Draba dorneri HEUFF., A RARE ALPINE ENDEMIC IN THE RETEZAT NATIONAL PARK (SOUTHERN CARPATHIANS, ROMANIA): DISTRIBUTION, ECOLOGY AND CONSERVATION

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Abstract. The Retezat National Park harbours an impressive number of plants with a narrow distribution, being considered an important centre of endemism. In the present paper we examine the ecological features of *Draba dorneri* Heuff. (*Brassicaceae*), an endemic species restricted to the Southern Carpathians (Romania), the *locus classicus* of this species being represented by the population from Retezat Mountains. Aspects regarding habitat requirements, population ecology and main threats are presented. Despite the small area of the habitat and the low number of individuals, the population remained stable throughout the monitoring period (2010-2015). Restrictive factors that may affect the population are recreational activities, its vulnerability to competition with other plant species (*Pinus mugo, Juniperus communis*) and the low power of seed dispersal and colonisation.

Keywords: *Draba dorneri*, Retezat, conservation, endemic.

Rezumat. *Draba dorneri* Heuff., endemit alpin rar în Parcul Național Retezat (Carpații Meridionali, România): distribuție, ecologie și conservare. Parcul Național Retezat găzduiește un număr impresionant de plante cu o distribuție restrânsă, fiind astfel considerat un important centru de endemism. În lucrarea de față analizăm caracteristicile ecologice ale lui *Draba dorneri* Heuff. (Brassicaceae), o specie endemică cu o distribuție restrânsă la Carpații Meridionali (România), *locus classicus* al acestei specii fiind reprezentat de populația din Munții Retezat. Sunt prezentate aspecte legate de cerințele de habitat, ecologia populației și principalele amenințări. În ciuda suprafeței mici a habitatului și a numărului scăzut de indivizi, populația a rămas stabilă de-a lungul perioadei de monitorizare (2010-2015). Factori restrictivi care pot afecta populația sunt activitățile recreaționale din proximitatea sitului, vulnerabilitatea speciei la competiția cu alte specii de plante (*Pinus mugo, Juniperus communis*) și capacitatea scăzută de diseminare și colonizare.

Cuvinte cheie: *Draba dorneri*, Retezat, conservare, endemic.

INTRODUCTION

In the first half of the 17th century, in today's Banat, then under Austro-Hungarian occupation, intensive investigation of the flora of these lands took place for János Heuffel, a young graduate of the Budapest School of Medicine. As the topic of his dissertation thesis, he chose the geographical distribution of plants at the foot of the Carpathian Mountains in Banat. He loved these lands so much that he settled there not only to continue his botanical study, but also to adopt the profession of doctor and he stayed in the region until the end of his life. He intensively botanised, being the discoverer of over 70 new plant species and wrote numerous scientific papers. Also, during this period, Dörner, a Hungarian morphologist, physiologist and botanist made a botanical excursion in Banat, occasionally meeting Heuffel. In 1858, Heuffel named in his honour a new species discovered in the Retezat Mountains (Retezat Mts.), *Draba dorneri* (SZINNYEI, 1891). The type is found in the Herbarium of Botanic Garden and Botanical Museum of Berlin-Dahlem, Freie Universität Berlin.

Draba dorneri is an emblematic species for the Retezat National Park, being the first endemic plant reported for this protected area. The Retezat Mountains harbours more than one third of Romanian flora and is one of the most diverse centres of endemism with 5 local endemic taxa and 63 with a wider distribution (HURDU et al., 2012). The richness and the outstanding variety of the flora and vegetation is due to its geographic position, the geological past and the rugged relief that produce a very wide range of edaphic and climatic conditions within the massif (CSÚRÖS, 1971).

About half of the species of *Draba* have restricted distributions (JORDON-THADEN, 2009). *Draba dorneri* is a rare member of the *Brassicaceae* family, endemic to Southern Carpathians, with its *locus classicus* being represented by the population from Retezat Mountains. It was originally named by BAUMGARTEN (1817) as *D. stellata* Jacq., described later by HEUFFEL (1858a, b) as a new species under the name of *D. dorneri*.

The species is currently listed in Annex II of Council Directive 92/43/EEC-Habitats Directive; Annex I of Bern Convention; and in Annexes 3 and 4A of Governmental Decision (OUG) no. 57/2007 regarding the regime of protected natural areas, natural habitat conservation, flora and fauna in Romania. It is also included in the Red List of vascular plants for Romania (OLTEAN et al., 1994) and is defined as a vulnerable and rare species. In the Red Book of vascular plants, it is ranked as critically endangered (DIHORU & NEGREAN, 2009).

At the national level, the Retezat National Park was established in 1935, at the initiative of Professor Alexandru Borza. It was the first national park in Romania. At the international level, the national park was designated as the Retezat Biosphere Reserve in 1979. When Romania joined the European Union in 2007, the Retezat Mountains were included in the European Natura 2000 network, under the name of ROSCI0217 Retezat.

Despite its reputation, prior research has poorly documented specific habitat requirements or evaluated the population size of important taxa. Thus, the aims of this research are: (1) a critical review of the distribution in Retezat

National Park; (2) to characterise *D. dorneri* habitat particularities with abiotic and plant community characteristics; (3) evaluation of the population size; and (4) identification of the primary threats to this rare taxon.

MATERIAL AND METHODS

The Retezat National Park is located in the south-western part of Romania, within the Southern Carpathians. The studied area, Prelucele Ridge (Fig. 1), belongs to the north-western sector of the Retezat Mountains, located in the Râușor basin and part of the Central Subunit, Drăgșanu-Slăveiu-Zlata Microunit (URDEA, 2000). Piciorul Prelucelor, the lower part of the Prelucele Ridge, is covered by coniferous forests and runs for a modest length, starting from Văleresca Glade (1570 m) and up to the altitude of 1750-1800 m at the forest limit. From this point, the ridge widens and presents flattened or slightly inclined surfaces (cryoplanation terraces) developed on granitoids and where a series of elements of the periglacial morphology appear: large angular rocks or reduced residual peaks chaotically arranged up to Prelucele peak area. The western part of the Prelucele Peak splits into two ridges that form together a glacio-nival cirque with a northern exposure (currently represented by the Valereasa basin): Prelucele Ridge, the SW arm of the cirque and Valereasa Ridge. Retezat National Park has a mountain climate with an annual mean temperature of 6◦C and an annual mean precipitation of 900-1300 mm.

Our study was based on available botanical literature, herbarium material collected from Retezat National Park and stored at B, BP, BUCA, CL, CLA and SIB herbaria (acronyms according to THIERS 2016) and field surveys carried out between 2010-2015. In order to characterise the plant community in which *D. dorneri* occurs, we performed a phytocoenological survey according to the Braun-Blanquet method (BRAUN-BLANQUET, 1921). The population size was estimated through absolute abundance and monitored over the years 2010, 2012 and 2014. The nomenclature of the vascular flora followed SÂRBU et al. (2013).

The monitoring project started in 2011 (Project SOP Environment) and the first results was reported in 2013 and published in 2015 (MIHĂILESCU et al., 2015a). According to the Habitats Directive, the conservation status assessment is based on the concept of "Favourable Conservation Status", and the degree of deviation from this status (European Commission, 2011). Such assessments differentiate between "Favourable" (FV), "Unfavourable-inadequate" (U1), "Unfavourable-bad" (U2) or "Unknown" (XX). For the monitoring and evaluation of the status of conservation, we followed the standard guide for evaluating European sites (MIHĂILESCU et al., 2015b).

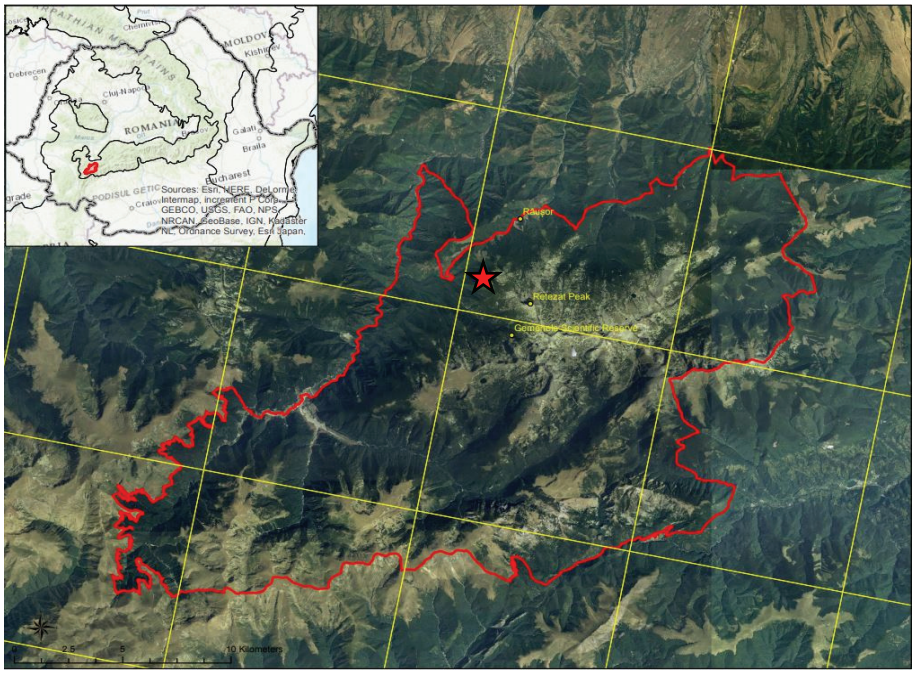

Figure 1. The distribution of *Draba dorneri* (marked by a red star) in Retezat National Park (red line); the left corner map indicates the location of Retezat National Park in Southern Carpathians, Romania.

RESULTS AND DISSCUSION

Distribution in the Retezat Mountains. As Heuffel mentioned, the *locus classicus* of *D. dorneri* occurs "in fissuris rupium (in regione mughi) iugi supra Vallye Rasza sub alpe Retyczát in Cottu Hunyad Transylvaniae", as a rocky area situated on the ridge that starts from Valereasca Glade (1570 m) and extends up to the Retezat Peak (2485 m). The toponym Piciorul Colțului appears for the first time on *D. dorneri* herbarium material after 1907, that includes Degen specimens. Even if it was not present on the maps at that time, the toponym Piciorul Colțului was very common

in botanical literature and appears for the first time associated with *D. dorneri* in SIMOMKAI (1878) and BORBÁS (1878) papers, being subsequently adopted by PRODAN (1939), NYÁRÁDY (1955, 1958), BICHICEANU (1967), CSÜRÖS (1971), DIHORU & PÂRVU (1987), DIHORU & NEGREAN (2009), DONIȚĂ et al. (2005) and OPREA (2005). Some confusion has been made based on the remarks of NYÁRÁDY (1958) about the position of Piciorul Colțului. He argued that the site "is a rocky peak of 2281 m, set on the ridge between Valereasca Peak and Retezat Peak, at about the middle of the ridge", but this was not supported and explained by BICHICEANU (1967) who assumed the altitude would be between 1600-1700 m, with the mention that it should be verified. Following the route of old botanists, we found the population of *D. dorneri* on a cluster of granitic rock blades located on Prelucele Ridge, at 1840 m elevation, at the border between the coniferous forest and *Pinus mugo* scrub (Fig. 1).

On newer maps, Piciorul Colțului appears as an adjacent forested area of lower altitude, the rocks where Heuffel described *D. dorneri* are called the Prelucele Ridge, after a cluster of creeks situated in the valleys under it. It is possible that in the past, the entire area west of the Prelucele Ridge had been known as Piciorul Colțului, and nowadays local people know that part of the mountain under the name "La Colți" (Fig. 2).

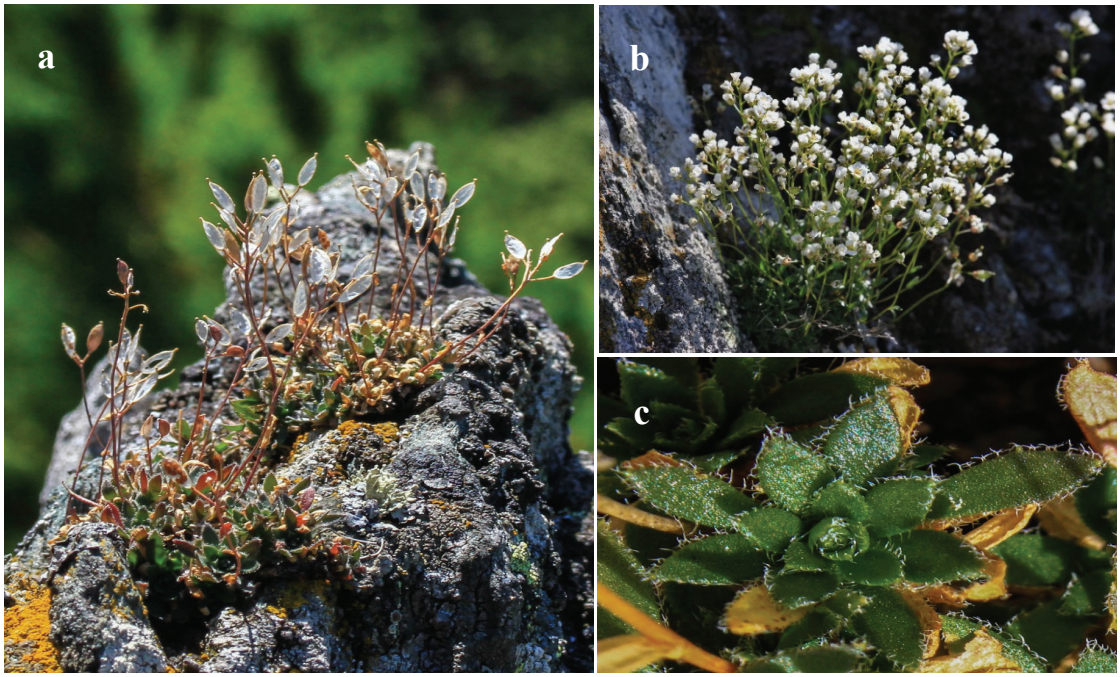

Figure 2. Habit of *Draba dorneri* in Retezat National Park (a, b); rosettes leaves with branched hairs (c) (original)

SÂRBU et al. (2007) added new locations for *D. dorneri,* among which Gemenele Scientific Reserve, but no herbarium voucher confirming the presence of the species there was found. The area was carefully inventoried by NYÁRÁDY (1958) in the study of flora and vegetation in the Retezat Mountains, and no mention of *D. dorneri* in this part of the massif was noted in his work. We also made several field surveys in 2010 and 2012 without confirming the presence of the rare *D. dorneri*. However, given the fact that large areas of the reserve have remained unexplored and the possibility of confusion with other alpine *Draba*, until there is further clarification, the full distribution of the species remain uncertain.

Habitat description in Retezat Mountains. The population occurs in a very small area, less than 200 mp. The habitat of the endemic *D. dorneri* (Fig. 2) is represented by vertical rocky blades with a layered aspect. The soil is shallow with 6.17 pH. The plant community is formed by plants adapted to rocky habitat conditions, with high prominence of *Juncus trifidus, Sedum annuum, Thymus praecox* subsp. *polytrichus*, *Silene nutans* subsp. *dubia*, and *Symphyandra wanneri.* The majority are perennials, with a dominance of hemicryptophytes and chamaephytes, the only annual species were *Sedum annuum* and *Euphrasia salisburgensis.* We also noted *Asplenium viride, Cystopteris fragilis* and *Polypodium vulgare* on north-facing rocks or shady crevices.

Some authors (DIHORU & PÂRVU, 1987 and DIHORU & NEGREAN, 2009) mentioned in their publications that *D. dorneri* grows within the plant association included in Daco-balkanic *Silenion lerchenfeldianae* Alliance. Communities of this alliance develop on siliceous rocks and are well represented in the Retezat Mountains (COLDEA, 1993). Another reference regarding the plant association with *D. dorneri* referred it to the *Asplenio trichomani-Poetum nemoralis* Association (ONETE & ION, 2010). According to the latest synthesis of plant associations (COLDEA, 2017) and based on original field surveys of *D. dorneri* community (Table 1), the floristic composition can be assigned to *Asplenietea trichomanis* Class, *Asplenion septemtrionale* Alliance and *Asplenio trichomani-Poetum nemoralis* Association.

Table 1. Floristic composition of the relevés with *D. dorneri* in the Retezat Mountains.

Relevés number	1	2	3	4
Altitude (m)	1842	1842	1843	1843
Inclination (°)	30	120	40	10
Solar exposure	S-SW	N-NW	W	SW
Vegetation cover (%)	40	40	35	35
Area of the relevés (m^2)	4	4	1	2
Caract. Ass.				
Poa nemoralis L.	+	+	+	+
Asplenium viride Huds.				+
Androsacetalia				
Symphyandra wanneri (Rochel) Heuff.		+		
Asplenietea trichomanis				
Silene nutans subsp. *dubia* (Rohrb.) Zapałł.	+	+		
Campanula kladniana (Schur) Witašek			1	+
Polypodium vulgare L.		+		
Cystopteris fragilis (L.) Bernh.			+	
Varia				
Draba dorneri Heuff.	+	+	+	+
Festuca ovina L.	1	+1	+	+1
Sedum annuum L.	+			
Agrostis rupestris All.		+		
Juncus trifidus L.	+	+	+	+
Thymus praecox Opiz subsp. *polytrichus* (A. Kern ex Borbás) Jalas	+1	1	+	+
Alchemilla flabellata Busser		+		
Hieracium caesium Fr. (Fr.)		+		
Euphrasia salisburgensis Funck		+		
Antennaria dioica (L.) Gaertn.		+		
Spiraea chamaedrifolia L.				+

Location and date: Retezat Mountains, Prelucele Ridge (1820 m), relevés 1-4: 25.07.2013

Phytocoenoses with *D. dorneri* alternate among fragments of shrub associations included in the *Vaccinio-Piceetalia* Order and *Pinion mugi* Suballiance containing: *Pinus cembra* L., *Juniperus sibirica* Lodd. in Burgsd., *Pinus mugo* L., *Vaccinium myrtillus* L., *Vaccinium vitis-idaea* L. *Bruckenthalia spiculifolia* (Salisb.) Rchb. with *Hypericum maculatum* Crantz and *Luzula luzuloides* (Lam.) Dandy et Wilmott. Due to past overgrazing, the coenotic structure has been altered by a large increase in *Festuca ovina* L., present in almost all the relevés.

***Population*.** There are no available historical data on population status. BICHICEANU (1967) briefly mentions several hundred specimens at most. In our observations, the population comprised up to 150 individuals (tufts), their number remaining stable over the monitoring period. Most individuals are in the reproductive stage, less than 25 % of them without inflorescence. The number of rosettes that compose the tufts may vary between 1 and 210, totalling about 4500 rosettes on the rocks of Prelucele Ridge. The establishment of new individuals is a scarce event; the population is maintained by mature individuals found in each inventory.

For the species *D. dorneri*, the results of assessments of the conservation status were summarised and analysed, and then reported to the EU Commission according to Article 17 of the HD. At the European level, *D. dorneri* is present only in the Alpine biogeographic region; the report for the status of conservation is "Unfavourable-inadequate" (U1) with unknown trend (MIHĂILESCU et al., 2015a).

***Threats*.** The primary threat to *D. dorneri* and the basis for its status as a critically endangered plant is its restricted distribution in Retezat National Park with a small population size and confined to a limited area. Nevertheless, a high level of genetic diversity (78.94% polymorphic bands) was found within that population (CĂTANĂ et al., 2013). Is it possible that this trait assists in long-term survival of this endemic taxon? Communities on granitic rock are considered an extremely stable habitat, but will the species manage to survive within the current context of climate change and the upward shifting of the tree line?

The Retezat Mountains are a popular hiking area, the only track that intersects with the population site (Râușor Resort to Retezat Peak) is in fact the old tourist way that approached Retezat peak through the Râușor Valley. Even though the route bypasses *D. dorneri* habitat, through easy accessibility of the rocky area, trampling and foot traffic affect the species integrity and damage the individuals located in the exposed places.

As the name suggests, the "Preluce" Ridge has an important significance in terms of land use history, '*preluce'* in Romanian means an opening, a small glade, in reference to cutting of mountain pine (*Pinus mugo*) in order to create more space for pastures. Nowadays, shepherds from Valereasca Valley use other routes, west of Valereasca Glade, but the remains of old sheepfolds can be seen from Valereasca Glade and on the ridge up to Preluce Peak. Old photos of this place (BICHICEANU, 1967) reveal an overgrazed area with isolated individuals of dwarf mountain pine or juniper and dominated by pastures. In the current situation with no grazing, the shrubs have recovered and the rocky habitat of *D. dorneri* is being surrounded by the initial vegetation. Furthermore, saplings of *Juniperus communis, Sorbus aucuparia* and even *Pinus cembra* and *Pinus mugo* have colonised the rock fissures increasing competition with the rock specialists. In the present situation

where the factor restricting dispersal is habitat size, reducing the suitable places for seed establishment through modification of vegetation structure may have a negative effect on demography and reproductive success of *D. dorneri*. In our observation, exceptionally, *D. dorneri* can tolerate shaded places under juniper canopy, with abnormally long stems and rosettes leaves, but this is often a correlated with a low number of fruit set.

CONCLUSION

After more than 160 years from its description by Heuffel, *D. dorneri* has an uncertain future in Retezat National Park. The conservation objectives must include the maintenance and continuing monitoring of the actual population along with a particular designed site management.

The objectives of this research have been reached: (1) A critical review of the distribution in Retezat National Park was done. (2) Characterisation of *D. dorneri* habitat particularities with abiotic and plant community characteristics were developed. (3) The evaluation of the population size led to the establishment of the conservation status: "Unfavourable-inadequate" (U1) with unknown trend. (4) The primary threats to this rare taxon were identified.

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