

## Bryofloristic characteristics of some notable vegetation types in Bohemian Forest

### Charakteristika bryoflóry některých význačných vegetačních typů na Šumavě

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#### Abstract

A bryofloristic description has been provided of the following notable vegetation types distributed in Bohemian Forest (Czech side): forb-rich beech forests, fir-beech forests, acidophilous beech forests, planted spruce forests of the lower belt (700–1000 m) and upper belt (1000–1200 m), and waterlogged spruce forests. The bryoflora of the glacial cirques and bryoflora of the Vydra valley are discussed in separate sections. The number of bryophyte species reported from the Czech side of Bohemian Forest and from the summit areas of the Bavarian part of the Šumava Mts. exceeds a total of 465 species, i.e., ca. 55% of the total recorded in the Czech Republic.

*Key words:* Šumava National Park, climax forest vegetation, glacial cirques, azonal stands, Vydra river valley, bryophytes

#### Introduction

Bryophytes represent a substantial part of plant diversity in Bohemian Forest. Bryologists indicated about 465 species of the bryophytes from both the Czech sector and summit area of the Bavarian part of these mountains. This total equals about 55% of the number of bryophytes reported from the Czech Republic (after VAŇA 1993, 1995). In the course my own collection and parallel revision of the PR and PRC herbaria, I have been able to verify 395 species.

The ecological role of the bryophytes, surely, cannot easily be overlooked. In the mires, themselves the most prominent ecosystems of Bohemian Forest, mosses produce the majority of the biomass. Their role in other ecosystems, as I shall try to point out, is far from being negligible.

In 1992–1995, I carried out bryological investigation on nearly the whole territory of the Šumava National Park (KUČERA 1995), striving after the epilithic bryophyte communities and bryofloristic characteristics of selected vegetation types. The Šumava mountains lack, so far, any complete study of their bryoflora and related bryological inventarisation. The following data, therefore, must be taken in as a first approximation towards such a goal.

MORAVEC (1964) distinguishes five units of the climax forest vegetation in Bohemian Forest. Three of them are represented in the area of my interest (approximately, the area of the National Park, without the plateaus of the Churáňovské and Kochánovské Pláně): forb-rich

beech forests, fir-beech forests, acidophilous montane beech forests, and climatic-climax spruce forests. These vegetation units, however, cover only a relatively smaller part of the national park. To the bryofloristic descriptions of these types, therefore, I have added other vegetation units typical for today's Bohemian Forest: azonal waterlogged spruce forests of the higher altitudes (ca. 1000–1100 m) and spruce forest plantations of the lower (ca. 700–1000 m) and higher altitudes (ca. 1000–1200 m). A separate chapter discusses the vegetation of the glacial cirques; therefore I treat their characteristics individually, as well as the characteristics of the Vydra river valley.

## Results

### Forb-rich beech forests and fir-beech forests

In the area of interest, this vegetation type is found only on Stožec hill and Spáleníště hill, and on Radvanovický hřbet ridge, in the altitudes between ca. 800 and 1000 m. The substrate of these localities is formed by the granites of the Rastenberg type which are, curiously enough, the most basic rock type in the area due to a high content of basic feldspars. Thus they allow the growth of the subcalciphyle species, such as *Neckera complanata*, *Tortella tortuosa*, *Anomodon attenuatus*, *Anomodon rugelii*, *Syntrichia ruralis*, *Homalia trichomanoides*, *Mnium stellare*, *Porella platyphylla* or *Apometzgeria pubescens*, i.e., species that are missing from other localities of the area.

Among the bryophytes that characterize species-rich mixed forests with *Abies alba*, *Picea abies*, *Acer pseudoplatanus* and other broadleaved tree dominants, I would include in particular *Plagiomnium cuspidatum*, *Plagiothecium nemorale*, *Plagiothecium succulentum*, *Eurhynchium angustirete*, *Brachythecium reflexum*, *Brachythecium rutabulum*, *Brachythecium salebrosum*, *Rhizomnium punctatum* and *Plagiochila porelloides*. Associated with them occur the species which are common in all types of beech forests (not only the species-rich types): *Isothecium alopecuroides*, *Hypnum cupressiforme* and *Grimmia hartmanii*. On drier half-shaded and open rocks, we find mostly *Cynodontium polycarpon* and *Rhabdoweisia fugax*, common in the area to all types of forests and substrates.

In these species-rich forests the bryophytes are found only on substrates typical for them, e.g. on rocks, decaying wood, and in lesser abundance on living trees. This typical phenomenon is due to strong competition of vascular plants.

### Acidophilous montane beech forests

These forests create the upper part of the beech vegetation belt and are found in altitudes between ca. 1000 and 1100–1150 m. Most of them are found in Trojmezenská hornatina highland.

This vegetation type is more open than the foregoing one, which is reflected in a much poorer herbaceous layer dominated mostly by *Calamagrostis villosa*. The bryoflora is quite poor too, probably due to the relatively lower air humidity, and is restricted mainly to stones and outcropping rocks. Typical species are *Paraleucobryum longifolium*, *Hypnum cupressiforme*, *Grimmia hartmanii*, in minor abundance also *Isothecium alopecuroides*, often are found the ubiquitous *Cynodontium polycarpon* and *Rhabdoweisia fugax*.

### Spruce forest plantations of the lower altitudes (about 700–1000 m)

These forests grow in the vegetation belt of indigenous beech forests. Spruce plantations cover vast areas especially in Trojmezenská hornatina highland, and are represented mostly by stands younger than 80–100 yrs., in a very bad state of health.

Bryophytes of these forest are almost exclusively epilithic, the herb layer is either complete-

ly lacking or formed by blueberry and other acidophilous species. Acidophilous ubiquitous *Dicranum scoparium*, *Polytrichastrum formosum*, *Lepidozia reptans*, *Bazzania trilobata*, *Plagiothecium laetum*, *Pohlia nutans*, *Pleurozium schreberi*, *Hylocomium splendens*, *Sphagnum capillifolium*, *Sphagnum quinquefarium*, are the typical representatives of bryophytes; scattered are *Barbilophozia attenuata*, *Anastrophyllum minutum*, *Heterocladium heteropterum* and *Scapania nemorea*.

### Spruce forest plantations of the higher altitudes (1000–1200 m)

These forests occur in the climatic conditions that would even naturally favour the Norway spruce, though in combination with beech, fir and other trees. Large areas of these forests are found predominantly on the plateaus near Kvilda and Modrava. The floristic composition represents the transition between the foregoing type and the climatic spruce forests; the majority of species found in the spruce forests at lower elevations is completed by high-montane bryophytes of the climax types (*Dicranum fuscescens*, *Dicranodontium undatum*, *Bazzania tricrenata*, *Anastrepta orcadensis*).

We can observe considerable difference in the epilithic bryoflora on (1) granites and granitoides (the species spectrum here is almost coincident with that observed in spruce plantations of lower altitudes, enriched by a few above listed species) and (2) gneisses where the typical epilithic bryophytes are *Andreaea rupestris*, *Cynodontium polycarpon*, *Cynodontium strumiferum*, *Rhabdoweisia fugax* and *Racomitrium sudeticum*. This bryophyte community, however, develops only in half-shaded or open habitats, never under a closed canopy.

### Climatic-climax spruce forests

This vegetation type is found in Bohemian Forest in the altitude above 1200 or 1250 m, up to the summits of the highest peaks, not exceeding the elevation of 1350 m on the Czech side of the range.

In these forests the bryophytes create an integral part of the understory, growing as epilithic and epiphytic component, and even on the ground among the vascular plants. Some species are phytosociologically considered to be the characteristic species of the climatic-climax spruce forests (*Barbilophozia lycopodioides*). Some ubiquitous species seem to reach here their ecological optimum – *Polytrichastrum formosum*, *Dicranum scoparium*, *Lophozia ventricosa*. Other ubiquitous, on the contrary, are found only rarely (such as *Hypnum cupressiforme*). Among the typical species of this vegetation type in Bohemian Forest I should include *Dicranum fuscescens*, *Polytrichastrum alpinum*, *Polytrichastrum longisetum*, *Plagiothecium undulatum*, *Hylocomium umbratum*, *Anastrepta orcadensis*, *Anastrophyllum minutum*, *Bazzania tricrenata*, *Lophozia longiflora* and *Scapania umbrosa*.

### Waterlogged spruce forests of the upper altitudes (1000–1100 m)

This vegetation type belongs to the most interesting ecosystems in terms of their bryoflora. Waterlogged spruce forests are spread mostly in the area of Modravské slatě mires, in the central part of Bohemian Forest. Bryophytes occur in particular along the streams and in numerous spring sites and create the majority of the ground layer .

Typical bryophytes of these forests are the peat mosses, namely *Sphagnum girgensohnii* and *Sphagnum fallax*. Other representative species are mainly the liverworts *Calypogeia azurea*, *Calypogeia neesiana*, *Barbilophozia floerkei*, *Lophozia incisa*, *Lophozia longiflora*, *Lophozia ventricosa*, *Jungermannia sphaerocarpa*, *Marsupella emarginata*, *Aneura pinguis*, *Scapania undulata*, and the mosses *Polytrichastrum formosum*, *Polytrichastrum longisetum*, *Plagiothecium platyphyllum*, *Plagiothecium undulatum*, *Rhizomnium magnifolium* and *Di-*

*cranella palustris*. Quite regular is the presence of some liverworts included in the preliminary Red List of bryophytes of the Czech Republic (*Moerckia blyttii* and *Riccardia multifida*) which are elsewhere rare.

## Bryoflora of the glacial cirques

The glacial cirques are probably the sites of the greatest bryophyte diversity in Bohemian Forest. This is caused mainly by the heterogeneity of microhabitats in combination with great moisture, air humidity and minor competitive force of vascular plants due to their bad nutrition on bare rocks and scree that shape the headwall relief of the cirques. The bryophyte flora of the individual cirques does not share much in common, and therefore I shall treat them in a brief description separately.

### The cirque of Plešné Lake

The bryoflora of this cirque clearly belongs to the most outstanding examples of bryophyte diversity in Central European middle-mountains.

The lush populations of the moss *Plagiothecium neckeroideum* and liverwort *Kurzia trichoclados*, both known in the Czech Republic only from Bohemian Forest, are the most interesting bryophytes of this cirque. Other interesting and rare species of the wet rocks are *Andreaea rothii*, *Lophozia obtusa* and *Jungermannia obovata*.

The typical inhabitants of wet boulders and rocks in the cirque are the mosses *Dicranodontium denudatum*, *Dicranodontium asperulum*, *Polytrichastrum alpinum* and *Polytrichum commune*, and the liverworts *Mylia taylorii*, *Anastrepta orcadensis*, *Anastrophyllum minutum*, *Jungermannia sphaerocarpa* and *Lophozia sudetica*. Quite interesting is the behavior of the liverwort *Gymnocolea inflata*, a species of the bog mires, growing here on wet rocks together with *Marsupella emarginata*, *Racomitrium aquaticum* etc. Also, we may find luxuriant cushions of *Sphagnum girgensohnii*, *Sphagnum quinquefarium* and *Sphagnum russowii* directly on the rocks.

### The cirque of Prášílské Lake

The rock faces above the lake are less developed than those above Plešné or Černé lakes; moreover most of the trees fell victim to the wind damage in recent years. Therefore the bryoflora of the cirque is very poor, resembling that of spruce plantations at comparable altitudes. *Dicranodontium asperulum* belongs to the „better“ species found here. On contrary, the expansion of the species *Campylopus flexuosus* together with *Orthodontium lineare* on the rocks seems to be very interesting.

### The cirque of Laka Lake

There is no genuine cirque above the Laka Lake; the slopes of Mt. Laka are only slightly concave and covered by a climatic-climax spruce forest up to about two thirds of their flanks.

In spite of the missing genuine cirque, the bryoflora has many interesting species found mostly on abundant extremely wet places, making the general appearance of the forest not unlike the waterlogged forest of the Modravské slatě mires.

*Hookeria lucens*, *Jungermannia obovata*, *Riccardia multifida*, *Rhizomnium magnifolium* and *Scapania uliginosa*, occurring here in masses even on permanently wet rocks, are the most interesting bryophyte species found here.

### The cirques of Černé Lake and Čertovo Lake

These two cirques possess almost the same set of bryophytes; although more detailed studies would be desirable, I treat them in a single section.

The cirque above Černé Lake is geologically the best sculptured corrie on the Czech side of Bohemian Forest. Its bryoflora, however, is somewhat poorer than that of the cirque of Plešné Lake. This is probably because of the greater openness of the cirque and therefore somewhat lower air humidity, and possibly, because of the heavier impact of atmospheric pollution affecting the health of spruces. Similar is the case of the cirque above Čertovo Lake.

Nevertheless these cirques harbour at least two species found nowhere else in Bohemian Forest, namely the moss *Rhabdoweisia crenulata*, growing in wet fissures of rocks in both cirques; and *Nardia compressa* in the cirque above Čertovo Lake, a species not discovered in the Czech Republic until 1994 almost simultaneously in the Jeseníky and Bohemian Forest. (cf. VAŇA 1994). Among the other interesting species it is worthwhile to indicate *Dicranodontium asperulum*, *Andreaea rothii* and *Moerckia blyttii*, all found in both cirques.

## Bryophytes of the Vydra river valley

The valley of Vydra river, especially its canyon-shaped part between Antigl and Čeňkova Pila, represents a striking illustration of the valley phenomenon. The violent stream has created a number of unique and interesting habitats, and its steep flanks stretched from the north to south serve as a crossroads of thermophilous and mountainous species.

The water moss *Hygrohypnum molle* was the most interesting find made by myself. The commonest inhabitants on the almost permanently inundated boulders in the riverbed are *Hygrohypnum ochraceum*, *Fontinalis squamosa* or *Racomitrium aciculare*. *Racomitrium sudeticum*, *Andreaea rupestris*, *Lophozia sudetica*, *Barbilophozia hatcheri*, *Tritomaria exsecta*, *Cynodontium strumiferum*, *Cynodontium polycarpon* and *Kiaeria blyttii* (here seemingly quite often) are the most typical species of the temporarily inundated or sprinkled boulders. Notable species of the inundated riverbanks are *Pseudobryum cinclidioides* and *Tayloria serrata*.

The scree offers a very interesting habitat as well; it is covered mostly by abundant cushions of the macrolichens, such as *Cladonia spp.* and *Parmelia spp.* Among mosses the most common species are members of the genus *Racomitrium* (*R. heterostichum*, *R. sudeticum*, *R. microcarpon*, *R. affine*), further *Hedwigia ciliata*, *Andreaea rupestris*, *Cynodontium polycarpon*, *Rhabdoweisia fugax*, *Polytrichum piliferum*, *Leucobryum juniperoideum*, and, found on a single place, *Antitrichia curtispindula*. A more detailed description of the bryoflora of this canyon is provided by Němcová in her Ms.S. Thesis (NĚMCOVÁ 1991).

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## References

- KUČERA J., 1995: Společenstva epilithických mechorostů na území Národního parku Šumava [Communities of epilithic bryophytes from Šumava NP]. *Ms.*, 89 pp., *dipl. thesis, depon. in: Knihovna katedry botaniky PřF UK Praha (in Czech)*.
- MORAVEC J., 1964: Vegetační poměry Šumavy [Vegetational conditions of Šumava]. *Ochrana přírody* 19: 66–72 (in Czech).
- NĚMCOVÁ A., 1991: Bryoflóra a bryosociologické poměry v SPR Povydří [Bryoflora and bryosociological characteristics at Povydří National Nature Reserve]. *Ms.*, 121 pp., *dipl. thesis, depon. in: Knihovna katedry botaniky PřF UK Praha (in Czech)*.
- VAŇA J., 1993: Preliminary list of threatened bryophytes in the Czech Republic. I. Liverworts (*Hepatophyta*) and hornworts (*Anthocerotophyta*). *Preslia, Praha*, 65/3: 193–199.
- VAŇA J., 1994: *Nardia compressa* (Hook.) S. F. Gray – nový druh játrovek (*Hepatophyta*) pro

území České republiky [*Nardia compressa* (Hook.) S. F. Gray – a new species of liverworts (*Hepatophyta*) for the Czech Republic]. *Preslia, Praha*, 66/4: 353–356 (in Czech).

VÁŇA J., 1995: Preliminary list of threatened bryophytes in the Czech Republic. II. Mosses (*Bryophyta*). *Preslia, Praha*, 67/2: 173–180.