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ASTRAGALUS PSEUDOPURPUREUS GUŞUL. IN ROMANIA'S VEGETATION

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Abstract: *Astragalus pseudopurpureus* was described as a new species for science by the botanist Mihail Guşuleac, from Bicaz and Şugău Gorges. It is a very rare and endangered plant species in Romania, being endemic for Eastern Carpathians (it is a Dacian floristic element).
From phytosociological point of view, this species has been previously attributed, by various authors, to class *Elyno-Seslerietea* or to alliance *Seslerion bielzii*.
It is made a proposal of a new syntaxon in this paper, namely: subassociation *astragaletosum pseudopurpurei* subass. nova, subordinate to the association *Thymetum comosi* Pop et Hodişan 1963. This new subassociation is described from Şugău Gorges (Neamţ county, Romania). This new syntaxon is framed, as follow:
Class *Thlaspietea rotundifolii* Br.-Bl. 1926
Order *Thlaspietalia rotundifolii* Br.-Bl. 1926
Alliance *Achnatherion calamagrostis* Br.-Bl. 1918
Asociation *Thymetum comosi* Pop et Hodişan 1963
– subassociation *astragaletosum pseudopurpurei* subass. nova
The differential species for this subassociation, *Astragalus pseudopurpureus*, together with all the other species, edify phytocoenoses with soil coverages between 30% and 50%, having a stabilizing role of limestone screes.

Keywords: *Astragalus pseudopurpureus*, Eastern Carpathians, endemic, new syntaxon, Şugău Gorges, Romania.

Introduction

Astragalus pseudopurpureus is an endemic plant species in Romanian flora, distributed only in the Eastern Carpathians Mountains. The vernacular name is that of "cosaci bicăjean".

It was described by the romanian botanist Mihail Guşuleac, as a new species for science, in 1932. It was cited from Bicaz Gorges, being identified on "Piatra Panţârului", at 840 m a.s.l. and "Dealul Glodului", between 800 m a.s.l. and 1300 m a.s.l. [GUŞULEAC, 1933].

Materials and methods

Individuals of *Astragalus pseudopurpureus* have been examined right on the field in Şugău Gorges, Eastern Carpathians, Romania (Fig. 1-2). It has also been looked after in Nemira Mountains, Hăşmaş Mountains, and Bicaz Gorges (Eastern Carpathians), without any trace of existence, at least, for the time being.

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Fig. 1. *Astragalus pseudopurpureus* (habitus) (Adrian Oprea)

Fig. 2. *Astragalus pseudopurpureus* (flowers) (Adrian Oprea)

Herbarium sheets were also examined for distribution, in IAGB (Fig. 3) and I (abbreviations follow Thiers) [THIERS, 2009].

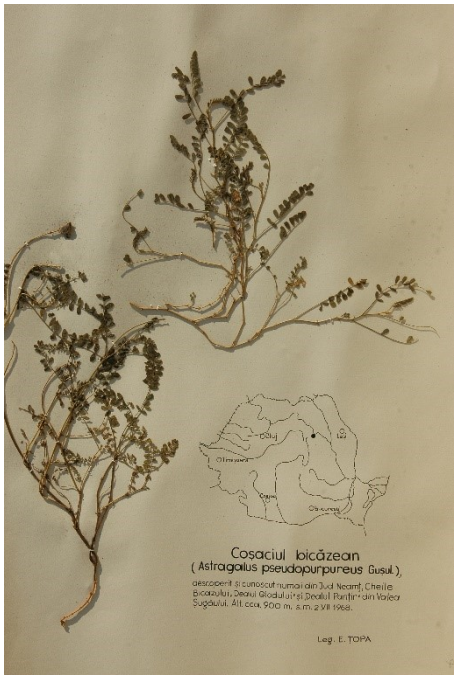

Fig. 3. A herbarium sheet with *Astragalus pseudopurpureus* (in IAGB) (Adrian Oprea)

The plant populations were followed between the years of 2007 and 2016, for their dynamics. The phytosociological surveys were made on the field in Şugău Gorges, Eastern Carpathians. The methodology for phytosociological surveys follow that one of Central European School of Phytosociology [BRAUN-BLANQUET, 1964].

Results and discussion

Plant species nomenclature

The nomenclature of *Astragalus pseudopurpureus* follow that existed in "Flora României", vol. 5 [GUŞULEAC, 1957], "Flora Europaea", vol. 2 [CHATER, 1968], "Plante endemice în România" [DIHORU & PÂRVU, 1987], "Cartea Roşie a Plantelor Vasculare din România" [DIHORU & NEGREAN, 2009], and in two monographs special dedicated to genus *Astragalus* [PODLECH, 1987, 2008]. The name and author(s) of all the plant species in this paper follow the most recent field identification book for plants in Romania [SÂRBU & al. 2013].

Distribution

Astragalus pseudopurpureus is distributed in the middle part of Eastern Carpathian Mountains only. The next distribution points for this species, are given as they are:

● Şugău Gorges: "Piatra Glodului", between 800 m a.s.l. and 1300 m a.s.l. (meters above sea level) [GUŞULEAC, 1932; SOÓ, 1940; ŢOPA, 1953 (in herbarium BUCA), 1960, 1968 (in herbarium IAGB), 1969; HOREANU, 1979 a, b; NEGREAN, 2009 (in herbarium BUCM];

● Bicaz Gorges: "Piatra Panţârului", at 840 m a.s.l. [GUŞULEAC, 1932];

● Bicaz Gorges: "Dealul Glodului" and "Dealul Panţa", "in pineto", at cca 900 m a.s.l., leg. (collected, in latin language), at 28.V.1934 [BORZA, 1935];

● Munticelu [SOÓ, 1940];

● Surduc, at 1267 m a.s.l. [GUŞULEAC, 1932; NYÁRÁDY, 1937; LÖRINCZI & GERGELY, 1977];

● **?** Suhardul Mic, between 900 m a.s.l. and 1300 m a.s.l. [GUŞULEAC, 1932], Suhardul Mic above the chalet called "Suhard" [LÖRINCZI & GERGELY, 1977];

● **?** Poliţele Bardosului, at 1132 m a.s.l. [GUŞULEAC, 1932; SOÓ, 1940];

● **?** Suhardul Mare [SOÓ, 1940; BUCA];

● **?** Nemira Mountains, at Dărmăneşti [MITITELU & al. 1971, 1993; CHIFU & al. 1987];

● **?** "… Limestone rocks. E. Carpathians (near Târgu Mureş and Bacău)" [CHATER, 1968].

As a matter of fact, the locations of *Astragalus pseudopurpureus* known for sure till now, are the Şugău Gorges only, on different local points, as they are "Piatra Glodului" /known also as "Dealul Glodului"/ and "Piatra Panţârului" /known also as "Dealul Panţa"/ [GUŞULEAC, 1932]. This species was identified on the entire length of the ridge Munticelu in the recent years, having as a maximum distribuiton area (in terms of individual numbers and populations) in Şugău Gorges (which are the southernmost part of the Nature Reserve Munticelu-Şugău Gorges, Neamţ county) (Fig. 4 a, b).

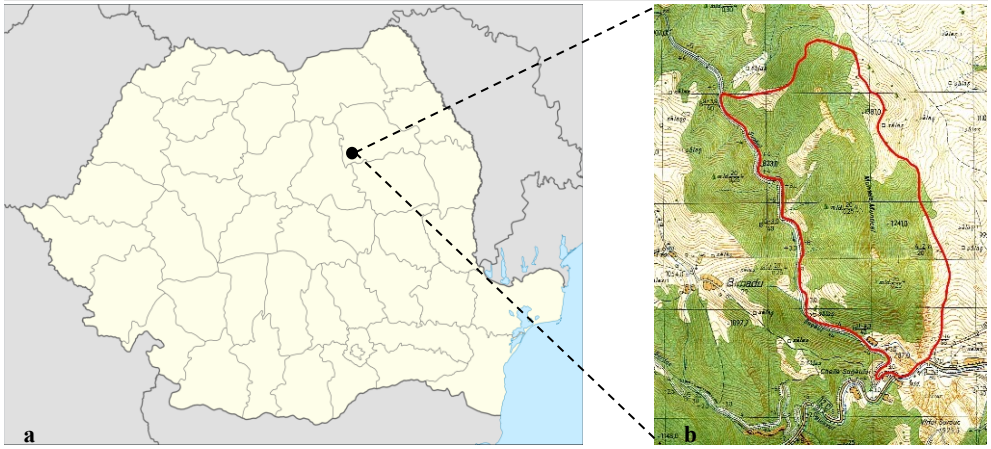

Fig. 4 a, b. Geographical location of the Nature Reserve Munticelu-Şugău Gorges (copyright: a) https://www.google.ro/search?q=harta+Romania&rlz; b) Romanian Mountain Club)

Plant ecology

a. *Geology*

Astragalus pseudopurpureus grows on limestone screes, moderately moisted, on medium inclined slopes, with various aspects, in lower mountain belt of vegetation (beech trees belt of vegetation), being in blossom in May-June, fruits reaching their maturity in July (sometimes, at the end of June).

The limestone screes are mobile or semi-mobile, with diameters of stones most often between 3 cm and 10-12 cm, underlying at the base of limestone walls of the Şugău Gorges (debris coming from the degradation of rocks or boulders detached walls).

The rocks are of upper age Jurassic limestones (Neocomian and Urgonian divisions), rich in fossils [CIOBANU & al. 1972; GRASU & al. 2010]. The peak called Munticelu is of 1387 m a.s.l.; the length of Şugău Gorges is about 350 m, with openings between the walls of 3-4 m only. There are also travertine rock formations situated at the northern part of the Şugău Gorges [OPREA & al. 2007].

b. *Pedology*

Lithomorphyc soils, of proto-rendzines and rendzines types, associated with outcrops of limestones and dolomites [BARBU & al. 1977].

c. *Climate*

Temperate-continental, with maximum absolute amplitudes, annual and diurnal quite large and winters over 4 months long. Annual average temperatures = cca 6 °C, the average annual precipipitations = cca 760 mm [HOREANU, 1979a].

The synthetic ecological factors that characterize this species, are the next ones: $L_9T_4U_3R_8N_x$, meaning that *Astragalus pseudopurpureus* is a plant growing in full sunlight (=heliophylous), in mountain and high mountain belts of vegetation (=mesothermal), on relatively dry soils at surfaces (=xero-mesophylous), usually indicative of limestone rocks (=neutral-basophylous) and euri-nitrophylous [SÂRBU & al. 2013].

Astragalus pseudopurpureus is accompanied by other plant species, normally growing among the limestone rock crevices, as: *Campanula carpatica*, *Hieracium pojoritense*, *Helictotrichon decorum*, *Androsace villosa* subsp. *arachnoidea*, *Silene zawadskii* and so on [LÖRINCZI & GERGELY, 1977].

Plant description

Astragalus pseudopurpureus is a perennial, hemicriptophyte, heliophylous, saxicolous, and calciphyluous plant species, 10-40 cm tall, with procumbent-ascending stems (Obs.: in "Flora României", vol. **V**, it is said that the stems are erected **!** [GUŞULEAC, 1957]); the stipules are connate around the stem at least on 1/3 of their length; the colour of corolla is bluish to violet, with standard weakly emarginate, of 17-18 mm long, keel connate, with a mucron at the apex on adaxial side; the fruit (legume) is of 10-15 mm long, villous, inflated at the rippen time (Fig. 1-2).

A black and white ink-drawing accompanies the description of the species in "Flora României", vol. **V**, page 283, fig. 1 a-e [GUŞULEAC, 1957].

The chromosoms number (2n) is unknown [DIHORU & NEGREAN, 2009].

Pathways of reproduction

It is an amphymictic and apomictic species, being reproduced by seeds and stolons, exhibiting also the phenomenon of polycormy; it is an allogamous, anemochorous, endozoochorous or barochorous species [DIHORU & NEGREAN, 2009]. This species does not produce viable seeds each year on the field, so the vegetative reproduction by stolons is more presumable.

Sozology

Astragalus pseudopurpureus is one of the very rare plant species in Romanian flora, being endemic for Eastern Carpathians (it is a Dacian floristic element), distributed in the mountain inferior belt of vegetation [BELDIE, 1967; ŢOPA, 1960]. It is an endangered (EN) plant species [DIHORU & NEGREAN, 2009].

Aspects on this topics are added in other papers [MANOLIU & al. 1979; HOREANU, 1979b; DIHORU & PÂRVU, 1987; DIHORU & NEGREAN, 2009], but with no any new or valuable information.

It is parasited by the fungus *Ovularia tuberculiformis* Höhnel 1987, matrix nova Negrean 2009 (in BUCM) [DIHORU & NEGREAN, 2009].

Specimens examined

Astragalus pseudopurpureus was collected for FRE, no. 1277, by the romanian botanist Emilian Ţopa, from Bicaz Gorges, on "Dealul Glodului" and "Dealul Panţa, in pineto", at cca 900 m a.s.l., in 1934. In herbarium IAGB (abbreviations according to Thiers [THIERS, 2009]) there is a single herbarium sheet only, under no. 4267, collected also by Emilian Ţopa, on July, the 2nd, 1968, from Şugău Gorges, on "Dealul Glodului" and "Dealul Panţir", at cca 900 m a.s.l. Another herbarium sheet (no. 10834) is in herbarium IASI, a specimen collected in Bicaz Gorges, on „Dealul Glodului and Dealul Panţa", on May, 28th, 1934, by the same Emilian Ţopa, for FRE [BORZA, 1935].

Phytosociology

From phytosociological point of view, *Astragalus pseudopurpureus*, has been previously attributed by various authors, either to Class *Elyno-Seslerietea* Br.-Bl. 1949 [CHIFU & al. 2006; SÂRBU & al. 2013) or to the Alliance *Seslerion bielzii* Br.-Bl. 1949 [SANDA & al. 1983], an alliance formerly named *Seslerion bielzii* (Pawł. 1935 em. A. Nyár. 1967) *calcophilum* I. Pop 1968 (also from Class *Elyno-Seslerietea* Br.-Bl. 1949) [SANDA & al. 1980].

Due to the fact that *Astragalus pseudopurpureus* is a strictly, local, and endemic species, located in Eastern Carpathians only, being accompanied by other endemic or near-

endemic plants, there is proposed a new syntaxon, namely subassociation ***astragaletosum pseudopurpurei*** **subass. nova** (ICPN, app. 1-11) [WEBER & al. 2000], subordinated to the association *Thymetum comosi* Pop et Hodişan 1963.

This plant association, *Thymetum comosi*, was originally named as "Asoc. *Thymus comosus*", by I. Pop and I. Hodişan [POP & HODIŞAN, 1963]. Later on, this association has received in synonymy [COLDEA, 1991, 1997], based on the Art. 25 of ICPN, the association *Galietum erecti*, initially described by I. Pop and collaborators, from Runc Gorges [POP & al. 1964b], and the association *Teucrietum montani*, described by I. Csűrös, from the Nature Reserve Scăriţa-Belioara [CSŰRÖS, 1958], under two names: "*Teucrietum montani*" in text of the paper, and "As. de *Teucrium montanum*" in table no. 5 attached to the same paper, based on the Art. 8, of ICPN [COLDEA, 1991, 1997].

The association *Thymetum comosi* Pop et Hodişan 1963, was described from Bulzeşti Gorges (Bihor-Vlădeasa Mountains) [POP & HODIŞAN, 1963]; it has also been identified in Runc Gorges (Gilău-Muntele Mare Mountains) [POP & al. 1964b], located on brown soils, rich in sand and gravel, of different sizes.

So far, within the plant association *Thymetum comosi* Pop et Hodişan 1963, there were described some infrataxa, as they are:

– subassociation *typicum* Coldea 1991 [COLDEA, 1991, 1997], described from Bulzeşti Gorges [POP & HODIŞAN, 1963]; it was cited also from Grohot Massif [ŞUTEU & FAUR, 1977], Runc Gorges [POP & al. 1964], Iadu valley [RAŢIU & al. 1984], Leaota Massif [DIACONESCU, 1973], and Tălmaciu-Podu Olt [SCHNEIDER-BINDER, 1970];

– subassociation *galietosum albi* (Pop et al., 1964b) Coldea 1991 [COLDEA, 1991, 1997], described from Runc Gorges [POP & al. 1964]; it was also identified in Vadu Crişului [BOŞCAIU & al. 1966], Râmeţ Gorges [ŞUTEU, 1968], Grohot Massif [ŞUTEU & FAUR, 1977], Iadu valley [RAŢIU & al. 1984], Sighiştel valley [POP & HODIŞAN, 1969], Ascunsa valley [POP, 1971], and Leaota Massif [DIACONESCU, 1973];

– subassociation *teucrietosum montani* (Csűrös 1958) Coldea 1991 [COLDEA, 1991, 1997] (syntaxon synonym association *Galio albi-Teucrietum montani* Ştefan et al. 2007 [ŞTEFAN & al. 2006-2007]), described from the Nature Reserve Scăriţa-Belioara [CSŰRÖS, 1958]; it was also cited from Crăciuneşti valley [POP & HODIŞAN, 1964a], Leaota Massif [DIACONESCU, 1973], and Bicaz Gorges/Eastern Carpathians [ŞTEFAN & al. 2006-2007].

There is a relatively high similarity of phytocoenoses with *Astragalus pseudopurpureus* from the Nature Reserve Munticelu-Şugău Gorges (Eastern Carpathians), with the phytocoenoses of the other subassociations (i. e. *typicum*, *galietosum albi*, *teucrietosum montani*), assigned to ass. *Thymetum comosi* Pop et Hodişan 1963 [POP & HODIŞAN, 1963]. Thus, we assumed that this new subassociation, *astragaletosum pseudopurpurei* subass. nova, is a vicariant one of the previous three syntaxa.

Coenotaxonomical framing of the newly proposed syntaxon is as follow:

Class *Thlaspietea rotundifolii* Br.-Bl. 1926

Order *Thlaspietalia rotundifolii* Br.-Bl. 1926

Alliance *Achnatherion calamagrostis* Br.-Bl. 1918

Association *Thymetum comosi* Pop et Hodişan 1963

– **subassociation** *astragaletosum pseudopurpurei* subass. nova

Holotype relevé: Tab. 1, relevé no. 5 (*****)

From phytosociologic point of view, *Astragalus pseudopurpureus*, together with all the other taxa belonging to association and alliance (e.g. *Teucrium montanum*, *Galium album*

subsp. *album*, *Geranium macrorrhizum* etc.), order (e.g. *Acinos alpinus* subsp. *alpinus*, *Gymnocarpium robertianum*), and class (e.g. *Carduus defloratus* subsp. *glaucus*, *Sedum telephium* subsp. *maximum* etc.), made a strong core of this new subassociation. Other taxa belong to alliance *Bromo-Festucion pallentis* (e.g. *Alyssum saxatile* subsp. *saxatile*, *Biscutella laevigata* subsp. *laevigata*, *Seseli libanotis* subsp. *libanotis* etc.) and to class *Festuco-Brometea* (e.g. *Anthemis tinctoria* subsp. *tinctoria*, *Centaurea stoebe* subsp. *australis*, *Teucrium chamaedrys*, *Campanula sibirica* subsp. *sibirica* etc.), indicating thus some xeric features of this habitat type. Other taxa are belonging to class *Asplenietea trichomanis* (e.g. *Asplenium ruta-muraria*, *Jovibarba heuffelii*, *Silene nutans* subsp. *dubia*, *Gypsophila petraea* etc.), thus indicating a series of species who entered here from the limestone walls surrounding the screes substratum of this new syntaxon. Other taxa are coming into the phytocoenoses of this coenotaxa from nearby, as: either from the meadows (many species belong to *Arrhenatheretalia* et *Molinio-Arrhenatheretea*: *Leucanthemum vulgare*, *Linum catharcticum* subsp. *catharcticum*, *Anthyllis vulneraria* subsp. *polyphylla* etc.), or forests (species belonging to *Querco-Fagetea*, *Vaccinio-Piceetea* and *Franguletea*: *Epipactis atrorubens* subsp. *atrorubens*, *Polygonatum verticillatum*, *Frangula alnus* juv., *Melica nutans* etc.), or from the weed communities (belonging to *Trifolio-Geranietea*, *Galio-Urticetea*, *Epilobietea*, or *Dauco-Melilotion*: *Geranium phaeum*, *Pteridium aquilinum*, *Cirsium erisithales*, *Epilobium montanum*, *Melilotus albus* etc.) (Tab. 1).

Tab. 1. The phytosociological table of association *Thymetum comosi* Pop et Hodişan 1963 subassociation *astragaletosum pseudopurpurei* subass. nova

***** = holotype relevé

Live's form	Geoelement	Relevé area (sq. m)	9	9	9	9	9
		Altitude (m a.s.l.)	1310	738	696	686	711
		Aspect	S	W	S	S-W	W
		Slope (degrees)	25°	30°	30°	20°	35°
		Herb layer coverage (%)	35	30	30	50	40
		Relevé no.	1	2	3	4	**5***
Difer. subass.							
H	End.	*Astragalus pseudopurpureus*	1	1	1	1	1
Achnatherion calamagrostis							
H	Centr. eur.-submedit.	*Teucrium montanum*	2	1	1	2	1
H	Eur.	*Galium album* subsp. *album*	+	+	+	+	+
H	Centr. eur.-medit.	*Melica ciliata* subsp. *ciliata*	-	+	+	+	+
T-Ht	Cosm.	*Geranium robertianum*	-	-	-	-	+
H	Euras.	*Origanum vulgare* subsp. *vulgare*	-	-	-	+	+
H	Pont.-medit.	*Scutellaria altissima*	-	-	-	-	+
H	Euras. cont.	*Vincetoxicum hirundinaria* subsp. *hirundinaria*	-	+	+	+	+
H	Alp.-carp.-balc.	*Geranium macrorrhizum*	-	+	-	-	-
Thlaspietalia rotundifolii							
H	Alp.-carp.	*Acinos alpinus* subsp. *alpinus*	-	-	-	+	+
G	Circ.	*Gymnocarpium robertianum*	-	-	-	-	+
Thlaspietea rotundifolii							
T-H	End. carp.	*Campanula carpatica*	-	+	+	-	+

H	E alp.-carp.	*Carduus defloratus* subsp. *glaucus*	+	-	-	+	+
Ch	Euras. arct.-alp.-eur.	*Saxifraga paniculata*	-	-	+	-	+
H	Eur.	*Sedum telephium* subsp. *maximum*	-	-	-	+	+
Ch	End. Romanian Carp.	*Thymus comosus*	-	-	-	+	+
Bromo-Festucion pallentis							
H	Grecia, Romania (E & S Carp.)	*Gentiana phlogifolia*	-	+	+	-	-
Ch	Cont. eur.	*Alyssum saxatile* subsp. *saxatile*	-	+	+	+	+
T-Ht	S-E Eur. (naturalized also in N Eur.)	*Sedum hispanicum*	-	+	+	+	-
H	Balc.-pan.	*Silene flavescens*	-	+	+	-	-
Ht	End. E Carp.	*Erysimum witmannii* subsp. *witmannii*	-	-	-	-	+
H (Ch)	Near-end. carp.(Romania, Ukraine)	*Dianthus spiculifolius*	-	+	+	-	-
H	Near-end. (Carp.)	*Dianthus tenuifolius*	-	-	+	+	+
H	Centr. eur. (mont.)	*Biscutella laevigata* subsp. *laevigata*	+	-	-	-	+
H	End. Romanian Carp.	*Helictotrichon decorum*	1	+	+	+	+
H	End. E Carp.	*Hieracium pojoritense* subsp. *pojoritense*	-	+	+	+	+
Ph	Eur. mont. - V As.	*Juniperus sabina*	-	+	+	+	+
H	Dacian / End. E Carp.	*Poa rehmannii*	-	-	+	+	+
H	Medit.	*Primula veris* subsp. *columnae*	+	-	-	-	-
H	Carp.-balc.	*Scrophularia heterophylla* subsp. *laciniata*	-	-	-	+	+
Ht-H	Euras. cont.	*Seseli libanotis* subsp. *libanotis*	-	+	+	+	+
H	Carp.-balc.	*Sesleria bielzii*	-	-	-	-	+
H	Centr. - S eur. (mont.)	*Pedicularis comosa* subsp. *comosa*	-	-	-	+	+
Stipo-Festucetalia pallentis							
H	Euras.	*Aconitum anthora*	-	-	-	+	+
G	Centr. eur.-submedit. (mont.)	*Allium lusitanicum*	+	-	+	-	-
H	Euras. cont.	*Carex humilis*	-	-	-	+	-

H	Centr. eur. (mont.)	*Festuca pallens* subsp. *pallens*	-	+	+	+	-
H	Alp.-eur.	*Kernera saxatilis* subsp. *saxatilis*	-	-	-	-	+
Ch	Centr. eur.-balc.-pont	*Minuartia setacea* subsp. *setacea*	-	-	-	+	+
H	Euras. cont.	*Thalictrum foetidum*	-	-	-	+	+
Festuco-Brometea							
H	Euras.	*Agrimonia eupatoria* subsp. *eupatoria*	-	-	-	+	-
H	Euras.	*Ajuga genevensis*	-	-	-	+	-
H	Euras. cont.	*Anthemis tinctoria* subsp. *tinctoria*	-	-	-	+	-
H	Centr. eur.-medit	*Asperula cynanchica*	-	-	-	+	-
Ht-H	Pont.-pan.-balc.	*Centaurea stoebe* subsp. *australis*	-	-	-	+	-
Ch	Eur.	*Helianthemum nummularium* subsp. *nummularium*	+	+	+	+	-
H	Pont.-pan.-balc.	*Inula ensifolia*	-	+	+	+	-
Ht-H	Euras. cont.	*Isatis tinctoria* subsp. *tinctoria*	-	-	-	-	+
H	Euras. (submedit.)	*Pimpinella saxifraga* subsp. *saxifraga*	-	-	-	+	-
H	Eur. cont.	*Potentilla heptaphylla*	+	-	-	+	-
H	Centr. eur.-medit.	*Salvia verticillata*	-	+	+	+	+
H	Pont.-medit.-centr. eur.	*Stachys recta* subsp. *recta*	-	-	-	+	+
Ch	Centr. eur. (submedit.)	*Teucrium chamaedrys*	-	+	+	+	
H	Euras. cont.	*Veronica teucrium* subsp. *teucrium*	-	+	+	-	+
Ht	Euras.	*Echium vulgare*	-	-	+	+	-
H	Carp.-balc.-cauc.-anat.	*Phleum montanum*	-	-	-	+	-
Ht	Euras. cont.	*Campanula sibirica* subsp. *sibirica*	-	+	+	+	+
Ht-H	Circ.	*Erigeron acris* subsp. *acris*	-	-	-	+	+
H	Pont.-pan.-balc.	*Linum flavum*	-	+	+	-	-
Asplenietea trichomanis							
H	Euras.	*Asplenium ruta-muraria*	-	+	+	-	+
H	Cosm.	*Asplenium trichomanes* subsp. *trichomanes*	-	-	-	-	+
Ch	Carp.-balc. (Dacian)	*Jovibarba heuffelii*	-	+	+	+	+
G	Circ.	*Polypodium vulgare*	-	-	+	-	+
H	End. Romanian Carp.	*Silene nutans* subsp. *dubia*	-	+	+	+	+

Ch	End. E Carp.	*Silene zawadzkii*	+	-	-	+	+
Ch	End. E & S Carp.	*Gypsophila petraea*	+	-	-	-	+
H	Euras.	*Sedum acre*	-	+	-	-	-
Arrhenatheretalia et Molinio-Arrhenatheretea							
H	Euras.	*Leucanthemum vulgare* subsp. *vulgare*	-	-	-	+	-
T-H	Eur.	*Linum catharcticum* subsp. *catharcticum*	-	+	+	-	-
H	Euras.	*Lotus corniculatus*	-	-	-	+	-
H	Euras.	*Potentilla erecta*	-	+	+	+	+
T	Eur.	*Trifolium campestre*	-	-	-	+	+
H	Euras. (submedit.)	*Valeriana officinalis*	-	-	-	+	+
H	Carp.-balc.	*Ranunculus montanus* subsp. *pseudomontanus*	+	-	-	+	+
H	Eur.	*Scabiosa columbaria* subsp. *columbaria*	-	-	+	+	+
G	Eur.	*Gymnadenia conopsea* subsp. *conopsea*	-	-	-	+	+
H	Eur. cont.	*Anthyllis vulneraria* subsp. *polyphylla*	-	-	-	-	+
Vaccinio-Piceetea							
H	Cosm.	*Athyrium filix-femina*	-	+	-	-	-
G	Euras.	*Epipactis atrorubens* subsp. *atrorubens*	-	-	-	-	+
Ph	Circ.	*Juniperus communis* subsp. *communis* juv.	-	-	-	-	+
Querco-Fagetea							
H	Eur.	*Carex muricata*	-	-	-	-	+
H	Euras	*Hieracium murorum* s. lato	-	-	-	-	-
H (G)	Euras.	*Melica nutans*	-	-	-	+	+
G	Euras.	*Platanthera bifolia*	-	+	-	-	-
G	Euras.	*Polygonatum verticillatum*	-	+	-	-	-
Ph	Eur.	*Ribes uva-crispa* subsp. *grossularia*	-	-	+	-	-
G	Euras.	*Polygonatum odoratum* subsp. *odoratum*	-	-	-	-	+
Franguletea							
Ph	Euras.	*Frangula alnus*	-	+	+	-	-
Trifolio-Geranietea							
H	Alp.-eur.	*Bupleurum falcatum* subsp. *falcatum*	-	+	+	+	+
H	Centr. eur.	*Geranium phaeum*	-	-	-	-	+
H	Eur. (mont.)	*Laserpitium latifolium*	-	-	-	+	+
G	Cosm.	*Pteridium aquilinum*	-	+	-	-	-
H	Circ.	*Solidago virgaurea* subsp. *virgaurea*	-	-	-	+	
Ht	Eur.	*Verbascum lychnitis* subsp. *lychnitis*	-	-	-	+	+

H	Euras	*Cruciata glabra* subsp. *glabra*	+	-	+	+	-
H	Centr. eur.-submedit.	*Coronilla varia*	-	+	+	+	+
H	Alp. eur.	*Geum urbanum*	-	+	-	-	-
Galio-Urticetea							
H	Centr. eur. (mont.)	*Cirsium erisithales*	-	-	-	-	+
H	Eur. cont.	*Sisymbrium strictissimum*	+	-	-	-	-
Epilobietea							
H	Euras.	*Epilobium montanum*	-	+	-	-	-
Rhamno-Prunetea							
Ph	Euras.	*Rhamnus catharcticus* juv.	-	-	-	-	+
Dauco-Melilotion							
Ht	Euras.	*Melilotus albus*	-	-	-	+	
T-H	Euras.	*Medicago lupulina*	-	-	-	+	+
Aliae							
H	Euras.	*Euphorbia cyparissias*	-	-	-	+	+

Date and place of relevés: May, 23rd, 2015, the Nature Reserve Munticelu - Şugău Gorges (Neamţ county)

i. The **differential species** for this newly proposed subassociation is *Astragalus pseudopurpureus*, which, together with the other species, edify pioneer phytocoenoses, covering the soil between 30% and 50%, sometimes even more.

Previously, *Astragalus pseudopurpureus* has been recorded in a single phytosociological relevé only, within the association *Calamintho baumgarteni-Galietum anisophylli* Beldie 1967, an association identified in Bicaz Gorges, as a characteristic species attributed to class *Elyno-Seslerietea* [ŞTEFAN & al. 2006-2007].

In a monography dedicated to flora and vegetation from Bicaz Gorges, Red Lake and Hăşmaş Mountains [NECHITA, 2003], *Astragalus pseudopurpureus* was not attributed to any coenotaxa.

ii. The **ecology** of these phytocoenoses is: slopes of various aspects (South, West, or South-West), with different slope degrees (from 20° to 35°), on surfaces of 10-15 sq. m, achieving coverages up to 50% of soil. All the species fits into a thin soil layer, mostly of them being heliophilous or helio-sciadophilous, xero-mesophilous, and calciphilous.

a) The live's forms spectrum of the new syntaxon shows the next value (both in terms of absolute figures and percentage): **H=62 (60,19%); Ch=10 (9,70%); G=9 (8,73%);** T-H=3 (2,91%); Ht=5 (4,85%); Ht-H=4 (3,88%); H(Ch)=1 (0,97%); T-Ht=2 (1,94%); Ph=5 (4,85%); H(G)=1 (0,97%); T=1 (0,97%) (in bold are given the prevailing categories) (Fig. 5).

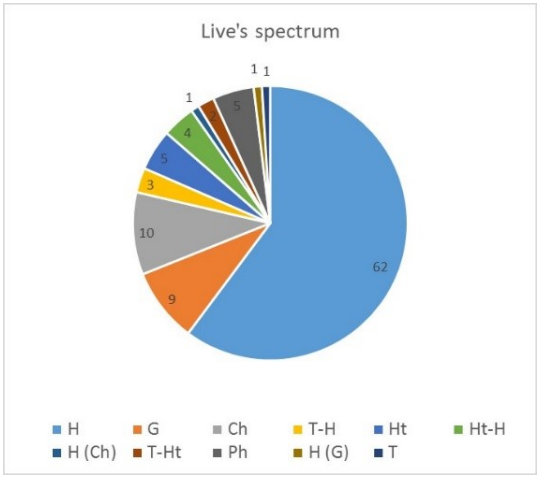

Fig. 5. The live's forms spectrum of subassociation *astragaletosum pseudopurpurei* subass. nova

b) The floristic elements (geoelements) spectrum of the new syntaxon shows the next value: **Euras.=34 (33%)**; **Eur.** (incl. eur. mont.)=**25 (24.27%)**; **Endemic=10 (9.70%)**; **Near-endemic=3 (2.91%)**; Centr. eur.-medit.-submedit.=11 (10.67%); Alp.-carp.-balc.=6 (5.82%); Pont.-pan.-balc.=5 (4.85%); Circ.=5 (4.85%); Cosm.=4 (3.88%) (in bold are given the prevailing categories) (Fig. 6). Beside the *Astragalus pseudopurpureus* itself, there are other several endemic or near-endemic species into the Romanian flora, (e.g. *Thymus comosus*, *Gentiana phlogifolia*, *Dianthus tenuifolius*, *Helictotrichon decorum*, *Poa rehmannii*, *Campanula carpatica* etc.), which increase the value of this new proposed subassociation.

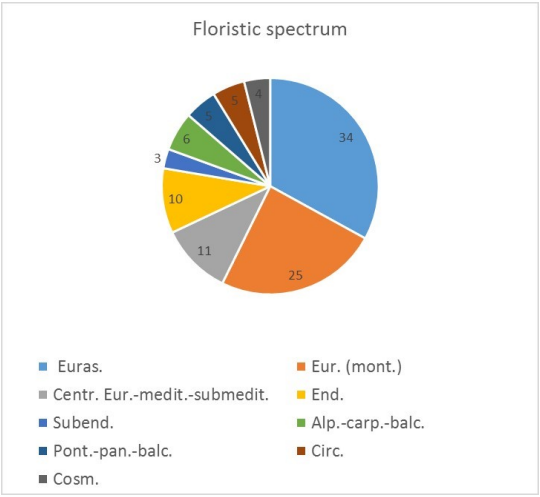

Fig. 6. The floristic elements spectrum of subassociation *astragaletosum pseudopurpurei* subass. nova

c) The soil moisture/humidity spectrum of the new syntaxon shows the next value: U_1=1 (0.97%); U_2=8 (7.76%); **U_3=31 (30.09%)**; **U_4=34 (33%)**; U_5=18 (14.47%); U_6=2

(1.94%); U_7=3 (2.91%); U_8=0; U_9=0; U_x=7 (6.79%) (in bold are given the prevailing categories) (Fig. 7).

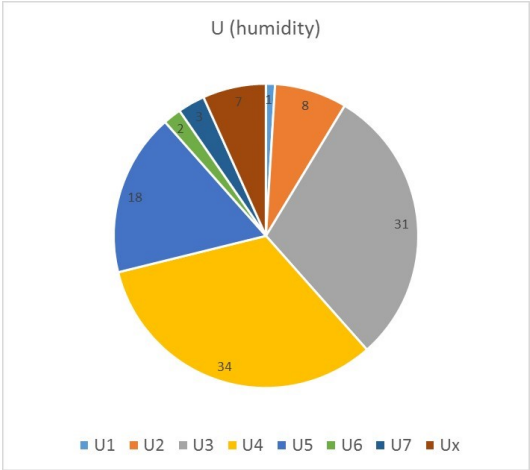

Fig. 7. The soil moisture spectrum of subassociation *astragaletosum pseudopurpurei* subass. nova

d) The temperature spectrum of the new syntaxon shows the next value: U_1=1 (0.97%); U_2=8 (7.76%); **U_3=31 (30.09%)**; **U_4=34 (33%)**; U_5=18 (14.47%); U_6=2 (1.94%); U_7=3 (2.91%); U_8=0; U_9=0; U_x=7 (6.79%) (in bold are given the prevailing categories) (Fig. 8).

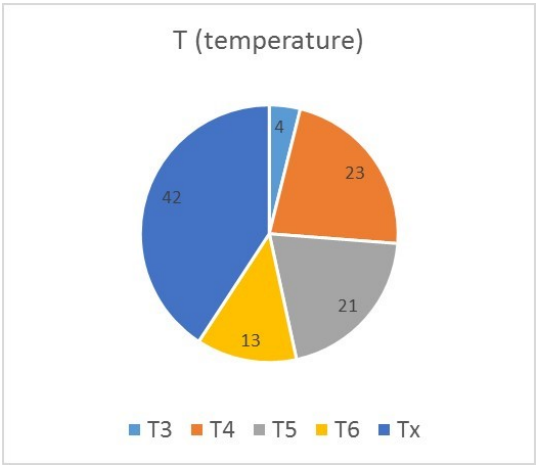

Fig. 8. The temperature spectrum of subassociation *astragaletosum pseudopurpurei* subass. nova

e) The *p*H soil spectrum of the new syntaxon shows the next value: R_1=0; R_2=1 (0.97%); R_3=1 (0.97%); R_4=4 (3.88%); R_5=8 (7.76%); R_6=13 (12.62%); **R_7=24 (23.30%)**; R_8=16 (15.53%); R_9=0; **R_x=36 (34.95%)** (in bold are given the prevailing categories) (Fig. 9).

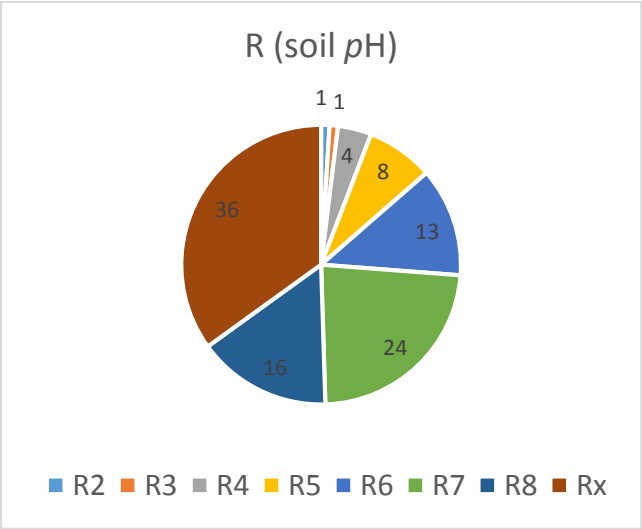

Fig. 9. The soil reaction (*p*H) spectrum of subassociation *astragaletosum pseudopurpurei* subass. nova

f) The light preferences spectrum of the of the plant species of the new syntaxon shows the next value: L_1=0; L_2=0; L_3=0; L_4=9 (8.73%); L_5=2 (1.94%); L_6=11 (10.67%); **L_7=35 (33.98%)**; **L_8=35 (33.98%)**; L_9=11 (10.67%) (in bold are given the prevailing categories) (Fig. 10).

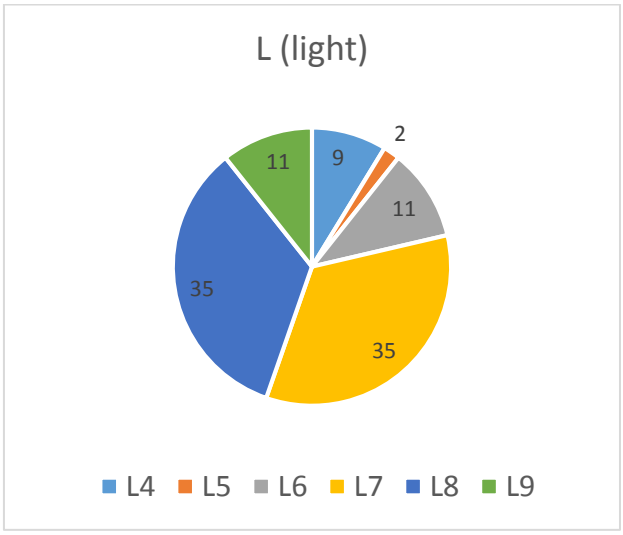

Fig. 10. The light spectrum of subassociation *astragaletosum pseudopurpurei* subass. nova

iii. The **distribution area** of this newly proposed infrataxa, subass. *astragaletosum pseudopurpurei*, is the Nature Reseve "Munticelu-Şugău Gorges" (Eastern Carpathians, Romania), solely.

Concerning the natural habitat of this new subassociation, it seems to be the best alloted to **8120** Calcareous and calcashist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) [Habitat Directive 92/43/EEC, 1992; GAFTA & al. 2008; European Commission, 2013] (Fig. 11-12).

Fig. 11. Calcashist stones habitat of subassociation *astragaletosum pseudopurpurei* subass. nova (Adrian Oprea)

Fig. 12. Calcareous screes habitat of subassociation *astragaletosum pseudopurpurei* subass. nova (Adrian Oprea)

From 2007, this nature reserve is a *Natura 2000* site, namely ROSCI0033 Cheile Şugăului-Munticelu [Ord. MESD, 2008], thus being protected the natural habitats, the most precious plant and animal species, as well as the natural landscapes, inside those 318 hectaries.

Conclusions

Astragalus pseudopurpureus is a very rare and endangered (EN) plant species, being endemic for Eastern Carpathians (Romania).

From phytosociological point of view, this species has been formerly attributed by various authors, to Class *Elyno-Seslerietea*, or to Alliance *Seslerion bielzii*.

It was made a proposal for a new coenotaxa in this paper, namely subassociation *astragaletosum pseudopurpurei* subass. nova, subordinate to the ass. *Thymetum comosi* Pop

et Hodişan 1963, alliance *Achnatherion calamagrostis*, order *Thlaspietalia rotundifolii*, and class *Thlaspietea rotundifolii*.

The differential species for this new subassociation is *Astragalus pseudopurpureus*.

The phytocoenoses are installed on limestone screes, on various aspects (South, West, or South-West), with different slope degrees (from 20° to 35°).

All the plant species fits into a thin soil layer, mostly of them being heliophilous or helio-sciadophilous, xero-mesophilous, and calciphilous.

Phytocoenoses of this new subassociation are distributed on nature reserve Munticelu-Şugău Gorges (Neamţ county, Romania) only.

The natural habitat of this subassociation is **8120** Calcareous and calcashist screes of the mountain to alpine levels (*Thlaspietea rotundifolii*).

Abbreviations used in this paper:

BUCA – herbarium of the Institute of Biology Bucharest, Romanian Academy
BUCM – mycological herbarium of the Institute of Biology Bucharest, Romanian Academy
FRE – Flora Romaniae Exsiccata
I – herbarium of the University "Alexandru Ioan Cuza", Iaşi, Romania
IAGB – herbarium of the Botanic Garden "Anastasie Fătu" - University "Alexandru Ioan Cuza", Iaşi, Romania
ICPN – International Code of Phytosociological Nomenclature
NGO – Non-Guvernamental Organisation
Ord. MESD – Order of the Minister of Environment and Sustainable Development

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