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Bryological inventory of the Plešné Lake cirque (Šumava National Park)

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Abstract

One hundred and ninety-seven species of bryophytes were recorded during the bryfloristic survey of the Plešné Lake cirque and moraine conducted in summer and autumn 2024. The inventory resulted in two new country records (*Coscinodon humilis* and *Racomitrium obtusum*) and at least two other species new to the Šumava region (*Ortholimnobium handelii* and *Ulota macrospora*). Ten of the recorded species are considered threatened according to the country's latest Red List. Verification of critical determinations included molecular barcoding, which confirmed the presence of some taxonomically not yet fully resolved taxa (*Calypogeia* aff. *fissa*, *Andreaea alpestris*). The bryoflora includes a large proportion of markedly oceanic taxa (*Kurzia trichoclados*, *Dicranodontium uncinatum*, *Racomitrium obtusum*), while the arctic-alpine taxa are nearly missing, in stark contrast to the bryoflora of the cirques in the Giant Mts. Of particular interest is a group of Alpic and Alpic-Himalayan species (*Plagiothecium neckeroideum*, *Ortholimnobium handelii*, *Coscinodon humilis*), generally absent from more northern cirques. No significant changes in the bryoflora over the period of historical exploration could unequivocally be documented, except for the retreat of several epiphytic species, confirming the exceptional value of the locality, which should continue enjoying the strict protection from human impacts in the future.

Key words: Bohemian Forest, bryoflora, Alpine elements, molecular barcoding

Introduction

Bryophytes are an important component of vegetation, especially in montane and alpine habitats. Although their diversity can significantly exceed that of vascular plants in peatland habitats and on substrates inaccessible to vascular plants, such as epilithic and epiphytic substrates, knowledge of bryophyte diversity is poor in most regions, including densely surveyed Central and Western Europe. This is due both to the small size of bryophytes and the frequently gregarious growth of individual plants intermingled with other species, which makes their detection difficult and time-consuming, and to the generally small number of specialists capable of carrying out effective surveys. The inadequate knowledge of the bryoflora applies to most regions in the world.

Glacier cirques are generally the sites of extraordinary high bryophyte diversity with respect to the diversity of microhabitats that are generally rich in bryophytes, such as the boulder screes with high air humidity, rock bases, seepage rock faces, small streams running through ravines and cirque slopes, or sloping spring sites in tall-herb vegetation. The species richness in the cirques of the Czech High Sudetes have been documented in the series of articles from dedicated bryological surveys in the early 2000s (KUČERA et al. 2004a, 2004b, 2009), although even these detailed works cannot be considered complete inventories, as evidenced by the numerous additions discovered at these localities since then (e.g., KUČERA & VÁŇA 2016, ELLIS et al. 2019, DŘEVOJAN et al. 2021).

Historical data

Unfortunately, the knowledge of bryoflora of the Bohemian Forest is rather poor, particularly with respect to modern-era surveys, and this also applies to the bryoflora of its glacial cirques. Only two systematic attempts were made at the Czech side of the mountain range, the first one made by M. Rivola, who surveyed the liverwort flora of the cirques at the Czech side in 1969 and published a simple list of records (RIVOLA 1971a, 1971b); the next contribution was published by SOLDÁN & VÁŇA (2002), who put together the literature records and results of their own recent surveys of four Czech glacial cirques (Plešné, Laka, Čertovo and Černé Lake cirques; Prášilské Lake cirque was not included because of the bark beetle infestation which made the survey impossible at that time). Even this paper, however, failed to explore the cirques comprehensively, as witnessed by the reported absence of numerous common species and did not present detailed site collection data even for the most important records.

The history of the bryological survey of the Plešné Lake cirque is remarkably sparse. The first concrete data were probably mentioned in the report by V. Schiffner, who made a one-day trip to this locality in 1887 (SCHIFFNER 1890) and reported 5 liverworts and 8 mosses, which caught his interest, and of which most were however reported from the valley of Roßbach (Koňský potok, c. 2 km E of Plešné Lake), and only *Schistostega pennata* is specifically mentioned from the spring below the monument to A. Stifter. More records (23 moss species, the liverworts were not reported at all) were reported specifically from Mt. Plechý (Plöckenstein) and the cirque face (Plöckensteiner Seewand) by J. Podpěra (PODPĚRA 1899), who discovered one of the peculiarities of the cirque's bryoflora, *Andreaea crassinervia* (reported, however, as *A. frigida*, cf. SOLDÁN & BURYOVÁ 2001). The following bryological data were provided by A. Hilitzer (HILITZER 1925), who studied the epiphytic vegetation in multiple localities of Bohemia. He reported several records of very interesting and never rediscovered bryophytes, such as *Frullania tamarisci*, *Metzgeria pubescens*, *Neckera pennata* or *N. pumila*. Most of the records have nevertheless never been revised, and those which were revised sometimes did not prove correctly identified (such as the specimen named *Dicranum muehlenbeckii* that proved to be *D. fuscescens*; KUČERA 1995). The continuity of exploration has been largely interrupted in the post-WWII period following the inclusion of the Plešné Lake surroundings in the no-entry boundary zone. Apart from the above-mentioned brief survey by Rivola, only a few records, made by non-specialists as a part of mostly phytosociological explorations in the 1960s–1980s exist (notably SOFRON & ŠTĚPÁN 1971). The post-1989 period finally brought a revival of interest in the bryological exploration of the Plešné Lake cirque and surrounding sites. Most records were presented by KUČERA (1995), who reported 97 species of bryophytes, found during the study of epilithic bryophyte communities in Šumava National Park. Although the results of this diploma thesis have never been published, they are available in the database of records of the Nature Conservation Agency of the Czech Republic (AOPK ČR n.d.). The above-mentioned survey by SOLDÁN & VÁŇA (2002) reported a total of 174 bryophytes from the cirque of Plešné Lake (109 verified literature records, 52 new and 13 unverified finds), making it the richest cirque locality on the Czech side of the mountain range. Additional records from the cirque were reported by M. Kočí in the Czech National Phytosociological Database (available through the Dalibor database, DALIBOR n.d., MAN et al. 2022).

As the study area of the current survey included the lake moraine ("Kamenné moře") east of the lake, three additional sources of information on bryophytes need to be mentioned, the records from a bryological excursion that passed Kamenné moře was reported by MIKULÁŠKOVÁ et al. (2007), the publication of several interesting records reported by F. Müller (KUČERA 2007), and the unpublished records from an excursion by J. Kučera in 2021 (AOPK ČR n.d.).

METHODS

We conducted a total of seven full-day visits to the surveyed area, during which we inventoried five sectors of the cirque (sub-localities 2, 3a, 3b, 4 and 5, Table 1 and Fig. 1), the lake surroundings (sectors 1a-c, with only sub-site 1a being inventoried in a focused manner) and the Kamenné moře scree to the east of the lake (sub-locality 6). The sub-localities were delimited in the field according to vegetation and geomorphological criteria, in order to achieve the best survey of the expected bryofloristic diversity of the entire surveyed area, and were the target of a full-day survey each. The lengths of the tracks within the studied sub-localities are estimated at c. 6.5 km, with the maximum width of surveyed area of c. 5 metres.

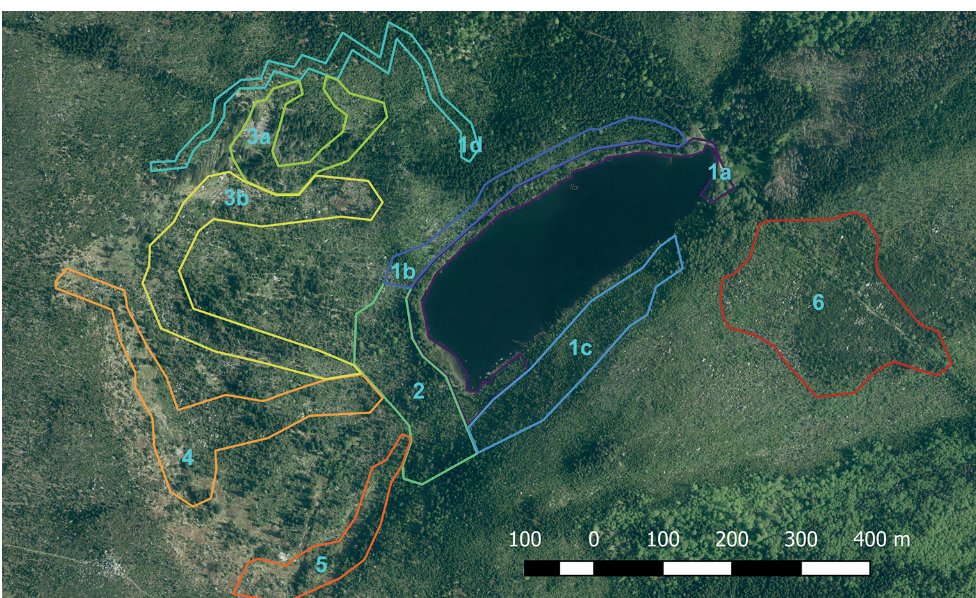

Fig. 1. Delimitation of the sub-localities on aerial map.

Table 1. Surveyed sub-localities. Sites marked with an asterisk were not the subject of a targeted survey.

Code	Locality	Elevation (m a.s.l.)	Survey date
1a	Immediate surroundings of the lake	1090	16. 7. 2024, also 18. 7. 2024, 25. 7. 2024, 26. 7. 2024, 20. 9. 2024
1b*	SE slope above the lake	1090–1130	16. 7. 2024, also 18. –19. 7. 2024, 26. 7. 2024
1c*	NW slope above the lake	1090–1130	16. 7. 2024, also 18. 7. 2024
1d*	spruce forest around the trail to the Stifter Monument	1130–1260	19. 7. 2024, also 25. 7. 2024
2	scree above the SW to S end of the lake	1090–1350	18. 7. 2024, also 16. 7. 2024, 25. 7. 2024
3a	N part of cirque NE of the Stifter Monument	1150–1230	19. 7. 2024
3b	N part of cirque E and SE Monument	1100–1270	26. 7. 2024
4	S part of cirque N-NNE of the summit of Mt. Plechý (Plöckenstein)	1105–1325	12. 10. 2024
5	S part of cirque ENE of the summit of Mt. Plechý (Plöckenstein)	1200–1340	25. 7. 2024
6	Kamenné moře	1070–1110	20. 9. 2024

Species which could be safely identified in the field were entered directly into the recording application BioLog, from where they were subsequently exported to the BioLog database (https://biolog.nature.cz/), with automatic synchronization to the Recording Database of Nature Conservation Agency of the Czech Republic (https://portal.nature.cz/nd/). Common species were generally recorded only once in each sector, while more important (rare or taxonomically critical) species were recorded more frequently or always (the latter in the case of endangered or regionally important species). After the inventory of each sector was completed, the frequency of occurrence of the recorded species was estimated on an *ad hoc* scale (1 = 1 occurrence, 2 = 2–3 occurrences, 3 = 4–6 occurrences, 4 = 7–10 occurrences, 5 = more than 10 occurrences). Species that could not be identified in the field or species, for which documentation was desirable, were documented by a collection (with recording the coordinates of the find using a Garmin eTrex 32x handheld GPS device, habitat data and, for rarer species, estimated population size) for subsequent filing in the herbarium of the Faculty of Science, University of South Bohemia (CBFS). Species identification followed the latest available identification literature. In cases of doubt, the molecular barcoding using either the nrITS or chloroplast *trn*F-*trn*T or *rps*4 was realized, with DNA isolation, amplification and purification in the molecular laboratory of the Department of Botany, Faculty of Science, University of South Bohemia, according to the protocols specified in KUČERA et al. (2019), followed by DNA sequencing in the facilities of Eurofins Genomics GmbH (Cologne, Germany). The frequencies of occurrences of species not recorded or not distinguished in the field were completed after the determination was finalized, and changes in field determinations were also corrected in the BioLog/NDOP databases.

The nomenclature used throughout this text follows HODGETTS et al. (2020), except in cases where the names were missing in this list, in which case we specify the authors. The threat categories follow KUČERA et al. (2012).

RESULTS

Summary of records and recorded taxa

During the 2024 bryological field inventory of the site, 1557 species occurrence records were uploaded to the BioLog database (https://biolog.nature.cz/). The records are also available through the interface of the Database of records of the Nature Conservation Agency of the Czech Republic (https://portal.nature.cz/nd/). These records are supported by 311 specimens containing 381 databased species records (some physical specimens contain several identified and databased species records); the specimens are filed in the CBFS herbarium. In total, 197 species of mosses and one additional variety (61 liverworts and 136+1 mosses) were recorded. Their overview is presented in Table 2. Of these, two species were recorded for the first time in the whole Czech Republic (*Coscinodon humilis and Racomitrium obtusum*, ELLIS et al. 2024), at least three other species are new to the whole Šumava region (*Lescuraea mutabilis*, *Ortholimnobium handelii* and *Ulota macrospora*). The species *Tortella commutata* has only recently been described (KÖCKINGER & HEDENÄS 2023), but occurs at least as frequently as *T. tortuosa* in the Czech Republic (ELLIS et al. 2024). *Sphagnum divinum* is also a relatively newly distinguished species, previously reported from Europe as *S. magellanicum* (HASSEL et al. 2018). Some of the taxa are not yet fully taxonomically resolved, e.g., the liverwort designated here as "*Calypogeia* aff. *fissa*", which appears to be an undescribed species of the *C. fissa* affinity, which is referred to as "*Calypogeia muelleriana* group B" by BUCZKOWSKA & BĄCZKIEWICZ (2011), or *Andreaea alpestris*, classified as a taxonomically unclear case in the last checklist (KUČERA et al. 2012), recognized here on the basis of newly available molecular data (see the comment below).

Of the total number of species, only ten (i.e., 5%) are considered threatened according to the latest, unfortunately no longer up-to-date, Red List (KUČERA et al. 2012). One moss (*Andreaea crassinervia*) is classified as Critically Endangered, eight bryophyte species (*Kurzia trichoclados*, *Lophozia ascendens*, *Marsupella sprucei*, *Obtusifolium obtusum*, *Dicranodontium uncinatum*, *Lescuraea mutabilis*, *Plagiothecium neckeroideum*, *Warnstorfia pseudostraminea*) are classified as Endangered, one (*Plagiothecium denticulatum* var. *obtusifolium*) is classified as Vulnerable, eleven are classified as Near Threatened and two as Data Deficient. Nine of the species found were not evaluated in the latest version of the checklist and red list, mostly due to their uncertain occurrence in our territory at that time. In addition to the above two recently found species, *Ortholimnobium handelii* and *Ulota macrospora*, some species were newly distinguished or reinstated from synonymy on the basis of new taxonomic knowledge (*Andreaea alpestris*, *Jochenia protuberans*, *Sphagnum divinum*, *Tortella commutata*, *Ulota crispula*).

Table 2. Moss taxa and frequency of their occurrence recorded in the inventoried sub-localities during the 2024 survey. Threat categories correspond Kučera et al. (2012). Asterisks in the column "Stat." (status) correspond to new records in the surroundings of Lake Plešné (*), to species newly found in the Czech part of Šumava (**), or in the whole Czech Republic (***). The site codes correspond to Table 1, the numbers in the species columns at the sub-localities correspond to the scale explained in the Methods section.

Stat.	Species	Threat	1a	1b	1c	1d	2	3a	3b	4	5	6
	Liverworts											
	Anastrepta orcadensis	LC-att			3		5	2	1	4	5	2
	Barbilophozia barbata	LC					2	1				
	Barbilophozia hatcheri	LC								2		
	Barbilophozia lycopodioides	LC			1		4		4	5	5	1
	Bazzania tricrenata	LR-nt			3	1	5	3	5	5	5	5
	Bazzania trilobata	LC	5	4	5		5	4	5	4		5
	Blepharostoma trichophyllum	LC	3	3			5		3	4	3	5
	Calypogeia azurea	LC				2	4	2	3	4	5	
*	*Calypogeia* aff. *fissa*	NE						2				
	Calypogeia integristipula	LC	1				5		3	5		5
	Calypogeia muelleriana	LC						2				
	Calypogeia suecica	LR-nt					3					
	Cephalozia bicuspidata	LC	4	5		2	5	2	3	1	5	1
*	*Cephalozia catenulata*	LR-nt	2	3		3	4	3		3	1	3
	Cephalozia leucantha	LR-nt		1	1		3			2		
	Cephalozia lunulifolia	LC			2		5		3	3		2
	Cephaloziella divaricata	LC							1			3
*	*Cephaloziella hampeana*	LC-att	1									
	Diplophyllum albicans	LC					3	3	5	5	5	
	Diplophyllum taxifolium	LC							1	2		1
	Frullania dilatata	LC	1						1			
	Gymnocolea inflata	LC	2					2	2	4		
*	*Isopaches bicrenatus*	LR-nt										2
	Kurzia trichoclados	EN					5					
	Lepidozia reptans	LC	5	5	5		5		5	5		5
	Lophocolea heterophylla	LC	5	4		3	4	3	4	4	5	4
*	*Lophozia ascendens*	EN					1			1		
	Lophozia guttulata	LC					3			1	2	
*	*Lophozia longidens*	LR-nt					2	2	1	2		
	Lophozia ventricosa var. *silvicola*	LC-att	5	3	5	3	5	5	5	5	5	5
	Marsupella emarginata	LC	5			2				3	3	
	Marsupella sphacelata	LC	5					3	2			
	Marsupella sprucei	EN	1			1						
	Metzgeria furcata	LC							2	1		
	Mylia taylorii	LC	1		5		5	4	5	5	5	5
	Nardia scalaris	LC									1	1
	Nowellia curvifolia	LC-att		2		2						1

Table 2. Continued.

Stat.	Species	Threat	1a	1b	1c	1d	2	3a	3b	4	5	6
	Obtusifolium obtusum	EN								1	2	
	Orthocaulis attenuatus	LC	5	5	5		5	5	5	5	5	5
	Orthocaulis floerkei	LC				2		1			2	
	Pellia neesiana	LC				1	1	1	2	5	5	
	Plagiochila asplenioides	LC					3	1	2	1	5	1
	Plagiochila porelloides	LC						1	1	1		
	Pseudolophozia sudetica	LC	5			2		2	5	5	5	
	Ptilidium ciliare	LC				1		1		3		4
	Ptilidium pulcherrimum	LC	5		5		5	5	5	5		5
*	*Radula complanata*	LC	1						2	2		
	Riccardia latifrons	LC-att	2	3	2	4	4		2	2		3
*	*Riccardia palmata*	LC-att									1	2
*	*Scapania curta*	LC	1									2
	Scapania irrigua	LC	5									
	Scapania nemorea	LC	5	2			1	2	1	4	3	
	Scapania subalpina	LR-nt	3									
	Scapania umbrosa	LC	1	5	3	5	5	3	5	3	5	2
	Scapania undulata	LC	5					1	4	2	5	
	Schistochilopsis incisa	LC			1		2		2	4	4	
	Solenostoma gracillimum	LC	1									
	Solenostoma sphaerocarpum	LC						1	3	2	5	
	Sphenolobus minutus	LC			3		4	3	1	3	4	3
	Tritomaria exsecta	LC		2		2		1		1		
	Tritomaria quinquedentata	LC					2					
	Mosses											
(*)	*Andreaea alpestris*	NE (tax.)						1	1	1		
	Andreaea crassinervia	CR						1	2	4		
	Andreaea rothii subsp. *falcata*	LC-att						3	2			
	Andreaea rupestris	LC	2					4	3	5	4	5
	Antitrichia curtipendula	LC-att								1		
	Atrichum undulatum	LC							1			
	Brachytheciastrum velutinum	LC	1									
*	*Brachythecium albicans*	LC	1									
*	*Brachythecium rivulare*	LC							1			
	Brachythecium rutabulum	LC	4	3						1		
	Brachythecium salebrosum	LC	5					1	2	3	2	1
	Bryum capillare	LC	2									
	Bryum moravicum	LC							1	2		
	Bryum pseudotriquetrum	LC									1	
*	*Calliergonella lindbergii*	LC	1									
	Campylopus flexuosus	LC	4					2	1			

Table 2. Continued.

Stat.	Species	Threat	1a	1b	1c	1d	2	3a	3b	4	5	6
	Ceratodon purpureus	LC	3	1								1
***	*Coscinodon humilis*	NE						1				
	Cynodontium polycarpon	LC	4					3	1	4	4	1
	Dicranella heteromalla	LC	4	1			1	1	2	2	5	
	Dicranodontium asperulum	LR-nt					2					2
	Dicranodontium denudatum	LC	5		5		5	5	5	5	5	5
	Dicranodontium uncinatum	EN			1		5	1		2		
	Dicranum flexicaule	LC	4		2		3	1	2	1		2
	Dicranum fuscescens	LC					3					
	Dicranum montanum	LC	5		5		5	5	5	5		5
	Dicranum scoparium	LC	5		5		5	5	5	5	5	5
*	*Didymodon rigidulus*	LC	1									
	Ditrichum pusillum	LC-att										1
*	*Encalypta streptocarpa*	LC	1									
	Eurhynchium angustirete	LC	2	2						3		1
*	*Grimmia ramondii*	LC-att							2			
*	*Hedwigia ciliata*	LC	2						1			
	Herzogiella seligeri	LC	4	4	4	3	3	4	5	2	5	2
	Heterocladium heteropterum	LC						1		1	1	
	Hylocomiadelphus triquetrus	LC	1				1				2	2
	Hylocomiastrum umbratum	LC-att	1		3		5	2	5	5	5	5
	Hylocomium splendens	LC	5		5		5	5	5	5	5	5
*	*Hymenoloma crispulum*	LC							2			
*	*Hypnum andoi*	LC	5				2	3	2		4	1
	Hypnum cupressiforme var. *cupressiforme*	LC	5				5	4	5	5	5	4
	Isothecium alopecuroides	LC	1				1			1		
	Jochenia pallescens	LC-att	3									
*	*Jochenia protuberans*	NE							1		1	1
	Kiaeria blyttii	LC										2
*	*Kindbergia praelonga*	LC		1								
*	*Lescuraea incurvata*	LC								1		
**	*Lescuraea mutabilis*	EN								1		
	Leucobryum juniperoideum	LC	4									
	Leucodon sciuroides	LC							2	1		
*	*Lewinskya affinis*	LC	2				2	2	3	3	2	1
*	*Lewinskya speciosa*	LC	4					1	3	2	2	1
	Mnium hornum	LC		1							1	
	Mnium spinulosum	LC							1			
	Oligotrichum hercynicum	LC				1						
*	*Orthodontium lineare*	LC								2		

Table 2. Continued.

Stat.	Species	Threat	1a	1b	1c	1d	2	3a	3b	4	5	6
**	*Ortholimnobium handelii*	NE								3	2	
*	*Orthotrichum pallens*	LC							1		1	
	Orthotrichum stramineum	LC	3					1	2	1		
	Paraleucobryum longifolium	LC	5		5		5	5	5	5	5	5
	Philonotis fontana	LC									1	
	Plagiomnium affine	LC					4	1	3	5	5	
*	*Plagiomnium medium*	LR-nt									2	
	Plagiothecium curvifolium	LC	3	3	2		5	2				2
	Plagiothecium denticulatum var. *denticulatum*	LC	2				3		2	5	5	
*	*Plagiothecium denticulatum* var. *obtusifolium*	VU								1	2	
	Plagiothecium laetum	LC	5				5	4	3	5	3	4
	Plagiothecium neckeroideum	EN					1		1	2		
	Plagiothecium undulatum	LC	3	1	5		5	3	5	4	5	1
	Platygyrium repens	LC										2
	Pleurozium schreberi	LC	5		5		5	5	5	5		5
	Pogonatum urnigerum	LC	1			2					1	
	Pohlia cruda	LC	1									
*	*Pohlia lutescens*	DD								1		
	Pohlia nutans subsp. *nutans*	LC	5				3	4	5	5	5	3
	Pohlia nutans subsp. *schimperi*	LR-nt						2				
	Polytrichastrum alpinum	LC	2				3	2		3	4	
	Polytrichum commune	LC	5				2	2	1	2	4	
	Polytrichum formosum	LC	5	5	5		5	5	5	5		5
	Polytrichum juniperinum	LC	1					2	2	3	1	1
	Polytrichum longisetum	LC						1	1		1	
	Polytrichum pallidisetum	LC-att	3	1	1	2	4	3	3	1	5	4
*	*Polytrichum perigoniale*	LC										1
	Polytrichum piliferum	LC	2			1			1			2
	Polytrichum strictum	LC	1									
	Pseudoleskeella nervosa	LC								2		
	Pseudotaxiphyllum elegans	LC	2				3	3	4	5	5	
	Pterigynandrum filiforme	LC							2	2		
	Ptilium crista-castrensis	LC-att	4				4	1	2	2	3	4
	Pulvigera lyellii	LC-att	1						1			
*	*Pylaisia polyantha*	LC								1		
	Racomitrium aquaticum	LC	5					5	3	5	5	
	Racomitrium canescens	LC	1						1			
*	*Racomitrium elongatum*	LC										3
	Racomitrium fasciculare	LC	5								1	2

Table 2. Continued.

Stat.	Species	Threat	1a	1b	1c	1d	2	3a	3b	4	5	6
*	*Racomitrium heterostichum*	LC	4									
	Racomitrium microcarpon	LC	5				2	3	3	5		5
***	*Racomitrium obtusum*	NE							1			
	Racomitrium sudeticum	LC	5					5	5	5	5	
	Rhabdoweisia fugax	LC						2	2	2	1	
	Rhizomnium magnifolium	LC-att									2	
	Rhizomnium punctatum	LC		1			3	1	2	3	5	
	Rhodobryum roseum	LC									1	
	Rhytidiadelphus loreus	LC	3	2		2	4	3	5	5	5	5
	Rhytidiadelphus squarrosus	LC	2									1
	Sanionia uncinata	LC		1			2		4	5	4	3
*	*Sarmentypnum exannulatum*	LC	3									
*	*Schistidium crassipilum*	LC	1									
*	*Schistidium dupretii*	LC	1			1						
*	*Schistidium papillosum*	LC	2									
*	*Schistidium robustum*	LC	1									
*	*Schistidium trichodon* var. *trichodon*	LC-att	1									
	Schistostega pennata	LC			1		2	1		1	2	
	Sciuro-hypnum curtum	LC	3	2	5		5	3	5	5		2
	Sciuro-hypnum populeum	LC	1									
	Sciuro-hypnum reflexum	LC	4	3			5	4	5	5		2
	Sphagnum capillifolium	LC								2		3
*	*Sphagnum centrale*	LC-att							1	1		
(*)	*Sphagnum divinum*	NE							1			
*	*Sphagnum fallax*	LC	3									
	Sphagnum girgensohnii	LC	5		5		5	5	5	5		5
*	*Sphagnum palustre*	LC					1				2	
	Sphagnum quinquefarium	LC	5		5		5	5	5	5		5
	Sphagnum russowii	LC	3				2	2	3	4	5	
	Sphagnum squarrosum	LC	2					1	3	1	3	
	Straminergon stramineum	LC									3	
*	*Syntrichia ruralis*	LC	1									
	Tetraphis pellucida	LC	5		5		5	5	5	5		5
	Tetrodontium ovatum	DD					1					
	Thuidium tamariscinum	LC	3		3		3	2				
*	*Tortella commutata* Köckinger & Hedenäs	NE	1			1						
	Tortula muralis var. *muralis*	LC	1									
	Ulota bruchii	LC	3					2	1	3		
	Ulota crispa	LC									1	1

Table 2. Continued.

Stat.	Species	Threat	1a	1b	1c	1d	2	3a	3b	4	5	6
*	*Ulota crispula*	NE	2				1	1		2		
**	*Ulota macrospora*	NE								1		
	Warnstorfia pseudostraminea	EN	5					2	3		5	

Diversity of the sublocalities

The distribution of diversity among the sub-localities is fairly even. Species numbers range between 74 (Kamenné moře) and 110 (central-southern part of the cirque south of “Kučerova vyhlídka” viewpoint, site 4), with higher species richness recorded at sites that were delineated on the longer transect between the cirque bottom and face (site 3b – 103 species, site 4 – 110 species) and thus generally included somewhat higher microhabitat diversity. Site 1a (around the lake) was also species-rich (107 species) and included a relatively high proportion of synanthropic species, e.g., those associated with mortar and concrete remnants from the foundations of the former border security facilities. Most sites also have a similar number of unique species (those that occur only at a given sub-site), which range between 5 and 9. The exceptional uniqueness was again recorded at site 1a (24 unique species, which included mainly terrestrial species of bare substrates and basiphilous species occurring synanthropically).

In terms of the occurrence of important and threatened species, sub-localities 4 and 2 stand out (1× CR species, 4× EN species, 1× VU species, 4× NT species, 2× commented NE species on site 4 and 4× EN species, 6× NT species, 1× DD species, 2× commented NE/LC species on site 2), while the least important species were recorded at sites 1a and 6 (2× EN species, 2× NT species at site 1a and 4× NT species, 1× commented NE species at site 6). However, all sub-localities except 6 (Kamenné moře) contain at least 2 CR or EN species. The highest concentration of important species is along the base of the cirque face in the upper part of the cirque (c. 1220–1270 m a.s.l., sites 3, 4 and 5) and in the mossy scree above the southern edge of the lake with dwarf spruce trees (site 2).

Site details and comments on important species

The sub-locality codes refer to Table 1. All collections are deposited in the herbarium of Faculty of Science, University of South Bohemia (CBFS) under the numbers specified in brackets next to the collector’s name.

Calypogeia aff. *fissa* (NE)

– 3a: base of SE-facing cirque face ca. 150 m NE of A. Stifter’s monument, 48.777389°N 13.859026°E, 1200–1210 m a.s.l., wet fissure at base of large, nearly vertical seepage granitic rocks, unshaded, 19 July 2024 coll. *J. Kučera* (25683).

A formally undescribed liverwort related to *C. fissa* but sharing some morphological features rather with *C. muelleriana* (BUCZKOWSKA & BĄCZKIEWICZ 2011). The identity was confirmed by molecular barcoding.

Isopaches bicrenatus (LR-nt)

– 6: at the path going through the "Kamenné moře" scree, 390 m SE of the water-gate from Plešné Lake, 48.775768°N 13.872059°E, 1075 m a.s.l., trampled acidic soil of the path through the boulder-scree, 20 September 2024 coll. *J. Kučera* (25932).

A liverwort with scattered occurrence on acidic disturbed sites, notably the tracksides. So far, there have been very few records from the Bohemian Forest, the closest near Lipka S of Vimperk (DUDA & VÁŇA 1993).

Kurzia trichoclados (EN)

– 2: ±open scree 80 m above SW bank, 440 m SE of A. Stifter's monument, 48.77421°N 13.8622°E, 1095–1100 m a.s.l., 18 July 2024 coll. *J. Kučera* (25631, 25634, 25636), 3 populations of ca. 2, 4 and 6 dm^2; dtto, 48.77417°N 13.86230°E, 6 dm^2, *sine coll.*; dtto, 48.77408°N 13.86232°E, 5 dm^2, coll. *J. Kučera* (25639); dtto, 48.77417°N 13.86231°E, 13 dm^2, *sine coll.*; dtto, 48.77416°N 13.86240°E, 15 dm^2, *sine coll.*; dtto, 48.77418°N 13.86239°E, 3 dm2, *sine coll.*; dtto, 48.77417°N 13.86238°E, 4 dm^2, *sine coll.*; dtto, 48.77427°N 13.86240°E, 20 dm^2, *sine coll.*; dtto, 48.77411°N 13.86248°E, 15 dm^2, *sine coll.*; dtto, 48.77422°N 13.86244°E, 3 dm^2, *sine coll.*; dtto, 48.77409°N 13.86243°E, 5 dm^2, coll. *J. Kučera* (25641, 25642); dtto, 48.77427°N 13.86256°E, 1 dm^2, *sine coll.*; dtto, 48.77431°N 13.86255°E, 2 dm^2, *sine coll.*; dtto, 48.77430°N 13.86253°E, 2 dm^2, *sine coll.*; dtto, 48.77440°N 13.86241°E, 3 dm^2, *sine coll.*; dtto, 48.77458°N 13.86257°E, 3 dm^2, *sine coll.*; scree in the N slope above the SW bank, 120 m SSW from the SE lake edge, 540–550 m SE of A. Stifter's monument, 48.77325°N 13.86284°E, 1115 m a.s.l., 0.60 dm^2, 25 July 2024 coll. *J. Kučera* (25698).

The liverwort is known in the Czech Republic only from the cirque of Plešné Lake, where it has been documented to occur in at least 20 microlocalities of scree above the southwestern end of the lake. The ecology is always similar, the liverwort inhabits ± vertical granite boulder faces at sheltered places affected by cold air from holes among boulders. Commonly associated species are *Dicranodontium uncinatum* and *D. asperulum*, *Mylia taylorii* and rarely also *Dicranum fuscescens* in forms similar to *D. elongatum*. The total size of recorded populations accounts for ca. 1.1 m^2 on about 20 occupied m^2. The species does not appear to be immediately threatened, but due to the size of the population, it could be assigned CR (Critically Endangered) status according to IUCN criteria in case that one occupied m^2 is taken as the equivalent of an individual, as recommended by BERGAMINI et al. (2019).

Lophozia ascendens (EN)

– 2: scree in the N slope above the SW bank, 120 m SSW from the SE lake edge, 540–550 m SE of A. Stifter's monument, 48.773254°N 13.86292°E, 1115 m a.s.l., on decaying spruce wood in mossy scree, half-shaded, 25 July 2024 coll. *J. Kučera* (25700). Population ca. 15 cm^2.

– 4: partly wooded scree in NE cirque slope 280 m NNE of the summit of Mt. Plechý and 350 m SSE of A. Stifter's monument, 48.773552°N 13.858889°E, 1210 m a.s.l., on decaying spruce wood, half-shade, 12 October 2024 coll. *J. Kučera* (26031). Population ca. 20 cm^2.

The liverwort has not yet been reported from the cirque of Plešné Lake, but it has been published from the nearby Mt. Koňský vrch and two microlocalities on Mt. Kamenná (MIKULÁŠKOVÁ et al. 2007). It is undoubtedly a relatively rare, but at the same time easily overlooked liverwort inhabiting decaying wood in areas with high humidity.

Marsupella sprucei (EN)

- 1a: path from the dam of Plešné Lake towards "Kamenné moře" ca. 130 m SE of the water-gate from Plešné Lake, 48.777093°N 13.869027°E, 1090 m a.s.l., on shaded damp granitic boulder on the path through spruce forest, 20 September 2024 coll. *J. Kučera* (25943). Population ca. 5 cm^2.
- 1d: NE slopes of Mt. Plechý, on tourist path 310 m NE of A. Stifter's monument, 48.778588°N 13.860197°E, 1200 m a.s.l., on damp granitic stone of a path through the forest, 19 July 2024 coll. *J. Kučera* (25658). Population ca. 20 cm^2.

This liverwort has been known from the Czech side of the Bohemian Forest only from an accidental finding by F. Müller in the Kamenné moře in 2007 (KUČERA 2007), while it is better known from the Bavarian side of the mountain range (ANONYMOUS n.d.). It is easily overlooked due to its size. We recorded it twice, always on a hiking trail.

Obtusifolium obtusum (EN)

- 4: NE slope below NE-facing cirque face 190 m NNE of the summit of Mt. Plechý and 440 m S–SSE of A. Stifter's monument, 48.7726918°N 13.858825°E, 1245 m a.s.l., wet seepage granitic rock, 12 October 2024 coll. *J. Kučerová* (26096). Population ca. 1 dm^2.
- 5: beneath the base of NW facing rocks, 320 m SW of the SE lake edge, 590 m SSE of A. Stifter's monument, 48.771869°N 13.861253°E, 1230 m a.s.l., larger granitic boulder in tall herb vegetation, 25 July 2024 coll. *J. Kučera* (25722). Population ca. 1.5 dm^2; uppermost part of cirque above Plešné Lake, 205 m ENE of the summit of Mt. Plechý, 48.771648°N 13.860034°E, 1305 m a.s.l., on wet wood beneath billberries, 25 July 2024 coll. *J. Kučera* (25733). Population ca. 5 cm^2; dtto, 190 m ENE of the summit of Mt. Plechý, 48.771483°N 13.859842°E, 1325 m a.s.l., beneath *Calamagrostis villosa*, 25 July 2024 coll. *J. Kučera* (25735). Population ca. 15 cm^2.

A rare, but at this locality since 1992 regularly found, liverwort, inhabiting wet silicate rocks and boulders in the higher montane and subalpine belts, typically under tall-herb vegetation. During our survey, it has often been recorded with *Ortholimnobium handelii*.

Scapania subalpina (LR-nt)

- 1a: NW bank of the lake 340 m SW of the water-gate, 48.77643°N 13.863594°E, 1090 m a.s.l., wet ground among boulders, 16 July 2024 coll. *J. Kučera* (25595). Population ca. 2 dm^2; W bank 400 m SW of the water-gate, 48.775992°N 13.862986°E, coll. *J. Kučera* (25597). Population ca. 3 dm^2; SE bank E of the southernmost lake edge 470 m SW of the water-gate, 48.774406°N 13.864017°E, coll. *J. Kučera* (25609). Population ca. 6 dm^2.

This mountain liverwort is in our country somewhat more common only in the Giant Mountains. From Šumava Mts. it has so far only been reported from Javoří Pila and Rejštejn (DUDA & VÁŇA 1971); there are no reports from the Bavarian side (ANONYMOUS n.d.).

Andreaea alpestris (NE-tax.)

– 3a: rock outcrops below SE-facing cirque face 155 m NE of A. Stifter's monument, 48.777415°N 13.859029°E, 1200–1210 m a.s.l., base of large open inclined seepage granitic rock outcrops, 19 July 2024 coll. *J. Kučera* (25674).
– 4: base of the NE-facing cirque face 205 m NNE of the summit of Mt. Plechý and 385 m S-SSE of A. Stifter's monument, 48.773089°N 13.857815°E, 1255 m a.s.l., E-facing seepage granite rock base, 12 October 2024 coll. *J. Kučera* (26039).

According to own unpublished molecular data, there are two distinct lineages of *Andreaea rupestris* agg. in Europe, one of them assignable to the taxon that has earlier been distinguished as *A. alpestris*, but which nowadays is commonly merged with *A. rupestris* due to the unclear morphological delimitation. Molecular barcodes of the two specimens listed above suggested they belong to the *A. alpestris*-lineage. Several additional collections, which based on morphology very probably also belong to *A. alpestris*, have been collected in similar conditions. In contrast, *A. rupestris* s.str. generally appears to prefer drier or less exposed sites, but both species can be encountered at the same sites occasionally.

Andreaea crassinervia (CR)

– 3a: base of SE-facing cirque face ca. 150 m NE of A. Stifter's monument, 48.77737°N 13.859079°E, 1200–1210 m a.s.l., unshaded base of large, nearly vertical seepage granitic rocks, 19 July 2024 coll. *J. Kučera* (25680). Population of a few dm^2, intermingled with *A. rothii* subsp. *falcata*.
– 3b: base of SE-facing rocks ca. 50 m E of the monument to A. Stifter, 48.776511°N 13.858095°E, 1225 m a.s.l., unshaded base of large, nearly vertical E-SE facing seepage granitic rocks, 26 July 2024 coll. *J. Kučera* (25754, 25755). Population of a few dm^2, intermingled with *A. rothii* subsp. *falcata*.
– 4: base of the NE-facing cirque face 205 m NNE of the summit of Mt. Plechý and 385 m S–SSE of A. Stifter's monument, 48.773089°N 13.857815°E, 1255 m a.s.l., E-facing seepage granite rock base, half-shaded, 12 October 2024 coll. *J. Kučera* (26038). Population ca. 5 dm^2; dtto, 230 m N-NNE of the summit of Mt. Plechý and 360 m S-SSE of A. Stifter's monument, 48.773315°N 13.857781°E, 1255 m a.s.l., coll. *J. Kučera* (26048). Population ca. 5 dm^2; dtto, 48.773470°N 13.857850°E, 1250 m, *sine coll.* Population ca. 2 m^2; dtto, 48.773851°N 13.857679°E, 1240 m, *sine coll.* Population ca. 20 m^2; dtto, 280 m N of the summit of Mt. Plechý and 310 m S of A. Stifter's monument, 48.773789°N 13.85734°E, 1260 m, coll. *J. Kučera* (26053). Population of 10 dm^2.

The cirque of Plešné Lake is one of three known localities of the species in the Czech Republic. The second locality from Šumava Mts. has not been verified recently (the same is true for the single record of the species from the Bavarian side of the range, which was made in 1961 at Mt. Gr. Arber, ANONYMOUS n.d.), while a new Czech locality has been discovered in the cirque of Pančavská jáma in the Giant Mountains (KUČERA – unpubl.). SOLDÁN & BURYOVÁ (2001) rediscovered the species at this locality after more than 100 years from the collection and carried out a rather thorough documentation of the site of occurrence. However, during this year's survey it turned out that the patch of *Andreaea* at the locality described by Soldán and Buryová (which, according to the verbal description, is probably identical to our site, although the given coordinates point to a place about 120 m away in the SSE direction) actually contains a mixture of the habitually similar species *A. crassinervia* and *A. rothii* subsp. *falcata*. The latter species dominated in the patch, while the population of *A. crassinervia* at this site could be estimated at a maximum of a few dm^2. The situation is similar at another microlocality in this part of the cirque. However, a much larger population of the species was discovered this year in the central (southwestern) part of the cirque (sublocality 4), where it was recorded at 5 microlocalities in pure stands of 5 dm^2 to 20 m^2 (!). This makes the population in the cirque clearly the largest population of the species in the Czech Republic and possibly one of the largest in Central Europe (the species is also relatively rare in the Alps and is assessed as endangered (EN) throughout Europe, cf. SCHNYDER 2019).

Coscinodon humilis (NE)

– 3a: base of SE-facing cirque face ca. 150 m NE of A. Stifter's monument, 48.77737°N 13.859079°E, 1200–1210 m a.s.l., unshaded base of large, nearly vertical seepage granitic rocks, 19 July 2024 coll. *J. Kučera* (25679). Population of ca. 10 dm^2, associated by *Andreaea rothii* subsp. *falcata*, *A. rupestris*, *A. crassinervia*, *Marsupella sphacelata*, *Warnstorfia pseudostraminea*.

This species, which has not been consistently distinguished from the more common *C. cribrosus* in the past, has recently been confirmed to be justified by molecular data (IGNATOVA et al. 2008) and has not yet been reported from the Czech Republic. It was found at a single site at the base of rocks NE of the Stifter Monument in a population of up to several dozens of dm^2. The species was already collected during a survey by J. Kučera in 1992, but not identified then and later determined as *C. cribrosus*. It is not clear, whether this collection originated from the same locality. Moreover, PODPĚRA (1899) reported another visually similar species, *Grimmia alpestris*, from the cirque face. The specimen, however, has probably not been preserved in the Podpěra herbarium stored at BRNM, PR and PRC, as no specimens of this species have been found in the course of several revisions of this species from our country (KUČERA 1995, KUČERA – unpubl.)

Dicranodontium asperulum (LR-nt)

– 2: ±open scree 80 m above the SW bank, 440 m SE of A. Stifter's monument, 48.774189°N 13.862237°E, 1095–1100 m a.s.l., vertical face of large granitic boulder, 18 July 2024 coll. *J. Kučera* (25635). Population of several dm^2; dtto, 75 m WSW from the SE lake edge, 490 m SE of A. Stifter's monument, 48.77403°N 13.862781°E, 1090–1095 m a.s.l., vertical face of large granitic boulder, 18 July 2024 coll. *J. Kučera* (25650). Population of 2 dm^2.
– 6: boulder scree ca. 120 m above the path, 330 m SE of the water-gate from Plešné Lake, 48.775345°N 13.869987°E, 1095–1100 m a.s.l., hanging over the top of granite boulder in scree, 20 September 2024 coll. *J. Kučera* (25931). Population size unrecorded; dtto, ca. 20 m below the path, 450 m SE of the water-gate from Plešné Lake, 48.775644°N 13.872774°E, 1070 m a.s.l., on vertical face of boulder, 20 September 2024 coll. *J. Kučera* (25941). Population size unrecorded.

Although previously reported as more common in the Šumava Mts. than *D. uncinatum*, in this year's survey most of the populations tentatively identified in the field as *D. asperulum* were re-determined as *D. uncinatum*. Outside the Bohemian Forest, the species is rarely reported from sandstone ravines of Bohemian Switzerland, Tiské stěny, Český ráj, Adršpašské skalní město and Broumovské stěny.

Dicranodontium uncinatum (EN)
- 1c: slope 80 m above SE bank of the lake, 410 m SSW of the water-gate, 48.774442°N 13.865484°E, 1120 m a.s.l., over large granitic boulder, half-shade, 18 July 2024 coll. *J. Kučera* (25657). Population size unrecorded.
- 2: ±open scree 80 m above SW bank, 440 m SE of A. Stifter's monument, 48.774207°N 13.862165°E, 1095–1100 m a.s.l., vertical face of large granitic boulder, 18 July 2024 coll. *J. Kučera* (25633). Population of ca. 1 dm^2; dtto, 48.77411°N 13.862484°E, 1095 m a.s.l., *sine coll*. Population of 14 dm^2; dtto, 48.774091°N 13.862434°E, 1095 m, coll. *J. Kučera* (25643). Population of 3 dm^2; dtto, 48.774086°N 13.862477°E, 1095 m, coll. *J. Kučera* (25645). Unrecorded size; dtto, 48.774187°N 13.862588°E, 1090–1095 m, coll. *J. Kučera* (25648). Population of 6 dm^2; dtto, 48.773426°N 13.863042°E, 1110 m, coll. *J. Kučera* (25655, 25656). Population of 15 dm^2; dtto, 48.773254°N 13.86292°E, 1115 m a.s.l., on vertical face of large granitic boulder, 25 July 2024 coll. *J. Kučera* (25699). Population size unrecorded.
- 3a: scree in SE slopes 180 m E of A. Stifter's monument, 215 m SW of the spring at the tourist path, 48.776661°N 13.859773°E, 1155 m a.s.l., on vertical face of large granitic boulder, 19 July 2024 coll. *J. Kučera* (25662). Population size unrecorded.
- 4: partly wooded scree in NE cirque slope 290 m NNE of the summit of Mt. Plechý and 350 m SSE of A. Stifter's monument, 48.773604°N 13.859009°E, 1205 m a.s.l., on vertical face of large granitic boulder, 12 October 2024 coll. *J. Kučera* (26029, 26030). Population size 5 dm^2.

Compared to the previous species, it is slightly more abundant in the cirque, with the centre of occurrence in the screes above the southern end of the lake.

Dicranum fuscescens (LC)
- 2: ±open scree 80 m above above the SW bank, 440 m SE of A. Stifter's monument, 48.774189°N 13.862237°E, 1095–1100 m a.s.l., vertical face of large granitic boulder, half-shade, 18 July 2024 coll. *J. Kučera* (25638). Population size 2 dm^2; dtto, 48.77408°N 13.862317°E, coll. *J. Kučera* (25640). Population size 2 dm^2; dtto, 48.774158°N 13.862401°E, *sine coll.* Population size 1 dm^2; dtto, 48.774086°N 13.862477°E, *J. Kučera* 25646. Population size 40 cm^2; dtto, 48.774187°N 13.862588°E, coll. *J. Kučera* (25647). Population size 1 dm^2.

The species has not been assessed as endangered in the past due to confusion with the more common *D. flexicaule*. However, it is undoubtedly a very rare species, occurring in upland mires or in mossy screes. All occurrences in the cirque of Plešné Lake were recorded in the mossy scree above the southern end of the lake in populations of several tens of cm^2 to 2 dm^2. With respect to its habitual similarity to *Dicranum elongatum*, it is possible that Podpěra's records (Podpěra 1899) in fact belonged to this species.

Grimmia ramondii (LC-att)

– 3b: SE-facing slopes beneath cirque face ca. 70 m E of the monument to A. Stifter, 48.776584°N 13.858348°E, 1210 m a.s.l., large open seepage granitic rock outcrop, inclined face on the ground level, SE-facing, 26 July 2024 coll. *J. Kučera* (25751). Population of ca. 3 m^2. Associated with *Racomitrium obtusum*.

The species is more common in the Czech Republic only in the Krkonoše Mountains and interestingly has not been reported from the Czech part of Šumava so far, although recent data exist from the Bavarian part (ANONYMOUS n.d.).

Jochenia protuberans (NE)

– 3b: SE-facing slopes ca. 170 m E of the monument to A. Stifter, 48.776518°N 13.85970°E, 1160 m a.s.l., on bark of *Sorbus aucuparia* in SE-facing slope with sparse trees, 26 July 2024 coll. *J. Kučera* (25743). Population of ca. 20 cm^2.
– 5: NE cirque slope above SW lake bank, 190 m SSW from the SE lake edge, 530 m SE of A. Stifter's monument, 48.772947°N 13.862133°E, 1140 m a.s.l., on stem of *Vaccinium myrtillus* in steep NE slope, 25 July 2024 coll. J. Kučera (25708). Population of 10–20 cm^2.
– 6: ca. 20 m below the path, 370 m SE of the water-gate from Plešné Lake, 48.776036°N 13.871911°E, 1070–1075 m a.s.l., 20 September 2024 coll. *J. Kučera* (25940). Population of 10–20 cm^2.

This species was previously not distinguished from *J. pallescens* (*Hypnum pallescens*) and has been confused with *Campylophyllopsis sommerfeltii* in our country since the late 1990s. It has been recorded (as *Campylophyllopsis sommerfeltii*) on nearby Mt. Kamenná by Košnar & Mikulášková (MIKULÁŠKOVÁ et al. 2007).

Lescuraea mutabilis (EN)

– 4: NE-facing cirque slope just below the cirque face 250 m N-NNE of the summit of Mt. Plechý and 335 m S of A. Stifter's monument, 48.773534°N 13.857588°E, 1260 m a.s.l., bark of *Acer pseudoplatanus* near base, 12 October 2024 coll. *J. Kučera* (26052). Population of 1 dm^2.

Probably the first record of this rare and endangered species of epiphytic moss in the Czech part of Bohemian Forest. The only other recent populations were recorded in the cirque of Krkonoše and Jeseníky Mts. (Velká Kotelní jáma, Labský důl, Velká and Malá kotlina, Sněžné strže, K*UČERA* et al. 2004a, 2009). The records from the summit region of the Bavarian part of the range are more numerous, including several recent records (ANONYMOUS n.d.).

Ortholimnobium handelii (NE)

– 4: partly wooded scree in NE cirque slope 360 m NE of the summit of Mt. Plechý and 380 m SE of A. Stifter's monument, 48.77382°N 13.860372°E, 1165 m a.s.l., on decayed grass in wet slope, half-shaded, 12 October 2024 coll. *J. Kučera* (26016). Population of 6 dm^2; dtto, 310 m NNE of the summit of Mt. Plechý and 370 m SE–SSE of A. Stifter' monument, 48.77357°N 13.859687°E, 1190–1195 m a.s.l., mossy slope above streamlet in small ravine, 12 October 2024 coll. *J. Kučera* (26023). Population of 2 dm^2; dtto, base of the NE-facing cirque face 185 m NNE of the summit of Mt. Plechý and 420 m S-SSE of A. Stifter's monument, 48.772807°N 13.858261°E, 1260 m a.s.l., in steep slope under vegetation, 12 October 2024 coll. *J. Kučera* (26045). Population of 7 dm^2.

– 5: beneath the base of NW facing rocks, 320 m SW of the SE lake edge, 590 m SSE of A. Stifter's monument, 48.771869°N 13.861253°E, 1230 m a.s.l., larger granitic boulder in the slope beneath rocks in tall herb vegetation, 25 July 2024 coll. *J. Kučera* (25722). Population of 1 dm^2; beneath the base of N facing rocks, 370 m SW of the SE lake edge, 610 m SSE of A. Stifter's monument, 48.77153°N 13.860883°E, 1265 m a.s.l., on wet granitic stone by a small stream, sheltered by tall herbs, 25 July 2024 coll. *J. Kučera* (25727). Population of 6 dm^2; uppermost part of cirque above Plešné lake, 190 m ENE of the summit of Mt. Plechý, 48.771483°N 13.859842°E, 1325 m a.s.l., below tall herbs in ± N slope, 25 July 2024 coll. *J. Kučera* (25735). Population of 3 dm^2.

This species, described from Yunnan, China, has only recently been discovered for Europe (Wynns & Schröck 2018), and so far, it has only been known in Czechia from the Krkonoše Mountains (Dřevojan et al. 2021). Given the apparent European distribution centre in the eastern Alps, the occurrence in Šumava is logical, similar in character to that of *Plagiothecium neckeroideum*. Populations are between 1 and 7 dm^2 in size.

Plagiothecium neckeroideum (EN)

– 2: wooded scree 70 m above the SW bank, 350 m SE of A. Stifter's monument, 48.775064°N 13.861610°E, 1105 m a.s.l., on plant detritus, 18 July 2024 coll. *J. Kučerová* (25909). Population size unrecorded, probably ca. 1 dm^2.
– 3b: SE-facing slopes ca. 150 m ESE of the monument to A. Stifter, 48.776246°N 13.859414°E, 1170 m a.s.l., wet shaded humus on the base of large boulder, 26 July 2024 coll. *J. Kučera* (25745). Population size 2 dm^2.
– 4: small ravine in E cirque slope 310 m NNE of the summit of Mt. Plechý and 390 m SE–SSE of A. Stifter's monument, 48.773522°N 13.859904°E, 1190 m a.s.l., on moss-covered granitic rock outcrop near base, shaded, 12 October 2024 coll. *J. Kučera* (26019). Population of ca. 25 dm^2; dtto, 48.773463°N 13.85978°E, coll. *J. Kučera* (26019), ca. 10 dm^2; dtto, 310 m NNE of the summit of Mt. Plechý and 355 m SSE of A. Stifter's monument, 48.773676°N 13.859505°E, 1190–1195 m a.s.l., vertical shaded face of larger granitic boulder by a streamlet, coll. *J. Kučera* (26024), ca. 25 dm^2.

The species has a similar distribution pattern as the previous one, but in Central Europe its northernmost localities are known from the Šumava Mts., no record has so far been reported from more northern sites. Its occurrence in the Plešné Lake cirque has been known since 1992, but no populations have been more precisely located and their size estimated so far.

Pohlia lutescens (DD)

– 4: base of the NE-facing cirque face 185 m NNE of the summit of Mt. Plechý and 420 m S–SSE of A. Stifter's monument, 48.772755°N 13.858327°E, 1260 m a.s.l., wet, humus-filled fissure of SE-facing granite rock base, 12 October 2024 coll. *J. Kučera* (26046).

A moss with little known distribution in the Czech Republic, occurring probably relatively commonly in lowland regions, particularly in oak woods on open soil. No occurrence has been known in the Bohemian Forest so far. The occurrence in the cirque on a wet site was very unexpected, the moss was considered to be a form of *P. wahlenbergii* on the site, but the molecular barcoding proved the identity with *P. lutescens.* It might be the highest altitudinal record in the country.

Racomitrium obtusum (NE)

– 3b: SE-facing slopes beneath cirque face ca. 70 m E of the monument to A. Stifter, 48.776584°N 13.858348°E, 1210 m a.s.l., large open seepage granitic rock outcrop, inclined face on the ground level, SE-facing, associated with *Grimmia ramondii*, 26 July 2024 coll. *J. Kučera* (25753). Population size unrecorded, probably several dm^2.

A newly discovered species in our territory (ELLIS et al. 2024) and a rather distinctly oceanic element of bryoflora, which has not been recorded so far even on the Bavarian side of the Bohemian Forest. The closest previously reported occurrences are from the Thuringian and Black Forests. The historical occurrences on the Saxon side of the Ore Mts. are considered extinct; www.moose-deutschland.de).

Tetrodontium ovatum (DD)

– 2: wooded scree above the SW bank, 40 m SW from the SE lake edge, 510 m SE of A. Stifter's monument, 48.774065°N 13.863283°E, 1095 m a.s.l., vertical face of a granitic boulder, 25 July 2024 coll. *J. Kučerová* (25694). A few dozens of sporophytes recorded.

A species from the Czech side of Šumava Mts. first reported by F. Müller (KUČERA 2007) from the "Kamenné moře", where it has not been found again, also not in this survey. Similar to the case of *Marsupella sprucei*, with which it shares similar habitats, it is difficult to detect this moss in the field due to its small size.

Ulota macrospora (NE)

– 4: NE-facing cirque slope just below the cirque face 300 m N of the summit of Mt. Plechý and 290 m S of A. Stifter's monument, 48.7738914°N 13.8574052°E, 1255 m a.s.l., bark of *Acer pseudoplatanus*, 12 October 2024 coll. *J. Kučera* (26084).

This species has been resurrected from synonymy with *U. bruchii* relatively recently (SAUER 1998).The first record in Czechia was only found in 2013 in the Ore Mts. (BIEDERMANN et al. 2014) and the moss was again collected in 2021 in the Novohradské hory Mts. (DŘEVOJAN et al. 2021).

Warnstorfia pseudostraminea (EN)

– 1a: 11 sites recorded around the lake shore (1090 m a.s.l.) with populations between 1–30 dm^2: 48.777673°N 13.867234°E, 16 July 2024 coll. *J. Kučera* 25753; 48.777560°N 13.865928°E, *sine coll.*; 48.77643°N 13.863594°E, *J. Kučera* 25596; 48.775510°N 13.862584°E, *sine coll.*; 48.775474°N 13.862545°E, *sine coll.*; 48.775198°N 13.862548°E, *sine coll.*; 48.774770°N 13.862940°E, *sine coll.*; 48.774624°N 13.864399°E, *sine coll*.

– 3a: base of SE-facing cirque face ca. 150 m NE of A. Stifter's monument, 48.77737°N 13.859079°E, 1200–1210 m a.s.l., wet base of large, nearly vertical seepage granitic rocks, 19 July 2024 coll. *J. Kučera* (25678); dtto, 48.777613°N 13.858819°E, 1235 m a.s.l., *sine coll*.

– 3b: 280 m E of the monument to A. Stifter, 48.77649°N 13.861205°E, 1130 m a.s.l., periodically inundated depression; on soil among grasses, 26 July 2024 coll. *J. Kučera* (25739); SE-facing slopes ca. 140 m ESE of the monument to A. Stifter, 48.776166°N 13.859145°E, 1185 m a.s.l., damp, shaded vertical face of NE-facing granitic rock outcrop in SE slope, 26 July 2024 coll. *J. Kučera* (25746); E slope 250 m SSE of the monument to

A. Stifter and 370 m NNE of the summit of Mt.Plechý, 48.774423°N13.858780°E, 1190 m a.s.l., hole among granitic boulders in boulder scree in E slope, 26 July 2024 coll. *J. Kučerová* (25773); dtto, 48.774388°N 13.859288°E, 1180 m, *sine coll*.
– 5: 48.771823°N 13.860910°E, 1240 m, 25 July 2024, *sine coll.*; 48.77167°N 13.86091°E, 1250 m, *sine coll.*; 48.771713°N 13.860875°E, 1250 m, *sine coll*.

This species was first recognized in the area of Lake Plešné only in 2012 (Hradílek 2013), although it has been probably collected here several times before, but identified probably as *W. fluitans*. The species forms a massive population in the littoral around almost the entire perimeter of the lake, but it has also been found in a number of other places in the cirque, where it grows, among others, on seepage rocks.

Not re-found historical records

Although most of the previously reported species have been re-found during the current survey, we have expectedly not managed to confirm all previous records. Of the 58 historically reported species (Table 3), 37 species are considered to be previously correctly identified, 13 species are considered doubtful and 8 historically reported species have been excluded following the revisions of herbarium material.

Discussion

The current survey, realized in 2024, was the most comprehensive bryological survey conducted at this locality to date, reporting 197 bryophyte species, of which 56 are reported for the first time. While only about 80 bryophyte species were known from the Plešné Lake cirque before 1992, the survey of epilithic bryophyte communities by Kučera (1995), who reported 97 species in total, added about 45 new species. The general survey by Soldán & Váňa (2002), who themselves recorded 161 bryophyte species, increased the known total by 56 to 174 bryophytes. The total number of reported bryophyte species so far has thus increased to 230 species and we can expect numerous future additions, if the survey will continue. While it is tempting to compare this number with the numbers reported from other glacial cirques in the region and country, such comparisons are notoriously difficult. The reported numbers of bryophytes found in the other two larger cirques of the Czech side of the Bohemian Forest, Černé and Čertovo Lake cirques are smaller (about 160 and 140 reported species, respectively; Soldán & Váňa 2002), but a similarly thorough survey has never been made in these two cirques (and no complete inventory exists even in the cirques on the Bavarian side, as far as we know). Similar surveys have, however, been made rather recently in the cirques on the Czech side of the Giant Mts. (Krkonoše). There, bryophyte numbers reported from the individual cirques range between c. 120 and 265 species (Kučera et al. 2004a, 2004b), but the survey effort was also somewhat bigger, particularly at the larger and more diverse sites (up to 3–4 people working for 8 days at the richest locality of Velká Kotelní jáma; Kučera et al. 2004a), suggesting that the bryophyte species diversity in the cirques of Krkonoše and Šumava Mts. is approximately equal. A substantially higher diversity was reported from the cirque of Velká kotlina in the Hrubý Jeseník Mts. There, 320 species were confirmed during the 2001–2003 survey (14 days, 3–4 people) and over 400 species have been reported from the site in total over the whole history of exploration (Kučera et al. 2009). The bedrock at that locality is, however, more diverse, including base-rich parts.

Table 3. Bryophytes reported from the Plešné Lake cirque and surroundings, unrecorded during the inventory in 2024. The flag '?' denotes unlikely historical occurrences, the flag 'x' denotes species excluded by later revisions of the corresponding collections.

Flag	Species	Collector (reference)	Note
	Aneura pinguis	J. Kučera 1992 (Kučera 1995)	
x	*Bazzania flaccida*	M. Rivola 1969 (Rivola 1971 a,b)	revised to *B. tricrenata* by J. Duda (Duda & Váňa 1989)
?	*Calypogeia neesiana*	Kamenné moře, not· I. Marková 2007 (Mikulášková et al. 2007)	record not supported by a collection, possible confusion with *C. integristipula*
?	*Cephalozia connivens*	Kamenné moře, I. Marková 2007 (Mikulášková et al. 2007)	ecologically very unlikely record, probable confusion with *C. lunulifolia*
	Cephaloziella rubella	J. Kučera 1992 (Kučera 1995)	
	Chiloscyphus pallescens	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	
	Chiloscyphus polyanthos	J. Kučera 1992 (Kučera 1995)	
	Frullania tamarisci	A. Hilitzer (Hilitzer 1925)	unrevised record
	Lejeunea cavifolia	A. Hilitzer (Hilitzer 1925)	unrevised record
	Lophocolea coadunata	M. Kočí 1998, Z. Soldán & J. Váňa 2001 (Dalibor n.d., Soldán & Váňa 2002)	data by M. Kočí originate from unrevised phytosociological records; Soldán & Váňa claim that the species occurs very abundantly in the cirque, which is at odds with our survey. The occurrence is definitely possible, but the species must be rather rare
x	*Lophozia wenzelii*	M. Rivola 1969 (Rivola 1971 a,b)	revised to *Pseudolophozia sudetica* (Soldán & Váňa 2002)
	Metzgeria conjugata	A. Hilitzer (Hilitzer 1925)	unrevised record
	Metzgeria pubescens	A. Hilitzer (Hilitzer 1925)	record confirmed by Soldán & Váňa (2002)
	Moerckia blyttii	J. Kučera 1992, Z. Soldán & J. Váňa 2001 (Kučera 1995, Soldán & Váňa 2002)	Rapidly declining liverwort, probably in response to the climatic change. The search for the species was unsuccessful also at the nearby locality in the valley of Medvědí potok
	Nardia geoscyphus	J. Vorel 1964 (Duda & Váňa 1972)	

Table 3. Continued.

Flag	Species	Collector (reference)	Note
	Riccardia multifida	M. Rivola 1969 (Rivola 1971 a,b)	unrevised record
?	*Solenostoma hyalinum*	M. Kočí 1998 (Dalibor n.d.)	unrevised record from phytosociological records
	Solenostoma obovatum	J. Kučera 1992, Z. Soldán & J. Váňa 2001 (Kučera 1995, Soldán & Váňa 2002)	
	Amblystegium serpens	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	
	Amphidium mougeotii	J. Podpěra 1899, Z. Soldán & J. Váňa 2001 (Podpěra 1899, Soldán & Váňa 2002)	
x	*Andreaea frigida*	J. Podpěra 1899 (Podpěra 1899)	excluded by Kučera (1995) and the specimen claimed to be *A. rothii* subsp. *falcata*
	Bartramia halleriana	J. Kučera 1992 (Kučera 1995)	
	Blindia acuta	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	
	Brachydontium trichodes	Z. Soldán & J. Váňa 2001, F. Müller 2007 (Soldán & Váňa 2002, Kučera 2007)	
	Bryum caespiticium	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	
	Calliergon cordifolium	J. Kučera 1992, M. Kočí 1998, Z. Soldán & J. Váňa 2001 (Kučera 1995, Dalibor n.d., Soldán & Váňa 2002)	
	Dicranella cerviculata	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	
?	*Dicranum elongatum*	J. Podpěra 1899 (Podpěra 1899)	record not revised recently, possibly *D. fuscescens*
?	*Dicranum flagellare*	J. Podpěra 1899 (Podpěra 1899)	record should be revised, possibly a confusion with the common *Campylopus flexuosus*
x	*Dicranum fulvum*	J. Podpěra 1899 (Podpěra 1899)	revised as *D. fuscescens* by J. Kučera (1995), but possibly rather belonging to *D. flexicaule* (see the comment to *D. fuscescen*s above)

Table 3. Continued.

Flag	Species	Collector (reference)	Note
x	*Dicranum muehlenbeckii*	A. Hilitzer 1924 (HILITZER 1925)	revised as *D. fuscescens* by J. KUČERA (1995), the same applies as with the preceding species
?	*Dicranum polysetum*	Z. Soldán & J. Váňa 2001 (SOLDÁN & VÁŇA 2002)	occurrence ecologically unlikely
	Ditrichum heteromallum	J. Kučera 1992, Z. Soldán & J. Váňa 2001; Kamenné moře, S. Kubešová 2007 (KUČERA 1995, SOLDÁN & VÁŇA 2002, MIKULÁŠKOVÁ et al. 2007)	
x	*Ditrichum lineare*	Kamenné moře, S. Kubešová 2007 (MIKULÁŠKOVÁ et al. 2007)	occurrence in Czechia not confirmed so far, refers to *D. pusillum* (FEDOSOV et al. 2025)
?	*Grimmia alpestris*	J. Podpěra 1899 (PODPĚRA 1899)	the specimen is missing from Podpěra's collections in the herbaria BRNM, PR and PRC; the species was recently confirmed on the summit of Gr. Osser
x	*Grimmia montana*	J. Kučera 1992 (KUČERA 1995)	revised to *G. muehlenbeckii* (SOLDÁN & VÁŇA 2002)
	Grimmia muehlenbeckii	J. Kučera 1992 (SOLDÁN & VÁŇA 2002)	not revised recently
	Kiaeria starkei	J. Podpěra 1899, Vondráček, Z. Soldán & J. Váňa 2001 (PODPĚRA 1899, VONDRÁČEK 1990, SOLDÁN & VÁŇA 2002)	occurrence possible, but confusions common, particularly with the commoner *K. blyttii*
x	*Leptodictyum riparium*	J. Kučera 1992 (KUČERA 1995)	revised to *Warnstorfia pseudostraminea*
	Leucobryum glaucum	Kamenné moře, not. R. Mudrová 2007 (MIKULÁŠKOVÁ et al. 2007)	unrevised record
	Neckera pennata	A. Hilitzer 1924 (HILITZER 1925)	unrevised record
	Neckera pumila	A. Hilitzer 1924 (HILITZER 1925)	unrevised record
	Oxystegus tenuirostris	Z. Soldán & J. Váňa 200 (SOLDÁN & VÁŇA 2002)	
?	*Paraleucobryum sauteri*	M. Kočí 1998 (DALIBOR n.d.)	unrevised record from phytosociological surveys

Table 3. Continued.

Flag	Species	Collector (reference)	Note
	Plagiothecium cavifolium	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	ecologically not very likely record, possible confusion with *P. handelii*
	Plagiothecium denticulatum var. *undulatum*	J. Podpěra 1899 (Podpěra 1899)	unrevised record, taxonomically dubious taxon
	Plagiothecium platyphyllum	J. Kučera 1992, Z. Soldán & J. Váňa 2001 (Kučera 1995, Soldán & Váňa 2002)	
	Pogonatum aloides	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	
	Pohlia elongata	J. Kučera 1992, Z. Soldán & J. Váňa 2001 (Kučera 1995, Soldán & Váňa 2002)	
	Pohlia proligera	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	
	Pohlia wahlenbergii	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	
	Racomitrium affine	J. Kučera 1992 (Kučera 1995)	not revised recently, revision necessary, might refer to *R. obtusum*
	Rhabdoweisia crispata	J. Podpěra 1899, J. Kučera 1992, Z. Soldán 1991, Z. Soldán & J. Váňa 2001 (Podpěra 1899, Kučera 1995, Soldán & Váňa 2002)	
?	*Schistidium apocarpum*	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	possibly one of the currently recorded *Schistidium* species, not recognized from *S. apocarpum* earlier
?	*Sciuro-hypnum starkii*	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	the record might refer to *S. curtum*, earlier not distinguished consistently
?	*Sphagnum fimbriatum*	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	ecologically a rather unlikely record
x	*Sphagnum magellanicum*	Z. Soldán & J. Váňa 2001 (Soldán & Váňa 2002)	probably refers to earlier not distinguished *S. divinum*
?	*Warnstorfia fluitans*	J. Kučera 1992, Z. Soldán & J. Váňa 2001 (Kučera 1995, Soldán & Váňa 2002)	probably refers to *W. pseudostraminea*, earlier not distinguished from *W. fluitans*

The bryoflora of the Plešné Lake cirque is nevertheless significantly different in composition and frequency of commonest species from the bryoflora of the cirques in Giant Mts., despite the similar prevailing bedrock (rather acidic granite), which is only locally enriched by base-rich substrates in some of the cirques in Giant Mts. In the cirque of Plešné Lake, arctic-alpine elements are extremely rare (perhaps only the liverwort *Moerckia blyttii*, which has not been recorded recently, and the moss *Andreaea crassinervia* can be designated as arctic-alpine; the latter species is possibly rather an alpine element in general). Even the most common montane species of the Krkonoše Mts., which generally have a more northern distribution pattern in Europe such as *Racomitrium sudeticum*, *Scapania undulata* or *Marsupella emarginata*, are rare in the cirque of Plešné Lake. On the contrary, the bryoflora of Plešné Lake cirque is rich in oceanic, western elements, both rare (*Kurzia trichoclados*, *Dicranodontium uncinatum*, *Racomitrium obtusum*, *Ulota macrospora*) and common species (e.g., *Dicranodontium denudatum*, *Campylopus flexuosus*, *Hylocomiastrum umbratum*, *Mnium hornum*, *Anastrepta orcadensis*, *Bazzania tricrenata*). These species are substantially less common in the bryoflora of the Giant Mts. or have not been reported there at all (*Kurzia trichoclados*, *Racomitrium obtusum*, *Ulota macrospora*). Possibly the most interesting and important group of species from the Šumava Mts. includes the Alpic and Alpic-Himalayan species (*Plagiothecium neckeroideum*, *Ortholimnobium. handelii*, *Coscinodon humilis*) that do not occur elsewhere in Central Europe outside the eastern Alps (except for *O. handelii*, which has been also recorded in the Giant Mts. and on Babia Góra).

With respect to the missing previous systematic surveys from the locality, the estimates of dynamics of the bryoflora are also difficult. Perhaps only the occurrence of the invasive neophytic species *Orthodontium lineare* can be safely considered a relatively recent addition, supported by the fact, that it was recorded only at two sites during the current survey. On the other hand, the epiphytes can probably generally be considered decreasing over the period of historical records, as particularly the rarer and more sensitive species have not been recorded since the survey by A. Hilitzer (*Metzgeria pubescens*, *Neckera pennata*, *N. pumila*, HILITZER 1925). The reasons for this decrease might be rather complex, including the gradual increase in temperatures resulting in prolonged periods of drought and the generally lower relative air humidity (BÍLÁ et al. 2018), the period of higher concentration of sulphur and nitrogen oxides in the atmosphere in 1980s (KOPÁČEK & HRUŠKA 2010), or the decrease of available epiphytic substrate following the bark beetle calamity that occurred at the locality since late 1990s. At the same time, numerous rare epiphytic species have been reported only recently (*Jochenia protuberans*, *Lescuraea mutabilis*, *Ulota macrospora*), reflecting, however, rather the inadequate previous survey, supported by the absence of previous records of common epiphytes (*Radula complanata*, *Lewinskya affinis*, *L. speciosa*, *Orthotrichum pallens*, *Pylaisia polyantha*).

Our failure to verify most of remaining historically recorded taxa can probably be attributed to the insufficient effort, particularly in case of records that have been reported in the relatively recent surveys by KUČERA (1995) or SOLDÁN & VÁŇA (2002). Many taxa occurred very rarely in the cirque (35 taxa, i.e., nearly 18% of the total number, have been recorded only once during the survey, Table 2) and we were able to explore only a fraction of the total area of the cirque in more detail (possibly ca. 10% of the area).

Despite all shortcomings, this survey can serve as a foundation for future qualified comparisons of diversity, distribution and frequency of occurrences of recorded bryophyte species at the locality and testifies about its the extraordinary value in terms of bryophyte diversity. The undisturbed nature of the site must, however, be preserved.

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