DOES *ERYSIMUM HUNGARICUM* ZAPĀŁ. (BRASSICACEAE) STILL GROW IN ROMANIA?

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Abstract: The Carpathian stenoendemic species *Erysimum hungaricum* ZapĀŁ. (Brassicaceae) had not been observed at its only known locality in the Maramureș Mts in Romania for more than 80 years. Research from June 2018 has confirmed its presence on the southern slope of Mt. Lostun Mic (1595 m). Compared to the past, the number of micro-locations was reduced to a single one of approximately 200 m². In the remaining population, approximately 100 flowering individuals, we made a phytocoenological relevé and determined the chemical properties of the soil (pH_{H2O} = 6.46; pH_{KCl} = 6.2; carbonate content = 8.0 g.kg⁻¹; nitrogen content = 10.99 g.kg⁻¹; phosphorus content = 19.57 mg.kg⁻¹). In the plant community, succession occurs from the original *Festucetum saxatilis* Domin 1933 to a tall-herb vegetation of the order *Adenostyletalia alliariae* Br.-Bl. 1931 and a growth of *Picea abies*. The presence of the species in different vegetation units and the comparison of older and actual soil characteristics point to its wider tolerance of the characteristics of the site. Thus, the causes of the extraordinary rarity of the species are not yet clear. Based on the IUCN zoological evaluation, the species was categorised as Critically Endangered (CR) according to criteria B2ab(ii,iv).

Keywords: wallflower, taxonomy, distribution, population characteristic, *Adenostyletalia alliariae*, zoological status, endemic species, Maramureș Mts, Carpathians

Introduction

Carpathian endemics belong to a relatively well-researched group of plants. Their taxonomy and distribution have been elaborated and refined many times since the 19th century to this day: for smaller parts of the Carpathians (e.g. Kaplan 2012 for the Czech Republic; Kliment 1999 for Slovakia; Piękoś-Mirkowa & Mirek 2003 and Mirek & Piękoś-Mirkowa 2009 for the Polish Carpathians; Čornej 2011 and Novikoff & Hurdu 2015 for the Ukrainian Carpathians; Negrean & Oltean 1989, Hurdu et al. 2012a and Hurdu et al. 2012b for the Romanian Carpathians); and over the whole mountain range [73, 70, 72, 84, 91, 92, 38]. Many have received attention from the molecular-morphological point of view (e.g. Hodálová 1999 on *Senecio nemorensis* agg., Těšitel et al. 2009 on *Melampyrum saxosum*, Kolarčík et al. 2010 on *Onosma viridis*, Olšovská et al. 2011 on *Cyanus triumfetti* agg., Șuteu 2012 on several endemic plants in the Eastern and Southern Carpathians, Catană et al. 2013 on *Draba dorneri*, Kučera et al. 2013 on *Cyclamen purpurascens* subsp. *immaculatum*, Kuzmanović et al. 2013 on *Sesleria rigida*, Șuteu et al. 2013 on *Primula leucophylla*, Budzáková et al. 2014 on *Sesleria tatrae*, Băcilă et al. 2015 on *Onobrychis transsilvanica*, Ferreira et al. 2015 on *Andryala laevisomentosa*, Lendvay et al. 2016 on *Syringa josikaea*, Tkach et al. 2019 on *Saxifraga wahlenbergii*), phytogeographical-chorological point of view (Pawłowski 1948 on the endemic species of Chyvcyhy Mts, Hendrych 1965 on *Daphne arbuscula*, Hendrych 1981a on endemic plants in

the former Czecho-Slovakia, Kochjarová et al. 2005 on *Scilla kladnii*, Bartók et al. 2014 on *Heracleum carpaticum*, Hurdu et al. 2016 on the centres of endemism in the South-East Carpathians) and biological-ecological point of view (Pawłowski 1969b on the relationship of endemic species to syntaxa (Erdelská & Turis 1995 on *Daphne arbuscula*, Piękoś-Mirkowa et al. 1996 on endemic species in the Tatra Mts, Negrea & Pricop 2009 on *Andryala laeovitomentosa*, Janišová et al. 2012 on *Tephrosieris longifolia* subsp. *moravica*, Mráz et al. 2016 on endemic species in the West Carpathians, Mihály & Komendar 1993 on *Crocus banaticus*, Şuteu et al. 2003 on *Astragalus peterfii*, Turis 2009 on *Cyclamen fatrense*, Bahlej 2010 on *Saussurea porcii*, Lendvay & Kalapos 2014 on *Ferula sadleriana*). In spite of this research, for several species, growing mainly in less botanically studied and less accessible areas, the most recent chorological data are missing (e.g. *Erysimum hungaricum*, *Nigritella carpatica*, *Primula wulfeniana* subsp. *baumgarteniana*), or they have been completed only recently (e.g. Mátis et al. 2014 on *Saussurea porcii*, Bartók et al. 2016 on *Silene zawadzkii* in the Făgăraş Mts).

In our article, we summarise information about the taxonomic position, distribution, selected population, coenological and ecological conditions of *Erysimum hungaricum* Zapał., which is considered to be a stenoendemic species of Mt. Lostun Mic (1595 m) in the Maramureş Mts in Romania.

Material and Methods

Taxonomy of *Erysimum hungaricum*

The species *Erysimum hungaricum* Zapał. (Fig. 1) was described by Zapałowicz (1913) on the basis of differences in the colour and shape of the edge of the stem leaves, the appearance of saccate bases of sepals, their size, the shape of the petals, the size, colour and hair of the fruits compared with the earlier described species *E. wahlenbergii* (Asch. et Engl.) Borbás and larger flowers and fruits compared with *E. hieracifolium* L. All three species are morphologically similar to *E. pieninicum* (Zapał.) Pawł., *E. marschallianum* M. Bieb. (ut *E. durum* Presl in Pawłowski 1946, Latowski 1975) and *E. virgatum* Roth (synonymous with *E. hieracifolium* L. according to Euro+Med). Pawłowski (1946) included these 6 species within the common series *Hieraciifolia*. In this series, also based on their morphological properties, he included the species *E. hungaricum*, *E. wahlenbergii*, *E. pieninicum* and *E. virgatum* in the subseries *Virgata*, while he placed the other two species, *E. hieracifolium* and *E. marschallianum*, into subseries *Euhieraciifolia*. Species in the *Virgata* subseries originated according to Hendrych (1981b) at the end of the Tertiary or at some stage of the Post-Tertiary by geographical differentiation from the species widespread in the Alps and in the Carpathians, which, according to Michalková (2002), was probably *E. hieracifolium* s. l.

According to some authors, *E. hungaricum* is a separate species due to its morphological features well differentiated from other species of the *Virgata* subseries [67, 43]. It is also mentioned in many other works at the species level [45, 66, 68, 69, 70, 72, 37, 91, 92, 38]. However, Latowski (1975), based on the results of the morphological study of fruits and seeds, tends to move towards the reassessment of the taxonomic value of the species belonging to the *Virgata* subseries to the level of subspecies or even variety. Other authors include it together with *E. wahlenbergii* or *E. pieninicum* within the wider-delimited species *E. hungaricum* Zapał., which is widespread not only in the Carpathians [3], but also in the Austrian Alps [53, 76, 77]. Likely based on the work of these authors, Tasenkevich (2002) describes the Carpathian-Alpine

area of the species. However, the taxon thus understood should be correctly called *Erysimum wahlenbergii* (Asch. et Engl.) Borbás according to the priority principle of the Code [97], since this species had been validly described before *E. hungaricum* Zapal. [37]. The species value of *E. hungaricum* thus conceived has not been rarely accepted and according to Polatschek (cf. Wittmann et al. 1987) it is necessary to assign it to *E. virgatum*. The latest carpological and molecular research of the species in the *Hieraciifolia* series shows that they represent a complex of cryptic species, morphologically poorly differentiated but with significant genetic differences [16].

There are discrepancies in the assessment of *E. hungaricum* by Romanian authors. While Ciocârlan (2009) considers it a critical taxon, Popescu & Sanda (1998) make it synonymous with *E. wahlenbergii* and perceive it as a solely Carpathian species. It can be assumed that Sârbu et al. (2013) understand it in a similar way, as they mention the Western and North-Eastern Carpathians in the distribution.

In our work we follow the evaluation of *Erysimum hungaricum* in the sense of Kliment et al. (2016).

Fig. 1: Flowering plants of *Erysimum hungaricum* on Mt. Lostun Mic (photo: P. Turis, 12.6.2018)

Sources for the historical distribution of *Erysimum hungaricum*

In addition to the published data, we have also used information on the occurrence of the species from the data on the herbarium labels of the only known specimens lodged in the Herbarium of the Polish Academy of Sciences in Cracow (KRAM) and in the Herbarium of the Jagiellonian University in Cracow (KRA). The localities described on the herbarium labels are

specified in the Results and Discussion chapter in their original wording along with their English translation.

Recent research into *Erysimum hungaricum*

The presence of *Erysimum hungaricum* on Mt. Lostun Mic (1595 m) was verified in June 2018 at the time of flowering. At the site where it occurred, we recorded a phytocoenological relevé using the Zürich-Montpellier school method (Braun-Blanquet 1964) and the extended Braun-Blanquet scale of abundance [4]. Here we took a topsoil sample from four places (no deeper than 15 cm), from which a representative soil sample was formed. Carbonate, nitrogen and phosphorus content, also pH (in H₂O and KCl), were analysed in the laboratory of the National Agriculture and Food Centre, Grassland and Mountain Agriculture Research Institute in Banská Bystrica (Slovakia). Soil characteristics are commented according to Bielek (1998), Gáborík & Prístavka (2013) and Šimanský et al. (2017).

The plants were determined according to Sârbu et al. (2013) and lodged in the private herbarium of the authors in Banská Bystrica (Slovakia) as documentary material. The nomenclature of vascular plants is according to Popescu & Sanda (1998) and Euro+Med (2006-), bryophytes according to Hill et al. (2006), and syntaxa according to Sanda et al. (2008). The threat assessment of the species was determined according to the rules defined by IUCN (2012). Toponyms are listed according to the Maramureşului tourist map [50].

Results and Discussion

Historical distribution of *Erysimum hungaricum*

According to literature and herbarium sources, *Erysimum hungaricum* was studied in the field only by the Polish botanists H. Zapałowicz, at the end of the 19th and the beginning of the 20th century [99], and B. Pawłowski, with his research team in 1933–1936 during the floristic-vegetation study of the Chyvchyny Mts [69]. Its presence at this locality had probably not been verified since then. Therefore, only the sites recorded by these two botanists or their collaborators are listed in the historical distribution of the species.

A. Literature sources

1. Lostun (1600 m) in latere marmarosienzi in magna rupe calcarea occidentali (a sinistra vallis rivi Lostun, partis fluminis Riu Vaser, sita) 1400–1450 m frequens [99]. – Mt. Lostun Mic (1600 m) on the Maramureş side on a large limestone rock in the west (left side of the valley of the river Lostun, tributary of the river Rîu Vaser) 1400–1450 m, frequent.
2. Lostun, in rupibus calcareis orientalibus, locis siccioribus 1430–1510 [99]. – Mt. Lostun Mic, on limestone rocks in the east, dry places, 1430–1510 m. The author described *E. hungaricum* var. *subdiscolor* Zapał. at this locality.
3. Kocioł Lozduński [69]. – Cirque of Mt. Lostun Mic; detail see in Table 1.

B. Herbarium sources

a) Herbarium KRAM: 5 herbarium specimens in total (some of them including more individuals)

1. Lostun, 16.8.1912, leg. et det. H. Zapałowicz. – Mt. Lostun Mic, 16.8.1912, leg. et det. H. Zapałowicz. This specimen was revised in 1995 by A. Polatschek and marked as the lectotype of *E. hungaricum* Zapał.

2. Lostun, 16.8.1912, leg. et det. H. Zapałowicz. – Mt. Lostun Mic, 16.8.1912, leg. et det. H. Zapałowicz. This specimen was revised in 1995 by A. Polatschek and marked as an isotype of *E. hungaricum* Zap.

3. Lostun, 16.8.1912, leg. et det. H. Zapałowicz. – Mt. Lostun Mic, 16.8.1912, leg. et det. H. Zapałowicz. This specimen was revised by A. Polatschek [s. a.] and marked as an isotype of *E. hungaricum* Zap.

4. *Erysimum hungaricum* Zap. var. *subdiscolor* Zap., Lostun, 13.9.1885, leg. et det. H. Zapałowicz. – *Erysimum hungaricum* Zap. var. *subdiscolor* Zap., Mt. Lostun Mic, 13.9.1885, leg. et det. H. Zapałowicz. This specimen was revised in 1995 by A. Polatschek as *E. hungaricum* Zap.

5. Lostun, 16.8.1912, leg. et det. H. Zapałowicz. – Mt. Lostun Mic, 16.8.1912, leg. et det. H. Zapałowicz.

In this herbarium, there are also several other plants grown in the Botanical Garden of the Jagiellonian University in Cracow from seeds gathered by B. Pawłowski on Mt. Lostun Mic during his research of the Chyvczyn Mts.

b) Herbarium KRA: 9 herbarium specimens in total (some of them including more individuals)

1. Łozdun od poł, skały i upłazy wapienne, 1450-60 m, w murawach i na żwirze pod skałami, 20.8.1934, lg. et det. B. Pawłowski. – Mt. Lostun Mic from the south side, limestone rocks and rocky terraces, 1450-60 m, in grasslands and scree under rocks, 20.8.1934, lg. et det. B. Pawłowski.

2. Łozdun od pd., wielka skała wapienna, 1470-90 m, 3.6.1936, lg. et det. B. Pawłowski. – Mt. Lostun Mic from the south side, large limestone rock, 1470-90 m, 3.6.1936, lg. et det. B. Pawłowski.

3. Łozdun od pd., wielka skała wapienna, 1470-90 m, 3.6.1936, B. Pawłowski. – Mt. Lostun Mic from the south side, large limestone rock, 1470-90 m, 3.6.1936, B. Pawłowski, see Fig. 2.

4. Lostun, jeden z niższych kompleksów skałek po stronie rumuńskiej, 20.8.1934, zb. J. Walas. – Mt. Lostun Mic, one of the lower rock complexes on the Romanian side, 20.8.1934, leg. J. Walas.

5. Łozdun, skały wap., poł. zach., ± 1450 m, pod skałami, w murawach i żwirze, 20.8.34, BP. – Mt. Lostun Mic, limestone rocks, southwest, ± 1450 m, under rocks, in grasslands and scree, 20.8.1934, B. Pawłowski.

6. Łozdun, wielka skała wapienna w kotle, 1470-90 m, 3.6.1936, lg. et det. B. Pawłowski; Łozdun, 3.6.1936, lg. et det. B. Pawłowski. – Mt. Lostun Mic, large limestone rock in the cirque, 1470-90 m, 3.6.1936, lg. et det. B. Pawłowski; Mt. Lostun Mic, 3.6.1936, lg. et det. B. Pawłowski.

7. Losten, 20.7.1934, lg. et det. J. Walas. – Mt. Lostun Mic, 20.7.1934, lg. et det. J. Walas.

8. Łozd, 20.8.1934, J. Wal. – Mt. Lostun Mic, 20.8.1934, J. Walas.

9. Łozdun, 1450, 20.8.1934, BP. – Mt. Lostun Mic, 1450 m, 20.8.1934, B. Pawłowski.

Fig. 2: The scan of the historical specimen of *Erysimum hungaricum* in Herbarium of the Jagiellonian University in Cracow (Poland)

Based on these records, it can be concluded that in the past *E. hungaricum* grew in several places on the southern slope of Mt. Lostun Mic (1595 m), situated in the Maramureş Mts. on the Romanian-Ukrainian border. This slope, representing the upper part of the Ştevioara Mare Valley, lies within Romania. Individuals of the wallflower grew on limestone rocks, on the screes below them and in the adjacent dry grasslands of the alliance *Festuco saxatilis*-*Seslerion bielzii* (Pawłowski & Walas 1949) Coldea 1984 [ut *Festucion marmarossicae* Pawł. et Wal. in Pawłowski & Walas (1949)] on steep, south to south-west-facing slopes at an altitude of 1400–1510 m above sea level. Apparently, the largest occurrence was in the area of a large limestone cliff located at 1470–1490 m above sea level on the western side of the valley (see Fig. 3), probably rarer on the eastern side of the valley. The occurrence of the species is reported only in the calciphilous association *Festucetum saxatilis* Domin 1933 [ut *Festucetum saxatilis* (Pawł. 1936) Pawł. et Wal. in Pawłowski & Walas (1949)], which primarily inhabits steep cliffs, but due to the deforestation of the country it also extends to the surrounding areas where it is influenced by livestock grazing [69].

There is inconsistent information about the later presence of the species in the Romanian

flora. While Săvulescu (1955), Beldie (1977) and Ciocîrlan (1990) do not mention it at all, Oltean et al. (1994) consider it extinct, Oprea (2005) admits its occurrence, and Sârbu et al. (2013) mention the need for its reconfirmation. Only Popescu & Sanda (1998) do not question its presence. It is rarely mentioned among endangered species of the Ukrainian Carpathians [89, 90], but Prokudin (1987), Kobiv (2007, 2010) and Čornej (2011) correctly report its occurrence only near the Ukrainian-Romanian border on the south side of Mt. Malyj Lostun (= Lostun Mic in Romanian) already in Romania. Data on its occurrence in Slovakia [8, 20, 51, 30] and in Poland [90, 77] relate to the West Carpathian endemic species *E. wahlenbergii* and *E. pieninicum*.

Recent occurrence of *Erysimum hungaricum*

During our research in 2018, we recorded *E. hungaricum* only in one place, probably identical to the above-mentioned “large limestone rock” (see Fig. 3). On a very steep slope on the western edge of the rock we found about 100 flowering individuals, with a few others on the rock itself. The vast majority of the population grows in an area of about 20 × 10 m under mature *Picea abies* trees.

The plants were determined on the basis of the length of the sepals (7–8 mm), petals (13–14 mm) and anthers (1–2 mm), by which, according to Sârbu et al. (2013), they differ from the similar *E. hieracifolium* (calyx length 2–6 mm, corona 8.5–12 mm) and *E. odoratum* (anthers length 2–4 mm). At the time of flowering of *E. hungaricum*, no other species of this genus were seen on the site and none were mentioned by Pawłowski & Walas (1949).

The historical and recent phytocoenological relevés with the presence of the species (see Table 1) were probably not recorded in the same place, but close to one another. While Pawłowski & Walas (1949) located its in a typical *Festucetum saxatilis* association and the presence of *E. hungaricum* was rather accidental, our relevé was targeted to an area where the species was present. For this reason, the two records cannot be compared for the purpose of assessing possible changes in the community which occurred more than 80 years later.

The place with the actual presence of the species was probably without woody plants in the past, which is confirmed by the still incoherent and uneven growth of trees in the surrounding area. We assume that it was also covered with a *Festuca rupicola* subsp. *saxatilis* community, since some of the taxa (e.g. *Aconitum anthora*, *Cirsium erisithales*, *Erysimum hungaricum*, *Festuca rupicola* subsp. *saxatilis*, *Thymus pulcherrimus*) defined by Pawłowski & Walas (1949) as characteristic of the association *Festucetum saxatilis* and the alliance *Festuco saxatilis-Seslerion bielzii* are present in our relevé. The cessation of grazing and progressive succession may be the reason for the absence of other characteristic taxa, in particular the light-loving plants of more skeletal and shallower soils (e.g. *Jovibarba hirta* subsp. *glabrescens*, *Polygala amara* subsp. *brachyptera*, *Silene nutans* subsp. *dubia* or *Thesium alpinum*). At the same time, higher species more demanding of nutrients and soil depth such as *Achillea distans*, *Anthriscus sylvestris*, *Chaerophyllum hirsutum*, *Rumex arifolius*, *Senecio nemorensis*, typical of tall-herb vegetation, began to accumulate. The actual community with the presence of *E. hungaricum* represents the succession stage within the order *Adenostyletalia alliariae* Br.-Bl. 1931, but its more precise identification is not possible. The steep grassy slope just below the site of our relevé (and beyond the influence of adult *Picea abies* on vegetation), as well as the slope below the great rock cliff, where, according to the description and species composition, the relevé of

Pawłowski & Walas (1949) was most likely recorded, are currently covered with the association *Festucetum saxatilis*, but without *E. hungaricum* being present.

Table 1: Phytocoenological relevés with presence of *Erysimum hungaricum*

- (A) historical relevé: cirque Lozduński, altitude 1410 m, area 30 m², exposition S, slope 30-40 °, cover E_{total} 85%, date 20.8.1934 and 3.6.1936 (Pawłowski & Walas 1949, table II, relevé Nr. 6). Note: Different plant names used by the authors are given in brackets as a synonym.
- (B) actual relevé: Mt. Lostun Mic (1595 m), a steep slope next to a distinctive limestone rock, the stand of higher herbs under an isolated tree group of *Picea abies*, altitude 1450 m, area 25 m², exposition S-SE, slope 60 °, cover E_{total} 98%, E₃ 20%, E₂ 0%, E₁ 98%, E₀ 1%, 24° 47' 10.1" E, 47° 49' 17.6" N (± 6 m), date 12.6.2018, authors P. Turis and I. Turisová.

Taxa	Abundance	
	A	B
<i>Picea abies</i> E ₃		2b
<i>Euphorbia amygdaloides</i> E ₁		2b
<i>Luzula sylvatica</i>		2b
<i>Cirsium erisithales</i>	+	2a
<i>Erysimum hungaricum</i>	1	2a
<i>Oxalis acetosella</i>		2a
<i>Valeriana tripteris</i>		2a
<i>Aposeris foetida</i>		1
<i>Carduus kernerii</i> (syn. <i>Carduus transsilvanicus</i>)	+	1
<i>Chaerophyllum hirsutum</i>		1
<i>Cystopteris fragilis</i>	+	1
<i>Fragaria vesca</i>	+	1
<i>Hieracium murorum</i>		1
<i>Picea abies</i> (syn. <i>Picea excelsa</i>)	+	1
<i>Poa nemoralis</i>	2	1
<i>Rubus idaeus</i>		1
<i>Rumex arifolius</i>		1
<i>Senecio nemorensis</i>	r	1
<i>Taraxacum</i> sp.		1
<i>Veronica urticifolia</i>		1
<i>Achillea distans</i> (syn. <i>Achillea tanacetifolia</i>)	+	+
<i>Aconitum anthora</i> (syn. <i>Aconitum anthora</i> var. <i>Jacquinianum</i>)	+	+
<i>Alchemilla</i> sp.		+
<i>Anthriscus sylvestris</i>		+
<i>Arabis alpina</i>		+
<i>Asplenium viride</i>		+
<i>Campanula persicifolia</i>	+	+
<i>Cruciata glabra</i> (syn. <i>Galium verum</i>)	+	+
<i>Digitalis grandiflora</i> (syn. <i>Digitalis ambigua</i>)	+	+
<i>Epilobium</i> sp.		+
<i>Festuca rupicola</i> subsp. <i>saxatilis</i> (syn. <i>Festuca sulcata</i> var. <i>saxatilis</i>)	4	+
<i>Galeopsis</i> sp.		+
<i>Glechoma hederacea</i>		+
<i>Hypericum montanum</i>		+
<i>Luzula luzuloides</i>		+
<i>Mycelis muralis</i>		+
<i>Poa chaixii</i>		+
<i>Potentilla aurea</i>		+
<i>Primula elatior</i>		+
<i>Ranunculus nemorosus</i>		+

Taxa	Abundance	
	A	B
<i>Saxifraga paniculata</i> (syn. <i>Saxifraga aizoon</i>)	+	+
<i>Stachys alpina</i>		+
<i>Symphytum tuberosum</i>		+
<i>Thymus pulcherrimus</i>	1	+
<i>Urtica dioica</i>		+
<i>Veronica chamaedrys</i>	+	+
<i>Campanula glomerata</i>		r
<i>Lilium martagon</i>	+	r
<i>Senecio papposus</i>	+	r
<i>Sorbus aucuparia</i>		r
<i>Silene nutans</i> subsp. <i>dubia</i> (syn. <i>Silene dubia</i>)	2	
<i>Scabiosa lucida</i>	2	
<i>Agropyron caninum</i>	1	
<i>Lotus corniculatus</i>	1	
<i>Arabis hornungiana</i> (syn. <i>Arabis Hornungiana</i>)	+	
<i>Asplenium ruta-muraria</i>	+	
<i>Avenula pubescens</i> (syn. <i>Avena pubescens</i> var. <i>carpatica</i>)	+	
<i>Cardaminopsis halleri</i> subsp. <i>orientalis</i> (syn. <i>Arabis Halleri</i> subsp. <i>ovirensis</i> var. <i>transsilvanica</i>)	+	
<i>Carlina acaulis</i> (syn. <i>Carlina acaulis</i> var. <i>alpina</i>)	+	
<i>Dianthus carthusianorum</i> (syn. <i>Dianthus carthusianorum</i> var. <i>carpaticus</i>)	+	
<i>Euphrasia picta</i>	+	
<i>Helianthemum nummularium</i> subsp. <i>grandiflorum</i> (syn. <i>Helianthemum obscurum</i> subsp. <i>grandiflorum</i>)	+	
<i>Heracleum sphondylium</i>	+	
<i>Hieracium bifidum</i>	+	
<i>Jovibarba hirta</i> subsp. <i>glabrescens</i> (syn. <i>Sempervivum soboliferum</i> subsp. <i>hirtellum</i>)	+	
<i>Laserpitium latifolium</i>	+	
<i>Lathyrus pratensis</i>	+	
<i>Linum catharticum</i>	+	
<i>Mercurialis perennis</i>	+	
<i>Phyteuma orbiculare</i>	+	
<i>Polygala amara</i> subsp. <i>brachyptera</i> (syn. <i>Polygala brachyptera</i> var. <i>carpatica</i>)	+	
<i>Ranunculus oreophilus</i> (syn. <i>Ranunculus Hornschuchii</i>)	+	
<i>Saxifraga luteoviridis</i> (syn. <i>Saxifraga corymbosa</i> subsp. <i>luteoviridis</i>)	+	
<i>Thesium alpinum</i>	+	
<i>Trisetum alpestre</i>	+	
<i>Verbascum lanatum</i> (syn. <i>Verbascum lanatum</i> subsp. <i>Hinkei</i>)	+	
<i>Vicia sepium</i> (syn. <i>Vicia sepium</i> var. <i>montana</i>)	+	
<i>Viola declinata</i>	+	
<i>Acer pseudoplatanus</i>	r	
<i>Aconitum moldavicum</i> subsp. <i>hosteanum</i> (syn. <i>Aconitum moldavicum</i> subsp. <i>Hosteanum</i>)	r	
<i>Ajuga reptans</i>	r	
<i>Campanula trachelium</i>	r	
<i>Moehringia trinervia</i>	r	
<i>Poa alpina</i> (syn. <i>Poa alpina</i> subsp. <i>gelida</i>)	r	
Total number of taxa	53	49
E ₀		
<i>Brachytheciastrum velutinum</i>		+

Taxa	Abundance	
	A	B
<i>Fissidens</i> sp.	+	
<i>Homomallium incurvatum</i>		+
<i>Hylocomium splendens</i>		+
<i>Isoetecium alopecuroides</i>		+
<i>Mnium marginatum</i>		+
<i>Thuidium assimile</i>		+
<i>Thuidium</i> sp.	+	
<i>Tortella tortuosa</i>	1	+
<i>Solorina saccata</i>	+	
Total number of taxa	4	7

The presence of *E. hungaricum* in several types of phytocoenoses indicates that it is not strictly bound to a particular community. Its high fidelity to the *Festucetum saxatilis* association determined by Pawłowski & Walas (1949) resulted from a very limited distribution and is not a manifestation of ecological demands of the species. In the wider spectrum of phytocoenoses on stabilised screes with shallow, skeletal, moist and humus-rich soils on limestone substrates, there occurs also the more abundant, closely-related West Carpathian *E. wahlenbergii* [54].

Fig. 3: The locality with recent occurrence of *Erysimum hungaricum* (photo: P. Turis, 12.6.2018)

Soil properties of localities with *Erysimum hungaricum*

Pawłowski & Walas (1949) consider the association *Festucetum saxatilis* to be markedly basiphilous and present on calcareous soils. At the site of their phytocoenological relevé with *E. hungaricum*, the soil was strongly calcareous with a neutral reaction. In the current locality, it has a weakly acidic reaction, is very weakly calcareous, and has a very low phosphorus and very high nitrogen content. These values are shown in Table 2.

Significantly lower levels of carbonate in the soil, as well as slight acidification compared to the past, suggest that *E. hungaricum* is a more tolerant species capable of growing at different sites. The causes of its extraordinary rarity may lie in the un-investigated biology of the species. Another factor may be the intensive grazing of the meadows, which is uneven on Mt. Lostun Mic, causing their degradation to a nitrified monotonous vegetation of *Anthriscus sylvestris* or *Rumex alpinus*.

Table 2: Chemical properties and characteristics of soil with presence of *Erysimum hungaricum*

Chemical properties of soil	A	B	Characteristic (with source)
pH _{H2O} / pH _{KCl}	7.28	6.46 / 6.20	neutral (A) / weakly acidic (B) ³
carbonate content (%)	42	0.8 (8.0 g.kg ⁻¹)	strongly calcareous (A), very weakly calcareous (B) ³
nitrogen content (g.kg ⁻¹)	-	10.99	very high (B) ¹
phosphorus content (mg.kg ⁻¹)	-	19.57	very high (B) ²

Legend: **A** – historical relevé (Pawłowski & Walas 1949), **B** – actual relevé; index **1** – Bielek 1998, **2** – Gáborík & Prístavka 2013, **3** – Šimanský et al. 2017

Sozological status of *Erysimum hungaricum*

The species is not listed in the Red Book of Vascular Plants of Romania [19] or in other Red Lists of plants of Romania [57, 58, 10, 18] and the Carpathians [96]. The EX (Extinct) sozological status for Romania is mentioned only by Oltean et al. (1994) and Tasenkevich (2002, 2003).

When assessing the threat to the species according to IUCN criteria [34], we have taken into account the current state of the population and the presupposed initial state based on the known information on its distribution. Given the geographic range (AOO < 10 km²), actual number of locations (= 1), the determined decline of area of occupancy (AOO) and decline number of subpopulations, it belongs to the category of Critically Endangered (CR) according to criteria B2ab(ii,iv).

For these area and population characteristics, the species belongs among the stenoendemics of the Maramureş Mts and the rarest plants of the Carpathians.

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MAI EXISTĂ *ERYSIMUM HUNGARICUM* ZAPAL. (BRASSICACEAE) ÎN ROMÂNIA?

(Rezumat)

Specia carpatică stenoendemică *Erysimum hungaricum* Zapal. (Brassicaceae) nu a mai fost observată de mai bine de 80 de ani în singura localitate știută din Munții Maramureșului, România. Cercetările din iunie 2018 au confirmat prezența speciei pe partea sudică a Muntelui Lostun Mic (1595 m). Numărul microstațiunilor s-a redus la una singură, de circa 200 m². În populația rămasă, de aproximativ 100 indivizi în floare, s-a făcut un relevu fitosociologic și s-au determinat proprietățile chimice ale solului (pH_{H2O} = 6.46; pH_{KCl} = 6.2; conținutul de carbonat = 8.0 g.kg⁻¹; conținutul de azot = 10.99 g.kg⁻¹; conținutul de fosfor = 19.57 mg.kg⁻¹). În comunitatea vegetală, succesiunea a început de la *Festucetum saxatilis* Domin 1933 la o vegetație de ierburi înalte din ordinal *Adenostyletalia alliariae* Br.-Bl. 1931 până la *Picea abies*. Prezența speciei în diferitele unități de vegetație și compararea caracteristicilor actuale ale solului cu cele mai vechi au indicat o toleranță mai mare a speciei la caracteristicile sitului. Astfel, motivele pentru care această specie este deosebit de rară nu sunt deplin înțelese. Pe baza evaluării sozologice IUCN, specia a fost catalogată ca fiind critic periclitată (CR), conform criteriului B2ab(ii, iv).

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