

Saxifraga scardica (Saxifragaceae) – a new record for the Bulgarian flora

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Abstract. *Saxifraga scardica* is an endemic plant occurring in the mountains of the Balkan Peninsula, between Montenegro and Southern Continental Greece. Morphologically, it is most similar to *S. marginata*, one of the 23 reported Bulgarian *Saxifraga* species. In Bulgaria, *S. marginata* is reported as growing on limestone, in the Forebalkan (*Western*) and Balkan Range (*Central*) floristic regions. *Saxifraga scardica* is reported for the first time for the Bulgarian flora. It was found in the Zemen Gorge of River Struma, in the Znepole floristic region. This location is the easternmost part of its distribution range. Under IUCN criteria, the species is classified as ‘Endangered’.

Key words: Bulgarian flora, first report, new records, *Saxifragaceae*

Introduction

Saxifraga is a diverse temperate genus of herbs distributed mainly across Eurasia and North America, where it most likely originated (Ebersbach & al. 2017b). After exclusion of *Micranthes* from *Saxifraga*, 13 sections remain in the genus (Gao & al. 2015; Tkach & al. 2015; Ebersbach & al. 2017a, b), two of them particularly species-rich, namely *Ciliatae* and *Porphyrion*. The latter is abundant in the mountains of Eurasia, and its fast diversification was associated with two morphological key innovations: lime-secreting hydathodes and cushion-like habitus (Ebersbach & al. 2017a, b).

Saxifraga scardica Griseb., an endemic plant occurring in the mountains of the Balkan Peninsula,

between Montenegro and South Greece (Webb 1993), is among the species bearing these particular morphological traits. However, so far it has never been recorded in Bulgaria. Morphologically, *Saxifraga scardica* is most similar to *S. marginata* Sternb., one of the 23 reported Bulgarian *Saxifraga* species. In Bulgaria, *S. marginata* is reported as growing in shady places between 900 and 2000 m on limestone, in the Forebalkan (*Western*: Vratsa Balkan Divide) and Balkan Range (*Central*: Troyan Balkan Divide) floristic regions (Kuzmanov 1970, Fig. 1). Both species belong to the section *Porphyrion* Tausch and are even depicted as potential sister taxa in the recent phylogenetic works (see Engler & Irmscher 1919: 561; Tkach & al. 2015). In this article, a short overview of the characters is provided, with emphasis on

the characters distinguishing both species. Furthermore, notes regarding their ecology, phenology and habitats are presented.

Material and methods

Digital photographs and GPS coordinates were taken in the field. Detailed photographs displaying the diagnostic features of the newly recorded *Saxifraga* population were compared to 10 specimens of *Saxifraga marginata* and eight specimens of *S. scardica* deposited in the Herbarium (SOM) of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, and in the Herbarium (SO) of the St. Kliment Ohridski Sofia University and the Herbarium (SOA) of the Agricultural University, Plovdiv. The overview of the morphological traits provided for both species has been based on herbarium vouchers from the Balkan region and on personal observations in the field. Furthermore, in order to evaluate taxonomy, distribution and phylogenetic relationships of the

species at hand, the authors have referred to a series of seminal publications on *Saxifraga* (Engler & Irscher 1919: 561; Horný & al. 1986; Webb & Gornall 1989; Webb 1993; Tkach & al. 2015; Wightman & al. 2018).

Vouchers have not been gathered and deposited to any of the public Bulgarian herbaria, because collecting plant material would be hazardous for the population, which is rather isolated even though a dense one. We documented the record by photographs only.

The document 'Guidelines for Using the IUCN Red List Categories and Criteria' (IUCN Standards and Petitions Subcommittee 2017) was followed to assign the threat category of this plant species.

Results and discussion

The authors have discovered a saxifrage matching the diagnostic characters of *Saxifraga scardica* in the Zemen Gorge of River Struma in Znepole floristic region. The species was first recorded on 16.09.2018 at late fruiting stage, and later, the flowering stage was

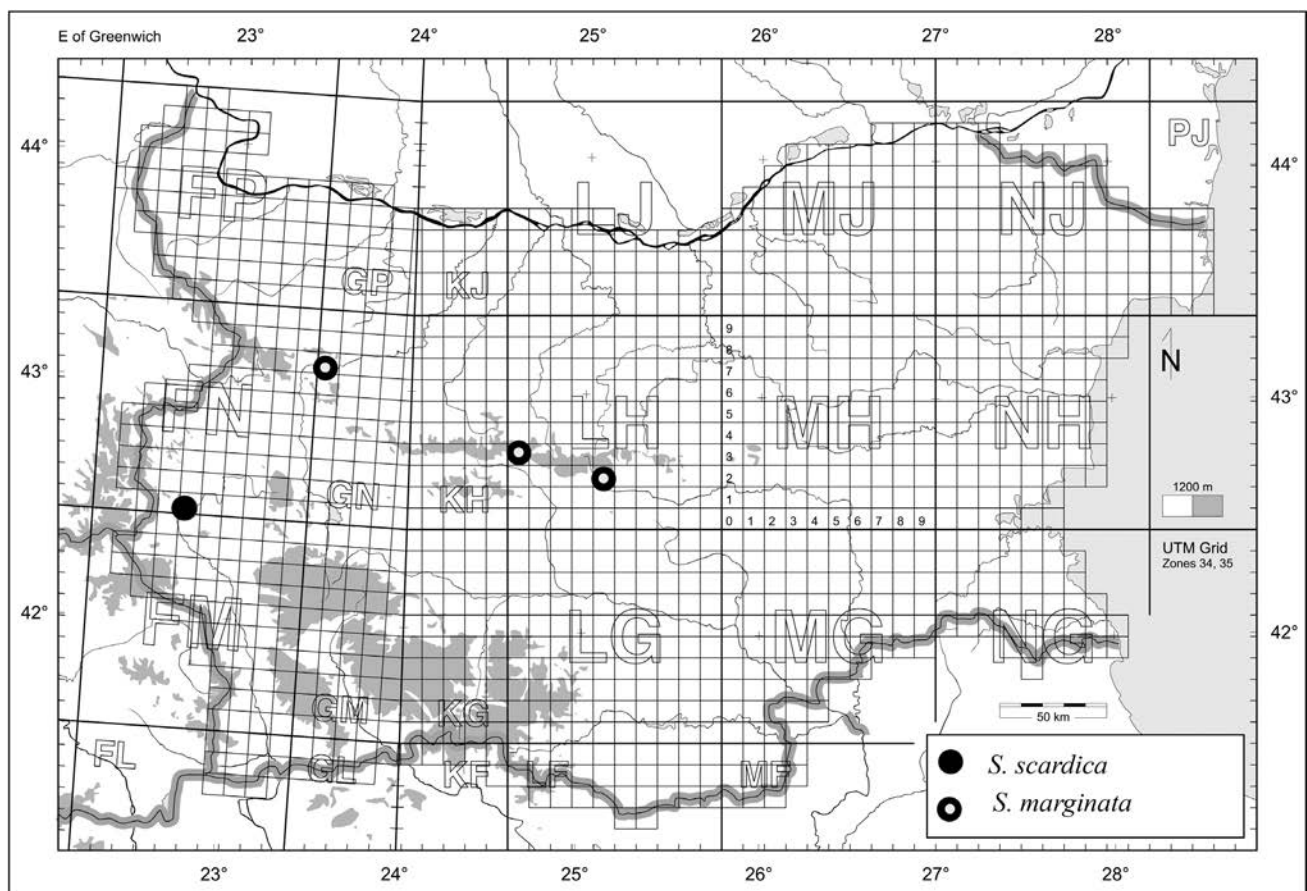


Fig. 1. Distribution map of *Saxifraga scardica* and *S. marginata* in Bulgaria (the blank map source is from Abadjiev 2000).

documented on 29.04.2019 (Fig. 1). The population was rather dense, with at least 50 individual cushions, each consisting of three to over 100 leaf rosettes. At the time of observation, most of them were vegetative. However, 15 individuals were bearing one to 10 flowering stems, with one to eight flowers each. As that particular winter and early spring were unusually dry in Bulgaria, it is advisable to carry out further observations in the coming years, in order to assess the health of the population.

The plants grew on two separate limestone cliffs facing north ($42^{\circ}27'07''\text{N}$, $22^{\circ}42'37''\text{E}$ and $42^{\circ}27'06''\text{N}$, $22^{\circ}42'39''\text{E}$, respectively), at ca. 600 m a.s.l. Morphologically, *Saxifraga scardica* is chiefly characterised by its acute or apiculate, dorsally keeled and grey-green leaves ($5\text{--}14 \times 2\text{--}4$ mm), which are occasionally serrulate in the proximal half. The species also bears (1)4–12 flowers on each stem, with white or pink petals ca. 7×3.5 mm. Many of these traits overlap with those of *S. marginata*, which has leaves ca. $3\text{--}12 \times 1\text{--}5$ mm, 2–8 flowers per stem with obovate white or pale-pink petals 7–14 mm. Although the leaves of *S. marginata* are rather variable in their general shape (linear-oblong to obovate-spathulate), other leaf traits make distinction between the two species possible. They include the leaves' apex, which is acute in *S. scardica* and obtuse in *S. marginata* (Engler & Irmscher 1919: 561; Webb & Gornall 1989; Webb 1993). Furthermore, the leaf margins of *S. marginata* are never proximally serrulate as those of *S. scardica* (Webb & Gornall 1989).

On the basis of morphological features, the newly discovered *Saxifraga* population could be excluded from belonging to *S. marginata*; although it is still poorly understood whether and how their respective habitats differ from each other. Location of the new record may correspond to the elevation range of both

species, which are usually recorded in relatively treeless environment at higher elevation, for example, above 900 m a.s.l. for *S. marginata* in Bulgaria (Assyov & Petrova 2012). However, both species occasionally occur in abyssal populations, usually located in sheltered gorges: *S. scardica* was reported at 400 m a.s.l. in the Matka Gorge in North Macedonia (Strid 1986; Webb & Gornall 1989), and *S. marginata* was found in the Vikos Gorge at ca. 500 m a.s.l. (GBIF 2017).



Fig. 3. *Saxifraga scardica* – flower (photo: Z.D. Naychov).



Fig. 2. *Saxifraga scardica* – leaf rosettes (Photo: Z.D. Naychov).



Fig. 4. Habit of *Saxifraga scardica* (photo: Z.D. Naychov).

Further efforts should be encouraged to determine the origin of these abyssal populations (either newly founded from local stock at higher elevations, or relictual), as well as to identify the extent of reproductive isolation between these species.

The new record of *S. scardica* raises the number of Bulgarian *Saxifraga* species to 24. In terms of distribution, both *S. scardica* and *S. marginata* are present on the Balkan Peninsula: in Albania, South ex-Yugoslavia, Greece and, including the present new record, also in Bulgaria. Distribution of *S. marginata* extends further than that of *S. scardica*, including nearby Romania (Carpathians) and Central and South Italy. Clearly, the populations of both species are few and usually far apart, which entails risk of extinction by consanguinity. Furthermore, the newly discovered population is located just above a railway tunnel on the Sofia-Kyustendil line. This provides some level of security from private economic interests but, on the other hand, any major renovations of the railway line might put the population in grave danger. With only few individuals, this single Bulgarian population of *S. scardica* represents *de facto* a critically endangered species in the Bulgarian flora, and we suggest for *S. scardica* to be included in the *Red List of Bulgarian Vascular Plants*. The closely related *S. marginata* was classified as ‘Rare’ (Ganchev 1984). It is listed in *Red List of Bulgarian Vascular Plants* (Peev & Tsoneva 2009) under the IUCN category of ‘Vulnerable’. Surprisingly, *S. marginata* is not included in the contemporary Bulgarian Red Data Book (Peev & al. 2015). We suggest for *S. scardica* to be considered as ‘Endangered’ across its entire distribution range, according to the following IUCN criteria: B1aC2a(i). Indeed, the distribution of this population is highly fragmented, and population numbers seem to be small. Climate change and human activities (building of roads and tourism at higher elevations) represent the main threats to *S. scardica*.

Conclusion

Saxifraga scardica is reported for the first time from Bulgaria. Its location in the Zemen Gorge of River Struma is the easternmost part of its range of distribution (Marhold 2011). Under the IUCN criteria, this species is classified as ‘Endangered’.

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References

- Abadjiev, S.** 2000. An Atlas of the Distribution of the Butterflies in Bulgaria (Lepidoptera: Hesperioidea & Papilionoidea). Pensoft Publishers, Sofia–Moscow.
- Assyov, B. & Petrova, A.** (eds). 2012. Conspectus of the Bulgarian Vascular Flora. Distribution Maps and Floristic Elements. Ed. 4. Bulgarian Biodiversity Foundation, Sofia.
- GBIF.** 2017. *Saxifraga scardica* Griseb. – In: GBIF Secretariat (2017). GBIF Backbone Taxonomy. Checklist dataset <https://doi.org/10.15468/39omei> accessed via GBIF.org on 2019-08-27.
- Ebersbach, J., Muellner-Riehl, A.N., Michalak, I., Tkach, N., Hoffmann, M.H., Röser, M., Sun, H. & Favre, A.** 2017a. In and out of the Qinghai-Tibet Plateau: divergence time estimation and historical biogeography of the large arctic-alpine genus *Saxifraga* L. – *J. Biogeogr.*, **44**: 900–910.
- Ebersbach, J., Schnitzler, J., Favre, A. & Muellner-Riehl, A.N.** 2017b. Evolutionary radiations of the species-rich mountain genus *Saxifraga* L. – *BMC Evol. Biol.*, **17**(1): 119.
- Engler, H.G.A. & Irmischer, E.** 1919. *Saxifragaceae* – *Saxifraga* II. – In: **Engler, H.G.A.** (ed.). *Das Pflanzenreich: Regni Vegetabilis Conspectus*. Vol. **69** (IV, 117): p. 709.
- Ganchev, S.** 1984. *Saxifraga marginata*. – In: **Velchev, V.** (ed.), *Red Data Book of People’s Republic of Bulgaria*. Publ. House of Bulg. Acad. Sci., Sofia (in Bulgarian).
- Gao, Q.-B., Li, Y.-H., Gornall, R.J., Zhang, Z.-X., Zhang, F.-Q., Xing, R., Fu, P.-C., Wang, J.-L., Liu, H.-R., Tian, Z.-Z. & Chen, S.-L.** 2015. Phylogeny and speciation in *Saxifraga* sect. *Ciliatae* (*Saxifragaceae*): Evidence from *psbA-trnH*, *trnL-F* and ITS sequences. – *Taxon*, **64**: 703–713.
- Horný, R., Webr, K.M. & Byam-Grounds, J.** 1986. *Porophyllum Saxifragae*. Byam-Grounds Publications, Stamford.
- IUCN Standards and Petitions Subcommittee.** 2017. Guidelines for Using the IUCN Red List Categories and Criteria. Version **13**. Prepared by the Standards and Petitions Subcommittee. – <http://www.iucnredlist.org/documents/RedListGuidelines.pdf>.
- Kuzmanov, B.** 1970. *Saxifragaceae*. – In: **Jordanov, D.** (ed.), *Fl. Reipubl. Popularis Bulgaricae*. Vol. **4**, pp. 652–704. In *Aedibus Acad. Sci. Bulgaricae, Serdicae* (in Bulgarian).
- Marhold, K.** 2011. *Saxifraga*. – In: Euro+Med PlantBase – the information resource for Euro-Mediterranean plant diversity. Published on the Internet <http://ww2.bgbm.org/EuroPlusMed/> <http://ww2.bgbm.org/euroPlusMed/PTaxonDetail.asp?NameId=31315&PTRefFk=7200000> [accessed 08.05.2019].
- Peev, D., Petrova, A., Anchev, M., Temniskova, D., Denchev, C.M., Ganeva, A., Gushev, Ch. & Vladimirov, V.** 2015. *Red Data Book of the Republic of Bulgaria*. Vol. **1**. Plants and Fungi. Bulgarian Academy of Sciences & Ministry of Environment and Water, Sofia.

- Peev, D. & Tsoneva, S.** 2009. *Saxifraga marginata*. – In: **Petrvoa, A. & Vladimirov, V.** (eds), Red List of Bulgarian Vascular Plants. – Phytol. Balcan., **15**(1): 86.
- Strid, A.** (ed.). 1986. Mountain Flora of Greece. Vol. **1**. Univ. Press, Cambridge.
- Tkach, N., Röser, M., Miehe, G., Muellner-Riehl, A.N., Ebersbach, J., Favre, A. & Hoffmann, M.H.** 2015. Molecular phylogenetics, morphology, and a revised classification of the complex genus *Saxifraga* (*Saxifragaceae*). – Taxon, **64**: 1159-1187.
- Webb, D.A.** 1993. *Saxifraga*. – In: **Tutin, T.G. & al.** (eds.), Flora Europaea. Ed. 2, vol. **1**, pp. 437-458. Cambridge Univ. Press, Cambridge.
- Webb, D.A. & Gornall, R.J.** 1989. Saxifrages of Europe: With Notes on African, American and Some Asiatic Species. Helm, London.
- Wightman, R., Wallis, S. & Aston, P.** 2018. Leaf margin organisation and the existence of vaterite-producing hydathodes in the alpine plant *Saxifraga scardica*. – Flora, **241**: 27-34.
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