

ADDITIONAL AND NEW LICHEN RECORDS FROM PAPUK NATURE PARK (SLAVONIA REGION, CROATIA)

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Ozimec, S. & Prlić, D.: Additional and new lichen records from Papuk Nature Park (Slavonia region, Croatia). Nat. Croat., Vol. 31, No. 1, 97–107, Zagreb, 2022.

This paper reports 85 taxa (79 species with 1 subspecies, and 5 varieties) of lichens from Papuk Nature Park, recorded during a survey carried out in the period 2013–2021. The knowledge on the lichen diversity of Papuk Nature Park has been enlarged by 28 newly recorded taxa, and total diversity includes 168 taxa. An exceptionally rich lichen habitat was discovered in an old-growth *Fagus* forest at the locality Svinjarevac, hosting 43 species, most belonging to the threatened epiphytic *Lobarion pulmonariae* community. This habitat is recognized as a kind of refugium of the species with suboceanic distribution in the continental part of Croatia.

Key words: biodiversity, lichenized fungi, *Lobarion*, forest, ecosystem

Ozimec, S. & Prlić, D.: Novi i dodatni nalazi lišajeva u Parku prirode Papuk (Slavonija, Hrvatska). Nat. Croat., Vol. 31, No. 1, 97–107, Zagreb, 2022.

Rad donosi 85 svojiti (79 vrsta, jednu podvrstu i 5 varijeteta) lišajeva zabilježenih u Parku prirode Papuk tijekom istraživanja provedenog u razdoblju 2013.–2021. godine. Proširene su spoznaje o raznolikosti lišajeva Parka prirode Papuk za 28 novozabilježenih svojiti, te ukupna raznolikost obuhvaća 168 svojiti. Izuzetno bogato stanište lišajeva otkriveno je u staroj bukovoju šumi na Svinjarevcu, u kojoj obitavaju 43 vrste, od kojih većina pripada ugroženoj epifitskoj zajednici *Lobarion pulmonariae*. Ovo stanište prepoznato je kao svojevrsni refugij lišajeva suboceanske rasprostranjenosti u kontinentalnom području Hrvatske.

Ključne riječi: bioraznolikost, lihenizirane gljive, *Lobarion*, šuma, ekosustav

INTRODUCTION

Lichenological exploration in the area of Papuk Nature Park started in the second half of the 19th century. Jozef Armin Knapp collected the first lichen samples and eight species were reported (SCHULZER v. MÜGGENBURG *et al.*, 1866). Carl Stoitzner gave further notes on 43 species (STOITZNER, 1869). August Ginzberger collected samples in August 1918 (GINZBERGER, 1935), which were determined by Fran Kušan, who added records from an excursion he made in June 1930 (KUŠAN, 1935). A specimen of *Cladonia* genus stored in the Fran Kušan Herbarium (HFK) in Zagreb confirms Kušan's later visit to

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the Papuk area in September 1967. Lichenological studies of Papuk Nature Park were revived in 2005.

Based on the evaluation of available papers, records from herbaria collections, and fieldwork carried out by Irena Labak in the period 2005–2007, a checklist with 129 lichen species was published (LABAK *et al.*, 2011), including one species, *Umbilicaria hirsuta*, that was new for Croatia, and eight that were new for Papuk Nature Park. Among the samples collected at the locality Svinjarevac by Dragan Prlić in October 2013, six species were new for Papuk Nature Park, and voucher specimens are stored in the herbarium GZU in Graz (MAYRHOFER *et al.*, 2018a). A field survey conducted by Hungarian and Croatian researchers at localities Sokolina (north of the settlement of Velika), and Svinjarevac in June and October 2015, contributed 54 recorded lichen species, of which two were reported as new for Croatia (*Psilolechia lucida* and *Umbilicaria polyphylla*), and seven species were presented by name as new for Papuk Nature Park (DEME *et al.*, 2017, ALEGRO *et al.*, 2018). A lichen survey carried out by Juro Zovkić in July 2018 along the Lapjak Educational Trail, resulted in 42 recorded species, out of which six were new for Papuk Nature Park (ZOVKIĆ, 2018). The research project on lichens in Papuk Nature Park was undertaken in the period from May to November 2019 (OZIMEC & PRLIĆ, 2019), with an emphasis on the presence of the lichens from the *Lobarion pulmonariae* community (PERIĆ, 2019).

MATERIAL & METHODS

Study area

Almost the entire area of Papuk Mountain, with an adjacent part of Krndija Mountain, located in the Slavonia region (north-eastern Croatia), was proclaimed protected in category of Nature Park in 1999 (ANONYMOUS, 1999). The total area is 34,307 ha, extending between 17°29'18" and 17°54'38" E, and 45°24'54" and 45°36'46" N (Fig. 1).

The lowest point (162 m) is located in the northern part, while the highest point - peak of Papuk (954 m) is located in the middle part.

Papuk Nature Park was designated in 2007 the first Croatian Geopark, and 30th member of the European and UNESCO Global Geopark Network. It also comprises three areas of the ecological network Natura 2000 in Croatia (ANONYMOUS, 2019): Special Protection Area HR1000040 Papuk, and Sites of Community Importance HR2000582 Papuk, and HR2001329 Potoci oko Papuka.

Papuk is geologically the most diverse Croatian mountain, consisting of rocks formed in different geological environments in a time span of 350 million years, from the Palaeozoic to Cenozoic (PAMIĆ *et al.*, 2003). The main rock types are: igneous rocks (basalt, andesite, granite), migmatite rock as an intermediary type, metamorphic rocks (schist, quartzite, sandstone) and limestones as sedimentary rock. Rock type affects the diversity of saxicolous lichens.

The climate is moderately warm and rainy. According to records of the Croatian Meteorological and Hydrological Service for the meteorological station in Voćin (1998–2017), the mean annual temperature is 10.7 °C, the lowest (0.4 °C) in January and highest (20.8 °C) in July. Absolute minimum recorded is –26 °C, and absolute maximum temperature is 38.9 °C. Annual precipitation averages 1,078 mm, the highest amount occurring in June (108 mm), and the lowest in February (73 mm). Mean annual number

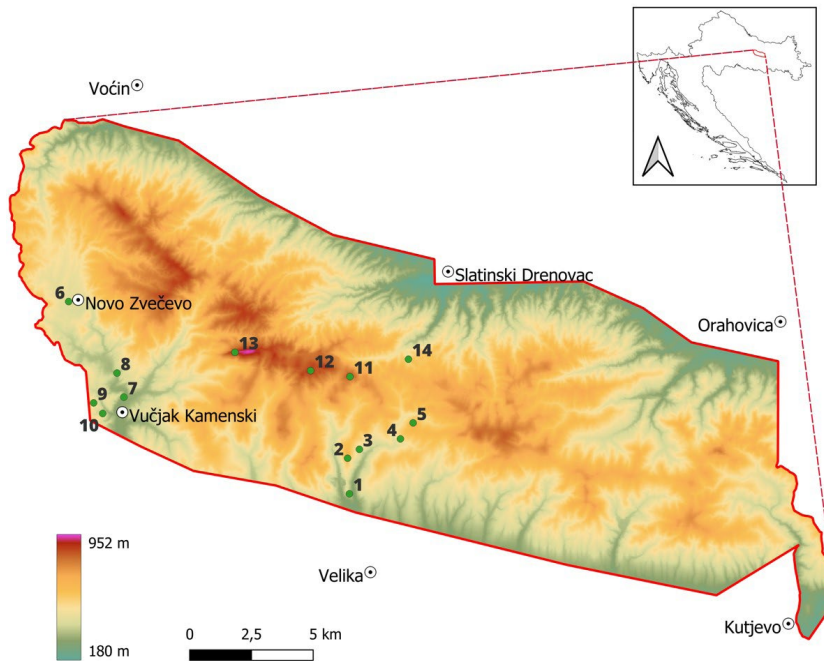


Fig. 1. Map of Papuk Nature Park with geographical position in Croatia and location of collection sites.

of days with snow is 22, and with frost is 45. Air humidity ranges from 72% in April to 83% in November and December, with 77% as mean value.

Forest habitats cover 32,699 ha or 95% of the Park area, and include 13 communities, distributed into three altitudinal belts (ŠKVORC *et al.*, 2011, VUKELIĆ, 2012). The community *Epimedio-Carpinetum betuli* grows in the colline belt (100-250 m). Beech forest communities: *Galio odorati-Fagetum*, *Cephalanthero longifoliae-Fagetum*, and *Cardamini savensi-Fagetum*, prevail in the montane belt (250-800 m). The beech-fir community *Festuco drymeiae-Abietetum* grows in the altimontane belt (above 800 m), beside the community *Chrysanthemo macrophylli-Aceretum pseudoplatani* in the northwestern part of the Papuk area. The thermophilic community *Quercetum frainetto-cerris* can be found in the southeastern Park area, reaching the westernmost border of its distributional range. The warmer exposure and basiphilic substrate favour the growth of another thermophilic community *Fraxino orni-Quercetum pubescentis* in the southern Papuk area.

Collection sites

Sampling was carried out during fieldwork in the period between 2013 and 2021, at 14 sites (Fig. 1) listed below. Coordinates of the sites follow the World Geodetic System (WGS84) as the reference frame.

1 – Lapjak ridge, trail from the valley of Dubočanka stream to ruins of Velika fortress, *Pinus nigra* plantation, forest community *Fraxino orni-Quercetum pubescentis*, 45.4697550 N, 17.6548814 E, alt. 320-452 m, 4 August 2014, 10 July 2018

2 – Lapjak ridge, Tauberove stijene, near the peak of Lapjak ridge, quartz sandstone rock outcrops, forest community *Fraxino orni-Quercetum pubescentis*, 45.4827256 N, 17.6541973 E, alt. 620-667 m, 10 July 2018

3 – Lapjak ridge, trail descending from the peak of Lapjak ridge to the valley of Dubočanka stream, forest community *Galio odorati-Fagetum*, 45.4859084 N, 17.6603597 E, alt. 430-540 m, 4 August 2014

4 – Trail from the Tisica quarry towards Tisovac ridge, forest community *Cephalanthero longifoliae-Fagetum*, 45.4894815 N, 17.6817098 E, alt. 540 m, 4 August 2014, 4 January 2021

5 – Peak of Tisovac ridge, quartz sandstone rock outcrops surrounded by low shrubs of *Vaccinium myrtillus*, 45.4952570 N, 17.6884040 E, alt. 640 m, 4 August 2014

6 – Zvečevo, a row of deciduous trees along the meadow, 45.5411851 N, 17.5107170 E, alt. 430 m, 21 August 2019

7 – The Jelen hunting lodge near Brzaja stream, on various conifer and deciduous trees, 45.5060947 N, 17.5387188 E, alt. 310 m, 5 June 2019

8 – Čarugin kamen and gorge of Brzaja stream, migmatite rock, 45.5149086 N, 17.5353090 E, alt. 350 m, 26 October 2018

9 – Svinjarevac, slopes above the valley of Svinjarevac stream, beech forest community *Cephalanthero longifoliae-Fagetum*, 45.5041460 N, 17.5230132 E, alt. 480 m, 21 August 2019

10 – Svinjarevac, a ravine of a small stream, tributary of Svinjarevac stream, forest community *Fagus sylvatica-Sphagnum quinquefarium*, 45.5002326 N, 17.5276270 E, alt. 390-430 m, 15 October 2013, 8 October 2019, 12 September 2020

11 – Koprivnato brdo, forest community *Cardamini savensi-Fagetum*, 45.5124328 N, 17.6560605 E, alt. 830 m, 20 August 2019

12 – Ivačka glava, forest community *Cardamini savensi-Fagetum*, 45.5148414 N, 17.6356886 E, alt. 910 m, 20 August 2019

13 – Peak area of Papuk mountain, forest community *Cardamini savensi-Fagetum*, 45.5218992 N, 17.5965835 E, alt. 940 m, 20 August 2019

14 – Jankovac, between the spring of the Jankovac stream and the locality of Count's tomb, forest community *Chrysanthemo macrophylli-Aceretum pseudoplatani*, 45.5184895 N, 17.6864753 E, alt. 480 m, 25 March 2021

Size of the beech (*Fagus sylvatica*) trees, hosting the community *Lobarion pulmonariae* at locality Svinjarevac, was assessed by measuring the stem diameter at breast height (dbh, 1.3 m aboveground).

Identification and nomenclature

The specimens were identified in the field by a hand lens, and in the laboratory using a dissecting microscope, a light microscope and the usual spot tests, according to the reference books and monographs such as: BOLUDA *et al.* (2019), DOBSON (2018), RANDLANE *et al.* (2011), SMITH *et al.* (2009), and WIRTH *et al.* (2013). Nomenclature mainly follows MAYRHOFER *et al.* (2018b), and NIMIS (2016). Voucher specimens are deposited in the Herbarium Croaticum (ZA) at Division of Botany, Faculty of Science, University of Zagreb.

In the list of recorded lichen taxa (Tab. 1), the genera and species within each genus are arranged alphabetically. New records for Papuk Nature Park are marked with an asterisk (*). Taxa with suboceanic distribution, most common in areas with a humid-warm climate (Nimis, 2016), are marked with (*). For each taxon, a note is given about locality and substrate.

Substrate abbreviations: Ace pse = *Acer pseudoplatanus*; Aln glu = *Alnus glutinosa*; Bet pen = *Betula pendula*; Car bet = *Carpinus betulus*; Fag syl = *Fagus sylvatica*; Fra exc = *Fraxinus excelsior*; Fra orn = *Fraxinus ornus*; lig = on lignum; Mal dom = *Malus domestica*; moss = on mosses; Pin nig = *Pinus nigra*; Pru avi = *Prunus avium*; Que pet = *Quercus petraea*; Que pub = *Quercus pubescens*; Sam nig = *Sambucus nigra*; sax = on rock; sil = on siliceous rock; ter = on soil; Til tom = *Tilia tomentosa*

RESULTS

Our study resulted in the finding of 85 taxa (79 species, one subspecies and 5 varieties) of lichens (Tab. 1), out of which there were 28 species newly recorded for Papuk Nature Park.

Tab. 1. The list of lichen taxa recorded during the survey in Papuk Nature Park.

Nr	Species	Locality	Substrate
1.	<i>Acarospora fuscata</i> (Schrad.) Arnold	2	sil
2.	* <i>Agonimia tristicula</i> (Nyl.) Zahlbr.	11	moss
3.	<i>Anaptychia ciliaris</i> (L.) Flot.	1, 10, 13	Fag syl, Fra orn, Que pub
4.	<i>Aspicilia cinerea</i> (L.) Körb.	2	sil
5.	* [▲] <i>Bacidia rosella</i> (Pers.) De Not.	10	moss, Fag syl
6.	* <i>Baeomyces rufus</i> (Huds.) Rebert.	4	ter
7.	<i>Bryoria fuscescens</i> (Gyeln.) Brodo & D. Hawksw.	4	Fag syl
8.	* [▲] <i>Buellia griseovirens</i> (Turner & Borrer ex Sm.) Almb.	10	Fag syl
9.	* <i>Candelariella aurella</i> (Hoffm.) Zahlbr.	1	sil
10.	* [▲] <i>Cetrelia olivetorum</i> (Nyl.) W.L. Culb. & C.F. Culb	10	Fag syl
11.	* <i>Chaenotheca chrysocephala</i> (Ach.) Th. Fr.	10	Fag syl
12.	* <i>Chaenotheca trichialis</i> (Ach.) Hellb.	10	Fag syl
13.	<i>Chrysothrix candelaris</i> (L.) J.R. Laundon	10, 11, 12	Ace pse, Fag syl
14.	[▲] <i>Cladonia cervicornis</i> (Ach.) Flot. subsp. <i>verticillata</i> (Hoffm.) Ahti	10	moss, ter
15.	* [▲] <i>Cladonia ciliata</i> Stirt.	5	ter
16.	<i>Cladonia coniocraea</i> (Flörke) Spreng.	7, 9	Aln glu, Que pet
17.	* <i>Cladonia crispata</i> (Ach.) Flot.	5	ter
18.	* [▲] <i>Cladonia foliacea</i> (Huds.) Willd.	1	ter
19.	<i>Cladonia furcata</i> (Huds.) Schrad.	4, 5, 9, 10	moss
20.	<i>Cladonia gracilis</i> (L.) Willd.	2, 5	moss
21.	* <i>Cladonia parasitica</i> (Hoffm.) Hoffm.	1	Que pub
22.	[▲] <i>Cladonia portentosa</i> (Dufour) Coem.	2, 9, 10	moss, ter
23.	<i>Cladonia pyxidata</i> (L.) Hoffm.	1, 4	ter, lig
24.	<i>Cladonia rangiferina</i> (L.) F.H. Wigg.	2, 5, 9, 10	moss
25.	* <i>Cladonia rangiformis</i> Hoffm.	10	moss

Tab. 1. Continued

Nr	Species	Locality	Substrate
26.	<i>Cladonia squamosa</i> Hoffm.	2, 9, 10	moss
27.	* <i>Dermatocarpon luridum</i> (With.) J.R. Laundon	8	sax
28.	<i>Dermatocarpon miniatum</i> (L.) W. Mann	1, 11	sax
29.	<i>Evernia prunastri</i> (L.) Ach.	6, 7, 10, 12	Ace pse, Aln glu, Bet pen, Fag syl, Mal dom
30.	<i>Flavoparmelia caperata</i> (L.) Hale	1, 2, 4, 6, 7, 10	Aln glu, Bet pen, Fag syl, Fra orn, Que pub
31.	<i>Graphis scripta</i> (L.) Ach.	4, 9	Car bet, Fag syl
32.	<i>Hypogymnia physodes</i> (L.) Nyl.	2, 3, 4, 6, 9, 10	Bet pen, Fag syl, Que pet
33.	<i>Hypogymnia tubulosa</i> (Schaer.) Hav.	10	Fag syl
34.	* <i>Icnadophila ericetorum</i> (L.) Zahlbr.	10	lig
35.	<i>Lasallia pustulata</i> (L.) Mérat	5	sil
36.	<i>Lathagrium auriforme</i> (With.) Otálora, P.M. Jørg. & Wedin	3, 11, 14	moss
37.	<i>Lathagrium cristatum</i> (L.) Otálora, P.M. Jørg. & Wedin var. <i>marginale</i> (Huds.) Cl. Roux	1	sax
38.	* <i>Lecanora albella</i> (Pers.) Ach.	10	Bet pen
39.	<i>Lecanora intumescens</i> (Rebent.) Rabenh.	9, 10	Fag syl
40.	<i>Lecidella elaeochroma</i> (Ach.) M. Choisy	1, 11	Car bet, Fra orn
41.	<i>Lepra albescens</i> (Huds.) Hafellner var. <i>albescens</i>	1, 10, 12	Ace pse, Bet pen, Fra orn
42.	<i>Lepra amara</i> (Ach.) Hafellner	4, 7, 9, 10, 11, 13	Aln glu, Fag syl, Fra exc
43.	* <i>Lepraria incana</i> (L.) Ach.	1	Fra orn, Pin syl
44.	▲ <i>Lobaria pulmonaria</i> (L.) Hoffm.	10	Fag syl
45.	*, ▲ <i>Lobarina scrobiculata</i> (Scop.) Nyl. ex Cromb.	8	ter
46.	* <i>Melanelixia glabra</i> (Schaer.) O. Blanco et al.	1, 12	Ace pse, Que pet
47.	<i>Melanelixia subaurifera</i> (Nyl.) O. Blanco et al.	6, 7, 9, 10, 11	Ace pse, Aln glu, Bet pen, Fag syl
48.	<i>Myriolecis dispersa</i> (Pers.) Šliwa, Zhao Xin & Lumbsch	1	sax
49.	▲ <i>Nephroma parile</i> (Ach.) Ach.	10	Fag syl
50.	*, ▲ <i>Pannaria conoplea</i> (Ach.) Bory	10	Fag syl
51.	<i>Parmelia saxatilis</i> (L.) Ach.	2, 9, 10	sax, Fag syl
52.	<i>Parmelia sulcata</i> Taylor	2, 3, 4, 7, 9, 10, 11, 12, 13	Aln glu, Ace pse, Fag syl, Fra exc, Mal dom, Que pub
53.	* <i>Parmelina quercina</i> (Willd.) Hale	1, 11	Ace pse, Que pub
54.	<i>Parmelina tiliacea</i> (Hoffm.) Hale	1, 4, 10, 11, 12, 13	Ace pse, Fag syl, Fra exc, Que pub
55.	*, ▲ <i>Parmotrema crinitum</i> (Ach.) M. Choisy	10	Fag syl
56.	▲ <i>Parmotrema perlatum</i> (Huds.) M. Choisy	10	Fag syl
57.	<i>Peltigera collina</i> (Ach.) Schrad.	10	Fag syl
58.	<i>Peltigera horizontalis</i> (Huds.) Baumg.	10	Fag syl
59.	<i>Peltigera praetextata</i> (Flörke ex Sommerf.) Zopf	3, 8, 9, 10, 14	Fag syl, moss
60.	▲ <i>Pertusaria flavida</i> (DC.) J.R. Laundon	11	Ace pse
61.	<i>Pertusaria pertusa</i> (L.) Tuck. var. <i>pertusa</i>	10, 11, 12, 13	Ace pse, Fag syl, Fra exc
62.	<i>Phlyctis argena</i> (Spreng.) Flot.	1, 10, 12	Ace pse, Car bet, Fag syl

Tab. 1. Continued

Nr	Species	Locality	Substrate
63.	<i>Physcia adscendens</i> H. Olivier	6, 7, 11, 12	Ace pse, Bet pen, Sam nig
64.	<i>Physcia stellaris</i> (L.) Nyl.	1, 12	Ace pse, Fra orn
65.	<i>Physcia tenella</i> (Scop.) DC.	12	Ace pse
66.	<i>Physconia distorta</i> (With.) J.R. Laundon	1	Fra orn
67.	* <i>Physconia grisea</i> (Lam.) Poelt	1, 12, 13	Fag syl, Fra exc, Fra orn
68.	<i>Platismatia glauca</i> (L.) W.L. Culb. & C.F. Culb.	4, 10	Fag syl
69.	<i>Pleurosticta acetabulum</i> (Neck.) Elix & Lumbsch	13	Fra exc
70.	* <i>Porpidia crustulata</i> (Ach.) Hertel & Knoph	4, 8, 14	sax
71.	<i>Pseudevernia furfuracea</i> (L.) Zopf var. <i>furfuracea</i>	1, 2, 10, 11	Ace pse, Fag syl, Fra orn, Pin nig
72.	* <i>Punctelia subrudecta</i> (Nyl.) Krog	1, 10	Fag syl, Fra orn, Til tom
73.	<i>Ramalina farinacea</i> (L.) Ach.	4, 9, 10	Ace pse, Fag syl
74.	<i>Ramalina fastigiata</i> (Pers.) Ach.	1, 10, 12	Ace pse, Fag syl, Fra orn
75.	<i>Ramalina fraxinea</i> (L.) Ach.	6, 11, 13	Ace pse, Bet pen, Fra exc
76.	▲ <i>Rhizocarpon distinctum</i> Th. Fr.	2	sil
77.	<i>Squamarina cartilaginea</i> (With.) P. James	1	ter
78.	<i>Umbilicaria hirsuta</i> (Westr.) Hoffm.	4	sil
79.	* <i>Usnea ceratina</i> Ach.	4	Fag syl
80.	* <i>Usnea dasopoga</i> (Ach.) Nyl.	10	Fag syl
81.	* <i>Usnea subfloridana</i> Stirt.	10	Fag syl
82.	<i>Verrucaria nigrescens</i> Pers.	1	sax
83.	<i>Xanthoparmelia conspersa</i> (Ehrh. ex Ach.) Hale	5, 8	sil
84.	<i>Xanthoparmelia pulla</i> (Ach.) O. Blanco et al. subsp. <i>pulla</i> var. <i>pulla</i>	2, 5	sil
85.	<i>Xanthoria parietina</i> (L.) Th. Fr.	6, 7, 11, 12	Ace pse, Bet pen, Sam nig

DISCUSSION

After revision of checklist provided by LABAK *et al.* (2011), considering previous reports (DEME *et al.*, 2017, ALEGRO *et al.*, 2018, MAYRHOFER *et al.*, 2018a), and results of the survey, the current lichen diversity of Papuk Nature Park is estimated to comprise 168 taxa, around 15% of the total lichen flora of Croatia.

The knowledge on lichen diversity of Papuk Nature Park has been expanded by an additional 28 new species: *Agonimia tristicula*, *Baeomyces rufus*, *Bacidia rosella* (Fig. 2), *Buellia griseovirens*, *Candelariella aurella*, *Cetrelia olivetorum*, *Chaenotheca chrysocephala*, *Chaenotheca trichialis*, *Cladonia ciliata*, *Cladonia crispata*, *Cladonia foliacea*, *Cladonia parasitica*, *Cladonia rangiformis*, *Dermatocarpon luridum* (Fig. 3), *Icmadophila ericetorum*, *Lecanora albella*, *Lepraria incana*, *Lobarina scrobiculata* (Fig. 4), *Melanelixia glabra*, *Pannaria conoplea* (Fig. 5), *Parmelina quercina*, *Parmotrema crinitum*, *Physconia grisea*, *Porpidia crustulata*, *Punctelia subrudecta*, *Usnea ceratina* (Fig. 6), *Usnea dasopoga*, and *Usna subfloridana*.

The locality Svinjarevac is recognized as a place of exceptionally rich lichen diversity with 43 recorded taxa (51% of reported taxa and 26% of the total lichen diversity of Papuk Nature Park). An old-growth acidophilic beech forest from the community *Fagus sylvatica*-*Sphagnum quinquefarium*, is developed on steep slopes (about 60-degree) in a ravine of a small nameless stream, a tributary of Svinjarevac stream (Fig. 7). Ground layer is characterized with fragments of peat bogs, consisting of peat moss (*Sphagnum quinquefarium*) on acid soil and growing over the granite and silicate rocks. In peat bogs

compact *Cladonia* mats develop, including species such as: *Cladonia cervicornis* subsp. *verticillata*, *Cladonia furcata*, *Cladonia portentosa*, *Cladonia rangiferina*, *Cladonia rangiformis* and *Cladonia squamosa*. Old beech trees, peculiar in their shape, with twisted branches, hollow stems and boles overgrown with mosses, harbour a well developed, threatened lichen community *Lobarion pulmonariae*. Selected lichen species from this community are good indicators of undisturbed forests, with long ecological continuity due to stable environment in terms of light, moisture and temperature (GRIMM *et al.*, 2021), as well as of high levels of general biodiversity in a forest (NASCIMBENE *et al.*, 2010). The flagship species is *Lobaria pulmonaria*, a large foliose lichen, threatened across Europe, due to negative impact of air pollution by sulphur dioxide (GAUSLAA, 1995), nitrogen-containing air pollutants, and degradation of forest habitats, caused by unfavourable management practices (BRUNIALTI *et al.*, 2015, HOFMEISTER *et al.*, 2016).



Fig. 2. *Bacidia rosella*.

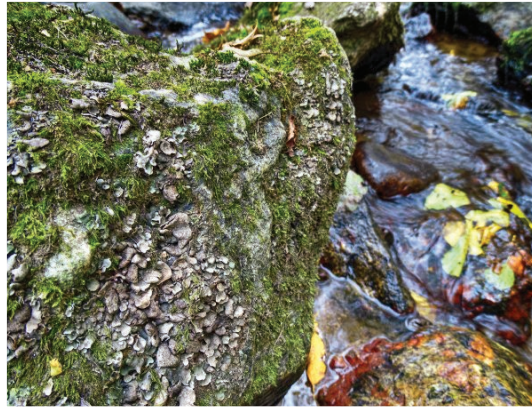


Fig 3. *Dermatocarpon luridum*.



Fig. 4. *Lobarina scrobiculata*.



Fig. 5. *Pannaria conoplea*.



Fig. 6. *Usnea ceratina*.



Fig. 7. Old-growth beech forest at the locality Svinjarevac

The *Lobarion pulmonariae* community and its specific species were recorded at Svinjarevac on beech trees with a stem diameter ranging from 102 cm to 167 cm dbh, and the mean tree size was 135 cm dbh.

Out of 43 lichen taxa recorded at the locality Svinjarevac, 10 taxa (22%) have suboceanic distribution, most common in areas with a humid-warm climate (NIMS, 2016). Their occurrence confirms that habitat conditions, mainly rainfall, dewfall and humid air, provide sufficient hydration sources for epiphytic lichens (GAUSLAA, 2014). Thus, the locality Svinjarevac, with an area of only 2.6 ha, is recognized as a kind of refugium of the lichens with suboceanic distribution in the continental part of Croatia.

Discovery of the epiphytic species *Bacidia rosella* is of considerable importance, because it is the most recent country record after 103 years, previously known from localities in the surroundings of Koprivnica, during the survey in spring 1917, carried out by the Hungarian lichenologist László Sántha (SÁNTHA, 1922). Records of two species: *Lobarina scrobiculata*, previously discovered by Marko Doboš at the locality Čarugin kamen in 2018, and *Pannaria conoplea*, are valuable because this is the first confirmed occurrence in the continental part of Croatia (Appendix 1). Their distribution range in Croatia is mostly confined to the Dinaric Mountains, including the coastal range and in the coastal and island area of the Adriatic Sea (OZIMEC, 2011).

ACKNOWLEDGMENTS

We are grateful to Helmut Mayrhofer, Peter Othmar Bilovitz, Brian Coppins and Neil Sanders for their help in checking the collected specimens and species identification.

We are also grateful to the Public Institution Papuk Nature Park for providing technical and financial support for implementation of the scientific project: Lichen Research in the Papuk Nature Park (contract no. 02/19), carried out in the period May - November 2019.

Received January 24, 2022

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APPENDIX 1.

Distribution maps of *Lobarina scrobiculata* and *Pannaria conoplea* in Croatia.

