

**ECO-COENOTIC STUDY ON THE *AQUILEGIA NIGRICANS* BAUMG.
SSP. *SUBSCAPOSA* (BORB.) SOÓ TAXON FROM THE
GILĂU-MUNTELE MARE MOUNTAINS (APUSENI MOUNTAINS)**

*Sorana HENTEA*¹, *Irina GOIA*², *CSERGŐ Ana-Maria*¹ *Alexandra ȘUTEU*¹,
*Mihai PUȘCAȘ*¹, *Florin CRIȘAN*², *Vasile CRISTEA*²

¹ Universitatea “Babeș-Bolyai”, Grădina Botanică “Alexandru Borza”
str. Republicii, nr. 42, RO-3400 Cluj-Napoca

² Universitatea, “Babeș-Bolyai”, Facultatea de Biologie și Geologie,
Catedra de Biologie Vegetală, str. Republicii, nr. 42, RO-3400 Cluj-Napoca

Abstract: The study evaluates the presence of the *Aquilegia nigricans* ssp. *subscaposa* taxon in the Gilău-Muntele Mare Mountains, characterizes the ecoenotic environment of populations, the spatial distribution of the individuals, and proposes protection measures.

A new locality and two associations unreported by the literature were identified to shelter this taxon. *Aquilegia nigricans* ssp. *subscaposa* is positively correlated with a high number of species from the coenoses where it develops (*Linum austriacum*, *Plantago media*, *Campanula rotundifolia*, *Veronica austriaca*, *Senecio jacobea*, *Polygonatum odoratum*, etc). The absence of aggregation on the forest border and an aggregation tendency ranging between 60-90 cm on the grassland were found. Due to the small surfaces occupied by the populations of this taxon, its rare status (R) is considered justified.

Introduction

Aquilegia nigricans ssp. *subscaposa*, an endemic taxon with a Carpathian distribution area restricted to Romania [5,24,27,28,29], was described and published as a new species under the name of *Aquilegia subscaposa* [3], by Borbás, following his researches in the Apuseni Mountains. In 1943, it was subordinated by Soó to the *A. nigricans* Baumg. species [29], and in 1947, by Borza, to the *A. vulgaris* L. species [3,27].

On the red lists of Cormophytes from Romania, the endemic columbine is mentioned as a rare [4, 18, 19] or vulnerable/rare [12] taxon.

Two forms of this subspecies are described [27]: f. *eusubscaposa* A. Nyár. and f. *virgatoramosa* A. Nyár., which are differentiated by the morphology of their stem leaves, as well as by the number of flowers on the stem.

Initially reported in the Scărița-Belioara Mountains (Șesul Craiului, Poșaga de Sus locality), where it was collected by Simonkai, G. and J. Wolff, Péterfi, Borza, Nyárády [2,3,27], *Aquilegia nigricans* ssp. *subscaposa* was subsequently identified and reported from other localities of the Apuseni Mountains: Cheile Runcului [15,16,20], Cheile Pociovaliștei [16], Colții Vulturesei [27], Trascău -

Bedelevu Mountains, on the Piatra Pleșorii [13,14] and Cheile Râmețului [25,26], as well as from the Bucegi Mountains [1].

Our researches, performed in the period 2001-2002, focused on the area along the basins of the Runc and Poșaga valleys and on the Scărița-Belioara Mountains.

This study aimed to: 1. evaluate the presence of the taxon in the Gilău-Muntele Mare Mountains; 2. characterize the ecocoenotic environment of this taxon's populations; 3. determine its spatial distribution in the plant communities found; 4. reevaluate its protective status.

Methods

The phytocoenological study was performed based on phytosociological records, according to the method of the Central European school. The assignment to different associations followed both the classical method, based on characteristic species, and modern methods, a dendrogram being drawn (based on the Sorensen index, average linkage algorithm) using the SYN-TAX 5.0 [32] software. The correlations with the species existing in the phytocenotic environment, calculated by means of the Spearman's coefficient, allowed for the construction of a constellation that showed the ecocoenotic nucleus of the subspecies.

In order to analyze spatial distribution and formulate plausible hypotheses, two test surfaces of 25 m² each were selected, which were considered to be the most representative ones, situated on the border of a common oak-beech forest (tab. 1, relevé 14) and on a grassland (tab. 1, relevé 10), on the Tîlva Valley.

The position of each individual was determined on these surfaces, by measuring the distance between the individuals and the borders of the test surface.

Population correlations and statistical processing were performed using the SAS/Stat 7.0 - Online Doc module [33].

Results and discussion

a. Corology. *Aquilegia nigricans* Baumg. ssp. *subscaposa* (Borb.) Soó was found in Scărița-Belioara and Cheile Runcului. It was not identified in Colții Vulturesei and Cheile Pociovaliștei. However, it was reported from a new locality, on the Tîlva Valley, at its confluence with the Pociovaliștei Valley (Runc basin).

b. Ecocoenotic characterization. Although in the researched territory, *Aquilegia nigricans* ssp. *subscaposa* was reported in the phytocoenoses of 6 plant associations [7,8,9,10,11,13,16,17,20], following field researches, this taxon was identified only in two of these associations: *Asperulo capitatae* - *Seslerietum rigidae* (Scărița-Belioara) and *Agrostio* - *Festucetum rubrae* (Tîlva Valley), but at Scărița-Belioara, it was also reported by us in two other associations: *Scorzonero roseae* - *Festucetum nigricantis* (Pușcaru et al. 1956) Coldea 1987 and *Festuco* - *Caricetum humilis* Csűrös et Kovács 1962.

The plant associations in which the subspecies was reported were included in the following coenotaxonomic conspectus [6,21,22]:

- SESLERIETEA ALBICANTIS** Br. - Bl. 1948 em. Oberd. 1926
 SESLERIETALIA ALBICANTIS Br. - Bl. 1926
Seslerion rigidae Zólyomi 1939
 1. *Helictotrichetum decori* Domin 1932
 2. *Asperulo capitatae - Seslerietum rigidae* (Zólyomi 1939) Coldea 1991
 (Syn.: *Thymo comosi - Seslerietum rigidae* (Zólyomi 1939) Pop et Hodişan 1985)
- MOLINIO - ARRHENATHERETEA** Tx. 1937
 ARRHENATHERETALIA Pawl. 1928
Cynosurion cristati Br - Bl. et Tx. 1943
 3. *Agrostio - Festucetum rubrae* Horv. (1951) 1952
- FESTUCO - BROMETEA** Br. - Bl. et Tx. 1943
 FESTUCETALIA VALESIIACAE Br. - Bl. et Tx. 1943
Festucion rupicolae Soó (1929 n.n.) 1940 corr. Soó 1964
 4. *Festuco rupicolae - Caricetum humilis* Csűrös et Kovács 1962
- NARDO - CALLUNETEA** Prsg. 1949
 NARDETALIA Oberd. 1949
Potentillo - Nardion Simon 1957
 5. *Scorzonero roseae - Festucetum nigricantis* (Puşcaru et al. 1956) Coldea 1987
- QUERCO - FAGETEA** Br. - Bl. et Vlieger 1937 em. Soó 1964
 FAGETALIA SILVATICAE (Pawl. 1928) Tx. et Diem. 1936
Symphyto - Fagion Vida 1959
 Moehringio muscosae - Acerenion Boşcaiu et al. 1982
 6. *Aceri - Fraxinetum* Tx. 1937
 (Syn.: *Acereto - Ulmetum* Beldie 1951)
 Symphyto - Fagenion (Vida 1959) Soó 1964
 7. *Pulmonario rubrae - Abieti - Fagetum* Soó 1964
- ERICO - PINETEA** Horv. 1959
 ERICO - PINETALIA Horv. 1959
Erico - Pinion Br. - Bl. 1939
 8. *Seslerio - Pinetum sylvestris* Csűrös 1958

The presence of the subspecies in the association *Asperulo capitatae - Seslerietum rigidae* (Zólyomi 1939) Coldea 1991, reported in the literature from Scăriţa-Belioara, Cheile Pociovaliştei and Cheile Runcului, was only confirmed at Scăriţa-Belioara. In spite of a thorough investigation of Cheile Runcului, only three individuals of the endemic columbine were found grouped under a *Rosa canina* shrub.

The phytocoenoses of this chalcophilic plant association are situated at an altitude of approximately 1330 m, on slopes with 2° - 10° inclination and SSE-SSW exposure, with a pH ranging between 6.17 and 6.29. On the plateau of the reserve, the structure of these grasslands is strongly marked by cattle pasturing, which will be reflected in time by a strong nitrosation of the soil and an alteration in the structure of phytocoenoses. Along with *Sesleria rigida* ssp. *rigida*, *Helictotrichon pubescens* and *Briza media* are also found. It can be estimated that the high number of species (64) of this phytocoenosis, in relation to the mean number of seslerietea species, is given by the infiltration of grassland and nemoral species, in addition to that of calcareous rock species (Tab. 1).

In the phytocoenoses of the association *Agrostio - Festucetum rubrae* Horv. (1951) 1952, the endemic columbine is mentioned in Cheile Runcului. Our researches have also shown this taxon on the Tîlva Valley, in the same ecocoenotic environment.

In the coenoses of this association, *Aquilegia nigricans* ssp. *subscaposa* is present at an altitude of approximately 480 m, on slopes with moderate inclination ($12^\circ - 30^\circ$), on sunny slopes (SW), with well structured vegetation (Tab. 1). The soil is skeletal, with a 7.17 pH value.

The association *Festuco rupicolae - Caricetum humilis* Csűrös et Kovács 1962 was identified in the close proximity of the Scărița-Belioara reserve, on a sunny slope, with skeletal soil and 5.68 pH. The species characteristic of *Molinio - Arrhenatheretea* and *Seslerietalia* (Tab. 1) are well represented in this phytocoenosis.

The phytocoenosis of the *Scorzonero roseae - Festucetum nigricantis* association (Pușcaru et al. 1956) Coldea 1987 was analyzed outside the reserve, on the NE slope, towards Colțul Negru, where *Nigritella nigra* (L.) Rchb. ssp. *rubra* (Wettst.) Beauv. is also present. Due to its relatively high pH value (6.32) and higher xerophytisation, this phytocoenosis is marked by the presence of species characteristic of *Seslerietalia*, by the abundance of the *Carex humilis* species, as well as by the absence of some *Potentillo - Nardion* species (Tab. 1).

The dendrogram (Fig. 1) shows two groupings (a, b), corresponding to a large extent to the associations *Asperulo capitatae - Seslerietum rigidae* and *Agrostio - Festucetum rubrae*. A third grouping (c) includes three records: two of them are ranged into *Festuco - Caricetum humilis* and *Scorzonero roseae - Festucetum nigricantis*, and the third into *Asperulo capitatae - Seslerietum rigidae*. This one is separated from the main grouping, probably due to the different vegetation periods where the records were performed.

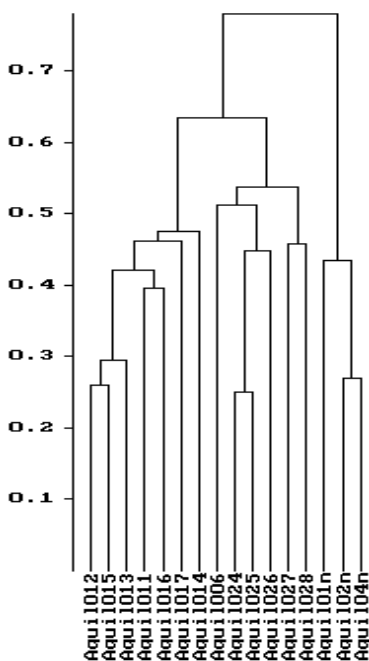


Fig. 1. Dendrogram (Sorensen similarity index, average linkage algorithm) of the analyzed phytocoenoses: 1-8: *Asperulo capitatae - Seslerietum rigidae*; 9-14: *Agrostio - Festucetum rubrae*; 15: *Festuco - Caricetum humilis*; 16: *Scorzonero roseae - Festucetum nigricantis* (Tab. 1).

From an ecological point of view, *Aquilegia nigricans* ssp. *subscaposa* is preferentially integrated in xeromesophilic grass phytocoenoses, where the number of mesophilic species is also significant. From a thermal point of view, micromesothermal species are dominant in the analyzed phytocoenoses, followed in the case of the association *Agrostio - Festucetum rubrae* by eurythermal species [20, 23].

Concerning the chemical reactivity of the substrate (pH values range between 5.68 - 7.17), the coenotic environment where the Carpathian columbine is found is dominated by weakly acid-neutrophilic species. Given these findings, we believe that the value of the R ecological index should be reconsidered, from **R_{3,5}** [21] to **R₄**. Thus, the values of the main ecological indices would be: **U_{2,5} T₂ R₄**.

1-8 - *Asperulo capitatae - Seslerietum rigidae* (Zólyomi 1939) Coldea 1991

9-14 - *Agrostio - Festucetum rubrae* Horv. (1951) 1952

15 - *Festuco - Caricetum humilis* Csűrös et Kovács 1962

16 - *Scorzonero roseae - Festucetum nigricantis* (Puşcaru et al. 1956) Coldea 1987

Table 1.

Relevé	1*11	2*12	3*13	4+14	5	6	7	8	9	10	11	12	13	14	15	16
Altitude (m)	1350	1350	1350	1360	1350	1360	1360	1320	480	480	480	480	480	490	1310	1300
Exposure	SSE	SSE	SSE	SSE	SSE	SSE	SSE	SSV	SV	SV	SV	SV	SV	SV	S	NE
Slope (°)	5	5	7	10	5	3	5	2	30	12	12	30	15	30	15	15
Surface (m) ²	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Cover (%)	80	75	90	70	90	80	85	100	100	100	98	95	60	65	95	90
Car. ass.																
<i>Asperula capitata</i>	+	+	.	+	+	.	+	+	+	.	.	.	.	.	+	.
<i>Sesleria rigida</i> ssp.rigida	3	3	3	3	2-3	2-3	3	2	.	.	.	.	.	.	1	+
<i>Agrostis tenuis</i>	.	.	.	.	.	.	.	.	2	3	2-3	3	1-2	2	.	.
<i>Festuca rubra</i> incl.	1	1	1	1	1	+	+	.	3	2	2	1-2	1	1	+	3
<i>nigricans</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Nardus stricta</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
<i>Festuca rupicola</i>	.	.	.	.	.	+	.	+	.	.	.	.	.	.	2	.
<i>Carex humilis</i>	.	+	.	.	1	.	.	+	+	+	.	+	.	.	3	2
Seslerietalia, Seslerio-Festucetalia pallentis, Seslerion rigidae																
<i>Acinos alpinus</i> ssp. alpinus	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+
<i>Ranunculus oreophylus</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+
<i>Aster alpinus</i>	.	+	+	+	+	.	+	.	.	.	.	.	.	.	+	.
<i>Carduus defloratus</i>	+	+	+	+	+	+	.	.	.	+	.	.	.	.	+	+
ssp. glaucus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Centaurea pinnatifida</i>	.	+	.	.	.	.	.	+	.	.	.	.	.	.	+	+
<i>Helianthemum alpestre</i>	.	+	+	+	+	+	+	.	+	1	+	+	.	.	.	.
<i>Minuartia verna</i>	+	.	.	.	.	+	.	.	+	.	+	+	.	.	+	.
<i>Phyteuma orbiculare</i>	+	.	.	.	.	.	+	+	.	+	+	.	.	.	+	+
<i>Festuca pallens</i>	+	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Melica ciliata</i>	+	+	.	+	+	+	+	.	.	.	.	.	.	.	.	.
<i>Thymus comosus</i>	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.
<i>Alyssum repens</i>	+	.	+	+	.	.	.	.	+	+-1	.	.	.	.	.	.
ssp. transilvanicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Seseli rigidum</i>	.	.	1	+	+	+	+	.	.	.	.	.	.	.	.	.
<i>Centaurea triumfettii</i>	+	+	+	+	+	+	+	+	+	+	+	1	+	+	.	+
<i>Biscutella laevigata</i> + (16), <i>Trisetum alpestre</i> + (15, 16), <i>Seseli gracile</i> + (2, 6), <i>Saxifraga marginata</i> + (7), <i>Viola jooi</i> + (1, 2), <i>Allium flavum</i> + (7, 12)																
Molinio-Arrhenatheretea, Arrhenatheretalia, Molinietaalia																
<i>Linum catharticum</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+
<i>Lotus corniculatus</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+
<i>Plantago lanceolata</i>	.	+	+	+	+	.	.	.	+	.	+	.	.	+	.	.
<i>Prunella vulgaris</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+
<i>Achillea millefolium</i>	.	+	+	.	+	.	.	+	+	+	+	.	.	+	+	+
<i>Knautia arvensis</i>	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.
<i>Leucanthemum vulgare</i>	.	.	.	+	+	.	.	+	+	.	.	.	.	+	+	+

Helianthemum nummularium	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	+	+
Hepatica nobilis	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Hieracium murorum	.	.	.	+	.	.	.	.	+	.	.	+	.	+	.	.	.
Hieracium pilosella	.	.	.	.	.	.	.	.	.	.	+	.	.	1	+	+	+
Hieracium piloselloides	+	+	+	+	.	+	+	.	+	+	+	.	.	+	.	.	.
Hieracium transsilvanicum	.	.	.	+	.	.	+	.	.	+	+	.	.	.	.	.	.
Hypericum perforatum	.	+	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.
Juniperus communis	.	.	+	.	1	+	+	+	.	.	.	.	.	.	.	+	.
Kernera saxatilis	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.
Lembotrops nigricans	.	.	.	.	.	.	.	.	+	.	+	+	+	1	.	.	.
Leontodon crispus	+	.	.	.	.	+	+	.	+	.	.	+	.	+	.	.	.
Linum austriacum	.	.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	.
Linum flavum	+	+	+	.	+	+	+	+	.	+	+	+	.	.	+	.	.
Linum tenuifolium	+	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.
Medicago lupulina	.	.	.	.	.	.	+	.	+	.	.	.	.	+	.	.	.
Paronychia cephalotes	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.
Pedicularis comosa	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+
Peucedanum austriacum	+	+	.	+	+	+	+	+	.	.	.	+	+	.	.	.	.
Peucedanum longifolium	.	.	.	.	.	.	.	.	.	+	+	+	+	+-1	.	.	.
Peucedanum oreoselinum	+	+	+	+	+	+	+	+	+	+	+	.	+	.	.	.	.
Phleum montanum	+	+	+	.	+	.	+	.	.	+	+	+	.	+	.	.	.
Plantago media	.	+	+	.	+	1	1	.	1	+-1	+-1	1	+	+	+	+	+
Poa trivialis	.	.	.	.	.	.	.	.	.	1	1	1	1	.	.	.	.
Polygala amara	+	.	+	+	+	.	.	.	+	.	.	.	.	+	.	.	.
Polygonatum odoratum	.	.	.	.	.	.	+	.	+	.	+	+	+	.	.	.	.
Potentilla recta	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.
Potentilla reptans	.	.	.	.	.	+	.	.	+	.	.	+	+	+	.	.	.
Primula veris	+	+	.	+	+	+	+	+	+	+	.	+	+	+	+	+	+
ssp. columnae																	
Pulsatilla grandis	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
Ranunculus repens	.	+	.	1	+	.	1	.	.	.	.	.	.	.	.	.	.
Salvia verticillata	+	+	+	.	+	+	.	.	+	+	+	1	1	+	.	.	.
Scabiosa columbaria	+	+	+	.	+	.	+	+	+	+	.	.	.	+	+	+	+
ssp. pseudobanatica																	
Scabiosa ochroleuca	.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	.	.
Sedum acre	.	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.
Senecio jacobaea	+	.	.	.	+	+	+	.	+	+	+	+	.	.	.	.	.
Seseli annuum	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.
Seseli pallasii	.	.	+	.	.	.	.	.	.	.	.	+	.	+	.	.	.
Succisa pratensis	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Tanacetum corymbosum	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.	+	+
Thalictrum minus	.	+	+	+	+	+	1	.	+	+	+	+	+	.	.	.	.
Thymus pulegioides	.	.	+	.	1	1	+	.	+	.	.	.	.	+	.	.	.
Trifolium pratense	.	+	.	.	+	.	+	.	+	+	+	+	.	+	.	.	.
Valeriana sambucifolia	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.
Veronica austriaca	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.
Holcus lanatus	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+
Hypochoeris maculata	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+
Rhinanthus minor	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+
Stellaria graminea	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+
Varia species, k<13%:																	
<i>Asplenium ruta-muraria</i> + (5), <i>Corylus avellana</i> + (13), <i>Silene nutans</i> ssp. <i>dubia</i> + (11), <i>Senecio rupestris</i> + (9, 11), <i>Vincetoxicum hirundinaria</i> + (9, 12), <i>Acer campestre</i> + (13), <i>Acinos arvensis</i> + (4), <i>Alyssum montanum</i> ssp. <i>montanum</i> + (13), <i>Arctostaphylos uva-ursi</i> + (2, 3), <i>Arenaria serpyllifolia</i> + (10, 11), <i>Betula pendula</i> + (10, 11), <i>Calluna vulgaris</i> + (7); 1 (4), <i>Campanula rapunculoides</i> + (14), <i>Cardaminopsis arenosa</i> + (12), <i>Centaurea melanocalathia</i> + (2), <i>Clematis vitalba</i> + (13), <i>Cornus mas</i> + (13), <i>Crocus banaticus</i> + (1, 7), <i>Cruciata glabra</i> + (8, 9), <i>Daphne cneorum</i> + (1, 6), <i>Echium vulgare</i> + (9), <i>Epipactis helleborine</i> + (12), <i>Fagus sylvatica</i> 1 (13), <i>Fragaria vesca</i> + (10), <i>Galeopsis angustifolia</i> + (13, 14), <i>Genista tinctoria</i> + (12), <i>Geranium sanguineum</i> +																	

(12), *Helianthemum rupifragum* 1 (1), *Inula ensifolia* 1 (6); + (7), *Jovibarba sobolifera* + (1, 5), *Larix decidua* + (5), *Luzula sylvatica* + (13, 14), *Lysimachia nummularia* + (13, 14), *Melampyrum bishariense* + (9), *Moehringia trinervia* + (13, 14), *Molinia caerulea* + (7), *Pinus sylvestris* + (6, 8), *Poa pratensis* + (8, 12), *Polygala major* + (9), *Polygonatum latifolium* + (7, 9), *Prunus spinosa* + (6), *Ranunculus auricomus* + (11), *Rhinanthus rumelicus* + (6, 9), *Rosa canina* + (7), *Sambucus nigra* + (13), *Sanguisorba officinalis* + (9), *Sedum album* + (3, 7), *Stachys germanica* + (12), *Tanacetum vulgare* + (11), *Trifolium fragiferum* + (14), *Trifolium medium* + (9), *Vaccinium vitis-idaea* + (1, 7), *Viola alba* + (9, 11), *Viola arvensis* + (6), *Viola reichenbachiana* + (13), *Alchemilla vulgaris* ssp. *montana* + (15, 16), *Carex pilulifera* + (8); 1 (16), *Cerastium caespitosum* + (15, 16), *Cirsium oleraceum* + (8), *Crepis praemorsa* 1 (8), *Crocus heuffelianus* + (16), *Galium molugo* + (16), *Gentiana asclepiadea* + (16), *Helictotrichon pubescens* 2 (8); + (16), *Hieracium caesium* + (16), *Leontodon asper* + (15), *Lilium martagon* + (8, 15), *Mellitis melissophyllum* + (8), *Orchis militaris* + (8), *Picea abies* + (8), *Polygonum aviculare* + (8), *Ranunculus polyanthemos* + (8, 15), *Senecio integrifolius* + (8), *Silene italica* ssp. *nemoralis* + (8), *Thymus austriacus* + (15), *Thymus marschallianus* + (15, 16), *Trifolium alpestre* + (8, 15), *Trisetum flavescens* + (8), *Brachytecium salebrosum* + (8, 16), *Ctenidium molluscum* + (16), *Dicranum bonjeanum* + (8), *Dicranum polysetum* + (16), *Ditrichum flexicaule* + (16), *Ditrichum flexicaule* var. *densum* + (15), *Hylocomium splendens* + (16), *Hypnum cupressiforme* + (15, 16), *Plagiomnium rostratum* + (8), *Pleurozium schreberi* + (8, 16), *Rhytidiadelphus triquetrus* + (8, 16), *Rhytidium rugosum* + (15, 16), *Thuidium philibertii* + (16), *Thuidium abietinum* + (15, 16), *Tortella tortuosa* + (8, 16), *Weissia brachycarpa* + (15), *Cetraria islandica* + (15), *Cladonia furcata* + (16).

Localities and data of the relevés: 1-7 - Şesul Craiului, 30.08.2001; 8, 15 - Şesul Craiului, 19/20.06.2002; 9 - V. Tîlvei, 24.07.2001; 10-14 - V. Tîlvei, 1.09.2001; 16 - spre Colţul Negru, 21.06.2002.

The ecocoenotic analysis showed the presence of this taxon in the *habitat type no. 6170* [31], i.e. **36.41-36.43 PAL CLASS** [30] - *open xerothermophilic, chalcophilic alpine and subalpine grasslands, on base-rich soils.*

It should be mentioned that according to literature, this subspecies appears in Romania in a particular type of habitat (characterized by the phytocoenoses of the *Helictotrichetum decori* association) which is not included in the synthesis for the European Union, which is explained by the endemic character of the association.

Based on the calculated correlations, it was shown that in the analyzed communities, *Aquilegia nigricans* ssp. *subscaposa* had no negative correlations and was positively correlated with a high number of species: *Linum austriacum*, *Plantago media*, *Campanula rotundifolia*, *Veronica austriaca*, *Senecio jacobea*, *Polygonatum odoratum*, *Filipendula vulgaris*, *Centaurea phrygia*, etc. (Fig. 2). These results demonstrate the high coenotic cohesion and the complex structure of phytocoenoses.

c. Spatial distribution. Based on the analysis of spatial distribution, the individuals situated on the common oak-beech forest border were shown to manifest no aggregation tendency (Fig. 3), probably due to the reduced number of seeds or/and the more reduced germinative capacity, under the conditions of a more shaded environment (Fig. 4).

However, on the test surface situated on the grassland, which includes a high number of xeromesophilic species, individuals show an aggregation tendency, at a scale ranging between 60-90 cm (Fig. 5). This different situation is probably due to the open character of this community and to the presence of the rocks at the surface, the individuals occupying the spaces between them, on surfaces with a thicker soil layer (Fig. 6).

The confirmation of these results should be completed with the analysis of the number of seeds (an increased number of flowers does not always involve an increased seed production) and of the influence of some environmental factors on their dispersion capacity as well as on the multiplication capacity of the studied taxon.

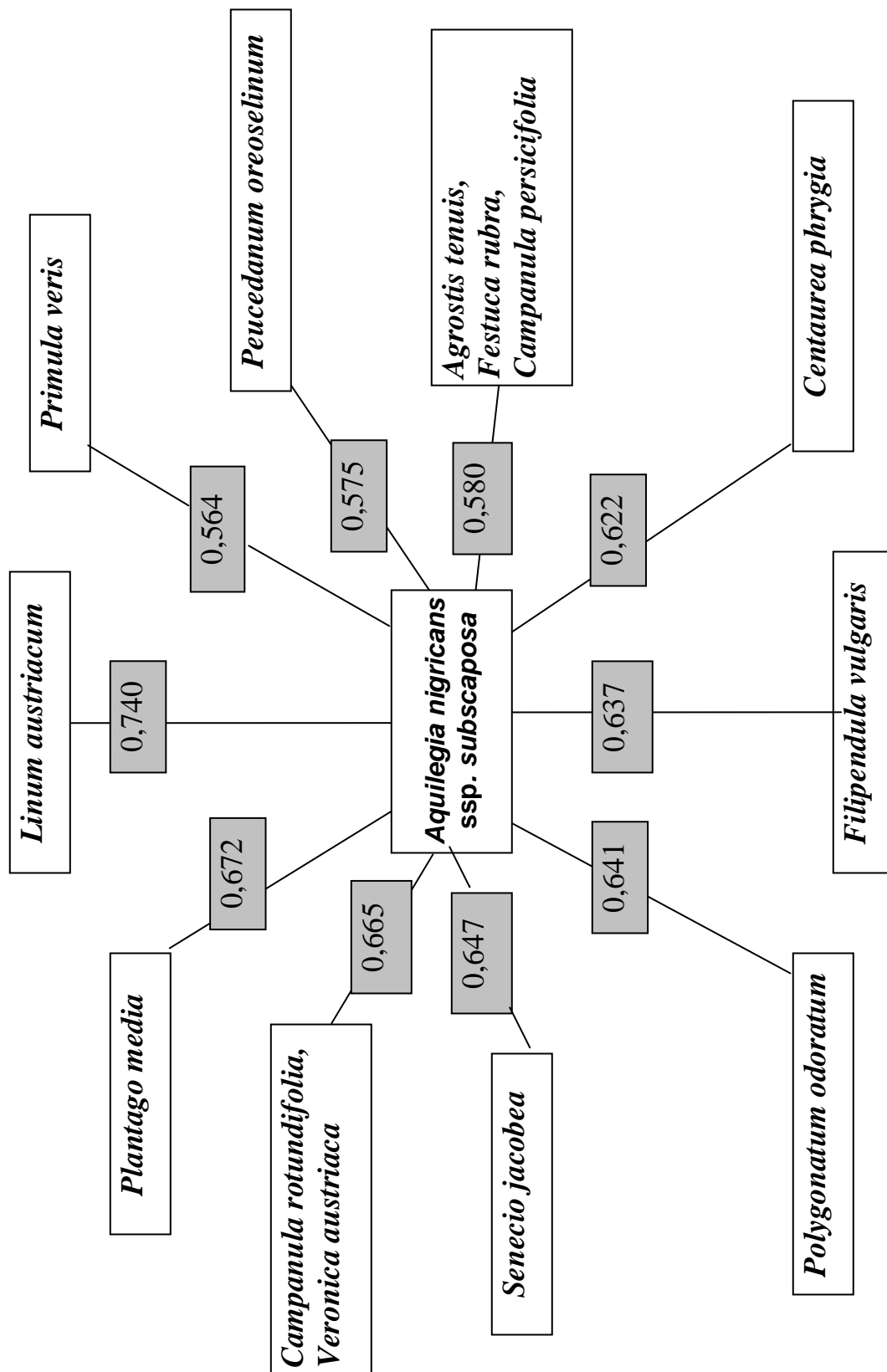


Fig. 2: Main species of the coenotic environment correlated with *Aquilegia nigricans* ssp. *subscaposa* (only species with correlations higher than 0.550 and a probability less than 0.0001 were represented).

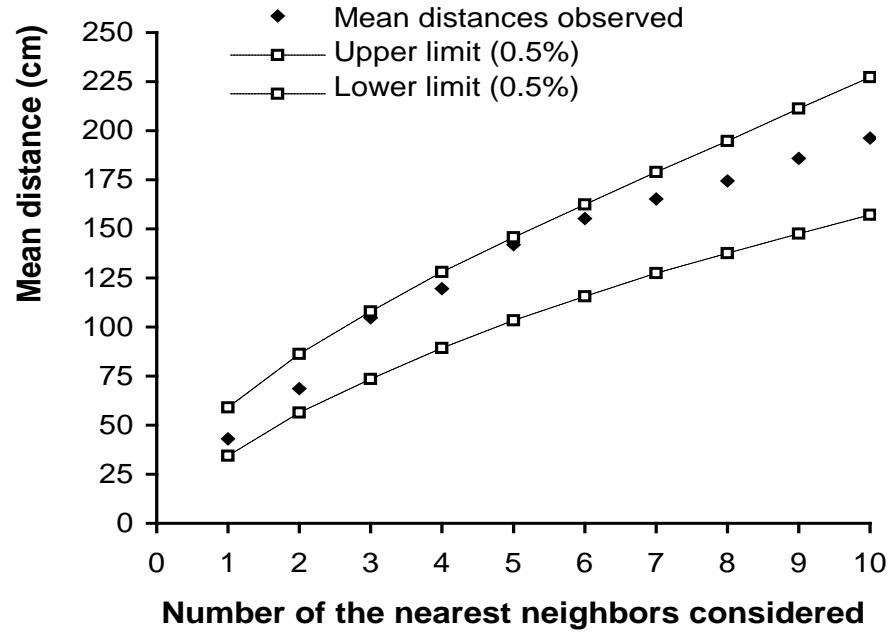


Fig. 3: Aggregation tendency of *Aquilegia nigricans* ssp. *subscaposa* individuals, on the common oak-beech forest border.

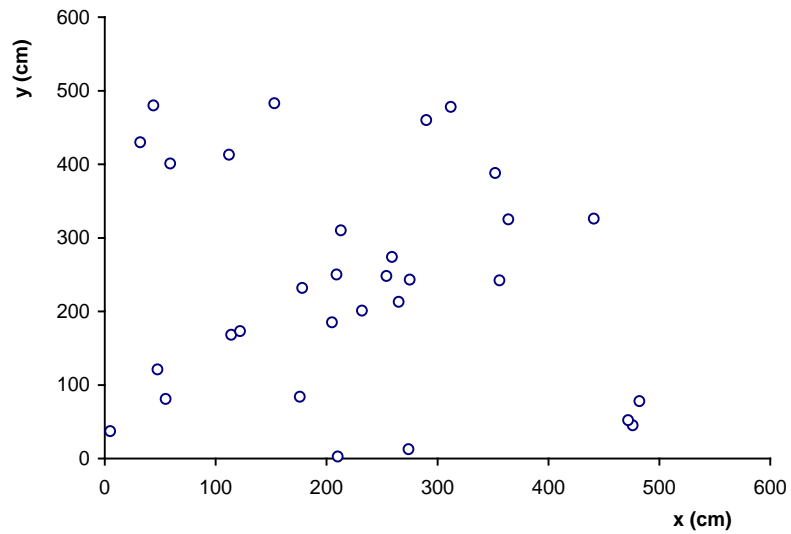


Fig. 4: Spatial distribution of *Aquilegia nigricans* ssp. *subscaposa* individuals, on the common oak-beech forest border.

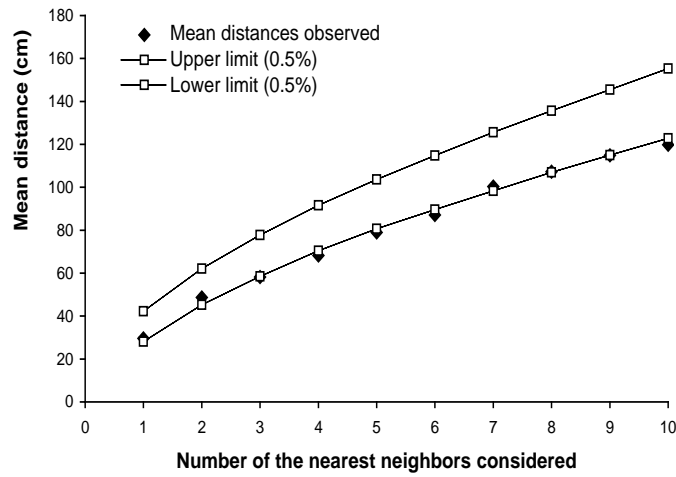


Fig. 5: Aggregation tendency of *Aquilegia nigricans* ssp. *subscaposa* individuals on the grassland.

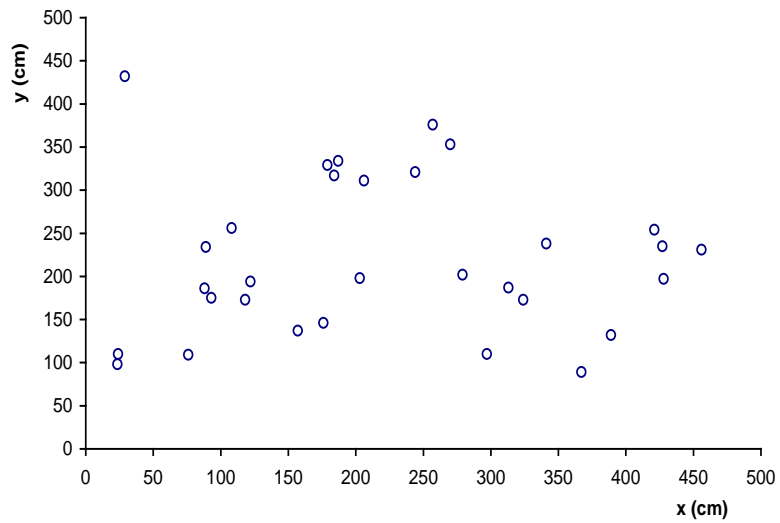


Fig. 6: Spatial distribution of *Aquilegia nigricans* ssp. *subscaposa* individuals on the grassland.

Conclusions

Following the studies performed, a new locality was identified - Valea Tîlvei, as well as two associations in which *Aquilegia nigricans* ssp. *subscaposa* vegetates: *Festuco - Caricetum humilis* and *Scorzonero roseae - Festucetum nigricantis*, which are not reported by the literature

The ecocoenotic analysis made us reconsider the value of the R ecological index, from **R_{3,5}** to **R₄**.

It can be estimated that the analyzed taxon has a high competitive capacity, being positively correlated with numerous grassland species (*Linum austriacum*, *Plantago media*, *Campanula rotundifolia*, *Veronica austriaca*, *Senecio jacobea*, *Polygonatum odoratum* etc).

For the first time the literature presents the spatial distribution of *Aquilegia nigricans* ssp. *subscaposa* individuals, emphasizing the fact that the type of the phytocoenosis in which they develop influences the presence and the extent of aggregation.

The reduced surfaces occupied by *Aquilegia nigricans* ssp. *subscaposa* populations in the researched territory justify the maintenance of the endemic columbine on the red lists from Romania, with the status of rare taxon (R).

Aquilegia nigricans ssp. *subscaposa* populations require protection measures, by mediatization as well as by the ecological education of the population from the concerned area (including tourists) in order to increase awareness regarding the scientific value of this species, and even by the extension of its culture as an ornamental plant.

Acknowledgements

The present study comprises part of the results of the researches performed within the grant program ANSTI B16/2000, ANSTI-MEC A18/2001, MEC-CNCSIS A52/2002.

We thank Assoc. Prof. Dr. Dan Călin Gafta for his support in population data processing.

REFERENCES

1. Beldie, Al., 1967, *Flora și vegetația Munților Bucegi*, Ed. Acad. R.S.R., București.
2. Borza, Al., 1939-1942, Monumentele naturii din Ardealul Central și Apuseni, *Bul. Muz. Reg. Alba-Iulia*, **1**: 3-14.
3. Borza, Al., 1947, *Conspectus Florae Romaniae regionumque affinum*, Tip. Cartea Românească, Cluj.
4. Boșcaiu, N., Coldea, Gh., Horeanu, C., 1994, Lista roșie a plantelor vasculare dispărute, periclitare, vulnerabile și rare din flora României, *Ocot. Nat. și a mediului înconjurător*, București, **1**: 45-56.
5. Ciocârlan, V., 2000, *Flora ilustrată a României, Pteridophyta et Spermatophyta*, Ed. Ceres, București.
6. Coldea, Gh., 1997, *Les associations végétales de Roumanie. Les associations herbacées naturelles*, **1**, Presa Univ. Clujeană, Cluj.
7. Csűrös, Șt., 1958, Cercetări de vegetație pe masivul Scărișoara-Belioara, *Studia Univ. "Babeș-Bolyai"*, ser. *biol.*, **7**, Cluj: 105-128.

8. Csűrös Št., Csűrös-Káptalan, M., 1975, Contribuții la studiul ecologic al florei masivului Scărișoara-Belioara, *Contrib. Bot.*, Cluj: 89-94.
9. Csűrös, Št., Csűrös-Káptalan, M., Gergely, I., 1988, Caracterizarea ecologică a unor asociații de pe muntele Scărișoara-Belioara (Jud. Alba), *Contrib. Bot.*, Cluj: 97-112.
10. Csűrös, Št., Pop, I., 1965, Considerații generale asupra florei și vegetației masivelor calcaroase din Munții Apuseni, *Contrib. Bot.*, Cluj: 113-13+1.
11. Csűrös, Št., Spârchez, Z., 1963, Cercetări fitocenologice în pădurile de pe Muntele Scărișoara-Belioara (Munții Apuseni), *Studia Univ. "Babeș-Bolyai"*, ser. *biol.*, **2**, Cluj: 7-15.
12. Dihoru, G., Dihoru, A., 1994, Plante rare, periclitare și endemice în Flora României - Lista roșie, *Acta Bot. Hort. Bucurestiensis*, (1993-1994): 173-199.
13. Gergely, I., 1972, Asociațiile de *Helictotrichon decorum* Bess. din R.S.România, *Contrib. Bot.*, Cluj: 207-221;
14. Gergely, I., Rațiu, F., 1962, Plante rare în flora Munților Trascăului, *Contrib. Bot.*, Cluj: 151-153.
15. Hodișan, V., 1970, Considerații floristice din Bazinul Runc (Jud. Alba), *Contrib. Bot.*, Cluj: 83-90.
16. Hodișan, V., 1971, Flora și vegetația din bazinul Văii Runcului (Munții Apuseni), Teză dr., Univ. "Babeș-Bolyai", Cluj.
17. Hodișan, V., 1972, Considerații generale asupra vegetației din bazinul Runc (jud. Alba), *Contrib. Bot.*, Cluj: 259-264;
18. Moldovan, I., Pázmány, D., Dragoș, L., 1989, List of rare, endemic and threatened plants in Romania, II, *Not. Bot. Hort. Agrobot.*, Cluj-Napoca (1988-1989).
19. Oltean, M., Negreanu, G., Popescu, A., Roman, N., Dihoru, G., Sanda, V., Mihăilescu, S., 1994, Lista roșie a plantelor superioare din România, *Studii, Sinteze, Documentații de Ecologie*, **1**, Acad. Rom. Inst. Biol., București: 1-52.
20. Pop, I., Csűrös, Št., Kovács, A., Hodișan, I., 1964, Flora și vegetația Cheilor Runc (Regiunea Cluj, Raionul Turda), *Contrib. bot.*, Cluj: 205-228.
21. Popescu, A., Sanda, V., 1998, Conspectul florei cormofitelor spontane din România, *Acta Bot. Hort. Bucurestiensis*: 3-336.
22. Sanda, V., Popescu, A., Barabaș, M., 1997, Cenotaxonomia și caracterizarea grupărilor vegetale din România, *Stud. Comunic. Biol. Veg.*, Bacău: 5-366.
23. Sanda, V., Popescu, A., Doltu, M. I., Doniță, N., 1983, Caracterizarea ecologică și fitocenologică a speciilor spontane din flora României, *Stud. Comunic. Št. Nat. Muz. Brukenthal*, Sibiu, **25**, supliment.
24. Ștefureac, T., Tăcină, A., 1978, Unele considerațiuni asupra edemismelor și corologia taxonilor endemici în România, *Stud. Cerc. Biol. Ser. Biol. Veg.*, București, **1**: 85-92.
25. Șteu, Št., 1968 **a**, Contribuții floristice din Cheile Rîmeșului (Jud. Alba), *Studia Univ "Babeș-Bolyai"*, ser. *biol.*, Cluj-Napoca, **2**: 15-24.
26. Șteu, Št., 1968 **b**, Vegetația ierboasă de sfîncărie din Cheile Rîmeșului (jud. Alba), *Contrib. Bot.*, Cluj-Napoca: 243-266.
27. *** 1953, *Flora RPR*, **II**, Ed. Acad. Rom., București.
28. *** 1976, *Flora RSR*, **XIII**, Ed. Acad. Rom., București.
29. *** 1964, *Flora Europaea*, **1**, Cambridge University Press, Cambridge.
30. *** 1991, *CORINE biotopes, Habitats of the European Community*, Eur. **12587/3**, Office for Official Publication of the Eur. Communities.
31. *** 1999, *Manuel d'interpretation des habitats de l'Union Européene*, Eur **15/ 2**, Com. Eur.
32. *** 1993, Syn-Tax-pc, Computer Programs for Multivariata Data Analysis in Ecology and Systematics (J. Prodani), version 5.0.
33. *** SAS Institute - SAS/Stat 7.0 - Online Doc.

**STUDIUL ECO-CENOTIC ASUPRA TAXONULUI *AQUILEGIA NIGRICANS* BAUMG.
SSP. *SUBSCAPOSA* (BORB.) SÓO DIN MUNȚII GILĂU-MUNTELE MARE
(MUNȚII APUSENI)**

(Rezumat)

În cadrul unui proiect mai amplu, care vizează studiul unor taxoni endemici, rari și periclitați din Munții Gilău-Muntele Mare (*Aquilegia nigricans* ssp. *subscaposa*, *Centaurea reichenbachii*, *Dianthus petraeus* ssp. *simonkaianus*, *Nigritella nigra* ssp. *rubra*), s-a reconfirmat prezența taxonului *Aquilegia nigricans* ssp. *subscaposa* în unele din localitățile menționate în literatură: rezervația Scărița-Belioara și Cheile Runcului. În Cheile Pociovaliștei și pe Colții Vulturesei, subspecia nu a mai fost identificată. Semnalăm și o nouă localitate: Valea Tâlvei (afluent al Văii Pociovaliștei) și două asociații în care aceasta nu a mai fost citată: *Festuco - Caricetum humilis* Csűrös et Kovács 1962 și *Scorzonero roseae - Festucetum nigricantis* (Pușcaru et. al. 1956) Coldea 1987. Analizând complexul eco-cenotic în care se dezvoltă subspecia, se propune reconsiderarea indicelui ecologic R, de la valoarea R_{3,5} la R₄.

Taxonul studiat nu prezintă tendință de agregare în lizieră (fig. 3), în pajiște însă se remarcă o agregare la o scară cuprinsă între 60 - 90 cm (fig. 5). S-a constatat existența corelațiilor pozitive cu numeroase specii de pajiști, ceea ce demonstrează o coeziune cenotică ridicată și o structură complexă a fitocenozelor (fig. 2).

Datorită suprafețelor reduse pe care *Aquilegia nigricans* ssp. *subscaposa* le ocupă în cadrul localităților identificate, se confirmă statutul acesteia de taxon rar (R) și se propun măsuri de conservare *in situ* și *ex situ*.