

## ON THE OCCURRENCE OF *Draba haynaldii* ŠTÚR IN THE CEAHLĂU MOUNTAINS

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**Abstract.** *Draba haynaldii* Štúr (Brassicaceae) is a critically endangered species, endemic to the South-Eastern Carpathians (Romanian territory). The rediscovery of the population from Ceahlău Mountains is reported here, where it occurs the south-western edge of the pyramidal Toaca Peak, at 1850 m altitude. In the old locality, the species could not be confirmed. Notes on community characteristics that provide habitat for *D. haynaldii* species are also discussed.

**Keywords:** *Draba haynaldii*, endemic, distribution.

**Rezumat.** *Draba haynaldii* Štúr – o nouă stațiune pentru Munții Ceahlău. *Draba haynaldii* Štúr (Brassicaceae) este o specie critic periclitată, endemică, a cărei distribuție este limitată la Carpații de Sud-Est (teritoriul României). În această lucrare este raportată redescoperirea populației din Munții Ceahlău, dar într-un nou loc ce acoperă muchia de sud-vest a vârfului piramidal Toaca la o altitudine de 1850 m. Specia nu a putut fi confirmată în vechea localitate. Sunt discutate și câteva aspecte privind caracteristicile comunității ce asigură habitat pentru specia *D. haynaldii*.

**Cuvinte cheie:** *Draba haynaldii*, endemic, distribuție.

### INTRODUCTION

Ceahlău Mountains, with cliffs that harbour rare and endemic flora, are an important area of plant diversity, considered, along with their neighbouring ranges, Hășmaș - Cheile Bicazului - Rarău, a major centre of endemism for the Romanian Carpathians. In terms of species richness, Ceahlău Mountain harbour 1,141 plant species, 59 of which are endemic (HURDU et al., 2012), *Draba haynaldii* being one of them.

*Draba* is the largest genus of the Brassicaceae family (AL-SHEHBAZ, 1987). It comprises more than 390 species, approximately half of which has a narrow distribution, restricted to the high altitude of mountain ranges (JORDON-THADEN et al., 2013). Out of the 14 species of the genus *Draba* present in the Carpathians, 11 species are found in the Romanian territory (CIOCÂRLAN, 2009), *Draba haynaldii* being one of the 4 Romanian Carpathian endemic species from the 9 present in Europe. According to DIHORU & NEGREAN (2009), *D. haynaldii* is a critically endangered species, restricted only to the Romanian Carpathians.

In 1816, under the name of *D. ciliaris* L., later described by ŠTÚR (1861) as *D. haynaldii*, BAUMGARTEN noted it for Pietra Mare and Bucegi Mountains, while in 1885 Römer discovered it for the first time in Pietra Craiului Mountains. The first mention of the species in the Eastern Carpathians was made more than 75 years ago and belongs to RĂVĂRUȚ (1936). Guided by Professor Popovici, the director of The Botanical Institute from Iasi, Răvărut begins a phytosociological study of the Ceahlău Mountains, a great opportunity for new floristic discoveries. Thus, in the summer of 1935, he found a small population of *D. haynaldii* on the cracks of Panaghia Rock, the voucher material being stored at the Herbarium of Cluj-Napoca University [CL 193.621].

Although the flora of these mountains is well known, as there were published many studies on the area (GRECESCU, 1906; PANȚU, 1913; GRINȚESCU, 1924; BURDUJA 1962; BORHIDI 1957; CHIFU et al., 2006) from the time of Răvărut discovery until the present day no new data was added about the presence of this species in this part of the Carpathians. All information is old, scarce and with no confirmation from the first record.

In this paper, we report the presence in a new location for Ceahlău Mountains of the endemic plant species *D. haynaldii* and try to illustrate why *D. haynaldii* is present in Ceahlău Mountains, a remote location, far from the main population cluster from the Bucegi-Pietra Mare-Pietra Craiului Mountains group and characterize the habitat in which *D. haynaldii* occurs.

### MATERIAL AND METHODS

*Draba haynaldii* Štúr is a poorly studied species, endemic to the South-Eastern Carpathians (DIHORU & PÂRVU, 1987). It can be recognized by its low stature (up to 5 cm tall), forming dens cushions. The flowering stem is glabrous, erect and leafless. The most differentiated character is the rosette leaf with simple hairs on the margins and tip. Blooming at the end of May till early June, the plants bear few (2-6) bright-yellow flowers. The style length is 1.4-1.8 mm. The silicule valves are covered with dens rigid hairs, fruit sets begin in late June. As noted by NYÁRÁDY (1955), two forms were described: *D. haynaldii* f. *orbáta* (Štúr) and f. *ciliáta* (Štúr), differentiated by fruit pubescence and stem, style and silicule size. For the *orbáta* (Štúr) form, reported for Ceahlău, the hairs of the rosette leaf are absent or reduced to a single mucron; the stem, silicules and styles are smaller.

The base chromosome number for *Draba* species is eight, cytotaxonomical data on *D. haynaldii* show that it is a diploid species  $2n=12$  (BUTTLER, 1967). The description of NYÁRÁDY (1955) and CIOCÂRLAN (2009) was used to determine *D. haynaldii* in the field.

### Study area

Ceahlău Mountain belongs to the central group of the Eastern Carpathians, having an isolated position both within the group, as well as from the Southern Carpathians. Quaternary glaciations manifested less intensely in Ceahlău Mountains, unlike their neighbours from the north: Rodna and Maramureş, mostly due to the strong fragmentation and low altitude. The main geological foundation is Cretaceous flysch, the upper rocky ridge stretches for about 6 km and is made up of a nival origin plateau (SÎRCU, 1964) bordered by the two rocky peaks: Toaca (1904 m) and Ocolaşul Mare (1907 m). Toaca Peak consists of massive blocks of conglomerate intercalated with gneiss, micashists, quartz and especially compact Neocomian limestones.

In the highest areas, temperatures below 0 °C were recorded over 193 days/year, with a mean annual temperature of about 0.7° C. Due to the Atlantic air masses, the number of days with precipitation is high, reaching 208.8 days/year, 50% of which are with snow. Mean annual precipitation is over 700 mm with 60-75% in spring and summer season. Nebulosity around Toaca Peak is high and reaches 6.6 and relative air humidity registers 86%. Fog is a phenomenon that occurs very often in 70% of the days/year, especially near the peaks. Westerly winds prevail, thus emphasizing temperate marine air masses circulation.

*Draba haynaldii* was first noticed on the rocks of Toaca Peak in the summer of 2012. During the field survey in Ceahlău Mts, on 15-16 June 2013, the species was reconfirmed. An inventory of all plant species was made and habitat characteristics were recorded. Based on the work of RĂVĂRUȚ (1936), Panaghia Rock was also inspected, but no individuals were found.

### RESULTS AND DISCUSSION

During the field survey in Ceahlău Mountain on 15-16 June 2013, *D. haynaldii* was identified in a new location, on the south-western edge of the pyramidal Toaca peak, not far from the classic place – Panaghia Rock. Elevation reaches about 1850 m a.s.l. The rocks that harbour *D. haynaldii* population have a ruiniform aspect made from more or less consolidated conglomerate. The population found is limited to an area of approximately 30 m<sup>2</sup> and the extent of the population on the examined site measures about 1,200 rosettes. Voucher material is deposited in BUCA Herbarium – the Romanian Academy Bucharest, number 157.926.

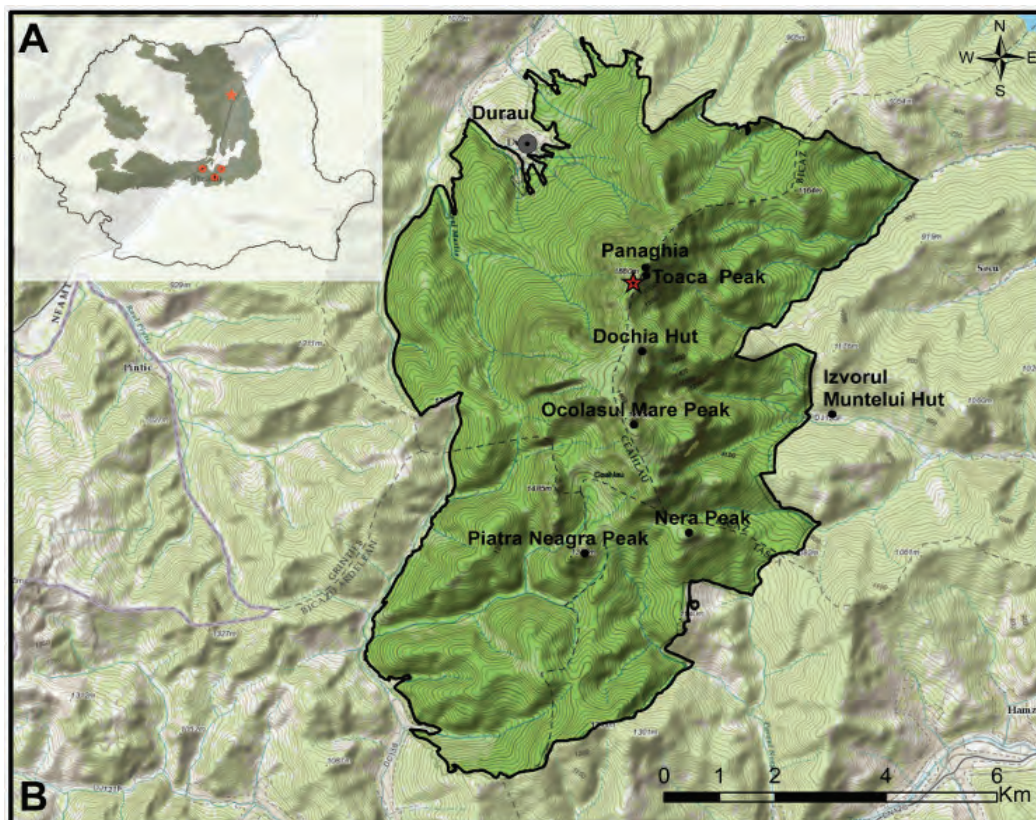


Figure 1. A- Distribution of *Draba haynaldii* populations in the Carpathians: Bucegi, Piatra Craiului, Piatra Mare and Ceahlău Mountains (orange circles); B- The green area represents Natura 2000 Ceahlău sites; Red star - new location found in Ceahlău Mountains, near Toaca Peak

Despite the fact that *D. haynaldii* f. *orbata* (Štúr) was reported for Ceahlău Mountain, the plants found on Toaca rocks belong to *D. haynaldii* f. *ciliata* (Štúr) with all the rosette leaves ciliated and bigger styles and silicules.

At the time of the field study, all the individuals were past the flowering period. An aspect observed was that

only a few of them reach maturity and set fertile fruits.

Before the record of Răvăruț, the existence of *D. haynaldii* in Ceahlău Mountain was regarded with scepticism. As observed by RĂVĂRUȚ (1936) from the biogeographical perspective of GRECESCU (1906), he supports the idea that *D. haynaldii* is an alpine plant of high altitudes that cannot exist in the isolated Ceahlău range, limiting its distribution in Bucegi Mountains. PANȚU (1915), not admitting the presence of this species in Ceahlău, supports Grecescu's theory regarding the isolation of Ceahlău Mountain and the 2° latitude further north than Bucegi Mountains.

Analogy has often been made between Ceahlău and Bucegi Mts, both due to the geological constitution and genesis as well as floristic composition. From Bucegi looking north, Ceahlău is the next mountainous region that can hold alpine vegetation. Although the number of alpine plants that grow in abundance in Bucegi miss from the top floor of Ceahlău, its alpine flora is not inferior to Bucegi Mountains (GRECESCU, 1906), being one of the richest areas in endemic species from the Eastern Carpathians (BORHIDI, 1957). COLDEA et al. (2009) argued that the altitude and the presence of limestone are determinant for species richness of an area and the number of alpine-subalpine endemic species increase with altitude, but when it comes to the most important predictor of the endemic species occurrence in the Romanian Carpathians, the same authors state that altitude is not decisive, and other factors like microhabitat differentiation and past events (glaciation, migration, selection, reproductive success, etc.) affect their presence. In Bucegi Mountains, *D. haynaldii* grows in rocky alpine habitats, preferring high, open and sunny places. The maximum altitude where it was recorded was Bucșoiu Peak with 2493 m (BELDIE, 1967). Unlike Bucegi, in Ceahlău, *Draba haynaldii* was found at a lower altitude, but this is compensated by the specific local habitat conditions: 2 degrees further north and shaded, often exposed to the north and wet habitat, this being confirmed also by the presence of hygrophilous accompanying species.

It is well known that limestone massifs can support a high number of endemic species. Special bedrock composition with limestone conglomerate found in Ceahlău offers a lot of suitable places for their establishment. KRUCKEBERG & RABINOWITZ (1985) state that the small range of an endemic species is due to the limited available places, in our case the geological composition, altitude and specific microhabitat conditions.

Ceahlău Mountains have an intermediate location between the Northern (Rodna and Maramureș Mts.) and Southern Carpathians. It is isolated by deep valleys formed by the Bistrita River and its tributaries, the Bistricioara and the Biczul streams and Pântecu from Transylvania, being the highest mountains of Moldova, standing out of the surrounding landscape. GRECESCU (1906) states that this isolation is an impediment for alpine plants from the southern Carpathians making it an impossible place to reach.



Figure 2. Photo of *Draba haynaldii* on the north-eastern slope of Toaca Peak - Ceahlău Mountains (photo Ion R.- original)

However, precisely this “deficiency” helped by bedrock composition, its position by 2 degrees north latitude and special microhabitat conditions prove to be an advantageous situation for the tiny *Draba* seeds to establish.

The only data available about the phytocoenology of the species, remain from BOȘCAIU & TĂUBER (1977) who put the relevée recorded in Pietra Craiului Mountains, in the Romanian Carpathian alliance *Gypsophilion petraea* Borhidi et Pocs 1957. Based on the presence of characteristic species (*Saxifraga corymbosa* Boiss., *Eritrichum nanum*



(L.) Schrad ex Gaudin subsp. *jankae* (Simonk.) Jáv., *Silene zawadskii* Herb. and *Gypsophila petraea* (Baumg.) Rchb.) (BORHIDI, 1957) we could assign the investigated area to the same alliance.

The plant species co-occurring with *D. haynaldii* are perennials, herbaceous, only two dwarf shrub plants grow, *Dryas octopetala* L. and *Helianthemum rupifragum* A. Kern. The dominant include rock specialist like *Gypsophila petraea*, *Saxifraga oppositifolia* L. and *Sesleria bielzii* Schur. Except for the *Polygonum viviparum* L. that prefers siliceous substrate, a large portion of the accompanying plants are calcophile: *Arthemisia eriantha* Ten., *Dryas octopetala*, *Eritrichum nanum* subsp. *jankae*, *Gypsophila petraea*, *Saxifraga corymbosa*, *Silene zawadskii* and *Viola alpina* Jacq.

Regarding moisture preferences and depending on solar exposition of the plot, some heliophilic plants were recorded: *Dryas octopetala*, *Saxifraga paniculata* Mill. and *Saxifraga corymbosa*, but they have a very low coverage and are present only in two plots. On north exposed or shaded rocks, some hygrophilic plants occur: *Saxifraga oppositifolia*, *Campanula alpina* Jacq., *Saxifraga aizoides* L., *Carex sempervirens* Vill. and *Pedicularis oederi* Vahl.

As noted by ONETE (2011) accompanying species can influence the dynamics, growth strategies and life cycle of the individuals in a population. Of the species associated with *D. haynaldii*, *Saxifraga oppositifolia* having a greater coverage, sometimes cushions of *D. haynaldii* and *Saxifraga oppositifolia* grow intertwined and this is where a greater abundance of *D. haynaldii* individuals could be observed. A similar situation was observed in Bucegi Mts, where *Draba* individuals were found growing in *Silene acaulis* cushions.

Ceahlău Mountains along with Toaca Peak is one of the most visited places in the massif and represent a special place for the Romanian people, from a recreational, historical, spiritual and scientific point of view. Since the creation of the first access paths to Toaca Peak, around 1860 by the Cantucuzino family (STĂNESCU, 1976), a large number of tourists visit the area. The vicinity of the hiking way may become a case of concern for *D. haynaldii* population due to erosion and contribution of habitat deterioration.

## CONCLUSIONS

This study confirms the existence of the Carpathian endemic *D. haynaldii* in Ceahlău Mountain, but in a new area than specified in the old record. The population growing on the cliffs of Toaca Peak is small and restricted to a very reduced area. Different habitat characteristics from those observed in Bucegi Mountains have been observed due to mountain position, bedrock composition and microhabitat conditions.

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