

# THE MOSS *BUXBAUMIA VIRIDIS* (BRYOPSIDA, BUXBAUMIACEAE) IN THE CZECH PART OF THE WESTERN CARPATHIANS – DISTRIBUTION AND ECOLOGY

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**Abstract.** The epixyloous moss *Buxbaumia viridis* (Moug. ex Lam. & DC.) Brid. ex Moug. & Nestl. is considered an endangered or vulnerable species in all countries in the Central Europe. In the Czech part of the Western Carpathians the species was recorded very occasionally in the twentieth century. In 1998 detailed field monitoring of the species together with verification of its occurrence on historically known localities were started. As a result, a number of new localities of *B. viridis* have been discovered in this region. Very little is known about the ecology and population biology of the species. This article provides some new data regarding the autecology and population-biology of *B. viridis* based upon studies of its Western Carpathian populations.

**Key words.** Bryophyta, *Buxbaumia viridis*, Western Carpathians, endangered species, ecology, population-biology

## INTRODUCTION

*Buxbaumia viridis* (Moug. ex Lam. & DC.) Brid. ex Moug. & Nestl. is a highly specialized and atypical moss with highly reduced leaves arising from a protonemal mat and having a large distinctive capsule (Fig. 1). The species is very specific in its habitat requirements being restricted to decaying wood in wet, shaded places in woodland. It is widespread in the Western Carpathians, but is apparently declining, rare and threatened in most countries of Central Europe, and is listed as endangered or vulnerable (e.g., Ochyra 1992; Jędrzejko 1997; Kubinská *et al.* 2001; Kučera & Váňa 2003). This may

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From STEBEL, A. & R. OCHYRA (eds),  
*Bryological Studies in the Western Carpathians*,  
Sorus, Poznań: pp. 37–44 (2004).



**Fig. 1.** Capsules of *Buxbaumia viridis* on a rotten spruce log in the Hlučová stream valley (Slezské Beskydy Mts). Photo made by Lukáš Macura.

be because of habitat destruction resulting from commercial forestry practices in semi-natural coniferous woodland.

This article summarizes all historical and recent data about the occurrence of the species, together with contemporary results of ecological research realized in the Western Carpathians in 1999–2003.

### HISTORICAL RECORDS

The following list of localities consists of all historical data on the occurrence of the species in the Czech part of the Western Carpathians based upon herbarium records up to 1955 from BRA, OLM, OP and BRNM (abbreviations of the herbaria according to Holmgren *et al.* 1990). The species was not recorded in this region between 1956 and 1997. Localities are ordered according to mountain ranges and collecting date.

#### Moravskoslezské Beskydy Mts

**Radhošťské Beskydy Mts.:** 5 km SW of Horní Lomná village, Malý Polom Mt, alt 1050 m, 1948, leg. Duda (BRNM); spring area of the Červík stream, alt. 750 m, 21.IX.1950, leg. Duda (OP); Staré Hamry village, 1951, leg. Duda (OP); Horní Bečva village, S slope of Čertův mlýn Mt, valley of brook, alt. 1190–1200 m,

22.X.1951, leg. Pospíšil (BRNM, OLM); Mt Smrk, alt. 600 m, 20.VI.1955, leg. Duda (OP); valley of the Červík stream, lower part of the brook near the border of the Staré Hamry village, alt. 600 m, 20.VI.1955, leg. Duda (OP).

### Oderské vrchy Mts

Kozlov village, 1946, leg. Jedlička (BRNM).

### Vsetínské vrchy Mts

Lipůvka village, between Dubová hora hill and Milonice village, valley of a stream, 4.VII.1936, leg. Šmarda (BRNM); Práseň village, 2.IX.1949, leg. Pospíšil (BRNM); Nový Hrozenkov village, Mt Popradný, loc. Hutě Brodské, on rotten wood of *Abies alba*, alt. 550 m, 23.VIII.1951, leg. Jedlička (BRNM); Nový Hrozenkov village, valley of the Kobylská stream, rotten wood, alt. 480 m, 24.VIII.1951, leg. Jedlička (BRNM); Malé Karlovice village, along a forest road from the Práseň village, 25.IX.1951, leg. Pospíšil (BRNM); SW of Mt Makyta, valley of the Senice stream, near the brook, 29.IX.1951, leg. Pospíšil (BRNM); Halenkov village, 1 km E of Mt Cáb, valley of brook, alt. 650–700 m, 1.X.1951, leg. Pospíšil (BRNM); Valašská Bystřice village, Tisňavy valley, 12.X.1951, leg. Pospíšil (BRNM); Velké Karlovice village, Mt Kasárna, 27.XII.1951, leg. Pospíšil (BRNM).

### Bílé Karpaty Mts

Lopeník Mt, *sine dato*, leg. Nábělek (BRA).

In addition, records of the moss exist in the historical literature, namely in the “vicinity of Český Těšín town” published by Plucar (1855). It seems to be the first known report of the species in the Western Carpathians. Unfortunately, Plucar’s herbarium specimen of *Buxbaumia viridis* could not be located.

## NEW RECORDS

### Moravskoslezské Beskydy Mts

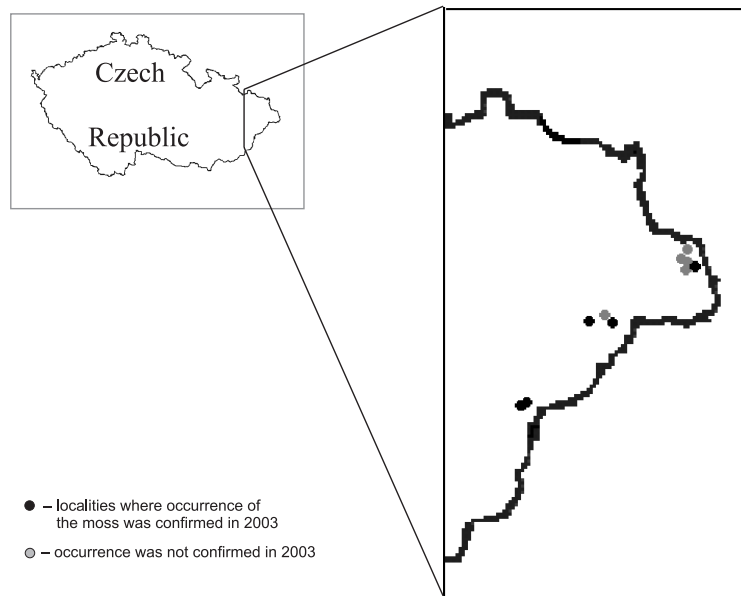
**Radhošťské Beskydy Mts.**: 4 km ESE of the Staré Hamry village, 1.8 km SE of Mt Malý Lučný and 1.4 km N of Mt Stříšky, spruce forest on the right bank of the stream, alt. 555 m, 4.VII.2000, leg. Plášek (OP); 5 km E of the Staré Hamry village, 2.7 km E of Mt Malý Lučný and 2.4 km NNE of Mt Stříšky, spruce forest on the right bank of stream, alt. 584 m, 4.VII.2000, leg. Plášek (OP); SE slope of Mt Smrk, upper part of the Kyčerov stream valley, S edge of the Peretanky Nature Reserve [GPS position: S-1942 grid, M33 zone: E=3744,719 N=5490,834], alt. 900 m, 29.IX.2003, leg. Plášek (OP).

**Slezské Beskydy Mts.**: 2 km SE of Nýdek village, middle part of the Hluchová stream valley, alder-spruce forest on the right bank of the stream, alt. 450 m, 22.I.1999, leg. Plášek (OP); ca 5.5–6 km SE of the Nýdek village, upper part of the Hluchová stream valley, near the right tributary between Mt Malý Stožek and Mt Velký Stožek, spruce forest, alt. 700 m, 8.V.1999, leg. Plášek (OP); upper part of Hluchová stream valley, NW slope of Velký Stožek Mt, spruce forest on left bank of the stream, alt. 690–720 m, 8.V.1999 leg. Plášek (OP); ca 5 km SE of Nýdek, SE slope of Ploský Grůň Mt, spruce forest on the right bank of the Hluchová stream valley, alt. 633 m, 14.V.1999, leg. Plášek (OP); 3 km ENE of the Nýdek village, upper part of the Střelma stream valley, under the loc. Beskydské sedlo, edge of spruce forest on the left bank of stream, alt. 520–530 m, 3.IX.1999, leg. Plášek (OP).

### Javorníky Mts

2.5–3 km SSE of the Halenkov village, N slope of Mt Čerňavská Kyčera, 0.5 km N of the loc. Dolní Kobylářka, spruce forest, alt. 610–650 m, 9.V.1998, leg. R. Dvořáková (PRC); 2 km SE of Halenkov village, N slope of Mt Čerňavská Kyčera, 50 m SW of the green tourist trail from the Halenkov village to loc. Kohůtka, spruce forest, alt. 600–650 m, 23.VI.2000, leg. R. Pohlová (priv. herb.).

Since 1999 the occurrence of the species at the above-listed localities has been observed every year by the author and R. Pohlová (Agency for Nature Conservation and Landscape Protection of the Czech Republic) in the course of the NATURA'2000 research project. The localities where *Buxbaumia viridis* still occurred recently (autumn 2003) are underlined in the list. In other localities the presence of the species has not been repeatedly verified. The current distribution of *Buxbaumia viridis* in the Czech part of the Western Carpathians is shown in Fig. 2.

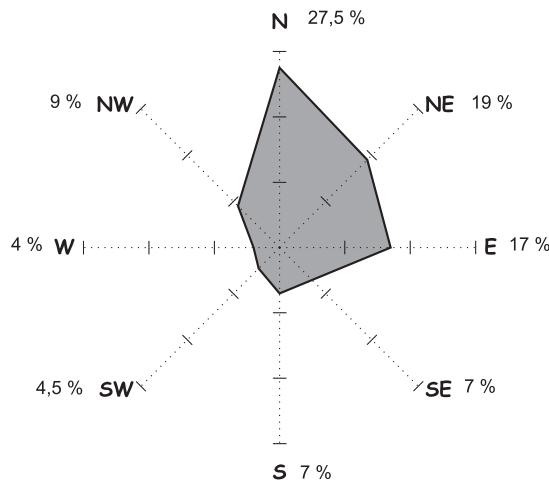


**Fig. 2.** Detailed map of the current distribution of the moss *Buxbaumia viridis* in the Czech part of the Western Carpathians

## ECOLOGY

Forests in the Czech part of the Western Carpathians, as elsewhere in these mountains, are dominated by conifers and this is why *Buxbaumia viridis* occurs there primarily on the decaying wood of spruce (*Picea abies*) and rarely on fir (*Abies alba*). It has not been observed on the wood of deciduous trees in the study area. The moss prefers valleys in coniferous forest, usually growing near streams. It is easily recorded only upon the production of sporophytes, thus preventing the collection of all biological and population-ecological data directly in the field, because one cannot detect the gametophyte's phase. Therefore most of the data collecting had to be based solely on observation of the capsules.

Screening of the sporophytes produced on different slopes showed that the species prefers the northern, northern-eastern or eastern slopes of rotten logs or stumps

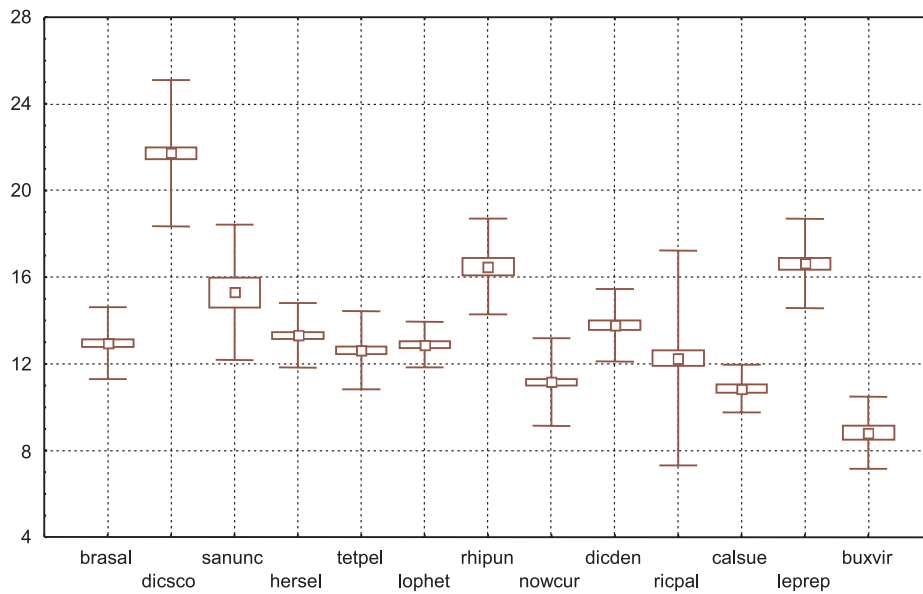


**Fig. 3.** Relative frequency of occurrence of *Buxbaumia viridis* sporophytes in relation to surface aspect

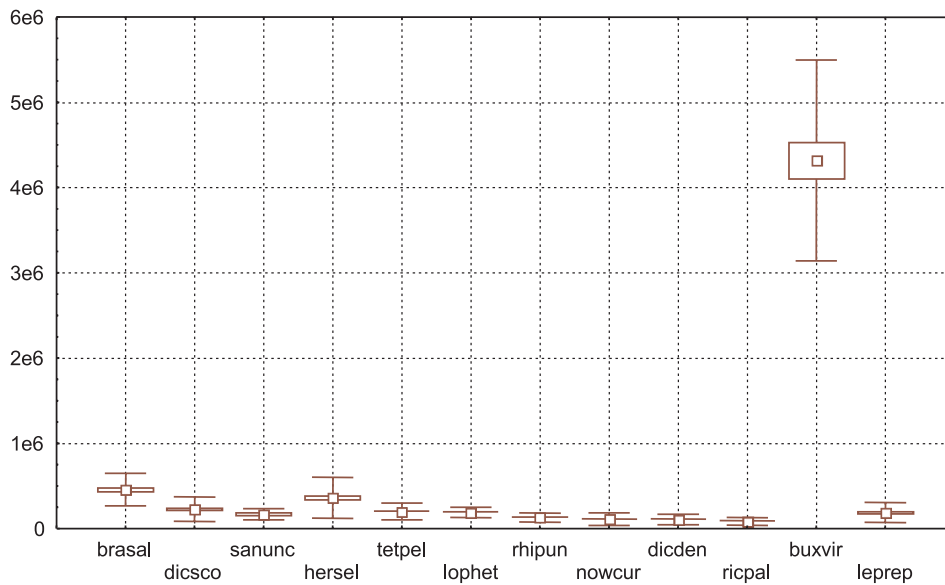
(Fig. 3). This may be because of the wetter and shadier conditions there as the wood on the southern or south-western slopes dries up more often and for a longer time. Spore germination may thus be reduced, affecting the survival ability of the moss populations there. In extremely dense forest, the lying, decaying wood is often completely shaded and sporophytes are also produced on the southern, southern-western, western or northern-western slopes or directly on the cut surface of the stumps (5% – not included in the figure 3).

For the conservation of *Buxbaumia viridis* it is necessary to know its ecological requirements (e.g., substrate and habitat preferences) and reproductive capacity (sporophyte production, spore numbers per capsule, germination success, dispersal on to available substrate).

There are two constraints affecting for epixylic bryophytes. Firstly, they must have diaspores that can reach the next available decaying wood. Secondly, the quality of substrate is continuously changing, right up to its final disappearance. This implies that species restricted to rotten wood have to disperse on to a new available substrate in order to persist in a locality (Wiklund 2002). In a landscape dominated by forestry, the quantity of dead wood is low and some bryophytes restricted to this substrate are rare or declining (Hallingbäck 1998). The probability of a moss being able to occupy a new substrate is determined by the distance between decaying logs or stumps, the suitable size and quantity of them, diaspore size and the total number of spores produced by the species. This is why study of the size and total number of diaspores within the capsules of the Carpathian populations of *Buxbaumia viridis* was begun by the author (in conjunction with I. Vacínová from the Botanical Institute of the Czech Academy of Science). Preliminary results have already been published (Plášek & Vacínová 2001).



**Fig. 4.** Differences in spore size among thirteen epixylous bryophytes (in  $\mu\text{m}$ ). Used abbreviations of bryophytes: **brasal** – *Brachythecium salebrosum*, **dicsco** – *Dicranum scoparium*, **sanunc** – *Sanionia uncinata*, **hersel** – *Herzogiella seligeri*, **tetpel** – *Tetraphis pellucida*, **lophet** – *Lophocolea heterophylla*, **rhipun** – *Rhizomnium punctatum*, **nowcur** – *Nowellia curvifolia*, **dicden** – *Dicranodontium denudatum*, **ricpal** – *Riccardia palmata*, **calsue** – *Calyptogeia suecica*, **leprep** – *Lepidozia reptans*, **buxvir** – *Buxbaumia viridis*.



**Fig. 5.** Differences in spore numbers among thirteen epixylous bryophytes (for abbreviations of bryophytes see Fig. 4).

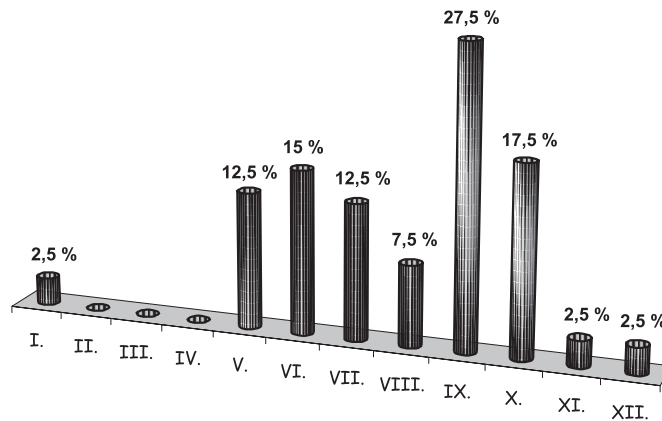
Thirteen epixylous bryophyte species from the Western Carpathians were used for measuring and evaluation of their spore size. The results of sizing showed that *Buxbaumia viridis* produces the smallest spore of them all – on average only 8.82  $\mu\text{m}$  in diameter (Fig. 4) – despite the fact that the differences among other species are not so significant. On the other hand *B. viridis* produces several times more spores than the other analyzed epixylous species – the count averaged of 4 318 519 spores per capsule (Fig. 5).

#### ASSOCIATED SPECIES

*Buxbaumia viridis* generally grows in association with other bryophytes. Among the most frequent accompanying species are the liverworts *Cephalozia bicuspidata*, *Lepidozia reptans*, *Lophocolea heterophylla* and *Scapania nemorea* and the mosses *Herzogiella seligeri*, *Plagiothecium laetum*, *Rhizomnium punctatum*, *Sanionia uncinata* and *Tetraphis pellucida*.

#### COMMENTS

Most of the newly discovered localities range in altitude from 555 to 700 m. The lowest occurrence of the species was recorded at 450 m and the highest at *ca* 1200 m. Sporophyte production is not seasonally restricted but happens throughout most months of the year (Fig. 6). Most capsules appear between May and October, with the greatest number of mature capsules being observed in September (more than 27% of the total number of discoveries).



**Fig. 6.** Relative frequency of sporophyte discovery in individual months of the year

## ACKNOWLEDGEMENTS

For the ecological analysis, the author's personal field investigation data were used together with field notes made by R. Pohlová in the course of researching the NATURA 2000 survey. I would like to thank her and, moreover, the Agency for Nature Conservation and Landscape Protection of the Czech Republic for financially supporting the research and accessing of their own biological data.

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ROZMIESZCZENIE I EKOLOGIA *BUXBAUMIA VIRIDIS* (BRYOPSIDA, BUXBAUMIACEAE) W CZESKIEJ CZĘŚCI KARPAT ZACHODNICH

## Streszczenie

Epiksyliczny mech *Buxbaumia viridis* (Moug. ex Lam. & DC.) Brid. ex Moug. & Nestl. jest traktowany jako zagrożony lub narażony gatunek we wszystkich krajach Europy Środkowej. W czeskiej części Karpat Zachodnich był on zbierany okazjonalnie w ubiegłym stuleciu. W 1998 r. autor rozpoczął szczegółowe monitorowanie *B. viridis* na tym obszarze, łącznie z weryfikacją historycznych stanowisk tego gatunku. W wyniku tych badań odkrytych zostało szereg nowych stanowisk tego gatunku. Wszystkie historyczne i nowe stanowiska *B. viridis* w czeskich Karpatach zostały zestawione w niniejszym artykule i przedstawione na punktowej mapie rozmieszczenia (Ryc. 2). *B. viridis* rośnie tu na próchniejącym drewnie świerkowym, rzadziej jodłowym, głównie na stokach o wystawie północnej, północno-wschodniej lub wschodniej (Ryc. 3). Spośród wielu gatunków rosnących na tych samych siedliskach *B. viridis* wyróżnia się najmniejszą wielkością zarodników (Ryc. 4) oraz największą ich liczbą w pojedynczej puszcze (Ryc. 5). *B. viridis* rośnie najczęściej na wysokości 555–700 m n.p.m., tworząc sporogony od maja do października, osiągając maksimum owocowania we wrześniu.