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DISTRIBUTION OF THREATENED SPECIES *TRIFOLIUM LUPINASTER* L., *HERACLEUM CARPATICUM* PORCIUS AND *RANUNCULUS THORA* L. IN ROMANIAN CARPATHIANS

Attila BARTÓK[1*], Beatrix-Medea BRENER[2], Gabriel COVÂZĂ[2], Irina IRIMIA[3]

Abstract: Maramureşului Mountains Nature Park is widely known as one of the last wilderness areas in Europe and also represents a real oasis for naturalists eager to explore the flora and fauna of this special land not very researched.
During a botanical trip in the area of Farcău Peak (on 19 July 2014) the authors of this paper found three very rare species (all 3 threatened, included in Romanian Red Book of Vascular Plants): *Trifolium lupinaster* L., *Heracleum carpaticum* Porcius and *Ranunculus thora* L.
Based on field studies, analyses of herbarium material and literature data, the authors managed to record the occurrence of *Trifolium lupinaster*, *Heracleum carpaticum* and *Ranunculus thora* in the Romanian Carpathians and determined the threatened status of species according to criteria and categories of IUCN.

Keywords: chorology, Eastern Carpathians, endemic species, "Maramureşului Mountains" Nature Park, Red Book, threatened species

Introduction

"Maramureşului Mountains" Nature Park (incorporates Maramureşului Mountains) having a total surface of around 1.500 km^2, is the largest protected territory in the Romanian Carpathians and is located in the Maramureş county.

Maramureşului Mountains are made up of crystalline schist penetrated by eruptive and sedimentary rocks.

Within the natural park a rich flora including a significant number of rarities such as: *Lysimachia nemorum* L., *Ranunculus thora* L., *Silene rupestris* L., *Salix bicolor* Willd., *Trifolium lupinaster* L., *Woodsia alpina* (Bolton) Gray, *Sagina apetala* Ard., *Rhinanthus alectorolophus* (Scop.) Pollich and so on and a great number of dacic elements such as: *Gymnadenia carpatica* (Zapał.) Teppner & E. Klein, *Heracleum carpaticum* Porcius, *Pulmonaria filarszkyana* Jáv., *Poa rehmannii* (Asch. & Graebn.) K. Richt, *Cochlearia borzaeana* (Coman & Nyár.) Pobed., *Silene zawadzkii* Herb. and so on can be found.

There are four natural reserves in "Maramureşului Mountains" Nature Park: Sâlhoi-Zâmbroslavele Rocks (1 ha), Cornu Nedeii-Ciungii Bălăsinei (800 ha), Tomnatec-Sehleanu Narcissus Meadow (100 ha) and Farcău Peak-Vinderel Lake-Mihăilecu Peak (150 ha).

Three of the rare and threatened species in the "Maramureşului Mountains" Nature Park that in recent decades have not been seen by botanists are: *Trifolium lupinaster* L., *Heracleum carpaticum* Porcius and *Ranunculus thora* L.

[1] Actavis, 11 Ion Mihalache Blvd., 011171, Bucureşti – Romania
[2] "Munţii Maramureşului" Nature Park, 22 Decembrie Str. 20, 435700, Vişeu de Sus – Romania
[3] "Alexandru Ioan Cuza" University of Iaşi, Faculty of Biology, Carol I Blvd. no. 20A, 700505, Iaşi – Romania
[*] Corresponding author. E-mail: bartok.attila@gmail.com

During a botanical trip on 19 July 2014 the authors of this paper found all three above mentioned species.

***Trifolium lupinaster* L.**

Trifolium L. sect. *Lupinaster* (Adans.) Ser. emend Lojac. contains 2 romanian species: *Trifolium lupinaster* L. and *Trifolium alpinum* L. (the presence of *Trifolium alpinum* in the Romanian Flora must be confirmed).

The species of this section can be distinguished by their exclusively perennial habit, their usually large flowers with essentially free standards and wing claws united for only a short distance to the staminal tube, the blades only lightly adhering to those of the keel.

The peduncles are usually long and often scapiform in the alpine species. The involucral bracts may be prominent or reduced but are not united into a continuous ring to form an involucre. The stigmas are exserted slightly beyond the cluster of anthers. All the species of the section appear to be outcrossers, often setting seed when hand triggered. The alpine members of sect. *Lupinaster* occupy old mountain ranges, the Rockies, the Alps, and the Caucasus. The disjunct distribution of these apparently related alpine species suggests that the group is an ancient one [GILLETTE, 1965].

In 1960 Iljin and Truchaleva published a paper on *Trifolium lupinaster* L. s.l. and concluded (on the basis of chromosome numbers) that *Trifolium lupinaster* comprises three species: *Trifolium lupinaster* with 32 or 40 chromosomes (covering the largest part of the area), *Trifolium ciswolgense* Sprygin with 16 chromosomes (spread in the Middle and Southern Urals, in the Volga Hills, and in trans-Uralian Western Siberia) and *Trifolium litwinowii* Iljin with 32 choromosomes which is identical to *Trifolium lupinaster* subsp. *angustifolium* [ILJIN & TRUCHALEVA, 1960].

In Flora of USSR *Trifolium lupinaster* subsp. *angustifolium* is accepted. The subspecies differs from the species by the following characters: leaflets narrowly lanceolate, the ratio of breadth to length one eight to one tenth, the plant as a whole more slender and lighter in colour. Also, *Trifolium lupinaster* var. *albiflorum* is accepted in Flora of USSR. The variety differs from the species by the following: flowers yellowish brown, somewhat smaller; leaflets slightly narrower than those of typical Siberian plants and it is distributed with the typical red-flowered form in the SW part of the distribution area of the species [BOBROV, 1945].

The taxonomical status of some species of genus *Trifolium* (section *Lupinaster*), according to different bibliographical sources is shown in Tab. 1.

Tab. 1. Taxonomical status of some species of genus *Trifolium*, section *Lupinaster*

Taxon name	**Taxonomic status**			
	Flora Europaea	The Plant List	Euro Med Plant Base	ILDIS
(1)*Trifolium lupinaster* L.	ACCEPTED	ACCEPTED	ACCEPTED	ACCEPTED
(2)*Trifolium lupinaster* L. subsp. *angustifolium* (Litv.) Bobrov	SYNONIM with (5)	ACCEPTED	ACCEPTED	ACCEPTED
(3)*Trifolium lupinaster* L. var. *albiflorum* Ser.	SYNONIM with (4)	SYNONIM with (1)	SYNONIM with (1)	SYNONIM with (1)
(4)*Trifolium ciswolgense* Sprygin ex Iljin & Trukh.	PROVI-SIONAL	SYNONIM with (1)	SYNONIM with (1)	SYNONIM with (1)
(5)*Trifolium litwinowii* Iljin	PROVI-SIONAL	SYNONIM with (1)	SYNONIM with (1)	SYNONIM with (1)
(6)*Trifolium romanicum* D. Brandza	-	SYNONIM with (1)	SYNONIM with (1)	SYNONIM with (1)

According to Ellison, genus *Trifolium* sect. *Lupinaster* (Fabricius) Ser. includes 3 species: *Trifolium eximium*, *Trifolium gordejevii* and *Trifolium lupinaster* with native distribution in East Europe-Siberia [ELLISON & al. 2006].

In the whole Carpathians *Trifolium lupinaster* L. was first discovered in Romanian Carpathians (Eastern Carpathians, Nemira Mts.) in subalpine forests, at the border between Transylvania and Moldova, at the altitude 1500 m, near to Băile Slănic town [BRÂNDZĂ, 1903].

Brândză described it as an independent species named *Trifolium romanicum* D. Brândză and he assumed that the plants he had collected differed from *Trifolium lupinaster* L. from other parts of its area and by tuberculously thick roots. The habitats of Carpathians plants are different from Poland or Ukraine habitats, where there are mostly of a semi-steppe to steppe character.

Degen specified [KLEIN, 1904] that the new species of Brândză does not differ from *Trifolium lupinaster* subsp. *angustifolium*.

Hendrych mentioned that the separation of the plants collected by Brândză and therefore also the other Carpathians plants from *Trifolium lupinaster* was unfounded [HENDRYCH, 1963].

Holub considered that the Carpathians plants remained in isolated enclaves from the rest of area (steppes), so he described the species as independent. Moreover, in 1984 he made a new nomenclatural combination and published a new species *Lupinaster romanicus* (D. Brandza) Holub [HOLUB, 1984].

However in "The Plant List" (www.theplantlist.org) taxonomical status of *Lupinaster romanicus* is "Unresolved", which shows that the species is not yet resolved taxonomically.

In 1948 Csűrös discovered the second localities of the plant in Carpathians (in Căliman Mts.), not far from where it was found by Brândză [CSŰRÖS, 1951; CSŰRÖS, 1956].

More than 30 years after, in 1980, Bârlea found the third localities in Carpathians of the species (Maramureşului Mts., Farcău Peak) on a rocky slope (on basalt soil) [BÂRLEA, 1984].

Recent Romanian botanical works [CIOCÂRLAN, 2009; OPREA, 2005; SÂRBU & al. 2013] mention that in Romania only *Trifolium lupinaster* subsp. *angustifolium* is present.

In most European countries *Trifolium lupinaster* is a threatened species. Threatened status of the species in different European countries is shown in Tab. 2.

Tab. 2. Threatened status of the *Trifolium lupinaster* L. in different European countries

Bibliographical source / Country	Poland	Slovakia	Romania	Ukraine
[JACKOWIAK & al. 2007]	EN	-	-	-
[TURIS & al. 2014]	-	CR	-	-
[DIHORU & NEGREAN, 2009]	-	-	CR	-
[KRICSFALUSY & BUDNIKOV, 2007]	-	-	-	EN

In romanian flora, *Trifolium lupinaster* L. is a rare species [OPREA, 2005; CIOCÂRLAN, 2009; SÂRBU & al. 2013], found in the Red list of vascular plants of Romania as vulnerable/rare (V/R) [OLTEAN & al. 1994], placed in the rare sozological

category (R) [BOȘCAIU & al. 1994] and in endangered (E) sozological category [DIHORU & DIHORU, 1994]. Species was also included in the Red book of superior plants of Romania [DIHORU & NEGREAN, 2009], in the "Critically Endangered" (CR) category, but without indicating IUCN criteria.

The threatened status of the species allocated by different authors is shown in Tab. 3.

Tab. 3. Threatened status of *Trifolium lupinaster* L. allocated by different authors

Bibliographical source	Threatened status
[OLTEAN & al. 1992]	V/R
[DIHORU & DIHORU, 1994]	E
[BOȘCAIU, 1994]	R
[WITKOWSKI, 2003]	EN
[DIHORU & NEGREAN, 2009]	CR

Another two species found by the authors of this paper in "Maramureşului Mountains" Nature Park – *Heracleum carpaticum* Porcius and *Ranunculus thora* L.– are also rare and threatened species in Romanian Flora. Moreover the distribution of *Heracleum carpaticum* is limited to the Eastern Carpathians (dacic elements).

The threatened status of the species allocated by different authors in Romania is shown in Tab. 4.

Tab. 4. Threatened status of *Heracleum carpaticum* Porcius and *Ranunculus thora* L. allocated by different authors

Bibliographical source / Species	***Heracleum carpaticum* Porcius**	***Ranunculus thora* L.**
[OLTEAN & al. 1992]	V/R	R
[DIHORU & DIHORU, 1994]	V	R(V)
[WITKOWSKI, 2003]	VU	VU
[DIHORU & NEGREAN, 2009]	CR	VU

Material and methods

Our investigation was based on recent field studies, analysis of herbarium material as well as literature data.

The identification of the taxa has been done using the following "floras" and papers: *Flora Europaea*, vol. 2; *Flora ilustrată a României – Pteridophyta et Spermatophyta* [CIOCÂRLAN, 2009]; *Plante vasculare din România*: *determinator ilustrat de teren* [SÂRBU & al. 2013].

The distribution of *Trifolium lupinaster* L., *Heracleum carpaticum* Porcius and *Ranunculus thora* L. in Romania, has been made based on data from the herbarium collections (BP, CL, SIB, BVS, P, I) [THIERS, 2012] and Personal Herbarium "A. Bartók" (HAB) and also different bibliographical sources. Herbarium abbreviation follows Index Herbariorum (http://sweetgum.nybg.org/ih/), except Personal Herbarium.

The collected materials were stored in the Personal Herbarium A. Bartók (HAB).

Results and discussion

Trifolium lupinaster L.

Literature data

Bibliographical data about *Trifolium lupinaster* L. (continental floristic element) from romanian botanical literature is presented in Tab. 5.

Tab. 5. Distribution in Romanian Carpathians of *Trifolium lupinaster* according to different bibliographical sources

Bibliographical source	Nemira Mts.	Căliman Mts.	Maramureşului Mts.
[BRÂNDZĂ, 1903]	+	-	-
[CSŰRÖS, 1951]	-	+	-
[CSŰRÖS, 1956]	-	+	-
[MITITELU & BARABAŞ, 1993]	+	-	-
[BÂRLEA, 1984]	-	-	+
[OROIAN, 1998]	-	+	-
[OPREA, 2005]	+	+	+
[CIOCÂRLAN, 2009]	+	+	+
[SÂRBU & al. 2013]	+	+	-

Herbarium data

During field trips over the last 110 years (since it was found for the first time) *Trifolium lupinaster* was collected from three localities, only in Eastern Carpathians.

We hereby list all the known specimens, including those traced by us in gathering.

? (CL): *Brândza*, Nemira Mountains
1948 (CL; BUCA): *Csűrös*, Câliman Mountains
1980 (BUCA): *Bârlea*, Maramureşului Mountains
2014 (HAB): *Bartók*, *Brener & Covâză*, Maramureşului Mountains

Altogether 6 voucher specimens were deposited in (CL, BUCA, HAB) from 3 different localities.

Herbarium materials found by the authors is shown in Tab. 6.

Tab. 6. Herbarium data of *Trifolium lupinaster* collected in Romanian Carpathians

Original label data	Collection date	Collected by	Source	Observations
Maramureş, Eastern Carpathians, Maramureşului Mountains				
"Mt. Farcău, 1,850 m, versant pietros, stânci de bazalt."	8/VIII/1980	L. Bârlea	(BUCA 144538)	(DIHORU & NEGREAN, 2009)
"In herbosis et saxosis sub cacumine Farcău. Solo basaltico. Alt. 1,791 m."	19/VII/2014	A. Bartók B. M. Brener G. Covâză	(HAB)	-
Transylvania, Eastern Carpathians, Călimani Mountains				
"Alpes „Călimani" – in saxosis sub mtis Izvor ad Fața Gardului, alt. 1,700 m."	2/VIII/1948	I. Csűrös	(CL 659790)	*Trifolium lupinaster* L. f. *albiflorus* Ser.

"Munții Căliman - lângă izvorul "La Fața Gardului", 1,700 m."	2/VIII/1948	I. Csűrös	(BUCA 10233)	*Trifolium lupinaster* L. f. *albiflorus* Ser. (DIHORU & NEGREAN, 2009)
"Alpes „Călimani"- in saxosis sub mtis Izvor ad Fața Gardului, alt. 1,700 m."	29/VII/1949	I. Csűrös	(CL 219619)	*Trifolium lupinaster* L. f. *albiflorus* Ser.
Moldova, Eastern Carpathians, Nemira Mountains				
"Creşce in pădurile subalpine printre tufele de Vaccinium la altitudinea de 1,500 metri, pe Muntele Nemira, lângă linia de frontieră in apropiere de Slănic in Districtul Bacău. Înfloreşce în Iunie."	?	D. Brândza	(CL 49167)	*Trifolium romanicum* Brandza As HOLOTYPUS electus, but herbarium material missing (original herbarium material (BUC) burned). G. Negrean (14/IX/2003)

The chorological map of *Trifolium lupinaster* L. is shown in Fig. 1.

Herbarium data analysis shows that *Trifolium lupinaster* is extremely rare in Romania and in Maramureşului Mountains it has not been seen for more than 30 years.

On the basis of chorological data and estimation of the geographical range (extent of occurrence) we can define *Trifolium lupinaster* as IUCN: CR B1a.

Field observations

During the floristical investigation performed in Maramureşului Mountains on 19 July 2014 we found one population of *Trifolium lupinaster* L. (about 15-20 individuals) on a grassy place with basaltic substrate.

Locality: Romania, Eastern Carpathians, Maramureşului Mountains, Farcău Peak, 1791 m a.s.l., exp. S-SE, incl. 60°, grassy place, area 10 m^2, leg. A. Bartók, B. M. Brener, G. Covâză; date: 19/VII/2014.

Together with *Trifolium lupinaster* L. we also found the following species: *Juncus trifidus* L., *Vaccinium vitis-idaea* L., *Vaccinium uliginosum* L., *Dianthus carthusianorum* L., *Asplenium viride* Huds., *Scorzonera purpurea* L. subsp. *rosea* (Waldst. & Kit.) Nyman, *Sempervivum montanum* L., *Juniperus sibirica* Burgsd., *Phyteuma orbiculare* L., *Pulsatilla alba* Rchb., *Hieracium villosum* Jacq., *Campanula alpina* Jacq., *Ligusticum mutellina* (L.) Crantz, *Festuca supina* Schur, *Scorzoneroides crocea* (Haenke) Holub (syn. *Leontodon croceus* Haenke).

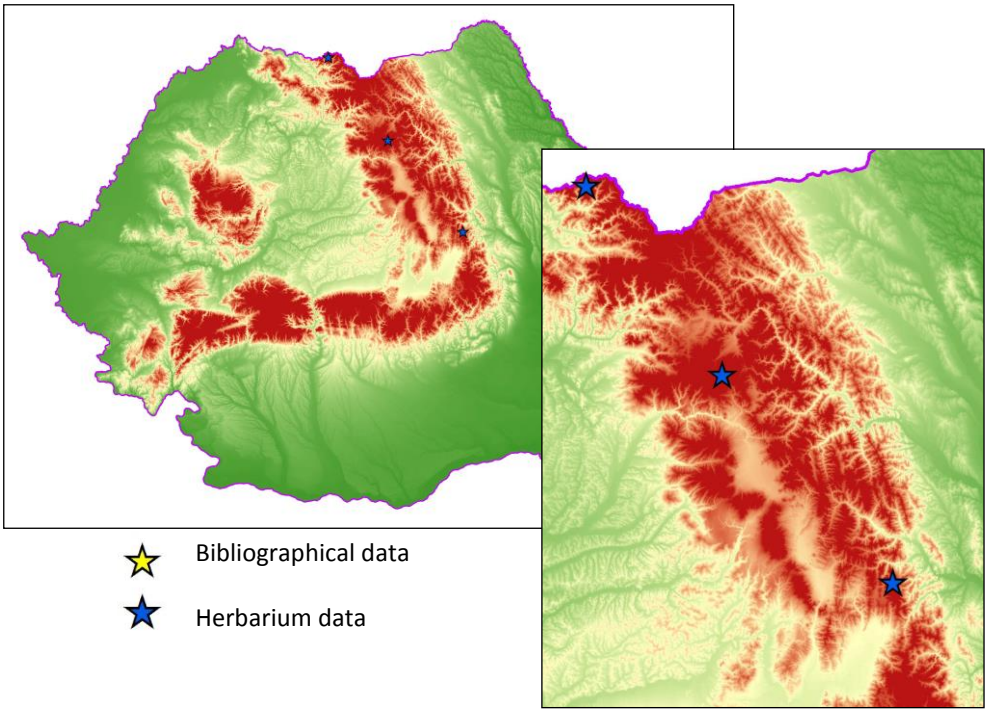

Fig. 1. Distribution map of *Trifolium lupinaster* L. in Romanian Carpathians

Heracleum carpaticum Porcius

Literature data

Bibliographical data about *Heracleum carpaticum* Porcius (dacian floristic element, Eastern and Southern Carpathians endemite, distributed only in Romania and Ukraine) from Romanian botanical literature is presented in Tab. 7.

Tab. 7. Distribution in Romanian Carpathians of *Heracleum carpaticum* according to different bibliographical sources

Bibliographical source	Maramureşului Mts.	Rodnei Mts.	Rarău Mts.	Bistriţei Mts.	Ceahlău Mts.	Nemira Mts.	Ciucaş Mts.	Bucegi Mts.	Făgăraş Mts.
[BAUMGARTEN,1816]	-	+	-	-	-	-	-	+	-
[FUSS, 1866]	-	+	-	-	-	-	-	+	-
[SCHUR, 1866]	-	+	-	-	-	-	-	+	-
[SIMONKAI, 1886]	-	+	-	-	-	-	-	+	-
[HAYEK, 1916]	+	+	-	-	-	-	-	-	-
[JÁVORKA, 1925]	+	+	-	-	-	-	-	+	-
[BELDIE, 1967]	+	+	-	-	-	-	-	+	-

[BELDIE, 1967]	-	-	-	-	-	-	-	+	-
[LUNGU, 1969]	-	-	-	+	-	-	-	-	-
[PUŞCARU-SOROCEANU & al. 1977]	-	-	-	-	-	-	-	-	+
[CIUCĂ, 1984]	-	-	-	-	-	-	+	-	-
[NEGREAN & OLTEAN, 1989]	+	+	+	-	-	-	-	+	-
[OPREA, 2005]	+	+	+	-	-	-	-	+	-
[DIHORU & NEGREAN, 2009]	+	+	+	-	-	-	+	+	+
[CIOCÂRLAN, 2009]	+	+	+	-	-	-	-	+	-
[SZABÓ, 2012]	-	-	-	-	+	+	-	-	-
[SÂRBU & al. 2013]	+	+	+	-	-	-	-	+	-

On the mentioned literature data *Heracleum carpaticum* Porcius can be found in 9 Mountain Massifs (Maramureşului, Rodnei, Rarău, Bistriței, Ceahlău, Nemira, Ciucaş, Bucegi, Făgăraş). It should be noted this is the first mention of *Heracleum carpaticum* Porcius in Ceahlău, and Nemira Mountains in a single bibliographical source [SZABÓ, 2012].

Herbarium data

Heracleum carpaticum was collected from ten localities, in Eastern Carpathians (Maramureşului, Rodnei and Rarău Mts.).

We hereby list all the known specimens, including those traced by us in gathering.

? (P): *Baumgarten*, Transylvania
1857 (CL): *Czetz*, Maramureşului Mts.
1860 (CL): *Czetz*, Rodnei Mts.
?, 1880 (CL): *Porcius*, Rodnei Mts.
1918, 1941(SIB): *Nyárády*, Rodnei Mts.
1936 (CL): *Borza & Pteancu*, Rodnei Mts.
1946 (CL): *Csűrös*, Rodnei Mts.
1950 (BVS): *Morariu*, Rarău Mts.
1987 (BUCM): *Negrean*, Rodnei Mts.
2001 (CL): *Puşcaş*, Rodnei Mts.
2013 (HAB): *Bartók*, Rodnei Mts.
2014 (HAB): *Bartók, Brener* & *Covâză*, Maramureşului Mountains

Altogether 18 voucher specimens were deposited in (CL, SIB, P, BVS, HAB) from 3 different localities.

Herbarium materials found by the authors is shown in Tab. 8.

Tab. 8. Herbarium data of *Heracleum carpaticum* collected in Romanian Carpathians

Original label data	Collection date	Collected by	Source	Observations
Transylvania				
"Transylvania"	?	J. C. Baumgarten	(P 2675039)	*Heracleum alpinum* L. Det. R.K. Brummit, 1965
Transylvania, Eastern Carpathians, Rodnei Mountains				
"Az Ünőkő éjszaki oldalán"	VIII/1860	A. Czetz	(CL 28730)	*Heracleum alpinum* L.
"In pascuis alpinis prope oppidum Rodna, in Transsilvania boreali-orientalis".	?	F. Porcius	(CL 210286) (CL 210287) (CL 210288) (CL 210289) (CL 210290)	-
"... auf Alpen in Grosse Corongis in bei Radna."	VII/1880	F. Porcius	(CL 28729)	*Heracleum alpinum* L. ß *carpaticum*
"Comit. Beszterce-Naszód. Montes Rodnenses. In declivibus graminosis et saxosis montis Nagy-Korongyis, alt. 1,600-1,990. Solo calc".	17/VIII/1918	E. I. Nyárády	(SIB 155944)	-
"Transilvania. Distr. Năsăud. Mte. Corongiş ad Valea Vinului. Calc. et schist. Alt. ad 1,400 m" .	28-29/ VII/1936	A. Borza P. Pteancu	(CL 503517)	-
"Transsilvania. Radnai-havasok. Lála csúcs- Vârfu Roşu déli, fűves oldalán, 1,600 m".	16/VIII/1941	E. I. Nyárády	(SIB 155946)	-
"Piatra Unică" ("Ünőkő")-Carpaţii Orientali	2/VIII/1946	I. Csűrös	(CL 599015)	Rev. G. Weimarck
"Muntele Negoiasa, alt. 1,940 m."	24/VIII/1987	G. Negrean	(BUCM 104934)	(DIHORU & NEGREAN, 2009)
"Căldarea Iezerul (Munţii Rodnei). Grohotiş înierbat. Alt. cca. 1,500 m."	28/VII/2001	M. Puşcaş	(CL 659100)	-
"Alpibus Rodnensibus. In pascuis alpinis montis Pietrosul Mare, supra lacum Iezer. Alt. 2,100 m s.m."	21/VII/2013	A. Bartók	(HAB)	-
Maramureş, Eastern Carpathians, Maramureşului Mountains				
"Máramarosi havasokban a Popp Iván tetejéről."	8/VIII/1857	A. Czetz	(CL 28731)	*Heracleum alpinum* L.
"Montibus Maramarosiensis. In herbosis et saxosis sub cacumine Farcău. Solo calcareo. Alt. 1,896 m s.m."	19/VII/2014	A. Bartók B. M. Brener G. Covâză	(HAB)	-
Moldova, Eastern Carpathians, Rarău Mountains				
"Rarău, prin pădure."	10/IX/1950	I. Morariu	(BV S022263)	-

The chorological map of *Heracleum carpaticum* Porcius is shown in Fig. 2.

On the basis of chorological data and estimation of the geographical range (extent of occurrence) we can define *Heracleum carpaticum* as IUCN: CR B1a, B1c(iii).

Field observations

During the floristical investigation performed in Maramureşului Mountains on 19 July 2014 we found one small population of *Heracleum carpaticum* Porcius (3 individuals) on a grassy place with limestone substrate.

Locality: Romania, Eastern Carpathians, Maramureşului Mountains, Farcău Peak, 1900 m a.s.l., exp. S-SE, incl. 30°, grassy place, area 2 m^2, leg. A. Bartók, B. M. Brener, G. Covâză; date: 19/VII/2014.

Together with *Heracleum carpaticum* Porcius we also found the following species: *Juncus trifidus* L., *Hieracium villosum* Jacq., *Ranunculus platanifolius* L., *Gentiana acaulis* L., *Anemone narcissiflora* L., *Hypericum alpigenum* Kit., *Solidago virgaurea* L., *Carduus kerneri* Simonk. subsp. *kerneri*, *Scorzoneroides crocea* (Haenke) Holub, *Campanula abietina* Griseb. & Schenk, *Laserpitium krapfii* Crantz.

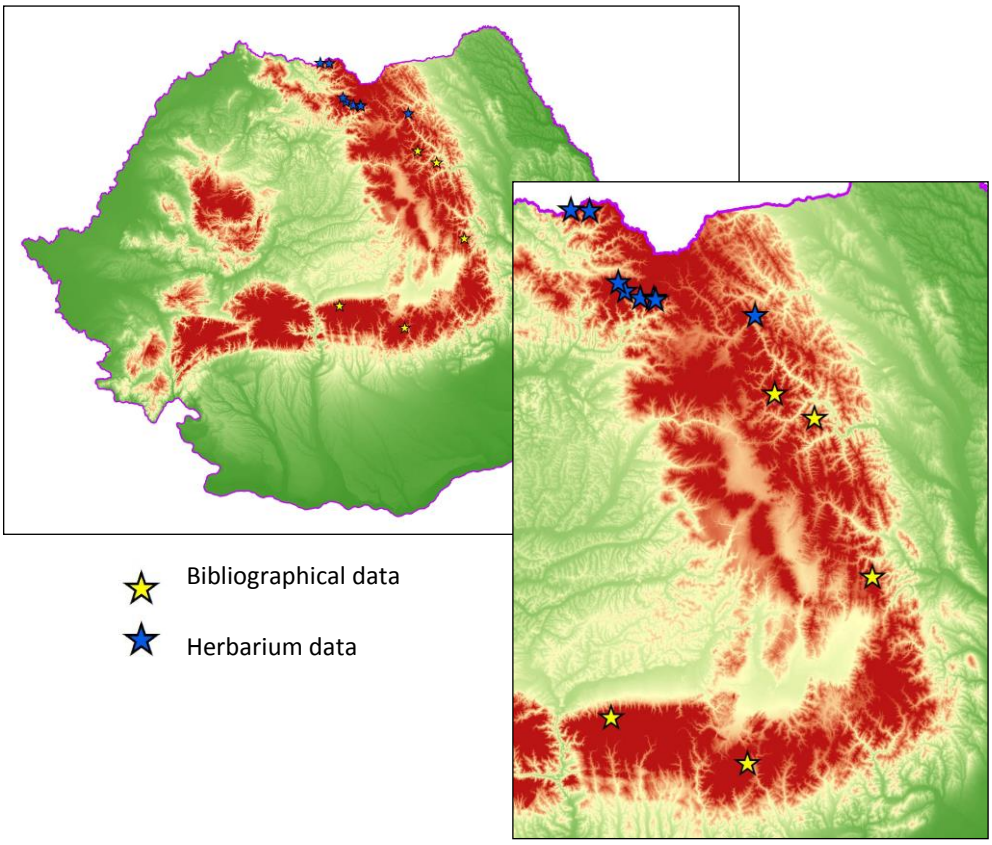

Fig. 2. Distribution map of *Heracleum carpaticum* Porcius in Romanian Carpathians

***Ranunculus thora* L.**

Literature data

Bibliographical data about *Ranunculus thora* L. (European endemite) from Romanian botanical literature is presented in Tab. 9.

Tab. 9. Distribution in Romanian Carpathians of *Ranunculus thora* according to different bibliographical sources

Bibliographical source	Maramureşului Mts.	Rodnei Mts.	Ceahlău Mts.	Ciucaş Mts.	Piatra Mare Mts.	Bucegi Mts.	Piatra Craiului Mts.	Iezer-Păpuşa Mts.	Făgăraş Mts.	Cindrel Mts.	Lotrului Mts.	Godeanu Mts.
[BAUMGARTEN,1816]	-	-	-	-	+	+	+	-	-	-	-	-
[FUSS, 1866]	-	+	-	-	-	-	-	-	-	+	-	-
[SCHUR, 1866]	-	+	-	-	-	+	+	-	-	-	-	-
[SIMONKAI, 1886]	-	+	-	+	-	+	+	-	-	+	-	-
[BRÂNDZĂ, 1879]	-	-	+	-	-	-	-	-	-	-	-	-
[GRECESCU, 1898]	-	-	-	-	-	-	+	-	+	-	-	+
[GRECESCU, 1909]	-	-	-	-	-	+	-	-	+	-	-	-
[GRECESCU, 1911]	-	-	-	-	-	+	-	-	-	-	-	-
[COMAN, 1939]	+	-	-	-	-	-	-	-	-	-	-	-
[BOŞCAIU, 1971]	-	-	-	-	-	-	-	-	-	-	-	+
[MIHĂILESCU, 2001]	-	-	-	-	-	-	+	-	-	-	-	-
[OPREA, 2005]	+	+	-	-	+	+	+	-	+	+	+	+
[DIHORU & NEGREAN, 2009]	+	+	+	+	+	+	+	+	+	+	+	+
[DRĂGULESCU, 2009]	-	-	-	-	-	-	-	-	+	+	+	-
[SZABÓ, 2012]	-	-	+	-	-	-	-	-	-	-	-	-

On the mentioned literature data *Ranunculus thora* L. can be found in 12 Mountain Massifs (Maramureşului, Rodnei, Ceahlău, Ciucaş, Piatra Mare, Bucegi, Piatra Craiului, Iezer-Păpuşa, Făgăraş, Cindrel, Lotrului, Godeanu).

Herbarium data

We hereby list all the known specimens, including those traced by us in gathering.

1853,1854 (CL): *Czetz*, Rodnei Mts.
1855 (CL): *Wolff*, Rodnei Mts.
1874,1883 (BVS, CL): *Porcius*, Rodnei Mts.
1883 (BP): *Simonkai*, Bucegi Mts.
1883 (BP): *Simonkai*, Piatra Craiului Mts.
1885, 1887, 1896, 1908 (BP, SIB, BVS): *Römer*, Piatra Mare Mts.
1886 (BP): *Barth*, Piatra Mare Mts.
1883 (BP): *Simonkai*, Bucegi Mts.
1891(BUC): *Grecescu*, Iezer-Păpuşa Mts.
1895 (BUC), *Grecescu*, Godeanu Mts.
1913 (BP): *Jávorka*, Maramureşului Mts.

1913 (BP): *Wagner*, Rodnei Mts.
1918, 1942 (SIB): *Nyárády*, Rodnei Mts.
1925 (CL): *Borza*, Rodnei Mts.
1939, ?, 1948 (SIB, CL, BUCF, I): *Coman*, Rodnei Mts.
1939, 1942 (BP): *Boros*, Rodnei Mts.
1941, 1942 (BP): *Andreánszky*, Rodnei Mts.
1941, 1942 (BP): *Kárpáti*, Rodnei Mts.
1941 (BP): *Soó, Nyárády & Felföldy*, Rodnei Mts.
1983 (CL): *Täuber & Groza*, Rodnei Mts.
1987 (BUCM): *Negrean*, Rodnei Mts.
2001 (CL): *Puşcaş*, Rodnei Mts.
2013 (HAB): *Bartók*, Rodnei Mts.
2014 (HAB): *Bartók, Brener & Covâză*, Maramureşului Mountains

Altogether 48 voucher specimens were deposited in (BP, CL, SIB, BVS, HAB, I, BUCF, BUCM, BUC). Herbarium materials found by the authors are shown in Tab. 10.

Tab. 10. Herbarium data of *Ranunculus thora* collected in Romanian Carpathians

Original label data	Collection date	Collected by	Source	Observations
Maramureş, Eastern Carpathians, Maramureşului Mountains				
"Com. Máramaros. In rupium fissuris montis Tomnatek."	5/VII/1913	S. Jávorka	(BP 64637)	as *Ranunculus carpaticus* Rev. A. Bartók 12/XII/2013
"Com. Máramaros: In rupium fissuris inter Farko et Mihailek supra pagum Havasmező."	7/VII/1913	S. Jávorka	(BP 64638) (BP 64639)	as *Ranunculus carpaticus* Rev. A. Bartók 12/XII/2013
"In saxosis inter cacuminis Farcău et Mihailecu. Solo calcareo. Alt. 1,728 m s.m."	19/VII/2014	A. Bartók B.M. Brener G. Covâză	(HAB)	-
Transylvania, Maramureş, Eastern Carpathians, Rodnei Mountains				
"Korongyis kupján éjszakra."	30/VI/1853 15/VI/1856	A. Czetz	(CL 40544)	-
"Alp. Radnensis. Korongyis la puarta."	VII/1855	G. Wolff	(CL 40545)	-
"Von der Alpe Corongişu bei Radna."	1874	F. Porcius	(BVS 037572) (BVS 037573)	-
"In gebirge Saca auf der gegen osten fallenden."	26/VI/1883	F. Porcius	(CL 40546)	-
"Rodnaer Alpen, Korongişului; Kalk., 1,990 m"	21/VIII/1895	F. Pax	(BP)	-
"Prope Rodnaborberek. Korongyis."	VIII/1913	J. Wagner	(BP)	-
"Comit. Beszterce-Naszód. Alpes Rodnenses. In saxosis montis Nagykorongyis supra balneas Radnaborberek. Alt. 1,800-1,900 m."	9/VII/1918 17/VIII/1918	E. I. Nyárády	(SIB 146838)	-

"Comit. Beszterce-Naszód. Alpes Rodnenses. In declivibus saxosis at graminosis montis Dosu Grasdiului supra pagum Major. Alt. 1,750 m".	10/VIII/1918	E. I. Nyárády	(SIB 146841)	-
"Transsilvaniae, distr. Bistrița-Năsăud. In saxosis calc. Corongiș. Alt. 1,994 m".	7/VIII/1925	A. Borza	(CL 504181)	-
"Transsilvania. Distr. Maramureș. In declivibus calcareis „Picioru Moșului montium Pietrosu Mare. Alt. cca. 1,888 m s.m".	17/VI/1939	A. Coman	(SIB 146844) (CL 197031) (CL 614422) (I 32465) (I 48548) (BVS 037571)	(FRE1940)
"Reg. Maramureș. Borșa. Fața Meselor. Alt. 1,700 m".	29/VI/1939	A. Coman	(CL 614388)	as *Ranunculus hybridus* Rev. ? 5/III/1985
"Muntii Rodnei: Iezer"	?	A. Coman	(BUCF 15703)	(DIHORU & NEGREAN, 2009)
"Com. Máramaros. In rupestribus arenosis montis prope Kőrösmező, 1,600-2,000 m".	30/VII/1939	A. Boros	(BP)	as *Ranunculus* ? Rev. A. Kurtto 1988
"Alpes Radnenses. In glareosis calcareis montis Kis-Korongyis, alt. cca. 1,600-1,700 m s.m".	22/VI/1941	G. Andreánszky	(BP 223582)	-
"Besztrece-Naszód. In alpe Korongyis supra pag. Radnaborberek. In rupibus. Alt. cca. 1,800 m."	22/VI/1941	Z. Kárpáti	(BP)	-
"Montes Radnenses. In rupibus calcareis ad „Portam" inter Montes Száka et Kiskorongyis. Alt. cca. 1,700 m s.m".	19/VII/1941	R. Soó E. I. Nyárády A. Nyárády L. Felföldy	(CL)	-
"Montes Radnenses. Transsilvaniae. In declivibus septentr. calcareis Vf. Repede. Alt. 1,900 m s.m".	8/VII/1942	A. Nyárády E. I. Nyárády	(CL 202218)	-
"Transilvania. Alpes Rodnenses. In graminosis montis Száka supra Radnaborberek. Alt. cca. 1,700 m s.m. Solo calc".	9/VII/1942	G. Andreánszky	(BP)	-
"Montes Radnenses, Transsilvaniae, Piatra Rea. In declivibus calcareis. Alt. 1,690 m s.m".	9/VII/1942	A. Nyárády E. I. Nyárády	(CL 202220)	-
"Montes Radnenses. Transsilvaniae. Nagy-Korongyis. In rupibus calcareis. Alt. 1,900 m s.m".	10/VII/1942	A. Nyárády E. I. Nyárády	(CL 202219)	-

"Com. Beszterce-Naszód. In alpe Korongyis supra pagum Radnaborberek, in rupibus calcareis. Alt. cca. 1,700 m"	18/VIII/1942	Z. Kárpáti	(BP)	-
"Com. Beszterce-Naszód. In rupestribus jugi sept. montis Korongyis prope pagum Radnaborberek. Alt. 1,800-1,994 m."	21/VIII/1942	A. Boros	(BP)	as *Ranunculus* ? Rev. A. Kurtto 1988
"Com. Beszterce-Naszód. Alpes Rodnenses. In rupestribus calcar. montis Száka pr. Radnaborberek. Alt. cca. 1,700 m s.m."	21/VIII/1942	A. Boros	(BP)	as *Ranunculus* ? Rev. A. Kurtto 1988
"Com. Máramaros. Mt. Nagy-Pietrosz. In rupibus calcareis infra lacum Mosolygó-tó supra pagum Borsa."	26/VIII/1942	Z. Kárpáti	(BP)	-
"Borşa, Aria Zimbrului, exp. N; 1,037 m."	29/VIII/1948	A. Coman	(BP 424061)	-
"Transsilvania, distr. Bistriţa-Năsăud, Mt. Rodnei."	VII/1983	F. Täuber Gh. Groza	(CL 649041)	-
"Turnul Roşu"	23/VIII/1987	G. Negrean	(BUCM 104877)	(DIHORU & NEGREAN, 2009)
"Căldarea Iezerul, Munţii Rodnei, stânci de calcar. 1,800 m."	5/VII/2001	M. Puşcaş	(CL 659102)	-
"Alpibus Rodnensibus. In declivibus calcareis "Piciorul Mosului", montium Pietrosul Mare."	15/VI/2013	A. Bartók	(HAB)	-
Transylvania, Eastern Carpathians, Piatra Mare Mountains				
"In alpibus: Piatra Mare."	VI/1885	J. Römer	(BP 64636)	Com. J. Barth
"In alpibus: Piatra Mare."	17/VII/1886	J. Barth	(BP)	-
"Hohenstein"	16/VI/1887	J. Römer	(SIB 38335)	-
"Hohenstein (Peatra Mare) 1,840 m."	19/VII/1896	J. Römer	(SIB 38336)	-
"Piatra Mare."	7/VI/1908	J. Römer	(BVS 037574)	-
Transylvania, Southern Carpathians, Bucegi Mountains				
"In alpe Bucsecs, locis saxosis alpinis."	30/VIII/1883	L. Simonkai	(BP 64621)	-
Transylvania, Southern Carpathians, Piatra Craiului Mountains				
"In graminosis alpis „Királykő" supra Zernyest, 2,000 m s.m."	27/VIII/1883	L. Simonkai	(BP 64622)	-
Muntenia, Southern Carpathians, Iezer-Păpuşa Mountains				
"Păpuşa, regiunea alpină, stânci cu muşchi."	12/VIII/1891	D. Grecescu	(BUC 322161)	(DIHORU & NEGREAN, 2009)
Transylvania, Southern Carpathians, Godeanu Mountains				
"Muntele Godeanu, micaşisturi, pe lângă zăpadă, la 2,200 m."	18/VII/1895	D. Grecescu	(BUC 322160)	(DIHORU & NEGREAN, 2009)

Checking herbarium materials for species *Ranunculus thora* two herbarium sheets were discovered (BP 64638 and BP 64639) with plants collected from the Farcău Peak, but it was recorded in the database of herbarium as *Ranunculus carpaticus*. Herbarium sheet

was reviewed by A. Bartók. The species was found by the authors of this paper in the mentioned area after 100 years after the collection of first herbarium material.

The chorological map of *Ranunculus thora* L. is shown in Fig. 3.

On the basis of chorological data and estimation of the geographical range (extent of occurrence) we can define *Ranunculus thora* as IUCN: VU C2a, B1(i).

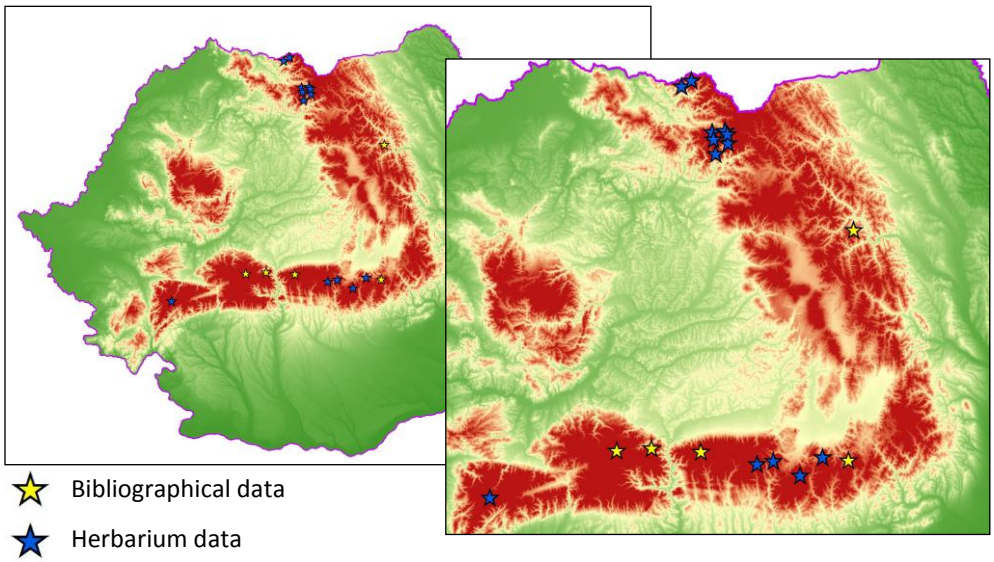

Fig. 3. Distribution map of *Ranunculus thora* L. in Romanian Carpathians

Field observations

During the floristical investigation performed in Maramureşului Mountains on 19 July 2014 we found one population of *Ranunculus thora* L. on exposed calcophyllite cliffs. Locality: Romania, Eastern Carpathians, Maramureşului Mountains, Farcău Peak, 1728 m a.s.l., exp. S-SE, incl. 90°, basalt (with dolomite inclusions) cliffs, area 25 m^2, leg. A. Bartók, B. M. Brener, G. Covâză; date: 19/VII/2014.

Together with *Ranunculus thora* L. we also found the following species: *Juncus trifidus* L., *Hieracium villosum* Jacq., *Saxifraga paniculata* L., *Asplenium viride* Huds., *Dianthus carthusianorum* L., *Aster alpinus* L., *Saxifraga adscendens* L., *Silene nutans* L. subsp. *dubia* (Herbich) Zapał., *Leontopodium alpinum* Cass., *Campanula alpina* Jacq., *Sempervivum montanum* L., *Hypochoeris uniflora* Vill., *Rhodiola rosea* L.

Conclusions

The authors of this paper during a botanical trip found in Farcău Peak (Maramureşului Mountains) area three very rare species (all 3 threatened, included in Romanian Red Book of superior plants): *Trifolium lupinaster* L., *Heracleum carpaticum* Porcius and *Ranunculus thora* L.

Herbarium data analysis shows that *Trifolium lupinaster* is extremely rare in Romania and in Maramureşului Mountains has not been seen for more than 30 years.

Authors rediscovered *Trifolium lupinaster* L. after 30 years from the collection this very rare and critically endangered species in Farcău Peak area.

Heracleum carpaticum is also rare in Romanian Flora and even though it was cited by several botanists in the Maramureş Mountains, herbarium data analysis indicates that the species was not collected from the Farcău Peak.

When checking herbarium materials for species *Ranunculus thora* L. two herbarium sheets were discovered (BP 64638 and BP 64639) with plants collected from the Farcău Peak, but the plant recorded in the database of herbarium as *Ranunculus carpaticus*. The species was refound by the authors of this paper in the mentioned area 100 years after the collection of the first herbarium material.

Based on field studies, analysis of herbarium material and literature data, the authors managed to record the occurrence of *Trifolium lupinaster* L., *Heracleum carpaticum* Porcius, and *Ranunculus thora* L. in Romanian Carpathians and determined the threatened status according to categories and criteria of IUCN.

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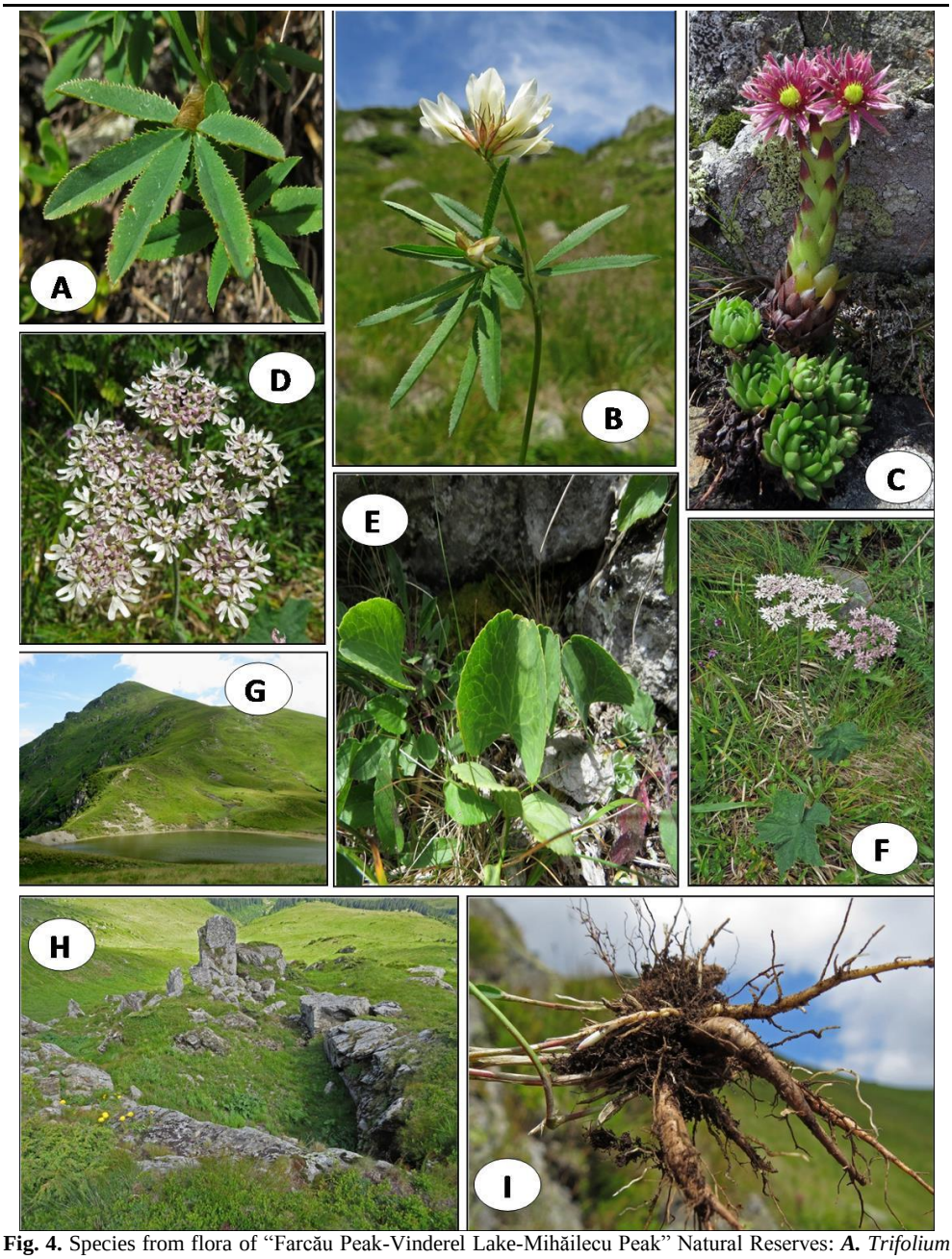

Fig. 4. Species from flora of "Farcău Peak-Vinderel Lake-Mihăilecu Peak" Natural Reserves: ***A.*** *Trifolium lupinaster* L. – leaf; **B.** *Trifolium lupinaster* L. – habitus; **C.** *Sempervivum montanum* L. – habitus; **D.** *Heracleum carpaticum* Porcius – inflorescence; **E.** *Ranunculus thora* L. – habitus; **F.** *Heracleum carpaticum* Porcius – habitus; **G.** Landscape – Vinderel Lake and Farcău Peak; **H.** Habitat of *Heracleum carpaticum* Porcius, near Farcău Peak; **I.** *Trifolium lupinaster* L. – root