THE BRYOPHYTE FLORA OF THE SANDSTONE REGION HRADČANSKÉ STĚNY NEAR DOKSY IN CENTRAL NORTH BOHEMIA

Bryoflóra pískovcové oblasti Hradčanské stěny

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Abstract: 182 bryophytes recorded and/or collected during fieldwork in the sandstone region Hradčanské stěny (Hradčanské stěny rocks walls) in Central North Bohemia are listed. Of special floristic interest are calcareous sandstone formations in the northern part of the area. The most interesting records (*Hypnum sauteri*, *Pseudoleskeella tectorum*) are discussed in detail.

Keywords: Hradčanské stěny, Kummergebirge, sandstone rocks, liverworts, mosses, bryophytes.

Introduction

The sandstone massif Hradčanské stěny (Kummergebirge) is situated north of the Máchovo jezero pond close to the town of Doksy. It is approximately 10 km long and 5 km broad. The highest sandstone elevations are 387 m a.s.l., the lowest place of the area is ca. 280 m a.s.l. The sandstone massif is frequently enriched by individual outcrops of basalt hills; the highest of them is the hill Dub (458 m). The area was formed in the Cretaceous period of the Mesozoic. The sandstone belongs to block sandstones of the Bohemian Cretaceous basin. The area is situated in a depression rich in bogs, swamps and ponds. Characteristic geomorphologic elements of the region are table mountains, solitary rocks, platforms, canyons and valleys. A few sandstone rocks in the northern part of the massif (e.g. Havraní skála, Tvarožník, Kozí kámen, Psí kostel, Skalní brána, Vinice) consist of calcareous sandstone. These sites have been well known since long time as the localities of remarkable vascular plants, including *Pulsatilla patens*, *Arctostaphylos uva-ursi*, *Minuartia caespitosa*, *M. setacea*, *Carex pediformis* subsp. *macroura*, *Sesleria calcarea*. Among the lichens, species including e.g. *Psora testacea*, *Toninia sedifolia*, *Psorotichia schaereri*, *Solorina saccata*, *Staurothele succedens* can be named (Anders 1928).

The area was for a long time closed to the public, as it was occupied by the Soviets, used as a military base. Another big area in the south-western part of the Hradčanské stěny is fenced as a game park until now. It was therefore impossible to include this area in the present investigation.

We have included the sandstone rocks of the Nature Monument Vranovské skály near Vranov in the lower parts of the north-western slope of the volcanic hill Ralsko near Mimoň in our investigations as well. The sandstone belongs to the same geological formation as the Hradčanské stěny rocks; the altitude of this site is 340 to 400 m. We investigated the area during excursions on 21 – 22 May and between 30 September and 3 October 2005. In addition to the bryophytes, we have surveyed the lichens, too. The results of the lichen survey will be published in a separate paper.

The nomenclature of bryophytes in the text follows Kučera & Váňa (2003) with minor exceptions.

List of visited sites

1. Havraní skála (Rabenstein), ca. 0.5 km W of Hradčany and surrounding rocks: N50°37’04”, E014°41’51”, 21.5.2005.
2. Tvarožník (Quargelstein), ca. 2 km W of Hradčany, and surrounding rocks: N50°37’20”, E014°40’43”, 22.5.2005.
3. Kozí kámen (Ziegenstein), ca. 3.5 km NW of Hradčany: N50°37’54”, E014°39’47”, 22.5.2005.

4. Psí kostel (Hundskirche), ca. 3 km WNW of Hradčany: N50°37’35”, E014°39’50”, 22.5.2005.
5. Skalní brána (Frauentor), ca. 3.3 km WNW of Hradčany: N50°37’35”, E014°39’38”, 22.5.2005.
6. Vinice (Weinberg), ca. 3.5 WNW of Hradčany: N50°37’41”, E014°39’30”, 22.5.2005.
7. Dubový vrch to Cikánská skála, ca. 6 km E-ENE of Doksy: N50°34’-N50°35’, E014°44’20-40”, 30.9.2005.
8. Vranovské skály near Vranov, ca. 2 km NE of Mimoň: N50°40’07”, E014°45’10-33”, 1.10.2005.
9. Hraniční důl and surrounding area, ca. 1.5 km E Provodín: N50°36’40”-N50°37’00”, E014°37’10-30”, 2.10.2005.
10. Vysoký vrch and surrounding, ca. 3.5 km W Hradčany: N50°37’10”, E014°39’20”, 2.10.2005.
11. Upper part of Uhelná rokle and canyons north of it, ca. 2.5 km WSW of Hradčany: N50°36’38-45”, E014°40’20”, 2.10.2005.
12. Bahno to Ve Skalách, ca. 0.5-1 km S Hradčany: N50°36’30-50”, E014°42’05-30”, 3.10.2005.
13. Lower part of Uhelná rokle, ca. 1.5 km SW of Hradčany: N50°36’20”, E014°41’15”, 3.10.2005.

List of recorded species

Table 1. – Bryophytes recorded at different sites in the Hradčanské stěny.
Records of common species were not noted regularly at all sites, therefore they are probably underrepresented in the table. Abbreviations: a – on acidic sandstone rocks, c – on calcareous sandstone rocks, o – on other substrates. Red list categories (Kučera & Váňa 2003, red-listed species printed in bold): CR – critically endangered, DD – data deficient, LC – not threatened, LC-att – not threatened-attention list, LR-nt – lower risk-near threatened, VU – vulnerable.

Species name	**Site / Red list category**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Anastrophyllum minutum	LC	a						a	a	a			a	
Aneura pinguis	LC	o												
Bazzania trilobata	LC	a						a	a	a	a	a	a	a
Blasia pusilla	LC							o						
Calypogeia integristipula	LC	a							a		a			
Calypogeia muelleriana	LC	a												
Cephalozia bicuspidata	LC	a												
Cephalozia lunulifolia	LC	o												
Cephaloziella divaricata	LC	a							a				a	
Chiloscyphus coadunatus	LC	o						o						
Chiloscyphus profundus	LC	o							o					
Conocephalum salebrosum Szweyk. & al.									c					
Diplophyllum albicans	LC	a												
Diplophyllum obtusifolium	LC										o			
Lepidozia reptans	LC	a							a					
Lophozia attenuata	LC	a										a		
Lophozia barbata	LC											a		
Lophozia excisa	LC-att			c										
Lophozia ventricosa s.l.								a	a					
Lophozia ventricosa* var. *silvicola	**DD**											a		
Marchantia polymorpha subsp. *ruderalis*	LC							o						
Metzgeria furcata	LC								c					
Nardia geoscyphus	LC-att							o						
Nardia scalaris	LC										o			
Nowellia curvifolia	LC-att							o						
Odontoschisma denudatum	LC-att	a												
Pellia endiviifolia	LC							o						
Pellia epiphylla	LC	a						o						
Plagiochila asplenioides	LC			c										

Species name	**Site / Red list category**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Plagiochila porelloides	LC	c							c		c			
Porella platyphylla	LC								c		c			
Preissia quadrata	LC	c												
Ptilidium ciliare	LC	o						o	o			o	o	
Ptilidium pulcherrimum	LC	o										o		
Riccardia incurvata	**VU**	o												
Scapania aequiloba	LC-att	c												
Scapania irrigua	LC							o						
Scapania nemorea	LC	a							a					
Tritomaria exsectiformis	LC-att	a									a			
Amblystegium serpens	LC		c						c	o				
Anomodon attenuatus	LC								c					
Atrichum tenellum	LC-att							o						
Atrichum undulatum var. *undulatum*	LC	o												
Aulacomnium palustre	LC				o			o						
Barbula convoluta	LC			c										
Barbula unguiculata	LC	o												
Brachythecium albicans	LC	o											o	
Brachythecium mildeanum	LC-att	o												
Brachythecium rutabulum	LC	o							o					
Brachythecium salebrosum	LC	o										o		
Brachythecium velutinum	LC	c							c			o		
Brachythecuim oedipodium	LC-att							o						
Bryoerythrophyllum recurvirostrum	LC	c							c					
Bryum argenteum	LC					c			c					
Bryum caespiticium	LC		c						c					
Bryum capillare	LC	c							c					
Bryum elegans	LC-att		c											
Bryum moravicum Podp.	LC							o	c					
Bryum pallens	LC							o				o		
Bryum pseudotriquetrum agg.	LC							o						
Calliergon cordifolium	LC											o		
Calliergonella cuspidata	LC	o												
Campyliadelphus chrysophyllus	LC	c	c											
Campylophyllum calcareum	**DD**	c							c			c		
Campylopus flexuosus	LC	a						a	a				a	
Campylopus fragilis	LC-att	a							a	a				
Campylopus introflexus	LC	o											a	
Ceratodon purpureus	LC	c												
Cirriphyllum piliferum	LC									o				
Cratoneuron filicinum	LC									o				
Ctenidium molluscum	LC	c												
Cynodontium polycarpon	LC	a						a	a	a			a	
Dicranella cerviculata	LC	a						a		a				
Dicranella heteromalla	LC	a						a	a	a			a	
Dicranella varia	LC	o												
Dicranoweisia cirrata	LC	a							a					
Dicranum flagellare	LC-att							a		a				
Dicranum fuscescens	LC								a					
Dicranum montanum	LC	a										o		

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Dicranum polysetum	LC	o								o		o	o	
Dicranum scoparium	LC	a						a	a	a	a		a	o
Dicranum spurium	LC	o	o										o	
Dicranum tauricum	LC								a					
Didymodon fallax	LC	c												
Didymodon insulanus	LC								c					
Didymodon rigidulus var. *rigidulus*	LC		c	c					c					
Distichium capillaceum	LC	c							c		c			
Ditrichum flexicaule	LC-att		c				c							
Encalypta streptocarpa	LC	c							c					
Encalypta vulgaris	LC	c												
Eurhynchium crassinervium	LC								c					
Eurhynchium hians	LC	c		c					c					
Eurhynchium striatulum	**LR-nt**								c					
Fissidens dubius var. *dubius*	LC	c							c		c			
Fissidens gracilifolius	LC								c					
Funaria hygrometrica	LC					o								
Grimmia pulvinata	LC	c							c					
Grimmia tergestina	LC-att		c											
Grimmia trichophylla	**LR-nt**								a				a	
Gymnostomum aeruginosum	LC		c						c		c			
Gyroweisia tenuis	**DD**	c							c		c			
Herzogiella seligeri	LC											o		
Homalothecium sericeum	LC					c			c					
Homomallium incurvatum	LC								c					
Hylocomium splendens	LC	o						o					o	
Hymenostylium recurvirostrum	**LR-nt**	c	c											
Hypnum cupressiforme var. *cupressiforme*	LC	a								o	a	a		
Hypnum cupressiforme var. *lacunosum*	LC			c					c					
Hypnum jutlandicum	LC	o							o					
Hypnum sauteri	**CR**		c											
Isothecium alopecuroides	LC								c		c			
Isothecium myosuroides	LC-att								c					
Leptobryum pyriforme	LC	c												
Leucobryum glaucum	LC	o								o			o	
Leucobryum juniperoideum	LC								a	a,o			a	
Leucodon sciuroides	LC		c											
Mnium hornum	LC	a							a	a	a		a	
Mnium stellare	LC	c							c					
Neckera complanata	LC		c						c					
Neckera crispa	LC			c					c					
Orthodontium lineare	LC	a						a						
Orthothecium intricatum	LC	c	c								c			
Orthotrichum affine	LC									o				
Orthotrichum anomalum	LC		c						c					
Plagiomnium affine	LC	o						o						
Plagiomnium rostratum	LC-att								o					
Plagiomnium undulatum	LC									o				
Plagiothecium cavifolium	LC								a					
Plagiothecium curvifolium	LC	o						a	o					

Species name	**Site / Red list category**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Plagiothecium denticulatum var. *denticulatum*	LC	a						a	a					
Plagiothecium laetum	LC	a							a					
Plagiothecium succulentum	LC								a					
Plagiothecium undulatum	LC											o		
Pleurozium schreberi	LC	o	o					o	o	o	o	o	o	o
Pogonatum aloides	LC										o			
Pogonatum urnigerum	LC	o										o		
Pohlia andalusica	**DD**	o						o						
Pohlia annotina	LC		o											
Pohlia cruda	LC		c	c										
Pohlia nutans subsp. *nutans*	LC	a						a					a	
Pohlia wahlenbergii	LC	o										o		
Polytrichastrum formosum	LC	o												
Polytrichum commune	LC									o				
Polytrichum juniperinum	LC	o											a	
Polytrichum piliferum	LC	a											o	
Pseudoleskeella catenulata	LC	c							c					
Pseudoleskeella nervosa	LC								c					
Pseudoleskeella tectorum	**CR**						c							
Pseudotaxiphyllum elegans	LC	a						a						
Pterigynandrum filiforme	LC								o					
Racomitrium heterostichum	LC	a						a	a				a	
Rhizomnium punctatum	LC	c							c					
Rhynchostegiella tenella	**LR-nt**	c		c					c		c	c		
Rhynchostegium confertum	**DD**								a					
Rhynchostegium murale	LC		c						c					
Rhytidiadelphus squarrosus	LC	o						o						
Rhytidiadelphus triquetrus	LC		c											
Sanionia uncinata	LC	o												
Schistidium apocarpum	LC		c											
Schistidium crassipilum	LC		c				c		c					
Schistidium dupretii	LC	c												
Schistostega pennata	LC							a						
Scleropodium purum	LC	o						o		o				
Seligeria donniana	LC	c							c					
Sphagnum capillifolium	LC	o												
Sphagnum fallax	LC	o						o		o			o	
Sphagnum girgensohnii	LC											o		
Sphagnum palustre	LC	o												
Sphagnum quinquefarium	LC							o			o		o	
Sphagnum russowii	LC	o												o
Syntrichia ruralis	LC						c		c					
Taxiphyllum wissgrillii	LC								c					
Tetraphis pellucida	LC	a						a	a	a	a	a	a	
Thuidium philibertii	LC	o												
Tortella inclinata	LC		c											
Tortella tortuosa	LC	c						o	c		c			
Tortula muralis var. *aestiva*	LC								c		c			
Tortula muralis var. *muralis*	LC	c	c						c					

Species name	Site / Red list category	1	2	3	4	5	6	7	8	9	10	11	12	13
Tortula subulata	LC								c					
Trichodon cylindricus	LC							o						
Trichostomum crispulum	LC-att	c												
Weissia controversa var. *controversa*	LC	c	c											

Comments and discussion

Many of the bryophytes inhabiting calcareous sandstone rocks are rare in northern Bohemia. These include e.g. *Campylophyllum calcareum*, *Ditrichum flexicaule*, *Eurhynchium striatulum*, *Grimmia tergestina*, *Gyroweisia tenuis*, *Orthothecium intricatum*, *Pseudoleskeella catenulata*, *Rhynchostegiella tenella*, *Scapania aequiloba*, *Seligeria donniana*, *Trichostomum crispulum*. *Conocephalum salebrosum* Szweyk., Buczkowska & Odrzykoski has been newly segregated from *C. conicum* by Szweykowski & al. (2005) and is probably widely distributed, particularly in calcareous regions. It was observed in the Vranovské skály near Vranov. *Riccardia incurvata*, a vulnerable species of the Czech bryoflora, was observed in small amounts among other wetland bryophytes on damp bare soil along a forest path near Havraní skála. Of special interest are however the records of *Hypnum sauteri* and *Pseudoleskeella tectorum*, two critically endangered species of the Czech bryoflora.

Hypnum sauteri was found together with *Tortella tortuosa* on a solitary calcareous sandstone boulder on the forest floor of a dense young pine forest on the bottom of a satellite of the Tvarožník (loc. 2). The population is extremely small in size (a few cm^2), but produced many sporophytes, immature at the time of collection. The species was just recently reported as new for the Czech Republic from one locality in the Giant Mountains at the altitude of 1100 m (Kučera & al. 2003). The authors describe *Hypnum sauteri* as a European endemic, known until now from the Alps, Western Carpathians, Jura Mts and northern Norway. The species normally grows on basic, usually calcareous rocks in montane and subalpine belts, sometimes encroaching to the alpine zone. The find of these species at an altitude of only 290 m in the Hradčanské stěny was highly surprising but fits other records of vascular plants from the region with a similar demontane type of distribution (see above).

Pseudoleskeella tectorum was found on the top of the sandstone rock Vinice (loc. 6) in small amounts on sun-exposed, calcareous sandstone rocks together with *Schistidium crassipilum*, *Syntrichia ruralis* and *Ditrichum flexicaule*. The species is known in Europe from Scandinavia and Iceland south to Spain, Italy and the Crimea. It is also known from North, East, Central and Southwest Asia, North and Central America. In Central Europe excluding the Alps, the species is rare and endangered in most countries. It grows mainly on synanthropic habitats (tiled roofs, walls, concrete), rarely as epiphyte and on rocks (Nebel & Schoepe 2001). Váňa (1995) treated the species as already extinct in the Czech Republic. In the meantime it was however found at two localities in the Hrubý Jeseník Mts. of Moravia and it could be moved to the category „critically endangered" in the new Red List of the Czech Republic (Kučera & Váňa 2003).

The calcareous sandstone rocks in the northern part of the Hradčanské stěny show bryofloristic affinities with calcareous sandstones in the Saxonian-Bohemian Switzerland and in the sandstone region Zittauer Gebirge (Müller 1990, Müller & Reimann 2002) but differ in three aspects. Firstly, the proportion of thermo- and heliophilous calciphilous bryophytes (*Ditrichum flexicaule*, *Grimmia tergestina*, *Tortella inclinata*, *Trichostomum crispulum*) is due to a milder and drier climate and the presence of fully exposed rocks much higher in the Hradčanské stěny region. Secondly, the bryophyte diversity of the non-calcareous sandstone formations of the Hradčanské stěny is in comparison with the well investigated formations of the Saxonian-Bohemian

Switzerland and the Zittauer Gebirge much lower. Typical elements of vertical rock walls include *Anastrophyllum minutum*, *Bazzania trilobata*, *Cynodontium polycarpon*, *Dicranella heteromalla*, *Pohlia nutans* subsp. *nutans* and *Tetraphis pellucida*, characteristic for the dry rocks and platforms are *Dicranum scoparium* and *Ptilidium ciliare*. And lastly, several characteristic species of the Saxonian-Bohemian Switzerland and the Zittauer Gebirge seem to be rare or absent in the Hradčanské stěny. The latter group includes montane-alpine elements (*Anastrophyllum michauxii*, *Cephalozia catenulata*, *C. leucantha*, *Dicranodontium asperulum*, *Jungermannia hyalina*, *Lophozia confertifolia*, *L. longiflora*, *Mylia taylorii*), suboceanic elements (*Gymnocolea inflata*, *Kurzia sylvatica*, *Odontoschisma denudatum*), and species of wet sandstone rocks (among others *Heterocladium heteropterum*, *Jungermannia pumila*, *J. sphaerocarpa*, *Marsupella emarginata*, *Trichostomum tenuirostre*, *Racomitrium aciculare*, *Scapania undulata*, *Tetrodontium brownianum*, *Thamnobryum alopecurum*).

Conclusions

Despite the high value of the regionally unique flora of both vascular and non-vascular plants, this interesting region of calcareous sandstone rocks on the northern edge of the Hradčanské stěny has not been protected as a nature reserve until now. It has been obviously caused by the contrasting interests of the army and the nature conservation. The conservation problems of the Hradčanské stěny include the intense forestry and the tourism. The complete deforestation of the areas surrounding the rocks had adverse effect on the specific damp microclimate of the rock bases. A clearly visible impact of tourism is the erosion caused by the walkers on footpaths and the climbers on rocks. The creation of a nature reserve is thus urgently needed for the protection of the biological values of this part of the Hradčanské stěny.

Souhrn

Bryoflóra pískovcových Hradčanských stěn severně Máchova jezera u Doks byla autory zkoumána během dvou dnů letošního května a čtyřech dnů na přelomu září a října. Celkem bylo zaznamenáno 182 mechorostů. Floristicky nejzajímavější se ukázaly pískovcové formace obohacené vápencem v severní části zkoumaného území. Mnohé z mechorostů, které byly na těchto skalách nalezeny, jsou v severních Čechách vzácné (např. *Campylophyllum calcareum*, *Ditrichum flexicaule*, *Eurhynchium striatulum*, *Grimmia tergestina*, *Gyroweisia tenuis*, *Orthothecium intricatum*, *Pseudoleskeella catenulata*, *Rhynchostegiella tenella*, *Scapania aequiloba*, *Seligeria donniana*, *Trichostomum crispulum*). Nejzajímavějšími nálezy pak byla zjištění dvou kriticky ohrožených druhů naší bryoflóry – *Hypnum sauteri* a *Pseudoleskeella tectorum*. Prvně jmenovaný, který byl pro bryoflóru České republiky zjištěn teprve nedávno na krkonošském Rudníku (Kučera & al. 2003) byl nalezen spolu s druhem *Tortella tortuosa* na osamoceném vápencovém balvanu v borovém lese na bázi jedné z menších skal okolo formace Tvarožník. Nález tohoto montánně-subalpínského prvku v nadmořské výšce pouhých 290 m byl překvapivý, avšak odpovídá dalším fytogeograficky podobným demontánním nálezům cévnatých rostlin a lišejníků z oblasti. *Pseudoleskeella tectorum* byla zjištěna na vrcholu pískovcové formace Vinice v malém množství na otevřených, vápnitých pískovcích spolu s druhy *Schistidium crassipilum*, *Syntrichia ruralis* a *Ditrichum flexicaule*.

Pískovce Hradčanských stěn vykazují bryofloristické příbuznosti s pískovci Česko-saského Švýcarska a pískovcové oblasti Zittauer Gebirge, avšak liší se třemi aspekty. Prvním je vyšší podíl teplo- a světlomilných kalcifilních mechorostů (*Ditrichum flexicaule*, *Grimmia tergestina*, *Tortella inclinata*, *Trichostomum crispulum*) díky mírnějšímu a suššímu klimatu a většímu zastoupení exponovaných skal. Druhým aspektem je naopak větší chudoba acidofilních mechorostů na kyselých pískovcových skalách oblasti ve srovnání s dobře prozkoumanými formacemi Česko-saského Švýcarska a Zittauer Gebirge. Posledním významným rozdílem je absence nebo podstatně menší zastoupení některých charakteristických druhů dvou výše uvedených oblastí

v Hradčanských stěnách – zejména horských a suboceánických prvků (např. *Dicranodontium asperulum*, *Jungermannia hyalina*, *Lophozia longiflora*, *Mylia taylorii*, *Kurzia sylvatica*, *Heterocladium heteropterum*, *Tetrodontium brownianum*, *Thamnobryum alopecurum*).

Výše uvedené doklady biologické hodnoty severní části Hradčanských stěn jsou významným argumentem pro snahu o formální ochranu oblasti vyhlášením velkoplošného chráněného území.

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LIŠEJNÍKY ZAZNAMENANÉ BĚHEM FLORISTICKÉHO KURZU ČBS 2005 V JIHLAVĚ

The lichens recorded during the CBS Floristic course (2005) in Jihlava (western Moravia)

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Abstract: Lichens recorded/collected in the Českomoravská vrchovina highland in the region surrounding the town of Jihlava (western Moravia) are listed. 67 lichen species were recorded in total, about two thirds of them were epiphytes. *Lecanora persimilis*, *Parmelia tiliacea*, *P. acetabulum*, *Ramalina farinacea*, *R.. fastigiata* and *Usnea filipendula* represent the best records.

Keywords: Czech Republic, lichens, epiphytic.

Během letošního floristického kurzu České botanické společnosti v Jihlavě konaného ve dnech 2.-8. července bylo na plánovaných trasách floristických exkurzí nelezeno několik zajímavých druhů lišejníků, což iniciovalo vytvoření celkového soupisu nalezených druhů.