GENERAL DESCRIPTION OF THE SĂLAJ FLORA

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Abstract: In this paper we present a general description of the flora of Sălaj County. The work is based on literature data and especially on our field research. The inventory consists of more than 2000 species and subspecies, and the results are remarkably interesting. The number of taxa is much higher than we expected. This is due to the rather varied landforms, except real mountains (more than 1000 a.s.l.), but mainly because of the presence of the extensive areas covered by limestone and gypsum. The region is situated at the junction of some major geographical areas: the Transylvanian Plain in the east, the Pannonian Plain in the west, the Eastern Carpathians in the north, and the Apuseni Mountains in the south.

A number of genera were identified as new for this region (*Arnica*, *Blechnum*, *Cynoglottis*, *Klasea*, *Menyanthes*, *Neslia*, *Ophioglossum*, *Oxytropis*, *Parnassia*, *Puccinellia*, *Scopolia*, *Waldsteinia*, etc.). Also, some rare species for Romania are particularly important from a phytogeographical point of view (*Anagallis minima*, *Aphanes arvensis*, *Arabis recta*, *Artemisia alba*, *Cardamine parviflora*, *Myosotis discolor*, *Rumex thyrsiflorus*, *Sorbus danubialis*, etc.). Many species new to Romania, important from a zoological point of view, were discovered. Some of these are of national interest, others are endangered at a European level. In the area 44 endemic and subendemic species have been found (Carpathian, Dacian, Pannonian, etc.): *Aconitum moldavicum*, *Centaurea scabiosa* subsp. *sadleriana*, *Cirsium furiens*, *Helleborus purpurascens*, *Phyteuma tetramerum*, *Thlaspi jankae*, *Viola jooi*, etc. The most important are the Transylvanian Basin endemics: *Jurinea transylvanica*, *Onosma pseudoarenaria*, *Salvia transsylvanica*, *Cephalaria radiata*. There are 16 Species of Community Interest (e.g. *Cypripedium calceolus*, *Eleocharis carniolica*, *Galanthus nivalis*, *Huperzia selago*, *Lycopodium clavatum*, *Sphagnum* spp.), 13 species from the Romanian Red Book (e.g. *Ophrys apifera*, *Sagina subulata*, *Gypsophila collina*), and 124 taxa are included in the National Red Lists of Romania (e.g. *Cephalanthera* spp., *Echinops ritro* subsp. *ruthenicus*, *Dactylorhiza* spp., *Daphne cneorum*, *Dictamnus albus*, *Erucastrum nasturtiifolium*, *Neottia ovata*, *Neotinea tridentata*, *Orchis purpurea*).

Keywords: Sălaj flora, general description, taxonomy, zoology, Romania, Transylvania and Crișana regions

Introduction

At first glance, the flora of the Sălaj region was less known with respect to surrounding areas (Maramureș, Satu-Mare, Bihor, Cluj). This is the reason why we have decided to carry out research, first Negrean and Karácsonyi, and after a while with our younger colleague Szatmari. However, the bibliographical research has shown that there are some works regarding the flora of this territory, but these are very dispersed and many have been lost in obscurity. There are about 900 papers, which in one way or another are related to botany.

The geographical landscape of Sălaj County is rather hilly, although it is surpassed by

two ‘mountains’ of quite large surface area. They do not exceed an altitude of 1000 m. The rest of the landscape is formed by hills, crossed by several important waters: Someș in the northeast, Crasna and Barcău in the west, Agrij and Almaș in the middle, building the Agrij-Almaș Depression. There are no real plains, only smaller or larger riversides which follow the main rivers. From the floristic point of view, the calcareous and gypsum areas are the most important. They impart a clear thermophilous character to the flora, and it is perhaps because of their presence that we have an unexpectedly large number of plants present here. The limestones comprise more important landforms in the north-eastern part (Prisnel Ridge) and in the central part of the Meseș Mountains (Buciumi area), where large surfaces are covered by gypsum and calcareous formations. The most important gypsum areas are encountered in the southern part of the county, near the border with Cluj County.

The history of botanical research in the Sălaj region

Our researches, scattered at the beginning, started in the 1970s at Șimleul Silvaniei (Karácsonyi, 10.IV.1971, 1.IX.1977), Sărmășag (Negrean, 1.IX.1977), Șimleul Silvaniei (Negrean, 2.IX.1977) and Buzușa-Băi (Negrean, 3.IX.1998). Without knowing each other, by extraordinary coincidence these two botanists were at the same place with a difference of just one day (Șimleul Silvaniei – Karácsonyi, 1.IX.1977; Negrean 2.IX.1977). Beginning with the year 2012 the research was carried out systematically.

The oldest botanical information comes from ethnobotany, a field that still maintains names of plants very little explored [1, 40]. Many medieval acts, revealed by Petri [58], show numerous toponyms based on plant names. For example, in the oldest document from 1349, is mentioned the Willow at Dioșad (Dioasad), and in the year 1400 the oak grove at Zalău. In the recent years, there are multiple published works regarding these ethnic toponyms [7, 26, 77, 78]; even a dictionary regarding this field has been published [6]. It seems that the name “Sălaj” derives from “szil”, which means in Hungarian „elm” (*Ulmus*) – Szilágy (Sălaj) [33]. According to other sources, the name comes from the Latin “silva, silvae”, which means “forest”. In fact, in those times, the area was mostly covered by large forests [33].

The oldest information regarding the flora were given by Baumgarten [3], who, in the year 1813, at the invitation of Count Cserey Farkas (1773–1842), visited Crasna, where Cserey possessed a botanical garden. According to some information, about 1000 plant species were cultivated here [33]. On that occasion, Baumgarten visited the surroundings of Crasna village and included some species from there in his work regarding the flora of Transylvania, a first document of this kind in the country [3]. The important guest honored Cserey with an eponym: *Silene csereii* Baumg., a new species for science, discovered in the surroundings of Deva city.

Between 1871 and 1873, Josef Freyn (1845–1903), an engineer from Prague and a great amateur botanist, worked on the Budapest-Brașov railway. He collected a series of plant species from the southern region of Sălaj, where the railway is passing through, especially from the surroundings of Stana railway station. These plants were published by Vincentio de Borbás [25]. Also, in those times, the botanist and doctor Feichtinger Sándor crossed the western part of the actual Sălaj region, called then Crasna. He published a great number of plants, among which are many rarities [23].

Erasmus Julius Nyárády (1881–1966) carried out some research over a few months at Meseșenii de Jos, where he collected many plants, some being very interesting. These were

included in the collection of the „Haáz Rezső” Museum at Odorheiul Secuiesc, and they have been published recently [68].

After 1940, the flora of the region began to be more actively researched. In August 1940, the former professor of Gavril Negrean from the Natural Sciences „Vasile Lucaciu” High School in Carei city, collected plants on the Puguior Hill near Ortelec village [62]. Then, in 1941, Balázs Ferenc (1913–2012) carried out serious phytocoenological research in the Meseş Mountains. In his phytocoenological tables he published around 1000 plants, and separately another 300 [2]. At the same time, another phytocoenological paper was published by Ujvárosi M. from the surroundings of Stana village [76]. In the 1940s Tamásy Géza published some plants from the surroundings of Șimleul Silvaniei [69, 70]. In the 1950s, the region was perambulated by Iuliu Prodan, who published plants in different articles and in the Romanian Flora [64], for example, a species with the only known locality in Romania, *Carex vulpinoidea* Michx., ”invasive in the orchards of the village Cehu-Silvaniei” [61]. After 1960, many researchers published phytocoenological papers, especially Gheorghe Coldea [9, 10, 11, 12, 13, 15]. His doctoral thesis regarding the flora and the vegetation of Plopiș Mountains comprises a part from the Sălaj region. After this, Coldea and his collaborators continued the research [14, 16]. Other botanists have studied the vegetation in different parts of the region [37, 28, 31]. The gypsum areas from the southern limit of the county were studied by Szabó [66] and Pop [60], and other authors carried out research in the entire ethnographical area of the Călata region [53]. More recently, Molnár and his collaborators made studies in this area [44].

The interfluvium of Agrij-Almăj was researched mainly by the botanists from the Agronomic University in Cluj-Napoca: Antal Nyárády and his collaborators [50]. Data from the Sălaj region are also included in many papers regarding the chorology of some species in Romania [18, 45, 63, 71].

There are several pieces of doctoral research regarding entirely [42] or partially [10, 32, 59] the flora of Sălaj, even very good graduate papers [40, 43]. Other botanists collected seeds for botanic gardens, published in seed catalogues.

Other descriptions of the Sălaj flora were recently carried out by the authors [47, 35, 48].

Evolution of the vegetation in the region

Several papers discuss the evolution of the vegetation in this area. Paleobotanists have made numerous surveys regarding the Tertiary flora [19, 20, 41, 49, 54, 55, 56, 57]. Also, Feurdean & al. [24] and Grindean & al. [27] carried out pollen analysis for the Quaternary vegetation. Bitiri & Carciumaru showed that around 20.000 years ago, in a full glacial period (Würm), coniferous forests existed here. They identified *Abies*, *Larix* and *Picea* pollen in the north-eastern part of Sălaj County, which means that the vegetation from the Carpathian Mountains had descended very low into the lowland areas to find shelter from the extreme cold [4].

As is known, the current landscape configuration is the result of the evolution of the landforms over time. The flora has also evolved, not only because of the changes in the relief, but also in response to the gradual cooling of the climate toward the end of the Tertiary. For example, the endemic Carpathian lilac species *Syringa josikaea* has some isolated populations, encountered in the Apuseni Mountains and in the Eastern Carpathians of Ukraine. In 2013, a team of biologists assembled some maps with the potential distribution area of the species, based

on climatic niche analyses, for the Last Glacial Maximum [39]. Thus, we can speculate that there may have existed a paleopopulation that stretched from the Apuseni Mts to the Upper Tisa Basin towards the north via Agrij Valley, throughout Sălaj County. Molecular evidence suggests that there are no clear genetic differences between the two major populations; thus the species had a much wider range than at the present day [38].

Materials and Methods

The field researches were carried out between 2012 and 2017. We made some observations and plant lists, and the critical plants were collected to analyze them in the laboratory. They were identified according to Romanian and European taxonomic keys: [64, 75, 74, 8, 65, 36, 72, 79]. The plants were deposited in public herbaria (Carei, Cluj, Jibou, Bucharest, Galati, Iasi, Budapest, etc.). Herbarium abbreviations follow Holmgren & al. [29] and Thiers [73].

Results and Discussions

Over five years of research, more than 2000 major taxa have been identified. This represents almost half of the Romanian flora. Among these taxa, over 1000 species are new for the Sălaj region. There are several new genera (*Arnica*, *Blechnum*, *Menyanthes*, *Ophioglossum*, *Ophrys*, *Oxytropis*, *Parnassia*, *Puccinellia*, *Scopolia*, *Waldsteinia*) or rare species in Romania (*Artemisia alba*, *Anagallis minima*, *Aphanes arvensis*, *Arabis recta*, *Myosotis discolor*, *Rumex thyrsoflorus*, *Sorbus danubialis*, *Waldsteinia geoides* etc.). From the zoological analysis we can conclude that the flora of the Sălaj region conserves species with a medium zoological character, in comparison with other areas much richer than Sălaj.

The toponyms of the plants have been published in a book that deals with the flora and the vegetation of Sălaj County [48].

We consider that the most important are the endemics. From this category in Sălaj were confirmed 44 species (Table 1.). One of the most interesting seems to be *Centaurea scabiosa* subsp. *sadleriana*, a species that was not found in Romania for over 50 years. The population is represented by very few individuals, so the species needs an urgent conservation programme.

In this category we have the Transylvanian endemics, followed by the Dacian, Carpathian and Pannonian species. In recent papers the majority of the Dacian species are considered to be also Carpathian elements [30].

Regarding Natura 2000 species, in Sălaj were identified 16 taxa of vascular plants and bryophytes: 11 vascular plants (3 Lycopodiaceae) and 6 Bryophytes. Most of them have a single population in the county and are critically endangered. The most frequent is *Galanthus nivalis* [80] (Table 2).

In the county there are 13 species from the Red Book of the Romanian Flora. Among these is *Gypsophila collina*, which forms important populations especially on the gypsum between Sfârș and Jebucu. This species is at the westernmost edge of its distribution area [22] (Table 3).

Table 1: Endemic and subendemic species in Sălaj County

1.	<i>Aconitum moldavicum</i>	Carpathian element
2.	<i>Cardamine glanduligera</i>	Sub-Carpathian element
3.	<i>Centaurea jacea</i> subsp. <i>banatica</i> (syn. <i>Centaurea rocheliana</i>)	Daco-Pannonic-(N) Balkan element
4.	<i>Centaurea phrygia</i> subsp. <i>indurata</i>	Daco-Balkan-Pannonic element
5.	<i>Centaurea pugioniformis</i>	Daco-Transylvanian element
6.	<i>Centaurea scabiosa</i> subsp. <i>sadleriana</i>	Pannonic element
7.	<i>Cephalaria radiata</i>	Transylvanian element
8.	<i>Cirsium furiens</i>	Pannonic-Dacian element
9.	<i>Crocus banaticus</i>	Sub-Carpathian element
10.	<i>Crocus vernus</i> subsp. <i>vernus</i>	Alpine (E)-Balkan (NW)-Carpathian element
11.	<i>Dactylorhiza maculata</i> subsp. <i>transsilvanica</i>	Daco-(NW) Balkan element
12.	<i>Delphinium simonkaianum</i>	Carpathian element
13.	<i>Galium abaujense</i>	Carpathian element
14.	<i>Galium eruptivum</i>	Daco-Pannonic element
15.	<i>Helictotrichon decorum</i>	Carpathian element
16.	<i>Helleborus purpurascens</i>	Carpatho-Pannonic-(N) Balkan-Dacian element
17.	<i>Jurinea transylvanica</i>	Transylvanian element
18.	<i>Melampyrum barbatum</i>	Apennin-Pannonic-Balkan-Dacian element
19.	<i>Onosma pseudoarenaria</i>	Transylvanian element
20.	<i>Phyteuma tetramerum</i>	Carpathian element
21.	<i>Pulsatilla montana</i> subsp. <i>dacica</i>	Transylvanian element
22.	<i>Rhinanthus wagneri</i>	Carpatho-(N) Balkan element
23.	<i>Rosa bohemica</i> var. <i>negreanii</i>	local endemic element
24.	<i>Rosa pocsii</i> var. <i>karacsonyii</i>	local endemic element
25.	<i>Rosa pocsii</i> var. <i>pocsii</i>	local endemic element
26.	<i>Rubus cîrlioarae</i>	local endemic element
27.	<i>Rubus</i> × <i>jibouensis</i>	local endemic element
28.	<i>Rubus</i> × <i>silasensis</i>	local endemic element
29.	<i>Rubus subvillicaulis</i>	local endemic element
30.	<i>Rubus</i> × <i>tunelensis</i>	local endemic element
31.	<i>Rubus vaccarum</i>	local endemic element
32.	<i>Salvia transsilvanica</i>	Transylvanian element
33.	<i>Scabiosa columbaria</i> subsp. <i>banatica</i>	Carpathian element
34.	<i>Scabiosa columbaria</i> subsp. <i>pseudobanatica</i>	Carpathian element
35.	<i>Seseli gracile</i>	Daco-(NW) Balkan element
36.	<i>Sesleria heuffleriana</i> subsp. <i>heuffleriana</i>	Carpathian element
37.	<i>Silene heuffelii</i>	Carpatho-Balkan element
38.	<i>Silene nutans</i> subsp. <i>dubia</i>	Carpathian element
39.	<i>Silene otites</i> subsp. <i>hungarica</i>	Apennin-Carpatho-(NW) Balkan element
40.	<i>Symphytum cordatum</i>	Carpathian element
41.	<i>Thlaspi jankae</i>	Carpatho-Pannonic element
42.	<i>Thymus comosus</i>	Carpathian element
43.	<i>Thymus dacicus</i>	Daco-(NW) Balkan element
44.	<i>Viola jooi</i>	Carpathian element

Table 2: Community interest species (Natura 2000 species)

	Species	Observation 1	Observation 2
1	<i>Adenophora liliifolia</i>	[44: 117]	1 choronim!
2	<i>Arnica montana</i>		2 choronims
3	<i>Cypripedium calceolus</i>	In the southern part of Gălăşeni is a large population with 49 flowering individuals.	4–5 choronims
4	<i>Pontechium maculatum</i>	Syn. <i>Echium maculatum</i> , <i>E. rubrum</i> , <i>E. russicum</i>	1 choronim! (Guruslău)
5	<i>Eleocharis carniolica</i>	Very few individuals, usually on the edges of small ponds	3 choronims
6	<i>Galanthus nivalis</i>	Usually in beech forests	The most frequent
7	<i>Huperzia selago</i>	Populations with few individuals	5 choronims
8	<i>Iris aphylla</i>	Populations with few individuals	3 choronims
9	<i>Leucobryum glaucum</i>		3 choronims
10	<i>Lycopodium clavatum</i>	Sometimes frequent	10 choronims
11	<i>Lycopodium complanatum</i>	Very rare	1 choronim!
12	<i>Sphagnum flexuosum</i>	Syn. <i>S. amblyphyllum</i> : The Swamp at Iaz	1 choronim!
13	<i>Sphagnum capillifolium</i>		1 choronim!
14	<i>Sphagnum contortum</i>	Published by Balázs 1942 as <i>Sphagnum riparium</i> , revised by Boros [2, 48]	1 choronim!
15	<i>Sphagnum subsecundum</i>	Published by Balázs 1942 as <i>Sphagnum riparium</i> , revised by Boros [2, 48]	2 choronims
16	<i>Sphagnum magellanicum</i>	Only in the Swamp at Iaz	1 choronim!

Table 3: Rare plants from the Red Book of Romania present in Sălaj County

1	<i>Alyssum montanum</i> subsp. <i>montanum</i>	Meseş Mts., Ortelec, Mirşid & Sângeorgiul de Meseş – Buciumi
2	<i>Carex supina</i>	1 choronim [Herbarium sheet CLA 23.860]
3	<i>Centaurea scabiosa</i> subsp. <i>sadleriana</i>	1 choronim (Carastelec), C. Karácsonyi
4	<i>Gypsophila collina</i>	Was treated under <i>G. fastigiata</i> ; only between Sfăraş and Jebucu, and also at Gălăşeni limestone quarry
5	<i>Lysimachia nemorum</i>	Treznea, 29 VI 2015, G. Negrean [Herbarium BUC CL].
6	<i>Myosotis discolor</i>	3 choronims
7	<i>Onosma pseudoarenaria</i>	Populations with a few individuals; Endangered!
8	<i>Ophrys apifera</i>	4 choronims [67]
9	<i>Rhinanthus alectorolophus</i>	Plopiş Mts., 31 V 2016, G. Negrean [Herbarium BUC].
10	<i>Rumex thyrsiflorus</i>	More than 10 choronims
11	<i>Sagina subulata</i>	Very rare; only 6 choronims
12	<i>Thlaspi jankae</i>	Riseg Hill; stable population
13	<i>Tripidium strictum</i> (syn. <i>Saccharum strictum</i>)	Meseşeni de Jos, 3 VIII 1903, E. I. Nyárády [ODORHEI 7115/137] [68: 65]

In Sălaj County we also identified a total of 124 plants from the main four Red Lists regarding the Romanian Flora (Table 4). From these, 27 are qualified as Vulnerable, species that

should be included in a protected area. Also, there are 26 orchid species that are in general protected at a European level, and other species from the flora of Romania that are very rare in this region: *Aconitum variegatum*, *Aira elegantissima*, *Astragalus austriacus*, *Asyneuma canescens*, *Epipactis greuterii*, *Equisetum fluviatile*, *Helictotrichon compressum*, *Iris pumila*, *Iris ruthenica*, *Leontodon saxatilis*, *Scopolia carniolica*, *Sedum album*, *Seseli elatum* subsp. *osseum*, *Silene gallica*, *Sonchus palustris*, *Viola alba* subsp. *scotophylla*, etc. More than 200 species are rare plants.

Table 4: Species from the main National Red Lists (some of them were not refound*; the symbol ◀ represent the synonyms of the species in different publications)

No.	Taxa	O & al.	B&al.	D&D	GN
1.	<i>Achillea ptarmica</i>	-	-	-	R
2.	<i>Adenophora liliifolia</i>	-	-	V	V
3.	<i>Adonis vernalis</i>	-	-	-	V
4.	<i>Agrostemma githago</i>	-	V	-	-
5.	<i>Amygdalus nana</i>	V	-	-	-
6.	<i>Anacamptis coriophora</i> (syn. <i>Orchis coriophora</i> ▶)	R ▶	-	-	R ▶
7.	<i>Anacamptis morio</i> subsp. <i>morio</i> ▶	R ▶	-	-	R ▶
8.	<i>Anacamptis morio</i> subsp. <i>picta</i> ▶	R ▶	-	-	R ▶
9.	<i>Anacamptis palustris</i> subsp. <i>elegans</i> (syn. <i>Orchis palustris</i> subsp. <i>elegans</i> , <i>O. laxiflora</i> subsp. <i>elegans</i> ▶)	R ▶	-	-	R ▶
10.	<i>Arnica montana</i>	V	-	-	R
11.	<i>Artemisia alba</i>	R	R	R	R
12.	<i>Bupleurum rotundifolium</i>	-	V	-	-
13.	<i>Calamagrostis canescens</i>	-	-	R	R
14.	<i>Cardamine parviflora</i>	R	-	V	R
15.	<i>Carex diandra</i>	R	-	R	R
16.	<i>Carex limosa</i>	R	-	R	R
17.	<i>Carex secalina</i>	R	-	R(V)	R
18.	<i>Carlina acanthifolia</i> subsp. <i>utzka</i>	R*	-	R	R
19.	<i>Centaurea calocephala</i> (syn. <i>C. atropurpurea</i>)	R ▶	-	R ▶	R ▶
20.	<i>Centaurea scabiosa</i> subsp. <i>sadleriana</i>	R	R	E	R
21.	<i>Cephalanthera damasonium</i>	R	-	-	-
22.	<i>Cephalanthera longifolia</i>	nt	-	-	-
23.	<i>Cephalanthera rubra</i>	R	-	R	-
24.	<i>Cephalaria radiata</i>	R	-	R	R
25.	<i>Cerastium gracile</i>	-	-	R	R
26.	<i>Cirsium eriophorum</i>	K*	-	-	R
27.	<i>Cirsium furiens</i>	nt*	-	R	nt
28.	<i>Crepis pannonica</i>	K	-	-	E
29.	<i>Crocus banaticus</i>	-	-	-	V/R
30.	<i>Cypripedium calceolus</i>	V/R	E	V	V/R
31.	<i>Dactylorhiza incarnata</i>	R	-	-	R
32.	<i>Dactylorhiza maculata</i> s. l.	R	-	-	R
33.	<i>Dactylorhiza maculata</i> subsp. <i>transsilvanica</i>	R	-	-	R
34.	<i>Dactylorhiza sambucina</i> subsp. <i>sambucina</i>	R	-	-	R
35.	<i>Daphne cneorum</i>	V/R	V	V	V
36.	<i>Delphinium fissum</i>	R	-	-	R
37.	<i>Delphinium simonkaianum</i>	R	-	V/R	R

38.	<i>Dictamnus albus</i>	V/R	-	-	-
39.	<i>Drosera rotundifolia</i>	R	-	-	R
40.	<i>Echinops ritro</i> subsp. <i>ruthenicus</i>	R	-	-	R
41.	<i>Eleocharis carniolica</i>	-	-	V	-
42.	<i>Elymus hispidus</i> subsp. <i>barbulatus</i>	R	-	-	-
43.	<i>Epipactis helleborine</i>	R	-	-	-
44.	<i>Epipactis microphylla</i>	R	-	R	-
45.	<i>Epipactis palustris</i>	-	-	-	R
46.	<i>Epipactis purpurata</i>	R	-	-	-
47.	<i>Eriophorum gracile</i> *	R	-	R	R
48.	<i>Erucastrum nasturtiifolium</i> subsp. <i>nasturtiifolium</i>	R	-	I	-
49.	<i>Fritillaria meleagris</i> subsp. <i>meleagris</i>	R	V	V	V
50.	<i>Galanthus nivalis</i>	nt	-	-	-
51.	<i>Galium abaujense</i>	-	-	K	-
52.	<i>Galium parisiense</i>	R	-	R	-
53.	<i>Galium pumilum</i>	R	-	R	R
54.	<i>Genista germanica</i>	R	-	R	R
55.	<i>Gentiana pneumonanthe</i>	-	-	-	V
56.	<i>Geranium purpureum</i>	R	-	R	R
57.	<i>Gladolus imbricatus</i>	-	-	R	-
58.	<i>Gymnadenia conopsea</i>	R	-	-	-
59.	<i>Gypsophila collina</i>	R	I	K	-
60.	<i>Hottonia palustris</i>	V/R [▲]	V	V	-
61.	<i>Hyoscyamus niger</i>	-	R	-	-
62.	<i>Iris aphylla</i>	-	-	R	R
63.	<i>Iris sibirica</i>	-	V	R	R
64.	<i>Jurinea transylvanica</i> (syn. <i>J. mollis</i> subsp. <i>transsilvanica</i> [▲])	R	-	R	R [▲]
65.	<i>Klasea radiata</i> (syn. <i>Serratula radiata</i> [▲])	R [▲]	-	-	R [▲]
66.	<i>Lathyrus pannonicus</i> subsp. <i>pannonicus</i>	R	-	R	R
67.	<i>Leucojum aestivum</i> subsp. <i>aestivum</i>	V/R	-	V	V
68.	<i>Leucojum vernum</i> subsp. <i>vernum</i>	-	-	R	R
69.	<i>Listera ovata</i> (syn. <i>Neottia ovata</i>)	R	-	-	-
70.	<i>Lycopodium complanatum</i> (syn. <i>Diphasium complanatum</i> [▲])	R [▲]	R	-	R
71.	<i>Lysimachia nemorum</i>	R	-	R	-
72.	<i>Medicago prostrate</i>	Ex	-	R(I)	V
73.	<i>Melampyrum nemorosum</i>	-	-	R(K)	R
74.	<i>Menyanthes trifoliata</i>	R	-	R	-
75.	<i>Moenchia mantica</i> [50: 81]	R	-	-	R
76.	<i>Monotropa hypopytis</i>	R	-	-	-
77.	<i>Montia fontana</i>	R	-	E	-
78.	<i>Myosotis discolor</i>	R	-	R	R
79.	<i>Narcissus poeticus</i> subsp. <i>radiiflorus</i> (syn. <i>Narcissus stellaris</i> [▲])	-	V [▲]	V	R [▲]
80.	<i>Neotinea tridentata</i> (syn. <i>Orchis tridentata</i> [▼])	R [▲]	-	-	R
81.	<i>Neotinea ustulata</i> (syn. <i>Orchis ustulata</i> [▲])	R [▲]	-	-	R [▲]
82.	<i>Onosma pseudoarenaria</i>	R	-	E	R
83.	<i>Ophrys apifera</i>	R	-	E	E
84.	<i>Orchis militaris</i>	R	-	-	R
85.	<i>Orchis purpurea</i> subsp. <i>purpurea</i>	R	-	-	R

86.	<i>Papaver lecoquii</i> (syn. <i>Papaver dubium</i> subsp. <i>lecoquii</i> *)	-	-	V	-
87.	<i>Peucedanum officinale</i>	R	V	-	R
88.	<i>Phleum hirsutum</i>	R	-	K	R
89.	<i>Phyteuma tetramerum</i>	R	-	-	R
90.	<i>Piptatherum virescens</i>	R	-	-	-
91.	<i>Platanthera bifolia</i>	R	-	-	-
92.	<i>Platanthera chlorantha</i>	R	-	-	-
93.	<i>Rhinanthus borbasii</i> subsp. <i>borbasii</i>	R	-	R	R
94.	<i>Rhinanthus wagneri</i>	R	-	-	R
95.	<i>Rorippa islandica</i>	R	-	-	-
96.	<i>Rosa micrantha</i>	R	-	-	-
97.	<i>Rosa subcollina</i>	-	-	R	-
98.	<i>Rosa vosagiaca</i>	-	R	-	-
99.	<i>Rumex aquaticus</i>	R	-	R	R
100.	<i>Rumex longifolius</i>	R	-	R	R
101.	<i>Rumex thyrsiflorus</i> subsp. <i>thyrsiflorus</i>	R	R	I	R
102.	<i>Sagina subulata</i>	R	R	R	R
103.	<i>Salix aurita</i>	R	-	-	-
104.	<i>Salvia nutans</i>	-	-	V	-
105.	<i>Saxifraga bulbifera</i>	R	V	-	R
106.	<i>Scabiosa columbaria</i> subsp. <i>pseudobanatica</i>	R	-	-	-
107.	<i>Scorzonera austriaca</i>	-	-	V	R
108.	<i>Sedum cepaea</i>	R	-	R	R
109.	<i>Sempervivum marmoreum</i>	R	-	-	-
110.	<i>Spergula pentandra</i>	R	I	R	R
111.	<i>Spiranthes spiralis</i>	R	-	-	R
112.	<i>Stipa dasyphylla</i>	R	R	V	R
113.	<i>Stratiotes aloides</i>	V	-	-	-
114.	<i>Succisella inflexa</i>	V/R	-	V	R
115.	<i>Thymus comosus</i>	nt	-	nt	nt
116.	<i>Thymus longicaulis</i>	R	-	R	R
117.	<i>Trapa natans</i>	V	-	-	-
118.	<i>Traunsteniera globosa</i>	R	-	-	R
119.	<i>Trinia kitaibelii</i> (syn. <i>Trinia ramosissima</i> ◀)	-	R ◀	-	-
120.	<i>Tripidium strictum</i> (syn. <i>Saccharum strictum</i> ◀)	R	R ◀	E ◀	R ◀
121.	<i>Trollius europaeus</i> subsp. <i>europaeus</i>	R	-	V	R
122.	<i>Typha laxmannii</i>	-	R	-	-
123.	<i>Viola jooi</i>	R	-	R	R
124.	<i>Waldsteinia geoides</i>	R	-	R	-

Legend: O&al. = Oltean, Negrean & al. 1994 [52]; B&al. = Boşcai, Horeanu & Coldea 1994 [5]; D&D = Dihoru G. & Dihoru A. 1994 [21]; GN = G. Negrean 2001 [46].

A total of 20 taxa were described from Sălaj, especially species from the Rosaceae family (*Crataegus*, *Rosa* and *Rubus*), very polymorphic species (Table 5).

During these botanical researches, we made an important new conclusion, namely: the main migration route westward of many continental (steppe) species passed through Sălaj, especially via the Ortelec Valley, on the saddle in the Buciumi area of the Meseş Mountains and very likely through the corridor of Crişul Repede River. Presumably only a few species have passed through the long and narrow corridor of the Mureş River. A description regarding this

phenomenon, with significant maps, was presented by the authors abroad and received with great interest [34].

Table 5: Taxa described from the Sălaj region

<i>Alyssum repens</i> Baumg. subsp. <i>transsilvanicum</i> (Schur) Baumgartner forma <i>latifolia</i> Pteancu [62]
<i>Crataegus lindmanii</i> Hrab.-Uhr. subsp. <i>kovacsii</i> Kerényi-Nagy [48]
<i>Crataegus</i> × <i>monostevenii</i> Péntes ex Kerényi-Nagy nothosubsp. <i>negreanii</i> Kerényi-Nagy [48]
<i>Crataegus</i> × <i>subsphaerica</i> Gand. nothosubsp. <i>karacsonyii</i> Kerényi-Nagy [48]
<i>Crataegus</i> × <i>subsphaerica</i> Gand. nothosubsp. <i>negreanii</i> Kerényi-Nagy [48]
<i>Ranunculus ulmeniorum</i> Prod. – Plant that was described by Prodan from the Sălaj region; the only known choronim in the world; unknown plant! [61]
<i>Rosa bohémica</i> Heinr. Braun var. <i>negreanii</i> Kerényi-Nagy 2013 [48]
<i>Rosa</i> × <i>geczii</i> Kerényi-Nagy nothospec. nova 2013 [48]
<i>Rosa</i> × <i>geczii</i> Kerényi-Nagy nm. <i>divekyii</i> Kerényi-Nagy & Karácsonyi (nothomorpha nova) [48]
<i>Rosa pocsii</i> Kerényi-Nagy var. <i>pocsii</i> [48]
<i>Rosa pocsii</i> Kerényi-Nagy var. <i>karacsonyii</i> Kerényi-Nagy 2013 [48]
<i>Rubus cîrlioarae</i> Nyár. – „In silva Păd. Cîrlioara inter pagos Jibou et Şoimuş [51: 898]. „The Forest Cîrlioara between Jibou and Şoimuş, 350 m” [51: 356, 359]
<i>Rubus</i> × <i>jibouensis</i> Nyár. (<i>Rubus drautensis</i> × <i>thyrsanthus</i>) – „In the Vacii Valley at Someş-Odorhei, 250 m (district Jibou)”. „In valle V. Vacii prope pagum Someş-Odorhei (r. Jibou)” [51: 563, 934]
<i>Rubus</i> × <i>silasensis</i> Nyár. (<i>Rubus procerus</i> × <i>questieri</i>) – „Stîna, near the tunnel and in the Silaş Forest” [51: 572]. „Ad viam ferream et in silva Silaş prope stationem Stîna” [51: 936]. Observation: The correct name of the locality is Stana, not Stîna (Zalău district)!
<i>Rubus</i> × <i>strugensis</i> Sprib. var. <i>impeditus</i> Nyár. (<i>Rubus caesius</i> × <i>vulgaris</i> var. <i>stinensis</i>) – „ad stationem viae ferreae Stîna” [51: 933]. „Stîna near the C. F. R. tunnel” [51: 559]. Observation: The correct name of the locality is Stana, not Stîna (Zalău district)!
<i>Rubus subvillicaulis</i> Nyár. – „Stîna on the Silaş Hill” [51: 400]
<i>Rubus subvillicaulis</i> Nyár. var. <i>quinnatus</i> Nyár. – „in monte Silaş prope stationem viae ferreae Stîna” [51: 906]. Observation: The correct name of the locality is Stana, not Stîna (Zalău district)!
<i>Rubus</i> × <i>tunelensis</i> Nyár. (<i>Rubus suberectus</i> × <i>thyrsanthus</i>) – „ad marginem silvae juxta viam prope stationem Stîna” [51: 937]. „Stîna, near the tunnel, alongside the field road” [51: 579]. Observation: The correct name of the locality is Stana, not Stîna (Zalău district)!
<i>Rubus vaccarum</i> Nyár. – „In the Vacii Valley at Someş-Odorhei, 250 m (district Jibou)” [51: 424, 427]. „In valle V. Vacii prope pagum Someş-Odorhei (r. Jibou)” [51: 911, 912]
<i>Rubus vulgaris</i> Weihe & Nees var. <i>stanensis</i> Nyár. – „Stîna prope tunellum viae ferreae” [51: 898]. „Stîna near the C. F. R. tunnel” [51: 371]. N.B. The correct name of the locality is Stana, not Stîna (Zalău district)!

Conclusions

During research carried out between 2012 and 2017, more than 2000 species and subspecies have been identified in Sălaj County, with more than 20 new genera for the regional flora. A high number of endemic and subendemic species were identified in this county, the most important being those with a small distribution area, such the Transylvanian, Dacian, Pannonic and Carpathian elements. These species confer a specific character to the region.

Of the species identified, 16 are Natura 2000 taxa, and 13 are included in the Red Book of Romania. These species need protection and conservation. Also, after analyzing the flora, we found that a high number of species belong to the National Red Lists: 124 species and subspecies, of which 27 are Vulnerable. These should be included within protected areas.

20 taxa were described from Sălaj (*locus classicus*), mostly very polymorphic species belonging to the genera *Crataegus*, *Rosa* and *Rubus*.

Also, we observed that many thermophilous species have their northern limit in this region: *Aira elegantissima*, *Alcea pallida*, *Artemisia alba*, *Asyneuma canescens*, *Melampyrum barbatum*, *Ophrys apifera*, *Piptatherum virescens*, *Plantago argentea*, *Quercus frainetto*, *Quercus pubescens*, *Rhinanthus wagneri*, *Saxifraga bulbifera*, *Sedum cepaea*, *Seseli gracile*, *Smyrniium perfoliatum*, *Sorbus danubialis*, *Thlaspi alliaceum*, *Tilia tomentosa*, etc. This fact is very important from a phytogeographical point of view. Other species are at their global western limit (*Gypsophila collina*), or their eastern limit (*Centaurea scabiosa* subsp. *sadleriana*, *Galium abaujense*, *Sagina subulata*) in this area.

Other species have found here a refugium during the glacial periods, and managed to survive in small refugia across the county. Some descended probably from the Gutin-Țibleș Mountains in the north, others from the Vlădeasa Massif in the south.

We have also observed many invasive and potentially invasive species that we have not discussed in this paper, but we can say that the region presents fewer invasive species populations than other areas in the country. The majority of them are problematic mostly on the Someș riversides.

During these botanical researches, we achieved an important new conclusion regarding the westward migration route of the continental species. This is very important even at a European level, because many botanists have challenged the possibilities of where these species migrated to the Pannonian Basin.

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DESCRIEREA GENERALĂ A FLOREI SĂLAJULUI

(Rezumat)

În acest articol se face o descriere generală a florei Sălajului. Lucrarea se bazează pe date din literatură și mai ales pe cercetările proprii. Lista este formată din peste 2000 de specii și subspecii, iar rezultatele sunt surprinzător de interesante. Numărul taxonilor este cu mult mai mare față de cât ne-am fi așteptat. Aceasta se datorează reliefului destul de variat, dar lipsit de munți adevărați (de peste 1000 m), situării zonei la interfeșă

dintre unele zone geografice importante: Câmpia Transilvaniei în est, Câmpia Panonică în vest, Carpații Orientali în nord și Munții Apuseni, în sud, dar mai ales prezenței masive a calcarelor și a gipsurilor.

Au fost identificate mai multe genuri noi pentru regiunea Sălajului (*Arnica*, *Blechnum*, *Cynoglottis*, *Klasea*, *Menyanthes*, *Neslia*, *Ophioglossum*, *Oxytropis*, *Parnassia*, *Puccinellia*, *Scopolia*, *Waldsteinia* etc.). Câteva specii rare pentru România (*Anagallis minima*, *Aphanes arvensis*, *Arabis recta*, *Artemisia alba*, *Cardamine parviflora*, *Myosotis discolor*, *Rumex thyrsiflorus*, *Sorbus danubialis* etc.) sunt deosebit de importante fitogeografic. Din punct de vedere zoologic, au fost descoperiți mai mulți taxoni, unii de interes național, alții de interes comunitar. Au fost găsite 44 de specii endemice sau subendemice (carpatice, dacice, panonice etc.): *Aconitum moldavicum*, *Centaurea scabiosa* subsp. *sadleriana*, *Cirsium furiens*, *Helleborus purpurascens*, *Phyteuma tetramerum*, *Thlaspi jankae*, *Viola jooi* etc.). Deosebit de importante sunt endemitele Bazinului Transilvan: *Jurinea transylvanica*, *Onosma pseudoarenaria*, *Salvia transsylvanica*, *Cephalaria radiata*. Au mai fost identificate 16 specii de interes comunitar (*Cypripedium calceolus*, *Eleocharis carniolica*, *Galanthus nivalis*, *Huperzia selago*, *Lycopodium clavatum*, *Sphagnum* spp. etc.), 13 specii din Cartea Roșie: *Ophrys apifera*, *Sagina subulata*, *Gypsophila collina* (plantă extrem de rară la nivel European, aflându-se în Sălaj la limita de vest a arealului mondial) și 124 taxoni din listele Roșii Naționale: *Cephalanthera* spp., *Echinops ritro* subsp. *ruthenicus*, *Dactylorhiza* spp., *Daphne cneorum*, *Dictamnus albus*, *Erucastrum nasturtiifolium*, *Neottia ovata*, *Neotinea tridentata*, *Orchis purpurea* etc.

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