

## ***Gymnomitrium adustum* – a liverwort new to Slovakia and Poland found in the Tatra Mts (Western Carpathians)**

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**Abstract** – *Gymnomitrium adustum* has been erroneously reported from Slovakia and Poland on several occasions. These data were published between 1865 and 1961 for the Tatra Mountains (Western Carpathians) area. *Gymnomitrium adustum* was mistaken for *Gymnomitrium brevissimum* and some species of the genus *Marsupella*, such as *M. sprucei*, *M. funckii* and *M. condensata*. This paper presents the first records of *Gymnomitrium adustum* in 23 localities in the Tatra Mts (20 from Slovakia and 3 from Poland), as well as characteristics of the diagnostic features of this species. In most of the European countries where *G. adustum* has been recorded, this liverwort is included in red lists of endangered species; this is a rare species in the Slovakian Tatra Mts, and it is very rare in the Polish Tatra Mts.

### INTRODUCTION

*Gymnomitrium adustum* Nees [syn. *Marsupella adusta* (Nees) Spruce, *Gymnomitriaceae*] is a species that has been recorded in Europe, Macaronesia, the Russian Far East and Eastern Asia (Váňa *et al.*, 2010). In Europe, *G. adustum* grows in northern (Norway, Britain, Iceland, Ireland), western (France, Portugal), southern (Italy, Bulgaria), central (Austria, Switzerland, Germany and Czech Republic) and eastern parts (Ukraine; Söderström *et al.*, 2002; Schumacker & Váňa, 2005). In most of these countries, this liverwort is included in red lists of endangered plants, at diverse status. In Germany, *Gymnomitrium adustum* has probably vanished (Ludwig *et al.*, 1996), in the Czech Republic it is regionally extinct (Kučera & Váňa, 2005), in Switzerland it is vulnerable (Schnyder *et al.*, 2004), and in Austria it has an indefinite status (Saukel & Köckinger, 1999). In some remaining countries it is extinct (Madeira, Sérgio *et al.*, 1992), endangered (Portugal, Sérgio *et al.*, 2007) and has vanished (Italy, Aleffi & Schumacker, 1995), and it is vulnerable in Bulgaria (Natcheva *et al.*, 2006).

In Poland and Slovakia, information on the occurrence of *G. adustum* has been reported numerous times in areas of the Tatra Mts. Most data come from the Slovakian part of the massif (Hazslinszky, 1865; Krajina, 1933; Šmarda, 1961). Ten localities in nine different community types were mentioned in a monograph concerning the vegetation of Mlynická dolina (High Tatra Mts; Krajina, 1933).

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The materials, however, were identified erroneously (see Váňa & Duda, 1965). The remaining data on *G. adustum* in Slovakia (Hazslinszky, 1865; Šmarda, 1961) actually concerned other species, i.e. *Gymnomitrium brevissimum*, *Marsupella sprucei*, *M. funckii* and *M. condensata* (rev. J. Váňa; see Duda & Váňa, 1978). In a conspectus of European liverworts (Söderström *et al.*, 2002), *Gymnomitrium adustum* was excluded from Slovakian bryoflora.

In Poland, *Gymnomitrium adustum* has been reported twice (Lilienfeldówna, 1914a, 1914b; Szafer *et al.*, 1927). The only available herbarium material, collected by F. Lilienfeldówna and T. Wilczyński and deposited in the herbarium of the W. Szafer Institute of Botany, Polish Academy of Sciences (Cracow, KRAM-B 44073), does not actually contain any specimens of the genera *Gymnomitrium* and *Marsupella* (rev. P. Górski). The presence of *G. adustum* in the catalogue of the liverworts of Poland (Szweykowski, 2006) was only based upon data in the literature. The second set of information regarding the occurrence of *G. adustum* in Poland was mentioned in phytosociological research by Szafer *et al.* (1927). Unfortunately, no bryophyte collection from that work remains.

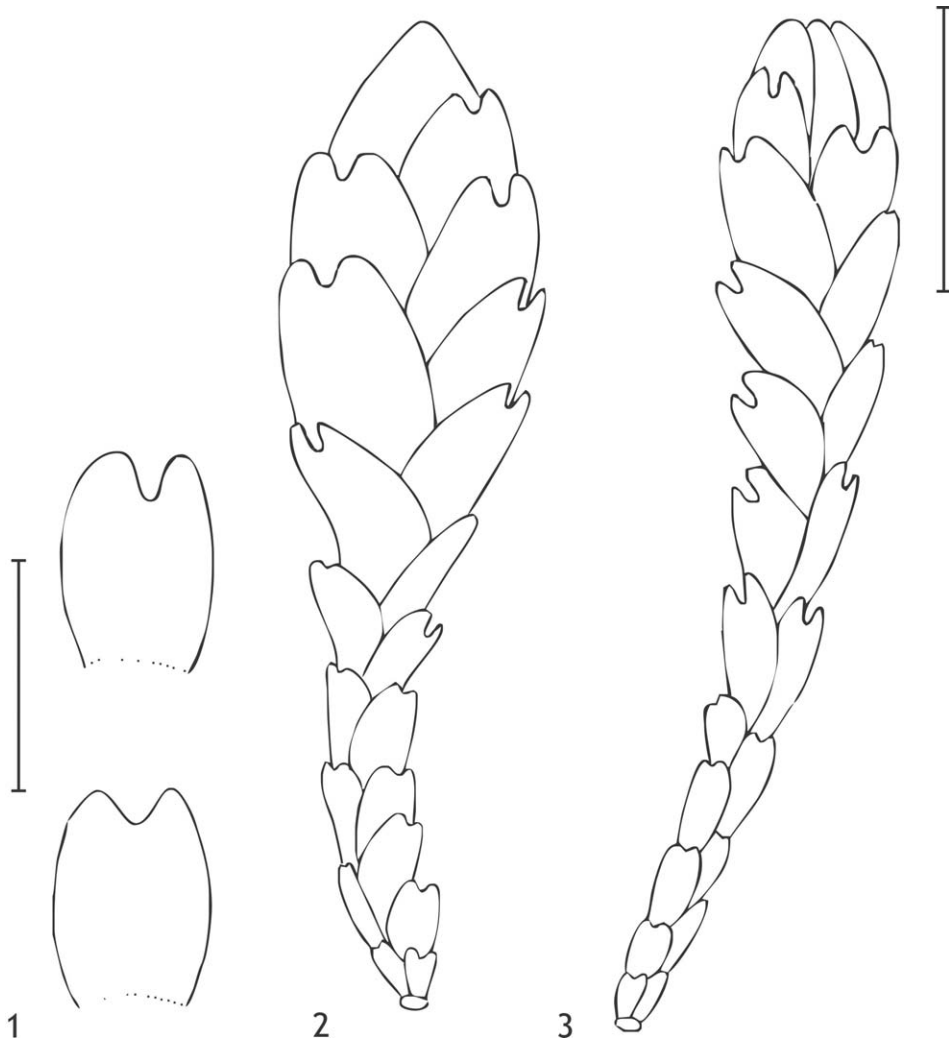
The present paper reports the occurrence of *Gymnomitrium adustum* in 23 localities of the Polish and Slovakian Tatra Mts. All herbarium material was collected by P. Górski in 2004-2010; each specimen was revised by J. Váňa.

### DIAGNOSTIC FEATURES OF *GYMNOMITRION ADUSTUM*

The diagnostic features of *Gymnomitrium adustum* are: narrowly ovate leaves, bilobed to 0.1-0.2 of the leaf length, a rounded sinus, paroicous shoots that are often with sporophytes, lacking perianth replaced by a shoot calyptra (Figs 1-3). *Gymnomitrium adustum* can be mistaken for *G. brevissimum* and some species of the genus *Marsupella* (*M. sprucei* and a small form of *M. funckii*). *Gymnomitrium adustum* differs from *G. brevissimum* in 1) having elliptical to narrowly ovate leaves, whereas the leaves of *G. brevissimum* are wide elliptical, and 2) having abruptly clavate paroicous shoots that do not occur in *G. brevissimum*. The lack of a perianth distinguishes *G. adustum* from *M. sprucei* and small forms of *M. funckii*. The leaves of *M. sprucei* have acute lobes, an acute sinus, are widest near the base and are divided to 0.2–0.3 of their length, whereas the leaves of *G. adustum* are elliptical with rounded lobes and a rounded sinus, and are bilobed to 0.1-0.2 of the leaf length. *Gymnomitrium adustum* can be mistaken for very variable forms of *M. funckii*, especially its smaller forms that also occur on stones. The depth of bilobing of the leaves is diagnostic. In *M. funckii*, the leaves are divided to 0.35–0.45, whereas in *G. adustum* they are divided to 0.2 of their length.

### DISTRIBUTION AND ECOLOGY OF *GYMNOMITRION ADUSTUM* IN THE TATRA MTS

Currently, *Gymnomitrium adustum* grows in 23 localities dispersed throughout the entire area of the Tatra Mts. (Fig. 4). Most of them (20) are in the High Tatra Mts. *Gymnomitrium adustum* is an alpine species, recorded within the



Figs 1-3. *Gymnomitrium adustum* Nees (all from POZNB 14, 28 July 2005, the High Tatra Mts, leg. P. Górski, drawn by A. Czarna): **1.** Two leaves (bar = 0,35 mm) **2-3.** Fertile and sterile shoots (bar = 0,5 mm).

altitude range of 1650–2110 m a.s.l, with most localities noted between 1800 and 1899 m a.s.l. It is an epilithic liverwort, growing on bare surfaces of loose stones or rock walls. It has often been found among rock blocks in kettles in deep shade. *Gymnomitrium adustum* has also been found to grow, among other places, in snow-bed vegetation phytocoenoses; however, always on bare rock surfaces. There were patches of *Pohlietum commutatae* (form with a higher participation of *Anthelia juratzkana* or *Marsupella condensata*), alpine forms of *Nardietum scalaris*, *Polytrichetum norvegici* (stony forms with a higher participation of *Pleurocladula albescens*), and communities of snow-bed-well-head characters, on

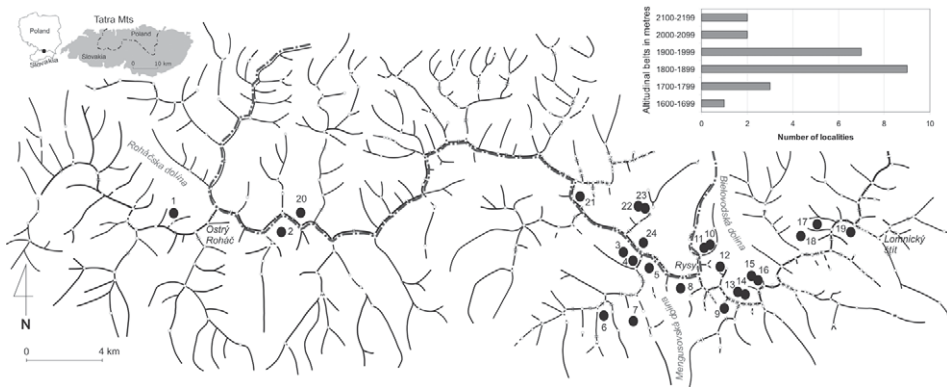


Fig. 4. Horizontal and vertical (at intervals of 100 metres) distribution of *Gymnomitrium adustum* in the whole Tatra Mts.

lower parts of water-dripped rock walls (community with *Marsupella emarginata* and *Andreaea nivalis-Anthelia juratzkana* comm.; Górski, unpublished).

### Specimens examined

#### SLOVAKIA:

##### Western Tatra Mts:

**1.** Roháčska dolina valley, rock walls at Horné Roháčske pleso, alt. 1755 m, 24.07.2006 (POZNB 22/2006) **2.** Račkova dolina valley, Račkov Zadok, rubble in a kettle under Jakubíná peak, alt. 1830 m, 49° 11'.845 N, 19° 48'.205 E, 21.07.2009 (POZNB 73)

##### High Tatra Mts:

**3.** Temnosmrečinská dolina valley, before the doorstep of Piargová dolinka, on stones under a rock wall, alt. 1860 m, 22.08.2006 (POZNB 4). **4.** Piargová dolinka (upper part of Temnosmrečinská dolina valley), in a kettle under Cubrina peak, alt. 1865 m, 49° 11'.224 N, 20° 02'.650 E, 28.07.2009 (POZNB 18/2009). **5.** Hincova dolina valley, rubble under the walls of Mengusovský štít, alt. 2075 m, 12.08.2008 (POZNB 47). **6.** Furkotská dolina valley, rubble at the N bank of Nižné Wahlenbergovo pleso lake, alt. 2055 m, 49° 09'.610 N, 20° 01'.548 E, 12.08.2010 (POZNB 207). **7.** Mlynická dolina valley, rock blocks in upper NE part of the valley, below the rock walls of Veľka Capia veža, alt. 2100 m, 11.08.2008 (POZNB 24/2008). **8.** Žabia dolina valley (upper part of Mengusovská valley), at SW bank of Veľké Žabie Pleso Mengusovské lake, alt. 1895 m, 13.08.2008 (POZNB 115). **9.** Kotlina L'adového plesa (upper part of Zlomisková dolina valley), stone walls under S bank of L'adové pleso lake, alt. 1975 m, 49° 09'.716 N, 20° 06'.369 E, 5.08.2010 (POZNB 209). **10.** Žabia Bielovodská dolina valley, rock walls SW from Mlynárovo sedlo pass, alt. 1930 m, 49° 11'.351 N, 20° 05'.775 E, 17.08.2009 (POZNB 106). **11.** Žabia Bielovodská dolina valley, rock walls between Mlynárovo sedlo pass and Veľký Žabi štít peak, alt. 1885 m, 49° 11'.345 N, 20° 05'.678 E, 19.08.2009 (POZNB 53/2009). **12.** Tažká dolina valley, upper part of the lower kettle, at the walls of Pustá stráž peak, alt. 1800 m, 26.08.2009 (POZNB 118). **13.** Kačacia dolina valley, Gierlachowskie Spady - upper (SE) part of the lower kettle, at the base of the glacial doorstep of the upper kettle, alt. 1820 m, 49° 10'.319 N, 20° 07'.252 E, 16.09.2009 (POZNB 139). **14.** Kačacia dolina valley, Gierlachowskie Spady - upper (SE) part of the lower kettle, at the base of the glacial doorstep of the upper kettle, alt. 1750 m, 49° 10'.341 N, 20° 07'.202 E, 16.09.2009 (POZNB 76/2009). **15.** Litvorová dolina valley, rock E from Litvorové pleso lake, alt. 1980 m, 17.08.2006 (POZNB 2). **16.** Litvorová dolina valley, rock outcrops E from Litvorové pleso lake, alt. 1940 m, 17.08.2006 (POZNB 34/2006). **17.** Javorová dolina valley, Suchá dolina valley, below rock walls of Predná Suchá

veža, alt. 1860 m, 18.08.2006 (POZNB 49). **18.** Javorová dolina valley, lower part of Zadná Javorová dolina valley, rubble, alt. 1650 m, 21.08.2007 (POZNB 7). **19.** Kotlina Piatich Spišských plies valley (upper part of Malá Studená dolina valley), rocks Baranie pliesko lake, alt. 2110 m, 27.08.2007 (POZNB 6).

## **POLAND:**

### *Western Tatra Mts:*

**20.** Dolina Starorobociańska valley, Krzywy Żleb, under rock walls, on a stone, alt. 1750 m, 11.08.2004 (POZNB 12).

### *High Tatra Mts:*

**21.** Dolina Pięciu Stawów Polskich valley, under rock walls N from Walentkowy Wierch peak, alt. 1970 m, 28.07.2005 (POZNB 14). **22.** Dolina Pięciu Stawów Polskich valley, rock walls descending from Marchwiczna Przełęcz pass, alt. 1810 m, 26.07.2005 (POZNB 9/2005).

**23.** Dolina Rybiego Potoku valley, Dolina za Mnichem valley, under rock walls descending from Cubryna peak, alt. 1900 m, 16.08.2004 (POZNB 19/2004).

## **FINAL REMARKS**

The distribution pattern of *Gymnomitrium adustum* in the Tatra Mts, determined from field studies carried out in 2004-2010, reveals that this species definitely occurs but is rare in the area of the two adjacent countries. However, it should be expected that the number of reported localities will increase with the intensification of studies conducted in the Tatra Mts. In the past, this species was often overlooked because of its small dimensions and specific habitats.

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