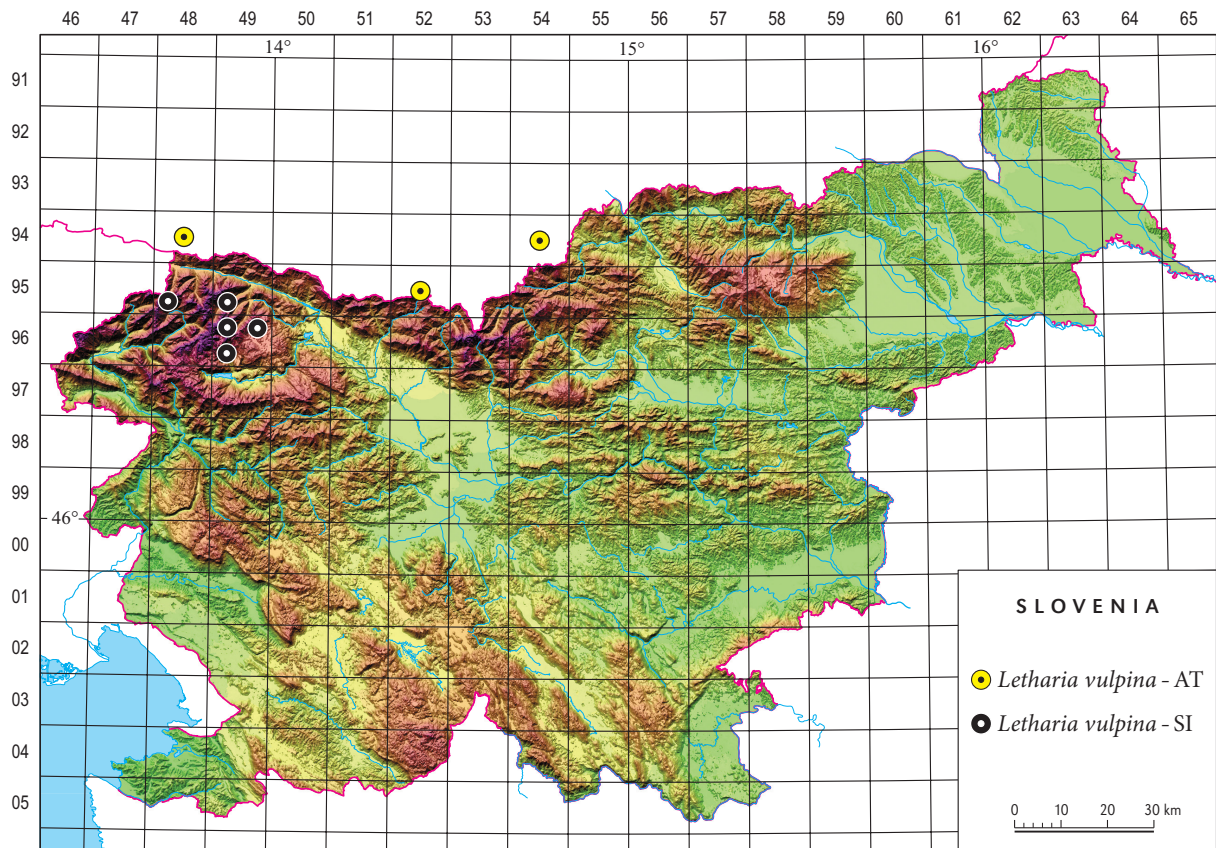


Figure 1: Distribution of *Letharia vulpina* in Slovenia and in the neighbouring regions (= bordering grids) of Carinthia (Türk & al. 2004: 70)

Slika 1: Razširjenost vrste *Letharia vulpina* v Sloveniji in v sosednjih območjih (mejnih poljih) Koroške (Türk & al. 2004: 70)

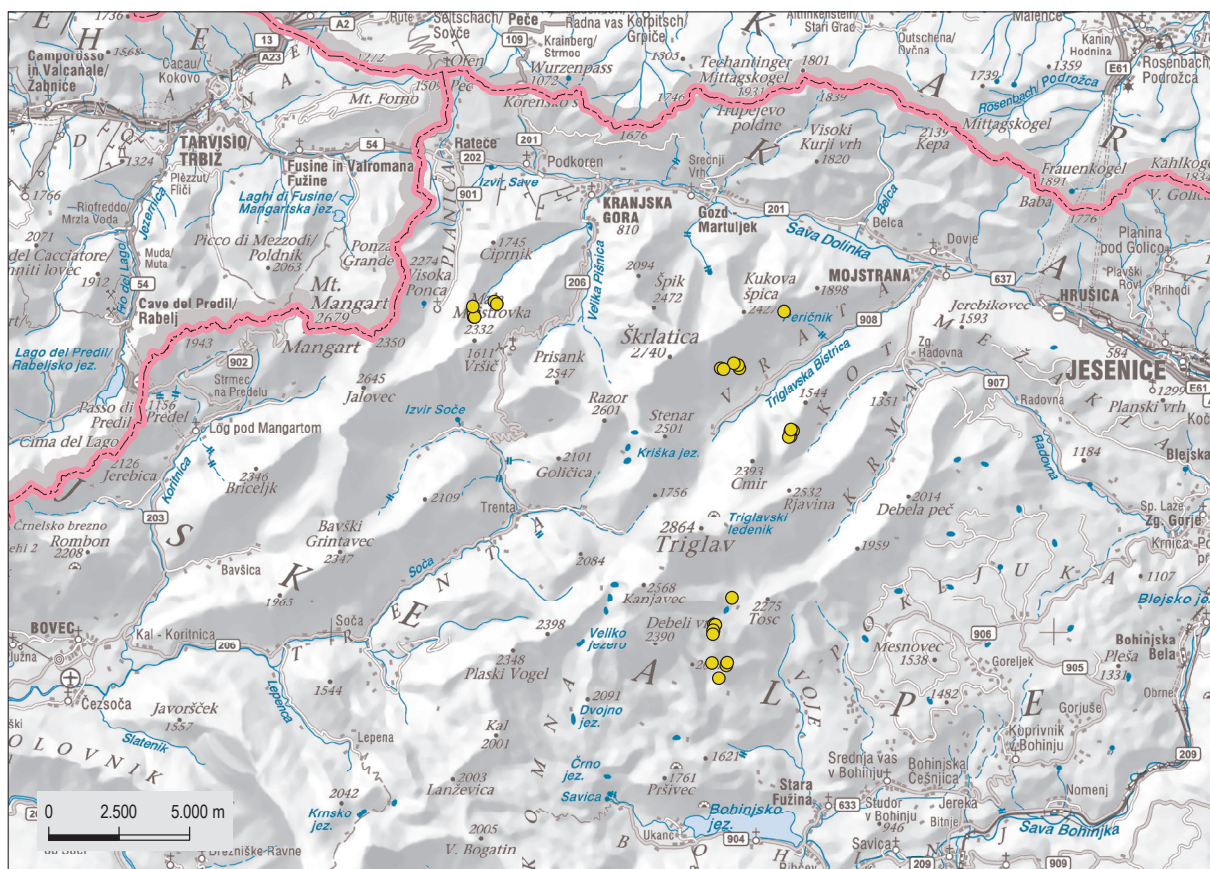


Figure 2: Localities of *Letharia vulpina* in the eastern part of the Julian Alps  
Slika 2: Nahajališča vrste *Letharia vulpina* v vzhodnem delu Julijskih Alp

The relevés in Table 1 were arranged with hierarchical classification. Combined cover-abundance values were transformed with numerical values (1–9) according to van der Maarel (1979) and numerical comparisons were performed with the SYN-TAX 2000 (Podani 2001) program package. Relevés were compared with the “Incremental sum of squares – MISSQ” method and with “(unweighted) average linkage method – UPGMA”. In both methods we applied Wishart’s coefficient of similarity (similarity ratio). The nomenclature source for the names of vascular plants is the Mala flora Slovenije (Martinčič & al. 2007), Frahm & Frey (1992) and Martinčič (2003) for the names of mosses, Jurc & al. (2005) for the names of fungi and Suppan & al. (2000) for the names of lichens. Table 1 comprises only some of the mosses, lichens and fungi that were observed on sample plots. Most species from these groups remained unidentified. Determined epiphytes in the table 1 are indicated with x, which means, that they were presented on the recorded plots.

### 3. RESULTS

#### 3.1 OVERVIEW OF THE RECORDED LOCALITIES OF *LETHARIA VULPINA* IN THE JULIAN ALPS

**9548/3 (UTM 33TVM04):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, Mala Pišnica valley, under Robičje, along the hunting path, a prominence overgrown with single old larch and beech trees, dominated by *Pinus mugo* groups (possibly burnt down in the past), 1450 m a.s.l., on an old larch tree with the breast height diameter of around 70 cm. Leg. & det. I. Dakskobler, 26. 8. 2010, Herbarium ZRC SAZU (SRC SASA) and *Boletus informaticus* (Herbarium of the Slovenian Forestry Institute); under Robičje, a steep slope above the Mala Pišnica valley, *Pinus mugo* stand, an old larch tree on the margin (breast height diameter 100 cm), 1480 m a.s.l. Leg. & det. I. Dakskobler, 28. 8. 2010, Herbarium ZRC SAZU (SRC SASA).



Figure 3: *Letharia vulpina*, Brinova glava, the Julian Alps (Photo A. Seliškar)  
 Slika 3: *Letharia vulpina*, Brinova glava, Julijske Alpe (foto A. Seliškar)

**9548/3 (UTM 33TVM04):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, Sleme, slopes under Slemenova špica, above the Mala Pišnica valley, near the Sleme–Grlo mountain path, open larch forest, from about 1570 to 1760 m a.s.l., on some 20 old larch trees with breast height diameters of 50 to 100 cm. Leg. & det. I. Dakskobler & A. Seliškar, 1. 9. 2010, Herbarium ZRC SAZU (SRC SASA).

**9549/3 (UTM 33TVM14):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, the Vrata valley, under the ridge of Vrtaško Sleme, larch forest, on three old larch trees, the thickest tree's breast height diameter is 90 cm. Leg. & det. I. Dakskobler & A. Seliškar, 2. 9. 2010, Herbarium ZRC SAZU (SRC SASA) and *Boletus informaticus*.

**9549/3 (UTM 33TVM14):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, Požgana Mlinarica, the ridge between the Vrata and the Kot valleys, open larch forest at the contact with *Pi-*

*nus mugo* stands, 1800 m a.s.l., on two old larch trees with the breast height diameters of 87 and 55 cm; a little lower on the same locality, slopes above the Vrata valley, 1760 m a.s.l., open larch forest, on an old larch tree with a breast height diameter of 73 cm. Leg. & det. I. Dakskobler & A. Seliškar, 14. 9. 2010, Herbarium ZRC SAZU (SRC SASA).

**9549/3 (UTM 33TVM13):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, Požgana Mlinarica, slopes above the Vrata valley, 1760 m a.s.l., old larch tree with a breast height diameter of 82 cm, tree height of some 15 m, dry top, also fruitbody (sporocarp) of fungus *Laricifomes officinalis*. Leg. & det. I. Dakskobler & A. Seliškar, 14. 9. 2010, Herbarium ZRC SAZU (SRC SASA).

**9549/3 (UTM 33TVM14):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, the Vrata valley, Brinova glava, open spruce and larch forest, on an old larch tree with a breast height diameter

of some 60 cm, also higher, above Brinova glava, Na brinju under the peak Šplevta, at the altitude of 1650 m a.s.l., on three old larch trees and on five larch trees at the altitude of 1740 m. Leg. & det. I. Dakskobler & A. Seliškar, 21. 9. 2010, Herbarium ZRC SAZU (SRC SASA).

**9549/3 (UTM 33TVM14):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, the Vrata valley, Prag under the peak Šplevta, larch forest, 1670 m a.s.l., on two larch trees and slightly lower at the altitude of 1640 m on larch tree with breast height diameter of 60 cm. Leg. & det. I. Dakskobler & A. Seliškar, 21. 9. 2010, Herbarium ZRC SAZU (SRC SASA).

**9649/2 (UTM 33TVM13):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, the Pokljuka plateau, alp Klek, larch stands above the pasture, near the mountain path to Debela peč, from 1570 to 1670 m a.s.l., on at least 20 larch trees, with breast height diameters of 40 to 80 cm. Leg. & det. F. Batič, I. Dakskobler, A. Seliškar, B. Vreš, L. Kutnar and A. Rozman, 28. 9. 2010, Herbarium ZRC SAZU (SRC SASA) and *Boletus informaticus*.

**9649/3 (UTM 33TVM13):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, alp Krstenica, larch forest on the northern summit slope of Krsteniški (Mali) Stog above the Voje valley, 1820 m a.s.l., on a larch tree with breast height diameter of about 50 cm; also lower on the slopes above the Voje valley, 1740 m a.s.l., on a very old larch tree (on which was also the fruitbody of fungus *Laricifomes officinalis*), with a breast height diameter of around 80 cm. Leg. & det. I. Dakskobler, 22. 9. 2010, Herbarium ZRC SAZU (SRC SASA).

**9649/3 (UTM 33TVM13):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, pasture Krstenica, a larch forest on the western slope of Krsteniški (Mali) Stog, under the mountain path, 1660 m a.s.l., on six larch trees with breast height diameters of 50 to 90 cm; also higher, 1730 m a.s.l., in *Pinus mugo* stands with larch, on a larch tree with a breast height diameter of 70 cm. Leg. & det. I. Dakskobler, 22. 9. 2010, Herbarium ZRC SAZU (SRC SASA).

**9649/3 (UTM 33TVM13):** Slovenia, Gorenjska (Upper Carniola), the Julian Alps, the slopes of Jezerski Stog above the alp Planina pod Mišelj



Figure 4: Subalpine larch stand above the pasture Klek, typical locality of *Letharia vulpina* (Photo A. Seliškar)

Slika 4: Subalpinski macesnov sestoj nad planino Klek, tipično nahajališče vrste *Letharia vulpina* (foto A. Seliškar)

vrhom, along the mountain path from Jezerski preval towards this alp, open larch stands at the altitude from 1720 to 1820 m, on some 15 larch trees with breast height diameters from 50 to 90 cm, also the fruitbody (sporocarp) of fungus *Laricifomes officinalis*. Leg. & det. I. Dakskobler, 14. 10. 2010, Herbarium ZRC SAZU (SRC SASA).

### 3.2 PHYTOSOCIOLOGICAL DESCRIPTION OF LARCH STANDS WHERE *LETHARIA VULPINA* WAS RECORDED (TABLE 1)

*Letharia vulpina* was found in natural larch stands in the Mala Pišnica and Vrata valleys above the alp Klek on the Pokljuka plateau and in the north-eastern part of the Fužina pasturelands (Fužinske planine), also on the slopes towards Velo polje. The climate in this part of the Julian Alps is mon-

tane and very cold, with a mean annual temperature from 2 °C to 4 °C (Pristov & al. 1998: 13), and moist (humid), with a mean annual precipitation ranging from 2400 to 3200 mm (slightly more in the Fužina pasturelands and in the northern part of the Pokljuka plateau than in the Upper Sava Valley) – Pristov et al. (1998: 26). The snow cover remains on the ground for more than 200 days a year (Pristov & al., *ibid.*, p. 39). *Letharia vulpina* has intermediate air pollution sensitivity. Air pollution in the Upper Sava Valley, however, is considerable (Batič & al. 2003), with lateral valleys (Mala Pišnica, Vrata, Kot) perhaps being slightly less exposed to pollution. The same is probably true for the northern part of the Pokljuka plateau and northeastern part of the Fužina pasturelands and Velo polje under Triglav.

Most of the recorded stands (relevés 4 to 17 in Table 1) are classified into the syntaxon *Rhodothamno-Laricetum* Willner et Zukrigl 1999 var. geogr. *Anemone trifolia* Dakskobler 2006 (compare Dakskobler 2006 and Zupančič & Žagar 2007), in which we distinguish between two variants. The stands on drier soils (relevés 4 to 10 in Table 1) are classified into the variant with *Calamagrostis varia* (one of the differential species is also *Erica carnea*) and the stands on moister soils (relevés 11 to 17) are classified into the variant with *Aconitum lycoctonum* subsp. *ranunculifolium* (differential species are also *Poa alpina*, *Alnus viridis* and *Saxifraga aizoides*). Relevé No. 1 in Table 1 is classified also into the syntaxon *Rhododendro hirsuti-Pinetum prostratae* Zöttl 1951 *laricetosum* Tregubov 1962 = *Rhodothamno-Rhododendretum hirsuti* (Aichinger 1933) Br.-Bl. & Sisingh and Br.-Bl. & al. 1939 var. geogr. *Paederota lutea* Zupančič & Žagar in Zupančič et al. 2006 *laricetosum* Tregubov 1962, and the two stands in relevés 2 and 3 indicate the contact of larch and Alpine beech forest (*Anemono-Fagetum* Tregubov 1962 *laricetosum* Tregubov 1962 or *Rhodothamno-Laricetum fagetosum* nom. prov.).

*Letharia vulpina* was found on old and usually thick larch trees (see Nascimbene & al. 2008 for influence of tree age and structure on frequency of this epiphytic lichen species) that grow at the altitude ranging from 1450 to 1820 m, i.e. in the subalpine belt almost up to the upper larch forest distribution borderline in the Julian Alps (which is at the altitude 1900 to 1950 m). Larch trees grew on gentle to very steep slopes (slope of 10° to 40°), on all expositions – on both explicitly shady (N, NE) as well as on explicitly sunny

slopes (S, SW). Geological bedrock is most often limestone admixed with dolomite, more rarely limestone, limestone admixed with marlstone or talus scree. The soil is shallow, moder rendzina. The studied forest stands are protective and have not undergone cut (forest plant) in a long time (although we noticed old, decaying tree stumps in some). Sheep and cattle have been grazing in some places (alp Klek, the Fužina pasturelands, Velo polje). On some of these localities (Požgana Mlinarica, Robičje) primary forest may have been burnt down once, perhaps with the intention to obtain more pasture areas for sheep. For at least 60 years and more the growth and development of these stands have been affected mainly by only natural factors (wind, avalanches, rockfalls). Other lichens that grow as epiphytes together with *Letharia vulpina* on larch bark were not recorded in more detail. Frequent species are *Bryoria fuscescens*, *Usnea subfloridana*, *Usnea* spp., *Ramalina farinacea*, *Evernia prunastri*, *E. divaricata*, *Vulpicida pinastris*, *Hypogymnia physodes*, *H. farinacea*, *H. tubulosa*, *Pseudevernia furfuracea*, *Platismatia glauca*, *Parmelia saxatilis*, *P. sulcata*, *Parmeliopsis ambigua*, *Parmeliopsis hyperopta*, *Hypocenomyce scalaris*, *Chrysothrix candelaris*, *Chaenotheca* spp., *Ochrolechia* spp., *Lepraria* spp., *Lecanora pulicaris*, *Cladonia digitata*, *Cladonia* spp.

#### 4. DISCUSSION

Wirth (1991: 231, 2010: 242) provides the following ecological description for *Letharia vulpina*. It is semi-heliophilous, distributed mainly in the altimontane and subalpine belt, in intermediate (suboceanic to subcontinental) climate with sufficient precipitation, but very unstable moisture conditions; it grows as an epiphyte on very acid and nutrient poor substrate, tree bark. Its life form is a fruticose and strap shaped lichen (Strauchflechte). This ecological description fully applies also to its localities and sites in the Julian Alps. In these locations it is, similarly to a very rare fungus *Laricifomes officinalis*, an indicator of natural larch forests on the upper forest line. One of the epiphytic lichen species that could be considered a character species of natural larch stands is also the crustose species *Mycoblastus sanguinarius* which was, in addition to *Letharia vulpina*, found in large numbers on larch trees above the alp Klek. Not much attention was paid to epiphytic lichen flora during our

phytosociological research until recently, so it is very likely that *Letharia vulpina* was overlooked in our relevés in more places than one, which is especially true for the less conspicuous bark species. Nevertheless, this lichen no longer grows on every site with old larch trees and natural larch stands. This can be confirmed for larch stands on the northwestern edge of the Komna plateau, above the alps Planina za Skalo and Planina za Črnim vrhom above Vrsnik (Soča) and for similar stands above the alp Planina v Plazeh and under Čisti vrh and Velika Tičarica (above the Lower Trenta valley). Even though there are old and thick larch trees growing in the listed areas, we noticed no *Letharia vulpina* on their bark. The reason might be the (over)polluted air brought by the west winds from the industrial flatlands of Friuli and the Po Valley. It would by all means be sensible to pay more attention to *Letharia vulpina* in the future, as well as to the communities (synusia) in which it grows and to epiphytes on larch trees, especially crustose species in their natural stands on the timberline in general.

## 5. POVZETEK

### Razširjenost lihenizirane glive *Letharia vulpina* v subalpinskih macesnovih sestojih (*Rhodothamno-Laricetum*) v vzhodnih Julijskih Alpah (Slovenija)

*Letharia vulpina* je grmičast lišaj, natančneje lihenizirana gliva iz družine *Parmeliaceae*. Zanj predlagamo slovensko ime navadni lisičji lišaj. Njen areal obsega Evropo (Skandinavija, Alpe in druga srednje- in južnoevropska gorovja), severno Afriko, Malo Azijo, Ciper, Kavkaz in borealni del Severne Amerike. Navadno uspeva na deblih in vejicah iglastih drevesnih vrst, v srednji in južni Evropi ter v gorovjih, ki obdajajo Sredozemlje predvsem na vrstah *Larix decidua*, *Pinus cembra*, *Pinus peuce*, *Pinus pinaster*, *Juniperus excelsa* in *Cedrus atlantica*. V preteklosti so navadni lisičji lišaj precej uporabljali za pridobivanje barvila, v ljudskem zdravilstvu za lajšanje prebavnih težav kot zelo razredčen poparek, nekaj tudi za lov lisic in volkov z mešanico mesa, lišaja in zdrobljenega stekla. Za mesojede živali je strupen. Vednost o pojavljanju vrste *Letharia vulpina* v Sloveniji je bila do leta 2010 zelo majhna. Schade (1954: 121) je objavil podatek o njenem uspevanju na macesnu pri Belem (=Velem) polju – 9649/1, UTM 33T VM13 (kjer naj bi jo

leta 1876 nabral E. H. iz Innsbrucka in kjer zelo verjetno uspeva še zdaj, saj smo jo 14. 10. 2010 našli nad bližnjo planino Pod Mišelj vrhom). Ta podatek povzema tudi Katalog liheniziranih in lihenikolnih gliv Slovenije (Suppan & al. 2000: 81). Tudi poznejša obdelava lišajev Julijskih Alp (Batič & al. 2003, Mrak & al. 2004) ni prinesla novih spoznanj, saj te vrste takrat niso popisali, ker so bile raziskave omejene na nižje ležeče gozdove. Pri naših raziskavah naravnih macesnovih gozdov v Sloveniji (Dakskobler & al. 2010) smo jo prvič opazili konec avgusta 2010 nad dolino Male Pišnice in jo potem popisali še na precej nahajališčih v vzhodnem delu Julijskih Alp, nad dolino Vrat, nad planino Klek na Pokljuki in v Fužinskih planinah (Krstenica, pod Krsteniškim in Jezerskim Stogom). Večina njenih nahajališč je v macesnovi združbi *Rhodothamno-Laricetum* Willner et Zukrigl 1999, nekaj pa tudi v ruševju z macesnom *Rhododendro hirsuti-Pinetum prostratae* Zöttl 1951 *laricetosum* Tregubov 1962 = *Rhodothamno-Rhododendretum hirsuti* (Aichinger 1933) Br.-Bl. & Sissingh in Br.-Bl. & al. 1939 *laricetosum* Tregubov 1962 in v alpskem bukovju z macesnom (*Anemomo-Fagetum* Tregubov 1962 *laricetosum* Tregubov 1962). Našli smo jo na starih in navadno debelih macesnih, ki uspevajo na nadmorski višini od 1450 do 1820 m, torej v subalpskem pasu skoraj do zgornje meje razširjenosti macesnovega gozda v Julijskih Alpah, ki je na nadmorski višini 1900 do 1950 m. Macesni so rasli na položnih do zelo strmih pobočjih (naklon od 10° do 40°), v vseh legah, tako na izrazito osojnih (N, NE), kot tudi na izrazito prisojnih (S, SW). Geološka podlaga je največkrat dolomitiziran apnenec, redkeje apnenec, apnenec s primesjo laporovca ali pobočni grušč. Tla so plitva, prhni-nasta rendzina. Preučeni gozdni sestoji so varovalni, sečenj v njih že dolgo ni (le v nekaterih smo opazili stare razpadajoče panje). Ponokod (pl. Klek, Fužinske planine, Velo polje) v njih pasejo drobnico in govedo. Na nekaj nahajališčih (Požgana Mlinarica, Robičje) je bil primarni gozd nekoč morda požgan z namenom pridobiti pašne površine za drobnico. Na rast in razvoj teh sestojev že najmanj 60 let in več v glavnem vplivajo le naravni dejavniki (veter, snežni plazovi, podori). Drugih lišajev, ki epifitsko rastejo skupaj z vrsto *Letharia vulpina* na macesnovi skorji, nismo podrobneje popisovali. Pogoste so vrste *Bryoria fuscescens*, *Usnea subfloridana*, *Usnea* spp., *Ramalina farinacea*, *Evernia prunastri*, *E. divaricata*, *Vulpicida pinastris*, *Hypogymnia physodes*, *H. farinacea*,

*H. tubulosa*, *Pseudevernia furfuracea*, *Platismatia glauca*, *Parmelia saxatilis*, *P. sulcata*, *Parmeliopsis ambigua*, *Parmeliopsis hyperopta*, *Hypocenomyce scalaris*, *Chrysothrix candelaris*, *Chaenotheca* spp., *Ochrolechia* spp., *Lepraria* spp., *Lecanora pulicaris*, *Cladonia digitata*, *Cladonia* spp. V Julijskih Alpah je lihenizirana gliva *Letharia vulpina*, podobno kot zelo redka gliva lekarniška macesnovka (*Laricifomes officinalis*), pokazatelj naravnih macesnovih gozdov na zgornji gozdni meji. V prihodnosti bo smiselno večjo pozornost posvetiti tudi njenim sinuzijam in sploh epifitom na macesnu v njegovih naravnih gozdovih.

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## 7. REFERENCES

- Batič, F., Primožič, K., Surina, B., Trošt, T. & Mayrhofer, H. 2003: Contribution to the lichen flora of Slovenia. X. Lichens from the Slovenian Julian Alps. *Herzogia* 16: 143–154.
- Berger, F., Priemtzhofer, F. & Türk, R. 2010: Atlas der Verbreitung der Flechten in Oberösterreich. *Stapfia* 90 (2009): 1–320.
- Bilovitz, P. O., Knežević, B., Stešević, D., Vitikainen, O., Dragičević, S., Mayrhofer, H. 2008: New or otherwise interesting lichenized and lichenicolous fungi from Montenegro. *Fritschiana* (Graz) 62: 1–44.
- Bolliger, J., Bergamini, A., Stofer, S., Kienast, F. & Scheidegger, Ch. 2007: Predicting the potential spetial distributions of epiphytic lichen species at the landscape scale. *The Lichenologist* 39 (3): 279–291.
- Braun-Blanquet, J. 1964: Pflanzensozioologie. Grundzüge der Vegetationskunde. 3. Auflage, Springer, Wien-New York, 865 pp.
- Dakskobler, I. 2006: Asociacija *Rhodothamno-Laricetum* (Zukrigl 1973) Willner & Zukrigl 1999 v Julijskih Alpah. *Razprave 4. razreda SAZU* (Ljubljana) 47 (1): 117–192.
- Dakskobler, I., Culiberg, M., Čas, M., Čelik, T., Firm, D., Kadunc, A., Leban, F., Kobal, M., Rozman, A., Seliškar, A., Urbančič, M. & Vreš, B. 2010: Naravni sestoji macesna v Sloveniji: zaključno poročilo projekta ciljnega raziskovalnega programa "Konkurenčnost Slovenije 2006-2013", 2008-2010, Biološki inštitut Jovana Hadžija, ZRC SAZU, Ljubljana, 27 pp.
- Frahm, J. P. & Frey, W. 1992: *Moosflora*. 3. Aufl. UTB, Eugen Ulmer, Stuttgart, 528 pp.
- Gams, H. 1955: Das Rätsel der Verbreitung von *Letharia vulpina*. *Svensk Botanisk Tidskrift* 49 (1–2): 29–34.
- Hafellner, J. 2008: Zur Diversität lichenisierter und lichenicoler Pilze im Gebiet der Koralpe (Österreich: Kärnten und Steiermark, Slowenien). *Mitteilungen des Naturwissenschaftlichen Vereins für Steiermark* 138: 29–112.
- Jurc, D., Piltaver, A. & Ogris, N. 2005: Glive Slovenije: vrste in razširjenost. Ljubljana, Silva Slovenica, Gozdarski inštitut Slovenije, 497 pp.
- Maarel van der, E. 1979: Transformation of cover-abundance values in phytosociology and its effects on community similarity. *Vegetatio* 39 (2): 97–114.
- Martinčič, A. 2003: Seznam listnatih mahov (*Bryopsida*) Slovenije. *Hacquetia* (Ljubljana) 2 (1): 91–166.
- Martinčič, A., Wraber, T., Jogan, N., Podobnik, A., Turk, B., Vreš, B., Ravnik, V., Frajman, B., Strgulc Krajšek, S., Trčak, B., Bačič, T., Fischer, M. A., Eler, K. & Surina, B. 2007: Mala flora Slovenije. Ključ za določanje praprotnic in semenk. Četrta, dopolnjena in spremenjena izdaja. Tehniška založba Slovenije, Ljubljana, 967 pp.
- Medjedović, S. 1971: Nova nalazišta vrste *Letharia vulpina* (L.) Vain u Jugoslaviji. *Glas. Republ. Zavoda Zašt. Prirode – Prirodnjačkog muzeja Titograd* 4: 77–81.
- Mrak, T., Mayrhofer, H. & Batič, F. 2004: Contributions to the lichen flora of Slovenia XI: Lichens from the vicinity of Lake Bohinj (Julian Alps). *Herzogia* 17: 107–127.
- Podani, J. 2001: SYN-TAX 2000. *Computer Pro-*



- grams for Data Analysis in Ecology and Systematics. User's Manual, Budapest, 53 pp.
- Nascimbene, J., Marini, L., Carrer, M., Motta, R. & Nimis P.-L. 2008: Influence of tree age and tree structure on the macrolichen *Letharia vulpina*: A case study in the Italian Alps. *Ecoscience* 15 (4): 423–428.
- Pristov, J., Pristov, N. & Zupančič, B. 1998: Klima Triglavskega narodnega parka. Razprave in raziskave 8. Triglavski narodni park in Hidrometeorološki zavod Slovenije, Bled, 60 pp.
- Schade, A. 1954: Über *Letharia vulpina* (L.) Vain. und ihre Vorkommen in der Alten Welt. *Ber. Bayer. Bot. Ges.* 30: 108–126.
- Seliškar, T., Vreš, B. & Seliškar, A. 2003: FloVegSi 2.0. Računalniški program za urejanje in analizo bioloških podatkov. Biološki inštitut ZRC SAZU, Ljubljana.
- Suppan, U., Prügger, J. & Mayrhofer, H. 2000: Catalogue of the lichenized and lichenicolous fungi of Slovenia. *Bibliotheca Lichenologica* 76: 1–215.
- Türk, R., Hafellner, J., Taurer-Zeiner, C. 2004: Die Flechten Kärntens. *Naturwiss. Ver. Kärnten, Klagenfurt*, 333 pp.
- Wirth, V. 1991: Zeigerwerte von Flechten. *Scripta Geobotanica* (Göttingen) 18: 215–237.
- Wirth, V. 2010: Ökologische Zeigerwerte von Flechten – erweiterte und aktualisierte Fassung. *Herzogia* 23 (2): 229–248.
- Zupančič, M. & Žagar, V. 2007: Comparative analysis of phytocoenoses with larch (*Rhodothamno-Rhododendretum* var. geogr. *Paederota lutea laricetosum*, *Rhodothamno-Laricetum*). *Razprave* 4. *Razreda SAZU* (Ljubljana) 48 (2): 307–335.
- [http://en.wikipedia.org/wiki/Letharia\\_vulpina](http://en.wikipedia.org/wiki/Letharia_vulpina) (3. 1. 2011)

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## APPENDIX

Table 1: Number of relevé, Date, Locality, Quadrant

1. 29. 8. 2010, Mala Pišnica – Robičje, 9548/3;
2. 29. 8. 2010, Mala Pišnica – Robičje, 9548/3;
3. 1. 9. 2010, Sleme – Mala Pišnica, 9548/3;
4. 14. 9. 2006, Planina Klek, 9649/2; 5. 14. 9. 2010, Požgana Mlinarica, 9549/3; 6. 14. 9. 2010, Požgana Mlinarica, 9549/3; 7. 21. 9. 2010, Vrata – Brinova glava, 9549/3; 8. 2. 9. 2010, Vrtaško Sleme-Črlovec, 9549/3; 9. 21. 9. 2010, Vrata – Šplevta – Prag, 9549/3; 10. 21. 9. 2010, Vrata – Brinova glava, 9549/3; 11. 2. 8. 2010, Sleme – Mala

Pišnica, 9548/3; 12. 2. 8. 2010, Sleme – Mala Pišnica, 9548/3; 13. 1. 9. 2010, Sleme – Mala Pišnica, 9548/3; 14. 14. 10. 2010, Planina pod Mišelj vrhom – Jezerski preval, 9649/3; 15. 22. 9. 2010, Planina Krstenica – Krsteniški Stog, 9649/3; 16. 22. 9. 2010, Planina Krstenica – Krsteniški Stog, 9649/3; 17. 22. 9. 2010, Planina Krstenica – Krsteniški Stog, 9649/3.

### Legend

- D – Dolomite (dolomit)
- A – Limestone (apnenec)
- L – Marlstone (laporovec)
- GR – Gravel (grušč)
- R – Rendzina (rendzina)

**Table 1:** Subalpine larch stands in Slovenia, localities of *Letharia vulpina*  
**Tabela 1:** Subalpinski macesnovi sestoji v Sloveniji, nahajališča vrste *Letharia vulpina*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Number of relevé (Zaporedna številka popisa)	236550	236531	236588	212184	236780	236782	236877	236617	236881	236876	236535	236536	236586	237665	236886	236887	236889	
Working number of relevé (Delovna številka popisa)	1480	1450	1570	1652	1730	1750	1740	1690	1670	1650	1720	1650	1760	1800	1820	1740	1660	
Altitude in m (Nadmorska višina v m)	N NW	NW	NW	SE	SW	SW	S	S	SE	SE	N	NNE	N	NE	N	N	W	
Aspect (Lega)	40	25	10	20	35	20	35	35	40	35	40	35	40	10	35	35	30	
Slope in degrees (Nagib v stopinjah)	DA	DA	DA	A	DA	DA	DA	DA	Gr	DA	DA	DA	DA	DA	AL	GR	A	
Parent material (Matična podlaga)	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	
Soil (Tla)	2	2	10	30	20	10	10	10	15	10	10	10	20	10	10	20	40	
Stoniness in % (Kamnitost v %)	Cover in % (Zaštranje v %):																	
Upper tree layer (Zgornja drevesna plast)	E3b	10	30	60	60	50	60	60	70	50	40	60	40	60	70	50	60	
Lower tree layer (Spodnja drevesna plast)	E3a	90	0	10	10	5	10	5	10	20	30	20	20	5	5	20	20	
Shrub layer (Grmovna plast)	E2	70	70	20	40	60	90	50	40	30	60	40	40	50	30	30	20	
Herb layer (Zeliščna plast)	E1	20	90	90	70	70	5	90	80	5	80	90	80	80	80	80	60	
Moss layer (Mahovna plast)	E0	0	10	10	10	0	10	5	5	0	5	5	5	10	15	10	20	
Maximum tree diameter in cm (Največji prsni premer v cm)		100	75	80	80	60	60	80	80	45	100	80	100	70	60	80	90	
Maximum tree height in m (Največja drevesna višina v m)		17	15	26	18	17	18	19	17	22	18	18	20	15	15	18	20	
Relevé area (Velikost popisne ploskve)	m <sup>2</sup>	100	200	400	400	400	400	400	400	400	400	400	400	400	400	400	400	
Number of species (Število vrst)		46	41	79	90	75	52	66	74	85	86	98	90	73	83	74	88	
<b>Character and differential species of the associations</b>		<b>Značilne in razlikovalne vrste asociacij</b>																
VP		5	4	+	.	4	3	3	3	1	.	.	+	1	3	1	+	14
EP											.	+	.	.	.	.	.	2
FS			2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
FS			1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
FS			1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
FS			1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
FS			+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
FS			+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
FS			+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
VP		1	2	3	4	3	4	4	4	3	3	4	3	4	4	3	4	17
VP		.	.	+	1	1	+	+	1	1	2	2	2	1	1	2	1	15
VP		.	+	+	1	1	+	1	1	+	2	2	2	.	1	.	1	14
VP		.	.	+	1	+	+	.	+	+	2	1	1	+	1	1	+	14
VP		.	+	1	.	.	.	.	.	.	.	.	.	1	.	.	.	3
EP		3	4	2	3	4	3	+	+	+	3	2	2	4	1	1	+	16
EP		+	+	1	+	+	.	.	1	.	1	1	1	2	.	+	1	12
AT		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	4
AT		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	3

Geographical differential species																		
Geografske različkovalne vrste																		
ES	<i>Laserpitium peucedanoides</i>	+	.	.	+	+	+	.	1	1	.	13	76					
AF	<i>Anemone trifolia</i>	1	1	.	1	1	+	.	.	.	.	10	59					
VP	<i>Homogyne sylvestris</i>	+	.	.	.	.	.	.	.	.	.	7	41					
TR	<i>Astrantia carniolica</i>	.	.	.	.	.	.	.	.	.	.	1	6					
Differential species of the lower syntaxonomical units																		
Različkovalne vrste nižjih sintaksonomskih enot																		
EP	<i>Calamagrostis varia</i>	+	1	+	2	1	1	1	3	2	.	.	12	71				
EP	<i>Erica carnea</i>	1	3	1	3	3	2	1	+	3	1	.	10	59				
MuA	<i>Aconitum lycoctonum</i> subsp. <i>ranunculifolium</i>	.	.	+	.	.	.	.	.	.	1	1	1	9	53			
ES	<i>Poa alpina</i>	.	.	.	.	.	.	.	.	.	1	+	1	8	47			
MuA	<i>Alnus viridis</i>	.	.	.	.	.	.	.	.	.	+	+	+	7	41			
TR	<i>Saxifraga aizoides</i>	.	.	.	.	.	.	.	.	.	+	.	.	5	29			
VP	<b>Vaccinio-Piceetea</b>	.	.	.	.	.	.	.	.	.	.	.	.	.	.			
	<i>Luzula sylvatica</i>	1	+	1	1	1	1	1	1	+	1	2	1	1	17	100		
	<i>Vaccinium vitis-idaea</i>	2	2	2	2	1	1	1	2	+	+	+	+	+	17	100		
	<i>Vaccinium myrtillus</i>	3	.	4	2	2	1	3	+	1	2	4	3	3	1	2	16	94
	<i>Valeriana tripteris</i>	+	1	+	+	+	1	1	.	+	1	1	1	1	1	1	16	94
	<i>Calamagrostis villosa</i>	1	1	3	+	1	3	1	3	+	1	1	3	2	.	.	14	82
	<i>Polystichum lonchitis</i>	.	.	1	2	+	+	1	+	1	1	1	1	1	+	.	14	82
	<i>Clematis alpina</i>	+	.	+	1	1	.	1	.	+	1	1	+	+	1	1	14	82
	<i>Dryopteris dilatata</i>	1	1	+	+	+	+	+	1	.	+	1	+	+	1	.	13	76
	<i>Lycopodium annotinum</i>	1	+	1	+	+	+	+	.	.	+	1	+	+	.	.	13	76
	<i>Lonicera caerulea</i>	+	.	+	+	+	+	+	+	+	+	+	+	+	+	.	13	76
	<i>Rosa pendulina</i>	+	1	.	+	+	+	+	+	+	.	1	.	+	+	+	11	65
	<i>Hieracium sylvaticum</i>	1	.	.	+	+	+	1	.	1	+	+	+	+	.	.	11	65
	<i>Homogyne alpina</i>	1	+	1	1	.	+	+	.	+	1	+	1	.	.	.	11	65
	<i>Oxalis acetosella</i>	.	.	+	+	+	+	+	+	+	.	+	+	+	.	.	11	65
	<i>Picea abies</i>	+	.	1	.	1	+	+	+	+	+	.	.	.	.	.	10	59
	<i>Picea abies</i>	+	.	+	.	+	+	1	1	1	+	.	.	.	.	.	8	47
	<i>Picea abies</i>	.	.	1	+	+	+	1	1	1	.	.	.	.	.	.	10	59
	<i>Picea abies</i>	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	8	47
	<i>Solidago virgaurea</i>	.	.	+	+	+	+	.	.	.	1	1	1	1	.	.	9	53
	<i>Huperzia selago</i>	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	7	41
	<i>Melampyrum sylvaticum</i>	.	.	1	+	.	.	.	+	+	+	.	.	.	.	.	6	35
	<i>Gymnocarpium dryopteris</i>	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	6	35
	<i>Maianthemum bifolium</i>	+	+	.	.	+	+	.	.	.	.	.	.	.	.	.	5	29
	<i>Saxifraga cuneifolia</i>	.	.	.	.	.	.	.	.	.	.	+	1	+	1	+	4	24
	<i>Dryopteris expansa</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	4	24
	<i>Veronica urticifolia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	18

Number of relevé (Zaporedna številka popisa)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Pr.	Fr.
<i>Phegopteris connexilis</i>	E1	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	3	18
<i>Abies alba</i>	E3b	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	12
<i>Abies alba</i>	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Gentiana asclepiadea</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	12
<i>Calamagrostis arundinacea</i>	E1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	2	12
<i>Ajuga pyramidalis</i>	E1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	2	12
<i>Luzula luzulina</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	2	12
<i>Luzula luzuloides</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	2	12
<i>Listera cordata</i>	E1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Lonicera nigra</i>	E2a	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1	6
<i>Luzula pilosa</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<b>EP</b>																			
<b>Erico-Pinetea</b>																			
<i>Rubus saxatilis</i>	E1	.	+	+	1	+	+	+	+	+	+	1	+	1	+	1	1	16	94
<i>Juniperus sibirica</i>	E2a	.	+	.	1	+	.	.	.	.	.	.	+	1	.	.	.	6	35
<i>Aquilegia nigricans</i>	E1	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	3	18
<i>Carex ornithopoda</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	2	12
<i>Amelanchier ovalis</i>	E2a	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Molinia caerulea</i> subsp. <i>arundinacea</i>	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Polygala chamaebuxus</i>	E1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Pyrola rotundifolia</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<i>Epipactis atrorubens</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
<b>AF</b>																			
<b>Arenonio-Fagion</b>																			
<i>Aposperis foetida</i>	E1	+	+	.	+	1	1	1	.	1	1	1	1	.	+	.	1	13	76
<i>Knaulia drymeia</i> subsp. <i>drymeia</i>	E1	.	.	+	.	.	+	+	+	1	.	.	+	.	.	.	+	9	53
<i>Cyclamen purpurascens</i>	E1	.	1	.	.	+	+	+	1	.	.	.	.	.	.	.	.	6	35
<i>Heilleborus niger</i>	E1	.	.	1	+	.	.	2	.	.	.	.	.	.	+	.	+	5	29
<i>Cardamine enneaphyllos</i>	E1	.	.	.	1	.	.	.	.	.	1	1	+	.	.	.	.	5	29
<b>FS</b>																			
<b>Fagetalia sylvaticae</b>																			
<i>Daphne mezereum</i>	E2a	+	+	+	1	1	+	+	+	+	1	1	+	.	.	+	.	14	82
<i>Melica nutans</i>	E1	.	.	+	1	+	+	1	+	+	.	+	.	.	.	.	.	9	53
<i>Dryopteris filix-mas</i>	E1	.	r	+	+	.	+	.	+	+	.	+	.	.	.	.	+	8	47
<i>Galeobdolon flavidum</i>	E1	.	.	+	.	+	+	1	.	+	.	.	.	.	.	.	+	6	35
<i>Lonicera alpigena</i>	E2a	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	+	4	24
<i>Phyteuma spicatum</i>	E1	+	.	.	.	+	.	.	.	.	+	+	.	.	.	.	.	4	24
<i>Prenanthes purpurea</i>	E1	+	1	.	.	.	.	.	.	.	+	+	.	.	.	.	.	4	24
<i>Polystichum aculeatum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	4	24
<i>Paris quadrifolia</i>	E1	.	.	.	.	r	.	+	.	+	.	.	.	.	.	.	.	4	24
<i>Poa nemoralis</i>	E1	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	3	18
<i>Lilium martagon</i>	E1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	3	18
<i>Acer pseudoplatanus</i>	E2b	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Pr.	Fr.
Number of relevé (Zaporedna številka popisa)																			
<i>Peucedanum ostruthium</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	6
<i>Allium victorialis</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	6
<i>Ranunculus plataniifolius</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	6
<i>Rumex arifolius</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	6
<i>Aconitum degenii</i> subsp. <i>paniculatum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	6
<i>Cirsium carniolicum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	6
<b>ES</b>																			
<b><i>Elyno-Seslerietea</i></b>																			
<i>Heliosperma alpestre</i>	E1	+	.	+	+	.	+	.	+	+	1	+	+	.	+	+	.	13	76
<i>Astrantia bavarica</i>	E1	.	.	+	+	.	+	.	+	+	1	1	1	+	1	+	.	12	71
<i>Carex ferruginea</i>	E1	.	.	+	+	.	.	+	+	2	1	1	1	+	+	2	.	12	71
<i>Sesleria caerulea</i> subsp. <i>calcaria</i>	E1	+	.	+	.	.	+	1	1	+	.	.	+	+	1	3	.	11	65
<i>Soldanella alpina</i>	E1	.	.	+	.	.	+	+	.	.	.	+	.	1	1	1	.	9	53
<i>Aster bellidiastrum</i>	E1	.	.	+	+	.	.	.	+	.	+	+	+	.	.	+	.	8	47
<i>Selaginella selaginoides</i>	E1	+	.	.	.	.	.	.	.	1	+	+	+	+	.	+	.	7	41
<i>Betonica alopecuroides</i>	E1	.	.	.	.	.	+	+	+	+	+	+	+	.	+	.	1	7	41
<i>Homogyne discolor</i>	E1	.	.	.	.	.	+	.	.	1	+	+	+	+	+	.	+	7	41
<i>Senecio abrotanifolius</i>	E1	.	.	+	.	.	.	.	1	+	+	+	+	+	.	.	.	7	41
<i>Juncus monanthos</i>	E1	.	+	.	.	.	.	.	+	.	+	+	+	+	.	+	.	6	35
<i>Phyteuma orbiculare</i>	E1	.	.	.	+	.	+	+	+	+	.	.	.	.	+	.	.	6	35
<i>Thymus praecox</i> subsp. <i>polytrichus</i>	E1	.	.	+	+	+	.	.	+	+	.	.	+	+	.	.	.	6	35
<i>Lotus alpinus</i>	E1	.	.	+	.	.	+	+	+	+	.	.	.	.	.	+	.	6	35
<i>Polygonum viviparum</i>	E1	.	.	.	.	.	.	.	+	.	1	+	+	+	+	.	.	6	35
<i>Pulsatilla alpina</i>	E1	.	.	.	.	.	.	.	+	.	.	.	+	+	.	+	.	6	35
<i>Campanula witasekiana</i>	E1	.	.	.	+	.	.	.	+	.	.	+	+	.	.	.	.	5	29
<i>Galium anisophyllum</i>	E1	.	.	.	.	.	.	+	.	.	+	+	+	.	+	+	.	5	29
<i>Ranunculus carinthiacus</i>	E1	.	.	+	.	.	.	.	.	+	+	+	+	.	.	.	.	4	24
<i>Scabiosa lucida</i>	E1	.	.	.	+	.	.	.	+	+	.	.	.	.	.	.	.	4	24
<i>Ranunculus montanus</i>	E1	.	.	.	+	.	+	+	+	+	.	.	.	.	.	.	.	4	24
<i>Cirsium eristhales</i>	E1	.	.	.	.	.	+	+	+	.	.	.	.	.	.	+	.	4	24
<i>Helianthemum nummularium</i> subsp. <i>grandiflorum</i>	E1	.	.	.	.	.	+	.	1	1	.	.	.	+	.	.	.	4	24
<i>Dryas octopetala</i>	E1	.	.	.	.	.	.	.	.	+	+	+	+	+	.	+	.	4	24
<i>Arabis vohinensis</i>	E1	.	.	.	+	.	.	.	.	+	+	+	+	.	.	.	.	3	18
<i>Euphrasia picta</i>	E1	.	.	.	.	+	.	.	.	+	.	.	.	.	.	+	.	3	18
<i>Festuca calva</i>	E1	.	.	.	.	.	+	.	1	1	.	.	.	.	.	.	.	3	18
<i>Heracleum austriacum</i> subsp. <i>siifolium</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	.	3	18
<i>Leucanthemum adustum</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	3	18
<i>Pinguicula alpina</i>	E1	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	3	18
<i>Barisia alpina</i>	E1	.	.	.	.	.	.	.	.	+	+	+	+	.	.	+	.	3	18
<i>Carex firma</i>	E1	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	+	3	18
<i>Gentianella anisodonta</i>	E1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	2	12



Number of relevé (Zaporedna številka popisa)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Pr.	Fr.
	<i>Campanula cespitosa</i>	E1	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	2	12
	<i>Gypsophila repens</i>	E1	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	2	12
	<i>Hieracium bifidum</i>	E1	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	2	12
	<i>Dryopteris villarii</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	2	12
	<i>Rhodiola rosea</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2	12
	<i>Valeriana montana</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2	12
	<i>Trisetum argenteum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
	<i>Sedum atratum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
	<i>Rumex scutatus</i>	E1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	6
	<i>Cerastium carinthiacum</i>	E1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	6
	<i>Crepis kernerii</i>	E1	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	1	6
	<i>Saxifraga caesia</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	6
AT	<b><i>Asplenietea trichomanis</i></b>																			
	<i>Asplenium viride</i>	E1	+	.	.	.	.	.	+	1	+	1	1	1	1	+	1	1	15	88
	<i>Paederota lutea</i>	E1	.	.	.	.	.	.	.	+	+	+	+	1	.	+	+	1	11	65
	<i>Moehringia muscosa</i>	E1	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	6	35
	<i>Cystopteris fragilis</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	5	29
	<i>Asplenium ruta-muraria</i>	E1	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	4	24
	<i>Asplenium trichomanes</i>	E1	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	3	18
	<i>Cystopteris regia</i>	E1	.	.	.	.	.	.	.	.	.	r	+	.	.	.	.	.	2	12
	<i>Ranunculus traunfellneri</i>	E1	.	.	.	.	.	.	.	.	.	r	.	+	.	.	.	.	2	12
	<i>Saxifraga squarrosa</i>	E1	.	.	.	.	.	.	.	.	.	.	.	r	+	.	.	.	2	12
	<i>Saxifraga hostii</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
	<i>Rhamnus pumilus</i>	E1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	6
	<i>Polypodium vulgare</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	6
PaT	<b><i>Poa alpinae-Trisetalia</i></b>																			
	<i>Campanula scheuchzeri</i>	E1	.	.	.	.	.	.	.	.	+	1	1	.	.	.	.	+	8	47
	<i>Trollius europaeus</i>	E1	.	.	.	.	.	.	.	.	.	+	+	+	.	1	.	1	7	41
	<i>Deschampsia cespitosa</i>	E1	.	.	.	.	.	.	.	.	.	.	2	+	.	.	.	.	4	24
	<i>Alchemilla monticola</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	4	24
	<i>Agrostis capillaris</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	3	18
	<i>Crepis aurea</i>	E1	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	2	12
MA	<b><i>Molinio-Arrhenatheretea</i></b>																			
	<i>Festuca rubra</i> agg.	E1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	5	29
	<i>Leontodon hispidus</i>	E1	.	.	.	.	.	.	.	.	.	+	+	+	.	1	1	.	5	29
	<i>Alchemilla xanthochlora</i>	E1	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	3	18
	<i>Dactylis glomerata</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	2	12
	<i>Astrantia major</i>	E1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
	<i>Veronica chamaedrys</i>	E1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	6
	<i>Cerastium fontanum</i>	E1	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	6





		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Pr.	Fr.
Number of relevé (Zaporedna številka popisa)																				
	<i>Rhodobryum roseum</i>	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	6
	<i>Homalothecium philippeanum</i>	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	6
L	<b>Lichens (Lišaji)</b>																			
	<i>Letharia vulpina</i>	E3a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	17	100
	<i>Hypogymnia physodes</i>	E3a	x	x	.	x	.	x	.	.	x	.	.	x	x	x	x	x	11	65
	<i>Peltigera leucophlebia</i>	E0	.	.	+	.	.	+	.	.	+	.	.	+	+	+	.	.	7	41
	<i>Cladonia pyxidata</i>	E0	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	4	24
	<i>Cetraria islandica</i>	E0	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	2	12
	<i>Usnea</i> spp.	E3a	.	.	.	.	.	.	.	.	x	.	.	.	.	.	.	x	2	12
	<i>Peltigera</i> spp.	E0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	2	12
	<i>Dermatocarpon minutatum</i>	E0	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	6
	<i>Cladonia furcata</i>	E0	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	6
	<b>Fungi (Gljive)</b>																			
	<i>Laricifomes officinalis</i>	E3a	.	.	.	x	.	x	.	.	.	.	.	x	x	.	x	.	5	29
Gl	<i>Laetiporus cf. huronensis (L. montanus)</i>	E3a	.	x	.	x	.	.	.	.	.	.	.	.	.	.	.	.	2	12