

## ASSESSMENT OF *BUXBAUMIA VIRIDIS* FROM TWO NATURA 2000 SITES: RETEZAT (ROSCI0217) AND RUSCA MONTANĂ - ȚARCU - RETEZAT CORRIDOR (ROSCI0292)

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### Abstract

*Buxbaumia viridis* (Moug. ex Lam. & DC.) Brid. ex Moug. & Nestl. is a moss species included in the Habitats Directive 92/43, being an umbrella species for mature forest habitats, especially spruce forest, well-conserved or with adequate forest management for long-term conservation. The results are based on field data collected in 2022-2024 and literature data. Research revealed that the species is undervalued, since at the beginning of the study there was a lack of data on the presence of the species in the Rusca Montană - Țarcu - Retezat Corridor site (ROSCI0292). Based on the field data, the number of *B. viridis* individuals and microhabitats (rotten wood) for the two sites were estimated.

**Key words:** *Buxbaumia viridis*, bryophyte, moss, threatened species, Habitats Directive 92/43.

### INTRODUCTION

*Buxbaumia viridis* (Moug. ex Lam. & DC.) Brid. ex Moug. & Nestl. is a moss species listed on Annex II of the European Habitats Directive (Council Directive 92/43/CEE, 1992), Natura 2000 species code: 1386. This moss is one of the easiest to identify bryophyte species of this Directive. Even if are two species of *Buxbaumia* in Romania (Ștefănuț & Goia, 2012) and in Europe (Hodgetts & Lockhart, 2020), *B. viridis* (Figure 1) and *B. aphylla* Hedw. (Figure 2), they can be easily distinguished in the field (no laboratory analysis is needed as for many bryophyte species).

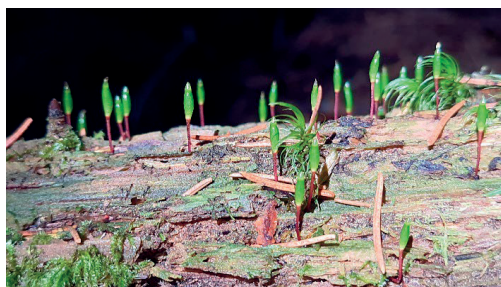


Figure 1. Young sporophytes of *Buxbaumia viridis*  
(photo Ștefănuț S.)



Figure 2. *Buxbaumia aphylla* (photo Ștefănuț M.M.)

Moreover, the two species have different habitat preferences, *B. viridis* is found mainly on rotten wood and *B. aphylla* never on this substrate. A number of 532 NATURA 2000 sites are designated for protection of *B. viridis* in Europe. Although it seemed to be a rare species, *B. viridis* turned out to be a frequently one in mature spruce and deciduous forests, after the increased attention given by this species' listing in the Habitats Directive.

By including it in the Habitats Directive it made *B. viridis* an umbrella species for protecting mature forest habitats, especially spruce forest, but beech forest, also.

## MATERIALS AND METHODS

The research area is delimited by the two NATURA 2000 sites: Retezat – ROSCI0217 and Rusca Montană-Țarcu-Retezat Corridor – ROSCI0292 (Figure 3).

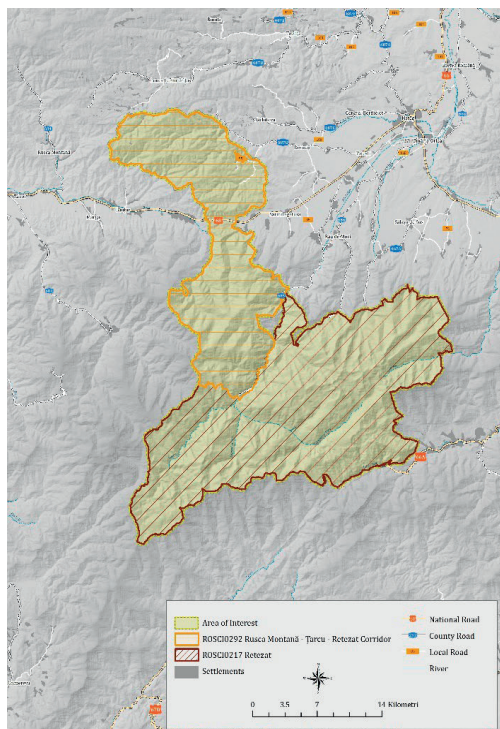


Figure 3. Retezat – ROSCI0217 site and Rusca Montană-Țarcu-Retezat Corridor – ROSCI0292 site

Because it is a species protected by Habitats Directive, no bryological material was collected, the determinations being made in the field. Photographs of the species and its habitats were taken, and the distribution data of the species were collected by GPS.

Transects were conducted along forested valleys from 600 m a.s.l. to 1850 m a.s.l. *B. viridis* was

recorded on spruce or beech logs, spruce stumps, maple bark or on soil. Even though it was identified on the soil, these soils are full of rotten wood.

The bryophytes nomenclature used is according to Hodgetts et al., 2020.

The Area of Occupancy (AOO) for *B. viridis* was estimated using the  $2 \times 2$  km grids, according to the IUCN Red List Categories and Criteria (IUCN Standards and Petitions Committee, 2024).

## RESULTS AND DISCUSSIONS

The habitat of the *Buxbaumia viridis* species in the Retezat site (ROSCI0217) consists of spruce and mixed forests, spruce with beech, located between 800 m a.s.l. to 1,750 m a.s.l., with an area of 20,204.19 ha (Figure 4).

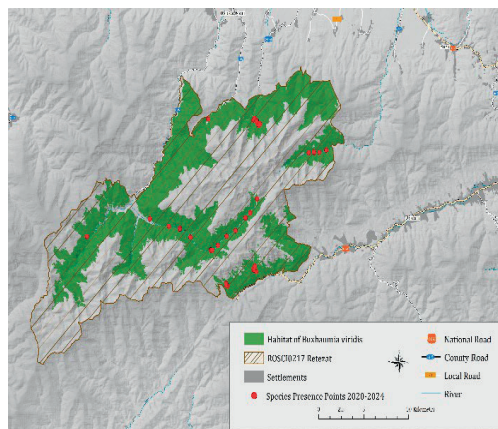


Figure 4. Habitat of *Buxbaumia viridis* in Retezat – ROSCI0217 site

To estimate the population of *B. viridis* in the Retezat site (ROSCI0217), previously published field data (Ștefănuț et al., 2023), data collected by the Retezat National Park Administration (2022-2023) and field data (2024) were used. During the field trip on August 21-25, 2024, the species *B. viridis* was reported from 16 different localities in the Retezat Mountains, Lăpușnicul Mare Valley (Table 1: LMV-2 – Lăpușnicul Mare Valley; Figure 5; Figure 6).





Figure 5. *Buxbaumia viridis* in Retezat

In the assessment of the population of *B. viridis* from the Retezat site (ROSCI0217), distribution data of the species provided by the Retezat National Park Administration, recently collected (2022-2023) (Table 1: RV-1 – Răușor Valley, BRV-1 – Bărbat River Valley and LMV-1 – Lăpușnicul Mare Valley).

Table 1. New records of *Buxbaumia viridis* in Retezat – ROSCI0217 site

| Locality | Latitude      | Longitude     | m<br>a.s.l. | Date       |
|----------|---------------|---------------|-------------|------------|
| RV-1     | 45°24'19.07"N | 22°49'20.86"E | 1482        | 16.05.2023 |
| BRV-1    | 45°22'57.90"N | 22°59'27.33"E | 1329        | 16.05.2023 |
| BRV-1    | 45°22'57.58"N | 22°59'26.64"E | 1320        | 11.10.2023 |
| BRV-1    | 45°22'50.61"N | 22°58'51.53"E | 1341        | 11.10.2023 |
| BRV-1    | 45°22'49.68"N | 22°58'25.87"E | 1364        | 11.10.2023 |
| BRV-1    | 45°22'49.48"N | 22°58'25.00"E | 1416        | 11.10.2023 |
| BRV-1    | 45°22'49.15"N | 22°58'24.86"E | 1407        | 11.10.2023 |
| BRV-1    | 45°22'51.19"N | 22°58'23.79"E | 1410        | 11.10.2023 |
| BRV-1    | 45°22'51.19"N | 22°58'23.48"E | 1416        | 11.10.2023 |
| BRV-1    | 45°22'49.14"N | 22°57'58.75"E | 1445        | 11.10.2023 |
| BRV-1    | 45°22'48.42"N | 22°57'57.73"E | 1449        | 11.10.2023 |
| LMV-1    | 45°18'51.51"N | 22°47'8.99"E  | 1205        | 03.11.2022 |
| LMV-1    | 45°18'51.07"N | 22°47'8.37"E  | 1262        | 03.11.2022 |
| LMV-1    | 45°18'51.60"N | 22°47'8.66"E  | 1245        | 03.11.2022 |
| LMV-1    | 45°18'49.71"N | 22°47'8.50"E  | 1245        | 03.11.2022 |
| LMV-1    | 45°18'50.27"N | 22°47'9.60"E  | 1260        | 03.11.2022 |
| LMV-1    | 45°17'49.80"N | 22°49'57.36"E | 1326        | 03.11.2022 |
| LMV-2    | 45°19'17.10"N | 22°44'34.30"E | 1124        | 21.08.2024 |
| LMV-2    | 45°18'56.60"N | 22°46'12.30"E | 1139        | 21.08.2024 |
| LMV-2    | 45°18'48.60"N | 22°47'7.00"E  | 1186        | 21.08.2024 |
| LMV-2    | 45°17'50.70"N | 22°49'47.90"E | 1264        | 21.08.2024 |
| LMV-2    | 45°17'49.50"N | 22°49'49.30"E | 1267        | 21.08.2024 |
| LMV-2    | 45°17'49.30"N | 22°49'49.50"E | 1268        | 21.08.2024 |
| LMV-2    | 45°17'50.60"N | 22°49'49.00"E | 1266        | 21.08.2024 |
| LMV-2    | 45°18'50.10"N | 22°51'52.40"E | 1404        | 21.08.2024 |
| LMV-2    | 45°20'26.61"N | 22°53'38.48"E | 1644        | 21.08.2024 |
| LMV-2    | 45°19'44.30"N | 22°53'4.80"E  | 1597        | 25.08.2024 |
| LMV-2    | 45°19'44.40"N | 22°53'5.30"E  | 1599        | 25.08.2024 |
| LMV-2    | 45°19'28.70"N | 22°52'42.40"E | 1476        | 25.08.2024 |
| LMV-2    | 45°19'29.50"N | 22°52'41.40"E | 1469        | 25.08.2024 |
| LMV-2    | 45°18'32.80"N | 22°51'7.50"E  | 1363        | 25.08.2024 |
| LMV-2    | 45°18'4.90"N  | 22°50'24.40"E | 1307        | 25.08.2024 |
| LMV-2    | 45°18'26.80"N | 22°48'3.00"E  | 1212        | 25.08.2024 |

A number of 63 logs, 59 spruce logs and 4 beech logs, colonized by *B. viridis* and one record on the soil were reported from the Retezat site (ROSCI0217). From these, 35 logs are new reported and 28 logs one record on the soil were published before (Ștefănuț et al., 2023).

The total number of *B. viridis* sporophytes identified in the Retezat site (ROSCI0217) is 483, with 261 sporophytes new reported here and 222 sporophytes published before (Ștefănuț et al., 2023).

For the Retezat site (ROSCI0217) a total population of 15,000 sporophytes of *B. viridis* and about 2,000 microhabitats (logs, stumps or m<sup>2</sup> soil) are estimated.



Figure 6. Spruce logs colonized by *Buxbaumia viridis* in Retezat – ROSCI0217 site

The habitat of the species *B. viridis* in the Rusca Montană - Țarcu - Retezat Corridor site (ROSCI0292) consists of spruce and mixed forests, spruce with beech, located between 800 a.s.l. to 1750 m a.s.l., totaling an area of 14,925.25 ha (Figure 7).

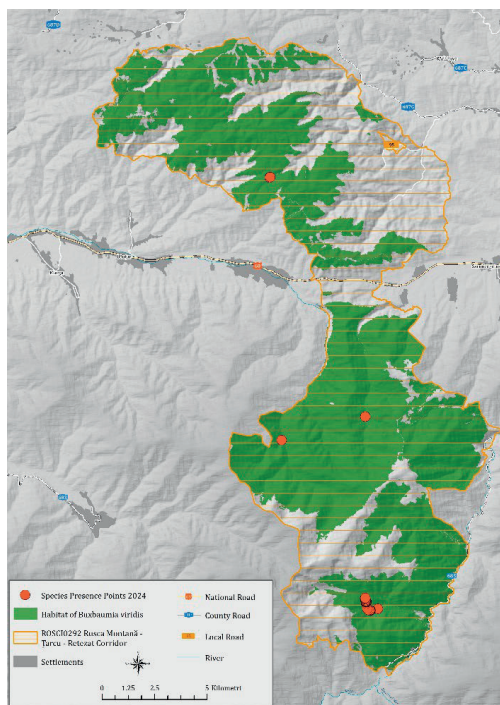


Figure 7. Habitat of *Buxbaumia viridis* in Rusca Montană-Țarcu-Retezat Corridor – ROSCI0292 site

To estimate the population of *B. viridis* in the Rusca Montană - Țarcu - Retezat Corridor site (ROSCI0292), no previously published data before 2023 were identified (Ștefănuț et al., 2023) and exclusively field data collected during August 22-26, 2024, were used (Table 2).

The reporting of *B. viridis* from the Poiana Ruscă Mountains proved to be the first record for these mountains (Sabovljević et al., 2024).

*B. viridis* were reported from 45 microhabitats in the Rusca Montană-Țarcu - Retezat Corridor site (ROSCI0292), 43 spruce logs, one beech log and one rotten maple (*Acer pseudoplatanus* L.) bark (Figure 11).

A total number of 239 sporophytes of *B. viridis* were identified in the Rusca Montană -Țarcu - Retezat Corridor site (ROSCI0292).

For the Rusca Montană - Țarcu - Retezat Corridor site (ROSCI0292) a total population of 5,300 sporophytes of *B. viridis* and about 1,000 microhabitats (logs, stumps or m<sup>2</sup> soil) are estimated.

Table 2. New records of *Buxbaumia viridis* to Rusca Montană-Țarcu - Retezat Corridor site

| Locality | Latitude      | Longitude     | m a.s.l. | Date       |
|----------|---------------|---------------|----------|------------|
| NV-T     | 45°21'57.50"N | 22°42'55.90"E | 1232     | 22.08.2024 |
| NV-T     | 45°21'54.80"N | 22°42'40.00"E | 1292     | 22.08.2024 |
| NV-T     | 45°21'54.90"N | 22°42'39.60"E | 1293     | 22.08.2024 |
| NV-T     | 45°21'54.80"N | 22°42'38.73"E | 1295     | 22.08.2024 |
| NV-T     | 45°21'54.40"N | 22°42'38.70"E | 1295     | 22.08.2024 |
| NV-T     | 45°21'54.70"N | 22°42'38.90"E | 1294     | 22.08.2024 |
| NV-T     | 45°21'55.10"N | 2°42'37.90"E  | 1297     | 22.08.2024 |
| NV-T     | 45°21'55.20"N | 22°42'35.10"E | 1307     | 22.08.2024 |
| NV-T     | 45°21'57.10"N | 22°42'32.70"E | 1315     | 22.08.2024 |
| NV-T     | 45°22'5.10"N  | 22°42'29.90"E | 1336     | 22.08.2024 |
| NV-T     | 45°22'6.92"N  | 22°42'29.70"E | 1341     | 22.08.2024 |
| NV-T     | 45°22'7.70"N  | 22°42'29.90"E | 1345     | 22.08.2024 |
| NV-T     | 45°22'8.10"N  | 22°42'29.90"E | 1347     | 22.08.2024 |
| NV-T     | 45°22'8.70"N  | 22°42'29.50"E | 1347     | 22.08.2024 |
| NV-T     | 45°22'8.60"N  | 22°42'29.10"E | 1343     | 22.08.2024 |
| NV-T     | 45°22'8.50"N  | 22°42'30.10"E | 1351     | 22.08.2024 |
| NV-T     | 45°22'9.20"N  | 22°42'29.20"E | 1346     | 22.08.2024 |
| NV-T     | 45°22'9.10"N  | 22°42'28.70"E | 1343     | 22.08.2024 |
| NV-T     | 45°22'10.30"N | 22°42'28.70"E | 1348     | 22.08.2024 |
| NV-T     | 45°22'11.70"N | 22°42'27.90"E | 1351     | 22.08.2024 |
| NV-T     | 45°22'13.10"N | 22°42'27.20"E | 1354     | 22.08.2024 |
| NV-T     | 45°22'13.70"N | 22°42'27.80"E | 1362     | 22.08.2024 |
| BV-T     | 45°26'14.40"N | 22°39'14.30"E | 1045     | 23.08.2024 |
| ZV-T     | 45°26'54.60"N | 22°42'16.30"E | 1099     | 23.08.2024 |
| FV-PR    | 45°33'1.20"N  | 22°38'31.70"E | 851      | 26.08.2024 |
| FV-PR    | 45°33'0.60"N  | 22°38'30.90"E | 859      | 26.08.2024 |
| FV-PR    | 45°33'1.25"N  | 22°38'32.20"E | 849      | 26.08.2024 |

On rotten woods, *B. viridis* was identified along with *Herzogiella seligeri* (Brid.) Z. Iwats. (Figures 8-10) in almost all localities.

During the field trip in 2024, *B. viridis* were reported from one locality in the Bistra Valley, Țarcu Mountains (Table 2: BV-Ț; Figure 8); 22 localities in the Netiș Valley, Țarcu Mountains (Table 2: NV-Ț; Figures 9,10); one locality in the Zeicani Valley, Țarcu Mountains (Table 2: ZV-Ț); 3 localities in the Fierului Valley, Poiana Ruscă Mountains (Table 2: FV- PR; Figure 11).



Figure 8. *Buxbaumia viridis* on beech log, Bistra Valley, Țarcu Mountains, Rusca Montană-Țarcu-Retezat Corridor – ROSCI0292 site





Figure 9. *Buxbaumia viridis* and *Herzogiella seligeri* on spruce stumps, Netiş Valley, Țarcu Mountains, Rusca Montană-Țarcu-Retezat Corridor – ROSCI0292 site

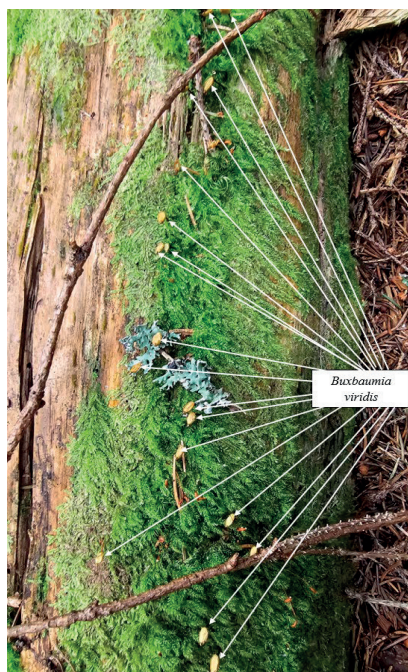


Figure 10. *Buxbaumia viridis* (18 mature sporophytes) and *Herzogiella seligeri* on spruce log, Netiş Valley, Țarcu Mountains, Rusca Montană-Țarcu-Retezat Corridor – ROSCI0292 site



Figure 11. *Buxbaumia viridis* (2 sporophytes) on rotten maple (*Acer pseudoplatanus* L.) bark, Fierului Valley, Poiana Ruscă Mountains, Rusca Montană-Țarcu-Retezat Corridor – ROSCI0292 site

## CONCLUSIONS

In the present, 256 microhabitats and 2,049 sporophytes of *Buxbaumia viridis* were reported to Romania.

According to our study, the Area of Occupancy (AOO) for *B. viridis* in Romania is increasing from 268 km<sup>2</sup> (Ștefănuț et al., 2023) to 304 km<sup>2</sup> and all population of *B. viridis* are estimated at more than 200,000 sporophytes and more than 25,000 microhabitats (logs, stumps or m<sup>2</sup> soil).

The conservation status of *Buxbaumia viridis* in Romania is unchanged at Vulnerable – VU A3c (Ștefănuț et al., 2023).

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