

Distribution and habitats of *Galium saxatile* L. in the Carpathian Mountains

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Abstract

Altitudinal and geographical distribution, as well as habitats of Sub-Atlantic species *Galium saxatile* L. in the Carpathian Mountains were characterized. Geobotanic and phytocoenotic species status in Poland was also discussed. The phenomenon of edaphic vicarism of *Galium saxatile* L. and closely related *G. anisophyllum* Vill. in the Polish Tatra Mountains was mapped. Some false and not actual information in the literature on this species was corrected.

Key words: *Galium saxatile* L., new combination, distribution, habitats

INTRODUCTION

According to Czechtowa (1925/26) *Galium saxatile* L. is a typical example of the species of the Sub-Atlantic range (Fig. 1). The eastern boundary of its range crosses Poland. Hence, it plays there an important diagnostic role in both geobotanic and phytocoenotic classifications and divisions. Moreover, it constitutes with closely related *Galium anisophyllum* Vill. the pair of edaphic vicariants. The phenomenon of edaphic vicarism of these species is presented on the map (Fig. 4).

TAXONOMIC COMMENTS

Galium saxatile L. belongs to the *Leptogalum* Lange section. According to the authors *Galium pawlowski*, closely related species, described by Kucowa (1962) for the Eastern Carpathian Mts. is conspecific with

Galium saxatile L. and should not be given a species rank (cp. also Ehrendorfer 1976). The differences between *G. saxatile* L. and *G. pawlowskii* are small in comparison with differences between the other members of *Leptogalum* section (cp. Tables 1-4 and Figs. 4-8 in Kućowa 1962). For this reason the authors propose to give *G. pawlowskii* a variety rank within *G. saxatile* i.e.:

Galium saxatile L. var. *pawlowskii* (Kućowa) comb. nova differs from var. *saxatile* in the lack of clear leaf trimorphism, seven-leaved whorl, shorter internodes and thicker peduncles (cp. Kućowa 1962).

DISTRIBUTION

Galium saxatile L. general range covers nearly the whole temperate part of western Europe. The eastern boundary of its compact range runs in central Europe at $\pm 15^\circ$ of eastern longitude (Fig. 1), so it is close

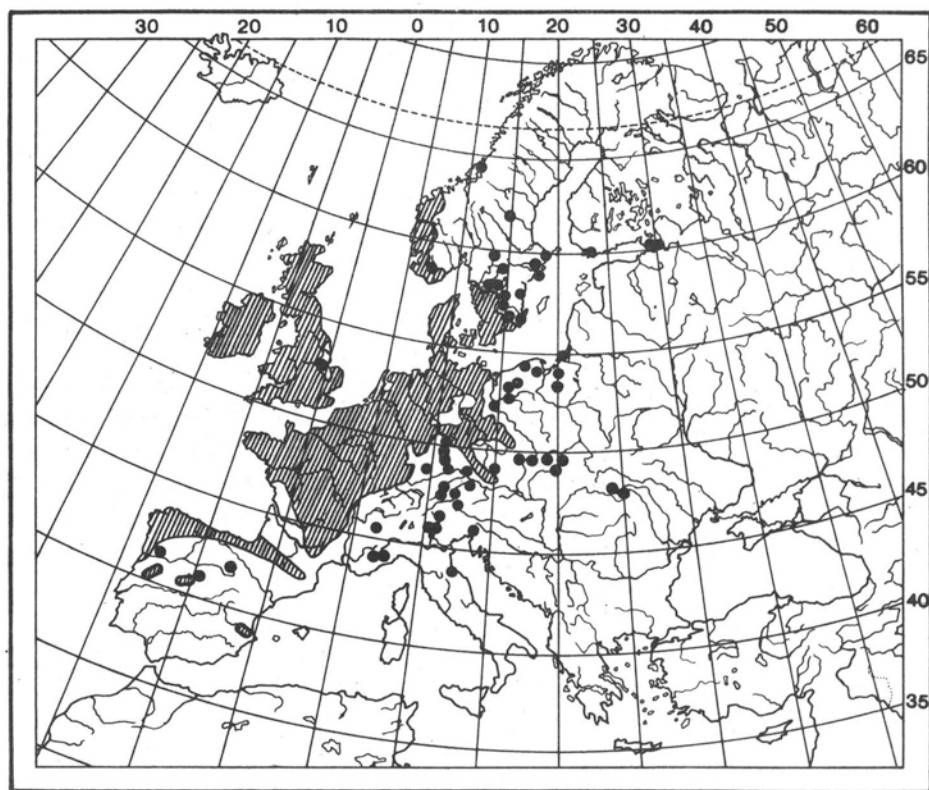


Fig. 1. General distribution of *Galium saxatile* L. (acc. to Czechtowa 1925/26 — supplemented)

to the western border of Poland. However, isolated localities of this species were recorded for Poland in the Pomerania and the Sudeten (Kucowa 1962). For the last ten years it has been also found in the Western Carpathian Mts. Broda (1973) has recorded it for the Beskid Śląski Mts., while Towpasz (1975) for the Beskid Wyspowy Mts. Later it has been unexpectedly found on many sites in the Tatra Mts. (Piękoś-Mirkowa

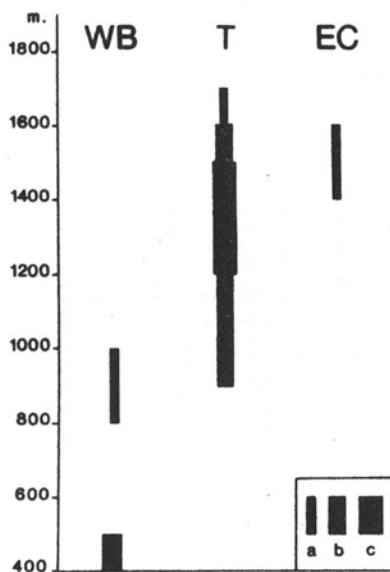


Fig. 2. Altitudinal distribution of *Galium saxatile* in the Carpathians. WB — Western Beskids, T — Tatra Mts., EC — Eastern Carpathians; a, b, c = respectively 1, 2 and 3 localities

and Mirek 1978). For many years the territory of the Tatra Mts. has been quite well explored and frequently visited by Polish and foreign botanists. Yet, *G. saxatile* L. has not been found there though it occurs often in the close vicinity of tourist routes and frequented paths.

G. saxatile L. has been recorded earlier for the Eastern Carpathian Mts.: for the Gorgany Mts. by Ujhelyi and Zolyomi (1942 sec. Dubovik 1972), for the Czywczyńskie Góry by Kucowa (1962 sub *G. pawlowskii*) and Dubovik (1972).

Figure 1 presents the general distribution of *Galium saxatile* L. completed with the Carpathian localities. All the Carpathian localities are listed in the end of the paper.

In Scandinavia *Galium saxatile* L. is treated as the lowland species, while in the Alps it grows up to 1500 m (Hulten 1958). It occurs up to the similar altitude in the Carpathian Mts (Fig. 2). The highest locality has been recorded for the Tatra Mts. at 1680 m.

HABITATS

Galium saxatile L. (var. *pawlowskii* included) is clearly an acidophilous species, which avoids calcareous substratum. In this respect it differs from calciphilous and basiphilous *Galium anisophyllum* Vill. which is a second species of the *Leptogalum* section growing in the Carpathian Mts. *G. saxatile* usually grows on the fresh, or periodically moist soils. Figure 3 shows acidity ($\text{pH}_{\text{H}_2\text{O}}$) and relative moisture recorded for the sites in the Tatra Mts. In Poland this species occurs in open places and forest clearances. It is regarded as a characteristic species for the *Nardo-Galion saxatilis* alliance (Szafer and Zarzycki 1972). In the Sudeten it can be encountered

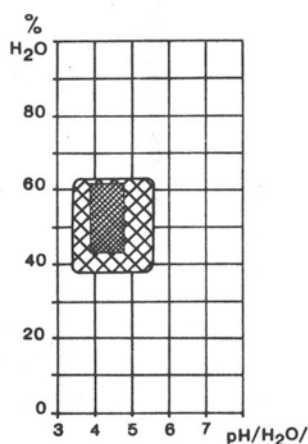


Fig. 3. Acidity ($\text{pH}_{\text{H}_2\text{O}}$) and moisture of rhizosphere layer found on localities of *Galium saxatile* in the Tatra Mts.

in some patches of *Luzulo-Fagetum* (Szafer and Zarzycki 1972). More often, however, it grows in *Plagiothecio-Piceetum hercynicum* and *Abieti-Piceetum hercynicum* (Matuszkiewicz 1977). Also in the Carpathian Mts. this species shows similar phytocoenotic status. Broda (1973) has recorded it for an spruce forest clearance, occurring on the moist substratum and for the edge of the young spruce forest. Towpasz (1975, and personal communication) has thought *G. saxatile* L. biotopes as moist and in the phytocoenotic respect she includes them to *Abieti-Piceetum* and *Hieracio-Nardetum*. In the Tatra Mts. it grows both in spruce forest clearances, which belong to *Plagiothecio-Piceetum tatricum*, and in the secondary poor swards composed mainly of *Nardus stricta* (Table 1: records, 3,4). In the dwarf mountain pine zone it occurs in swards which are intermediate between the communities of *Nardetalia* and *Caricetalia curvulae* orders (Table

1; records 5,6). It is also quite often encountered in the edges of spruce forests by the tourist routes.

In the Tatra Mts. *G. saxatile* is confined to the acid, limeless substrata. Hence its edaphic vicarism to basiphilous and calciphilous *G. anisophyllum* is clearly seen (Fig. 4).

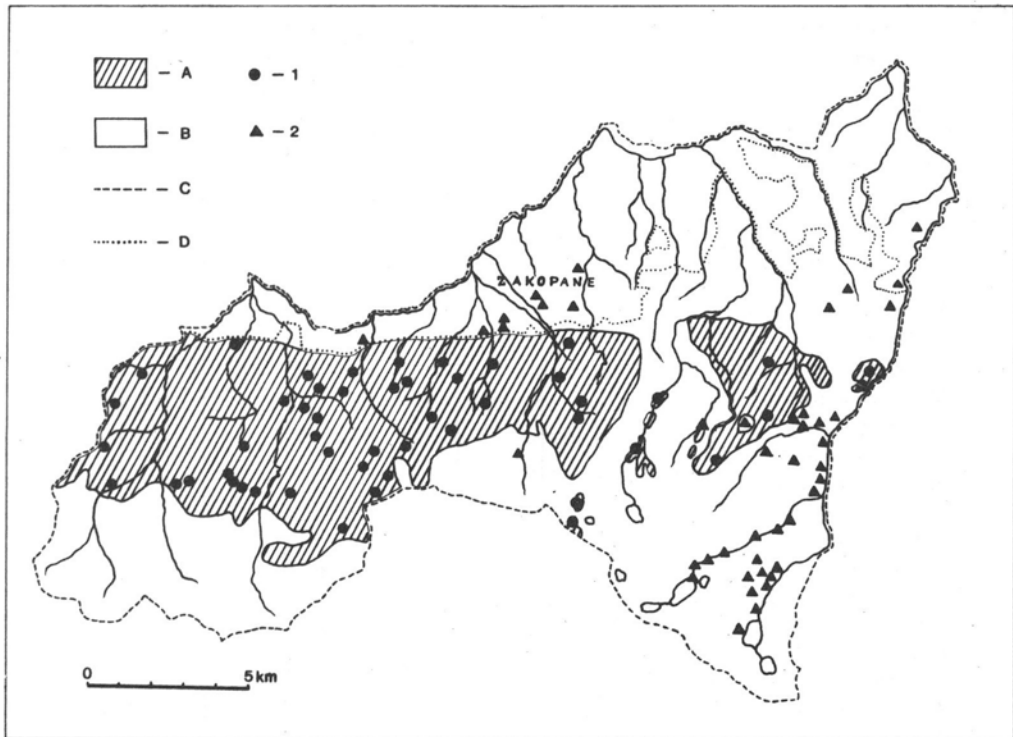


Fig. 4. Edaphic vicarism of *Galium anisophyllum* (1) and *G. saxatile* (2) in the Polish part of the Tatra Mts. and the adjacent Subtatra. A—calcareous rocks, B—poor, non-calcareous rocks, C—boundary of the investigated territory, D—boundary of the Tatra National Park

Table 1

Communities with *Galium saxatile* in the Tatras

Number of record	1	2	3	4	5	6
Altitude m asl.	1030	1020	1360	1350	1640	1640
Exposition	NE	NE	NEE	E	NEE	NEE
Inclination	30	4	10	6	10	10
Tree cover in %	50	50	—	—	—	—
Herb cover in %	70	85	95	95	95	95
Area of stand, m ²	25	30	10	10	10	10
<i>Galium saxatile</i>	1	2	2	3	2	+

Table 1 continued

Number of record	1	2	3	4	5	6
Tree layer (a)						
<i>Picea excelsa</i>	3	3	.	.	.	.
<i>Sorbus aucuparia</i>	1	.	.	.	.	.
Herb layer (c)						
<i>Homogyne alpina</i>	1	2	3	.	3	2
<i>Vaccinium myrtillus</i>	2	2	2	.	+	2
<i>Luzula nemorosa</i>	+	+	2	.	.	+
<i>Gentiana asclepiadea</i>	+	.	1	1	.	r
<i>Deschampsia flexuosa</i>	3	2	2	1	.	.
<i>Rubus idaeus</i>	+	1	+	+	.	.
<i>Picea excelsa</i> (juv.)	r	+	+	+	.	.
<i>Nardus stricta</i>	.	.	4	4	3	2
<i>Geum montanum</i>	.	.	+	+	+	r
<i>Calamagrostis villosa</i>	.	.	+	.	2	1
<i>Vaccinium vitis-idaea</i>	.	.	+	.	1	2
<i>Potentilla aurea</i>	.	.	1	1	.	r
<i>Campanula polymorpha</i>	.	.	r	+	.	r
<i>Oxalis acetosella</i>	3	3	.	.	.	.
<i>Dryopteris assimilis</i>	1	2	.	.	.	.
<i>Sorbus aucuparia</i> (juv.)	.	2	+	r	.	.
<i>Senecio nemorensis</i>	.	+	r	r	.	.
<i>Phleum alpinum</i>	.	.	1	2	.	.
<i>Agrostis vulgaris</i>	.	.	1	1	.	.
<i>Carex leporina</i>	.	.	+	+	.	.
<i>Chamaenerion angustifolium</i>	.	.	+	+	.	.
<i>Solidago alpestris</i>	.	.	+	r	.	.
<i>Rumex acetosella</i>	.	.	r	+	.	.
<i>Vaccinium gaultherioides</i>	.	.	.	.	1	2
<i>Agrostis rupestris</i>	.	.	.	.	1	1
<i>Anthoxanthum alpinum</i>	.	.	.	.	1	1
<i>Mutellina purpurea</i>	.	.	.	.	1	1
<i>Hieracium alpinum</i>	.	.	.	.	+	1
<i>Carex sempervirens</i>	.	.	.	.	1	+
<i>Luzula sudetica</i>	.	.	+	.	+	.
Bryophytes						
<i>Polytrichum attenuatum</i>	2	3	.	.	.	.
<i>Sphagnum girgensohnii</i>	2	+	.	.	.	.
<i>Dicranum scoparium</i>	+	2	.	.	.	.
<i>Plagiothecium undulatum</i>	1	.	.	.	.	.

Species occurring in 1 record: *Athyrium filix-femina* 1:++; *Calamagrostis arundinacea* 2:r; *Carex fusca* 4:r; *C. pilulifera* 5:l; *Cerastium trivium* 4:r; *Deschampsia caespitosa* 4:l; *Dryopteris carthusiana* 2:++; *Festuca picta* 5:l; *F. rubra* 4:l; *Hieracium lachenalii* 3:++; *Hypericum maculatum* 3:++; *Juniperus nana* 6:r; *Leontodon autumnalis* 4:r; *Luzula flavescens* 1:++; *L. silvatica* 2:++; *Rumex arifolius* 4:++; *Salix silesiaca* 4:r.

Localities of records:

1,2 — The High Tatra Mts: the Old Roztoka Valley, moraine above the Wincenty Pol shelter house, towards Wodogrzmoty Mickiewicza.

3,4 — The High Tatra Mts: between the Ejsmond's turn and Szalasiska.

5,6 — The High Tatra Mts: The Kępa Mt. (near the route from Morskie Oko valley to The Valley of Five Polish Lakes).

In the Eastern Carpathian Mts. its occurrence is similar. On the Wielki Gorgan Mt. it grows in the spruce forest (Dubovik 1972). In the Czywczynskie Góry Mts. it has been encountered on the limeless area (Kucowa 1962 sub. *G. pawlowskii*).

DISCUSSION

Till now, it has been stressed in Polish literature that one of the floristic differences between the Carpathian Mts. and the Sudeten was lack of *G. saxatile* in the former (Szafer and Zarzycki 1972; 1:203, 2:242, 247, 250). It has also been indicated that the analogous differences occur between such Carpathian and Sudeten associations as *Plagiothecio-Piceetum*, or *Abieti-Piceetum* (Szafer and Zarzycki 1972: 1:346, Matuszkiewicz 1977: 172, 186). In the light of the present facts all these opinions have to be modified or rectified.

Also the Čopik's error should be corrected. In his paper (Čopik 1976: 213) this author has treated *G. pawlowskii* as conspecific with calciphilous *G. bellatum* Klok. However, *G. bellatum* belongs to the widely considered *G. anisophyllum*, while *G. pawlowskii* to *G. saxatile*. While both these species differ clearly in respect of morphological features, as well as habitat requirements. All that has been already mentioned in the introduction.

The history of *G. saxatile* in the Carpathian Mts. is also very interesting, meant here as *G. saxatile* migration route and time of its arrival to the Carpathian Mts. General distribution of this species (Fig. 1) seems to indicate the Sudeten-Carpathian route as the proper one, because it was chosen by many other Sub-Atlantic plant species (cp. Czechtowa 1925/26). Unfortunately, the lack of fossils makes all the judgement about the time of *G. saxatile* arrival impossible. Yet, it can be inferred, with some probability that its appearance in the Carpathian Mts. was linked with the moistening and cooling of the climate. It happened at the beginning of the Sub-Atlantic period, when fir and beech started to spread in the Carpathian Mts. However, it is a problem open to discussion and it needs support of the facts.

LIST OF *GALIUM SAXATILE* L. LOCALITIES THAT HAVE BEEN RECORDED FOR THE CARPATHIAN MTS.

THE WESTERN CARPATHIAN MTS.

The Beskid Śląski Mts.: 1. Brenna in the Leśnica Valley 400-500 m (Broda 1973); 2. The Bukowa Valley 450 m (Broda 1973).

The Beskid Wyspowy Mts.: 3. Near the summit of Łopień Mts. 840-940 m (Towpasz 1975).

The Northern Subtatra: 4. Gronik Mt. 920 m (Mirek and Piękoś-Mirkowa, unpublished); 5. Zakopane 870-900 m, in the forest between Biały Potok (White stream) and Spadowiec Potok (Spadowiec stream) (Mirek, unpublished); 6. Zakopane 920 m, wood near the Antałówka summit-northern slope (Mirek and Piękoś-Mirkowa, unpublished); 7. Zakopane, the southern slope between the „To Bristol Road” and the Antałówka summit 900-940 m (Mirek, unpublished); 8. Jaszczurowskie Bory 840-900 m, on some sites (Mirek, unpublished); 9. The Poroniec Glade 1080 m (Mirek and Piękoś-Mirkowa, unpublished); 10. The Rynias Glade 880 m (Mirek, unpublished); 11. The Kiczora Niżnia Glade 1000 m (Mirek, unpublished); 12. The Hurkotna Glade 1080 m (Mirek, unpublished).

The Western Tatra Mts.: 13. The Goryczkowa Valley 1300 m (coll. K. Zarzycki 1980, unpublished).

The High Tatra Mts: 14. The Wierch Poroniec Mt. 1130 m (Piękoś-Mirkowa and Mirek 1978); 15. The Białka Valley between the Palenica Białczańska and Old Roztoka, on several sites 980-1030 m (Piękoś-Mirkowa and Mirek 1978); 16. Between the Palenica Białczańska and the Rusinowa Glade 1060-1190 m (Piękoś-Mirkowa and Mirek 1978); 17. Between the Przysłop Waksmundzki and the Waksmundzka Równień 1430 m (Piękoś-Mirkowa, unpublished); 18. The Wołoszyn Mt., north and north-eastern slope 1250-1300 m (Piękoś-Mirkowa and Mirek 1978); 19. The Roztoka Valley 1215-1440 m (Piękoś-Mirkowa and Mirek 1978, and unpublished); 20. The eastern slope of the Kępa Mt. above Szalasiska 1340-1680 m (Piękoś-Mirkowa and Mirek 1978, and unpublished); 21. Near the tourist route from the Morskie Oko pond to the Szpiglasowa pass 1450 m (Mirek and Piękoś-Mirkowa, unpublished).

THE EASTERN CARPATHIAN MTS.

The Gorgany Mts.: 22. Wielki Gorgan Mt. (Ujhelyi and Zolyomi 1942 sec. Dubovik 1972).

The Góry Czywczynskie Mts.: 23. The Czywczyn Mt. and Krinicznij Wielikij, coll. K. Malinowski 1961, as well as slightly lower in the Zelene village near Czarny Czeremosz, coll. J. Artemczuk 1962 (sec. Kucowa 1962).

REFERENCES

- Broda M., 1973. Stanowisko *Galium saxatile* L. w polskich Karpatach. *Fragm. Flor. Geobot.* 19: 371-372.
 Czczottowa H., 1925/26. Element atlantycki we florze Polski. *Rozpr. Wydz. Mat.-Przyr. PAU, ser III*, 25/26: 221-286.

- Čopik I. K., 1976. Vysokogirna flora Ukraïnskikh Karpat. Naukova Dumka, Kiyev. p. 276.
- Dubovik O. N., 1972. New data on *Galium* species in Flora of the Ukrainian Carpathians. Ukr. Bot. Zhurn. 29: 31-37.
- Ehrendorfer F., 1976. Genus *Galium* L. sect. *Leptogalum* Lange. In: Flora Europaea. vol. 4. Tutin T. G. et al. (eds.). Univ. Press, Cambridge. pp. 29-34.
- Hulten E., 1958. The amphi-atlantic plants and their phytogeographical connections. K. Svensk. Akad. Handl., Fjärde Ser. 4.7. Stockholm.
- Kucowa I., 1962. Gatunki rodzaju *Galium* L. sekcji *Leptogalum* Lange z Polski i ziem ościennych. Fragm. Flor. Geobot. 8: 417-442.
- Matuszkiewicz J., 1977. Przegląd fitosocjologiczny zbiorowisk leśnych Polski. Cz. 4. Bory świerkowe i jodłowe. Phytocoenosis 6: 149-227.
- Piękoś-Mirkowa H., Mirek Z., 1978. O rzadkich lub dotychczas z obszaru Tatr nie znanych gatunkach roślin naczyniowych. Fragm. Flor. Geobot. 24: 363-368.
- Szafer W., Zarzycki K. (eds.), 1972. Szata roślinna Polski. 1, 2. PWN, Warszawa. pp. 615, 347.
- Towpasz K., 1975. Rośliny naczyniowe południowo-wschodniej części Beskidu Wyspowego. Cz. 2. Monogr. Bot. 48: 1-143.
- Ujhelyi J., Zolyomi B., 1942. A Mármarosi Gorgán Alhavas cirbolya (*Pinus cembra*) állományai. Matematikai és Természettudományi Ertesítő 61.

Rozmieszczenie i warunki występowania *Galium saxatile* L. w Karpatach

Streszczenie

Stwierdzono, że opisany z Karpat Wschodnich gatunek *Galium pawlowskii* Kucowa, jest konspecyficzny z *G. saxatile* L., w obrębie którego zasługuje co najwyżej na rangę odmiany, tj. *Galium saxatile* L. var. *pawlowskii* (Kucowa) comb. nova. Ogólne rozmieszczenie *G. saxatile*, uzupełnione o nowo odkryte stanowiska karpackie, podano na ryc. 1, a jego zasięg pionowy na ryc. 2. Najwyższe stanowisko tego gatunku zanotowano w Tatrach na wysokości 1680 m npm. Wykaz wszystkich stanowisk w Karpatach wraz z wysokościami npm zamieszczono na stronie Siedliskami *G. saxatile* na terenie Karpat są najczęściej gleby kwaśne, bezwapienne, świeże lub okresowo wilgotne, głównymi zaś fitocenozy: *Plagiothecio-Piceetum*, *Abieti-Piceetum* oraz ubogie "psiary" z rzędu *Nardetalia* (najczęściej zespół *Hieracio-Nardetum*). W piętrze kosodrzewiny w Tatrach gatunek ten występuje także w murawach o charakterze pośrednim między zbiorowiskami z rzędu *Nardetalia* i *Caricetalia curvulae* (por. tab. 1). Wyraźne przywiązanie *G. saxatile* do kwaśnego (ryc. 3), bezwapiennego podłoża sprawia, że gatunek ten wykazuje na terenie Tatr wyraźną edaficzną zastępczość w stosunku do bazyfilnego i kalcyfilnego *G. anisophyllum*, drugiego gatunku z sekcji *Leptogalum* rosnącego na tym terenie (ryc. 4). Ponadto sprostowano błąd w opracowaniu Čopika (1976), gdzie autor traktuje *G. pawlowskii* jako konspecyficzny z kalcyfilnym *G. bellatum* Klok.