

STUDIES ON THE DISTRIBUTION, ECOLOGY AND PHYTOSOCIOLOGY OF *Ligularia sibirica* L. POPULATIONS IN THE CĂPĂȚĂNI MOUNTAINS, ROMANIA

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Abstract

Ligularia sibirica (L.) Cass. popularly called Siberian Leopard Plant is a species of community interest with a small area in the mountainous region of southwestern Romania. This rare species of Eurasian origin is found in Appendices II and IV of the Habitats Directive and the IUCN Red List of Threatened Species. *L. sibirica* was cited until the start of these studies from 2 locations in the Căpățâni Mountains: the basin of the Luncavăț river and the Buila Mountain, being mentioned as a single population with very few individuals. The populations identified in the studied territory are not stable and not well preserved. The populations in that area have a relatively small number of individuals, their size and state of preservation being closely related to soil moisture, nitrogen availability, temperature and lighting are the ecological factors that influence the morphological characteristics of *L. sibirica* populations.

Key words: *Ligularia sibirica*, populations, corology, ecology, plant communities, Căpățâni Mountains.

INTRODUCTION

Ligularia sibirica (L.) Cass. popularly called Siberian Leopard Plant is a species of community interest with a small area in the mountainous region of southwestern Romania. This rare species of Eurasian origin is found in Appendices II and IV of the Habitats Directive (<https://environment.ec.europa.eu/topics/nature-and-biodiversity/habitats-directive>) and the IUCN Red List of Threatened Species (<https://www.iucnredlist.org>). In Romania, it is considered a rare species (Oltean et al., 1994).

Taxonomic classification:

Kingdom: Plantae

Division: Tracheophyta

Class: Magnoliopsida

Order: Asterales

Family: Asteraceae

Genus: *Ligularia*

In Europe, the species occupies the most areas in France and Romania, then in Bulgaria, Poland, Austria, the Czech Republic, Croatia, Latvia and Slovakia (Hultén and Fries, 1986; Hegi, 1987; Lannie and Sammul, 2013; Niculescu, 2019). According to some authors, its main distribution area is the European part of Russia and the Siberian taiga area (Hultén and Fries, 1986; Lannie and Sammul, 2013).

Until the beginning of these studies in the Capatanii Mountains, only one population of *Ligularia sibirica* from the Luncavăț river basin and one from Cheia Valley, part of Buila Mountain, were cited. In Romania, it is found in depressions, clearings, marshes, weeds, in marshy places in forests, in mountainous and subalpine areas. From Romania it was mentioned from the following counties: Maramureș, Bistrița Năsăud, Cluj, Harghita, Covasna, Brașov, Vâlcea, Prahova, Neamț, Suceava, Bacău, Botoșani (Gh. Groza, 2008, M. Niculescu, 2006; 2019; 2020). Following the field research that we carried out between 2007-2023, we found that the most important populations in terms of the occupied surfaces and the number of individuals are found in the counties of Harghita, Bacău and Covasna. The Siberian Leopard plant is a hemicyptophyte species, with a height that can reach up to 130 cm, spread especially in the mountain area through depressions, clearings, marshes, forest edges, weedy forests along valleys, generally in places with high humidity and fairly high acidity.

MATERIALS AND METHODS

Study area: The thematic area is situated in the Căpățâni, Mountains (Figure 1). After the

physical-geographical division into sectors, the Căpățâanii Mountains belong to the Central European province, the Carpathian subprovince, the land of the Southern Carpathians, the Western District (Godeanu-Parâng). From an orographic point of view, the Căpățâanii Mountains present a high, main, bare ridge (crest) oriented in the east-west direction, from which there are numerous ramifications, to the north, as well as to the south, which have the shape of edges and crests and which locals call “plaiuri”. These mountains stand out by their deeply fragmented and well developed massive relief (Popescu, 1968). The most important crests and ridges of these mountains, are the following: *Ursu Peak* (2,124 m), *Căpățâna Peak* (2,113 m), *Balota Peak* (2,094 m), *Coșana Peak* (2,080 m), *Curmătura Funicelul* (1,820 m), *Mt. Piatra Roșie* (1,820 m), *Roman’s Peak* (1,810 m), *Mt. Dârjala* (1,900 m), *Mt. Petriceaua* (1,650 m), *Muchia Cășăriei* (1,721 m) (Niculescu, 2006).



Figure 1. Aspect from the researched territory, Căpățâna Peak (photo: Mariana Niculescu)

For the study of the plant community, we have used methods of phyto-sociologic research characteristic to the Central European phyto-sociologic School. In order to identify the plant communities in which the species *Ligularia sibirica* grows, the characteristic and dominant species were taken into account and the constant of the species was noted for each individual within the phytocoenosis. For the population and phytosociological studies of the species *Ligularia sibirica*, determinations were made in the field regarding the number of individuals within a phytocoenosis, the abundance-dominance of species within the phytocoenosis within the plant communities where it is found, the specific seasonal conditions in which it develops the species, variables related to the behavior of the species

as well as data on the chorology of the species develops the species, variables related to the behavior of the species as well as data on the chorology of the species.

RESULTS AND DISCUSSIONS

According to the European Nature Information System species Natura 2000 data base (<http://natura2000.eea.europa.eu>), *Ligularia sibirica* is a species of community importance reported from 32 Natura 2000 Sites from Romania. Following field research between 2007-2023 in the Căpățâanii Mountains, few populations of *Ligularia sibirica* were identified. The number of individuals varies from 2 to a maximum of 30 individuals, this being closely consistent with the substrate and ph-value as well as the degree of humidity in the soil, taking into account that it is a mesohygrophilous to hygrophilous species (Figures 2, 3).



Figure 2. *Ligularia sibirica* in the Căpățâanii Mountains - Govora Valley (photo: Mariana Niculescu)



Figure 3. *Ligularia sibirica* in the Căpățâanii Mountains - Costești Valley (photo: Mariana Niculescu)

Thus, in addition to the populations identified in previous years in the Luncavăț Valley (in the upper basin) and Cheia Valley, following the studies carried out, populations were also identified in the Blajului Valley, Polovrăgenilor Valley, Costești Valley, Stan's Valley, Curpenilor Valley, Cacova Valley and Govora Valley (in the upper basin).

The plant communities in which these populations were identified vary greatly depending on the existing eco-pedo-climatic conditions in these valleys in the Căpățâni Mountains.

The plant communities in which the species *Ligularia sibirica* is found in the Căpățâni mountains are: *Telekio speciosae-Petasitetum hybridi* (Morariu 1967 n.n.) Resmeriță et Rațiu, *Scirpetum sylvatici* Ralski 1931 em. Schwich 1944, *Carici remotae -Calthetum laetae* Coldea (1972) 1978 (Syn.: *Carici remotae Cardaminetum amarae* Dihoru 1964; *Caltheto-Ranunculetum* (Resmeriță et al. 1971) Resmeriță et O. Rațiu 1978; *Lythro salicariae-Juncetum effusi-inflexi* Todor et al 1971; *Deschampsietum caespitosae* Hayek ex Horvatić 1930 (Syn. *Agrostio stoloniferae Deschampsietum caespitosae* Ujvárosi 1947); *Cirsio waldsteinii-Heracleetum palmati* Pawl. et Walas 1940 (Syn. *Cardueto-Heracleetum palmati* Beldie 1967; *Heracleetum palmati* auct. roman.); *Hieracio rotundati-Piceetum* Pawl. et Br.-Bl. 1939 and *Salicetum fragilis* Passarge 1957 (Niculescu, M., 2006; 2020; Niculescu, M. et al., 2015; 2016; 2019).

It should be noted that compared to other locations in the country, especially compared to those in Moldova (Covasna, Harghita, Bacău), the populations identified in Oltenia, in the Căpățâni Mountains have much fewer individuals, the vigor of the plants is low and also the fruiting is not always at the expected level. In dry years, the population of *Ligularia sibirica* in the Căpățâni Mountains is low.

In Blajului Valley, in 2020, populations with only 2 maximum 3 individuals were identified (Figure 4).

Some of the populations with a small number of individuals are found at the edge of the spruce forests or in their clearings (Figure 5).

Cășăriei Mountain road, which has been widened and rebuilt in recent years, allowing the access of a large number of tourists to the

area and the intensification of traffic with road vehicles, ATVs or other means of transportation.

All of these exert a very large anthropogenic impact on the entire biodiversity in the area.

There is no control and no involvement of the local authorities, municipality, forestry personnel in this area regarding the conservation of biodiversity, of Natura 2000 species, both flora and fauna. In this area there are also many cow sheds, with a large number of animals and a lot of household waste resulting from tourist activities (with the development of this road, tourism exploded), forestry and pastoral.

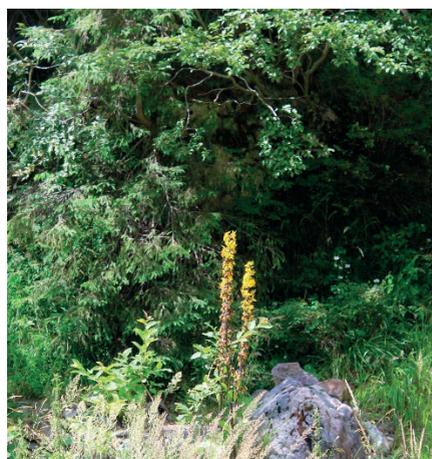


Figure 4. *Ligularia sibirica* in the Căpățâni, Blaj Valley (photo: Mariana Niculescu)

The Luncavăț basin with its tributaries is the limit of the protected area North of the East Gorge, Costești Valley and Cacova Valley are integral parts of the Buila-Vânturarița National Park, so conservation measures for the entire biodiversity should exist and their application should work .

In the Căpățâni Mountains this species grows in the following Natura 2000 habitats: 6430 - Hydrophilous tall-herb fringe communities of plains and of the montane to alpine levels, CLAS. PAL.: 37.7 și 37.8; 6440 - Alluvial meadows of river valleys of the *Cnidion dubii*, CLAS. PAL.: 37.23; 3220 - Alpine rivers and the herbaceous vegetation along their banks, CLAS. PAL.: 24.221 and 24.222; 91E0* - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion

incanae, *Salicion albae*), CLAS. PAL.: 44.3, 44.2 și 44.13 and 9410 - Acidophilous *Picea* forests of the montane to alpine levels (*Vaccinio-Piceetea*), CLAS. PAL.: 42.21 up to 42.23, 42.25. (Gafta and Mountford, 2008; Niculescu M., 2006).



Figure 5. *Ligularia sibirica* in the Căpățâanii, Curpenilor Valley (photo: Mariana Niculescu)

In the researched territory, populations with a smaller number of individuals were identified in the floristic composition of some phytocoenoses of meso-hygrophilous meadows. In these phytocoenoses, the individuals grow more in height and the vigor of the plants is low, the stems are thinner, the inflorescences have a much smaller number of flowers (Figure 6).



Figure 6. *Ligularia sibirica* in the Căpățâanii, in the meso-hygrophilous meadows (photo: Mariana Niculescu)

From the point of view of the habitat, in the Căpățâanii Mountains the species *Ligularia sibirica* was most often identified in the weed plant communities along the valleys, in the mountain ridge. Most populations were identified on the southern slopes of the Căpățâanii Mountains, less often on the northern ones. In meadows, through swampy places in meadows or forests, especially of spruce, the number of *Ligularia sibirica* populations is lower.

The most stable populations with the highest number of individuals were identified in the following plant community: *Telekio speciosae-Petasitetum hybridi* (Morariu 1967 n.n.) Resmeriță et Rațiu 1978 (Table 1). This plant community is frequently found along streams and springs in the mountain floor. The phytocoenoses of the association develop on flat or slightly inclined lands, with high humidity, more or less shaded.

In the Căpățâanii Mountains, such phytocoenoses are found on Polovrăgenilor Valley, Luncavăț Valley, Blajului Valley, Costești Valley, Stan's Valley, Curpenilor Valley, Cacova Valley and Govora Valley (in the upper basin) at altitudes between 700 m and 1200 m, preferring alluvial soils. Phytocoenoses are mainly mesophilic, micro-mesothermic and euriionic towards acid-neutrophilic (Niculescu, 2006). Following the analyzes carried out, a rich floristic composition is found, the 10 phytocoenoses totaling more 40 species of cormophytes. They are well-cohesed phytocoenoses, with vegetation coverage between 90% and 100%.

Along with the edifying species, high constancy presents some tall species: *Cirsium oleraceum*, *Urtica dioica*, *Leucanthemum waldsteinii*, *Festuca gigantea*, *Ranunculus repens*, *Agrostis stolonifera*, *Rumex obtusifolius*, *Mentha longifolia*, *Cirsium waldsteinii*, *Myosotis sylvatica*, *Impatiens noli-tangere*, *Lysimachia vulgaris*, *Chaerophyllum hirsutum*, *Festuca gigantea*, which edifies the physiognomy of the plant community. Following the studies carried out regarding the bioforms that dominate in these phytocoenoses, it was found that hemicryptophytes dominate, and that the floristic elements, with the largest weight, are Eurasian species. From a karyological point of view, it was found that in these phytocoenoses the highest percentage is polyploid species.

Table 1. *Telekio speciosae-Petasitetum hybridi* (Morariu 1967 n.n.)
Resmeriță et Rațiu 1978 plant community

No. of relevée	1	2	3	4	5	6	7	8	9	10	K
Altitude m.o.s. (x 10 m)	110	100	90	95	115	115	95	110	95	80	
Exposure	SE	E	SE	SV	-	SV	E	-	V	SE	
Inclination (in grades)	7	5	10	10	-	5	10	-	10	5	
Canopy (%)	90	90	100	100	90	100	90	100	100	90	
Area (m ²)	100	30	50	100	50	30	100	50	50	100	
Char. Ass.											
<i>Telekia speciosa</i>	+	+	2	2	1-2	1-2	1	+	+	1	V
<i>Petasites hybridus</i>	5	5	4	4	4	4	4	5	5	4-5	V
Petastion officinalis											
<i>Filipendula ulmaria</i>	+	+	+	-	-	-	-	+	-	-	II
<i>Carduus personatus</i>	-	-	+	+	+	+	-	+	+	-	III
<i>Cruciata laevipes</i>	-	+	+	+	-	-	-	-	+	-	II
<i>Chaerophyllum hirsutum</i>	-	-	+	+	-	-	+	-	-	+	II
<i>Lamium maculatum</i>	+	+	+	+	-	-	+	+	-	-	III
<i>Cirsium oleraceum</i>	+	-	+	+	+	1	1	+	+	1	V
<i>Heracleum sphondylium</i>	+	+	-	+	-	+	-	-	-	-	II
Adenostyletalia											
<i>Senecio germanicus</i>	-	-	+	+	-	+	+	-	+	+	III
<i>Stellaria nemorum</i>	-	-	+	+	+	+	-	+	+	-	III
<i>Leucanthemum waldsteinii</i>	-	-	+	+	-	-	+	-	-	+	II
<i>Cirsium waldsteinii</i>	+	+	+	+	-	-	+	+	-	-	III
Molinio-Arrenatheretea et Molinietaalia											
<i>Agrostis stolonifera</i>	+	-	-	+	-	+	+	-	+	-	III
<i>Trifolium pratense</i>	+	+	+	+	-	+	-	+	-	-	III
<i>Holcus lanatus</i>	+	+	+	+	-	+	-	+	-	+	IV
<i>Ranunculus repens</i>	1	1	+	+	+	+	1	+	+	+	V
<i>Mentha longifolia</i>	+	1	1	1	1	1	1	+	1	+	V
<i>Poa pratensis</i>	+	+	+	+	+	-	-	+	+	-	IV
<i>Centaurea phrygia</i>	+	+	+	+	-	+	+	-	-	-	III
<i>Lotus corniculatus</i>	-	-	+	+	+	+	-	+	+	-	III
<i>Prunella vulgaris</i>	-	+	+	+	-	-	-	-	+	-	II
<i>Dactylis glomerata</i>	-	-	+	+	-	-	+	-	-	+	II
<i>Lysimachia nummularia</i>	+	+	+	+	-	-	+	+	-	-	III
Artemisietea											
<i>Rumex obtusifolius</i>	-	+	+	+	-	-	+	-	+	+	III
<i>Urtica dioica</i>	+	+	+	+	+	+	-	+	-	+	IV
<i>Arcium lappa</i>	+	-	-	-	+	-	-	-	-	-	I
Quercio-Fagetea											
<i>Festuca gigantea</i>	+	-	+	+	+	+	-	+	+	+	IV
<i>Myosotis sylvatica</i>	+	+	+	+	+	+	+	+	+	+	V
<i>Salvia glutinosa</i>	-	+	+	+	-	-	+	+	+	+	II
<i>Impatiens noli-tangere</i>	+	-	+	+	+	-	-	-	+	+	III
<i>Brachypodium sylvaticum</i>	+	+	+	+	-	+	+	-	-	+	IV
<i>Poa nemoralis</i>	+	+	+	+	+	+	+	+	+	+	V
Epilobietalia											
<i>Chamerion angustifolium</i>	+	-	+	+	-	-	-	-	-	+	II
<i>Rubus idaeus</i>	-	-	-	+	-	-	-	+	-	+	II
Magnocaricion elatae											
<i>Ligularia sibirica</i>	+1	1	+	+	1	1	1	1-2	1-2	+1	V
<i>Lysimachia vulgaris</i>	+	-	+	+	-	-	-	+	+	+	III
Variae Syntaxa											
<i>Cardamine amara</i>	+	+	+	+	-	-	+	+	-	+	IV
<i>Carex remota</i>	-	+	+	+	-	-	-	-	+	-	II
<i>Equisetum telmateia</i>	-	-	+	+	-	-	+	-	-	+	II
<i>Hypericum maculatum</i>	-	-	+	+	+	+	-	+	+	-	III

Place and data of the relevés: 1, 2 - Blaj Valley, 10.VI.2014, 18.VII.2022; 3, 4 - Luncavăț Valley, 23.VII. 2007, 21.VI.2018; 5, 6, 7 - Curpenilor Valley, 9.VII.2011, 15.IV.2015, 2.VIII.2021; 8 - Govora Valley, 22.V.2017; 9, 10 - Costești Valley, 25.VI.2019, 10.VII.2023.

CONCLUSIONS

Following field research in the Căpățâni Mountains, few populations of *Ligularia sibirica* were identified. The number of individuals varies from 2 to a maximum of 30 individuals, this being closely consistent with the substrate and ph-value as well as the degree of humidity in the soil, taking into account that it is a mesohygrophilous to hygrophilous species

From the point of view of the habitat, in the Căpățâni Mountains the species *Ligularia sibirica* was most often identified in the weed plant communities along the valleys, in the mountain ridge. Most populations were identified on the southern slopes of the Căpățâni Mountains, less often on the northern ones. The most stable populations with the highest number of individuals were identified in the following plant community: *Telekio speciosae-Petasitetum hybridi* (Morariu 1967 n.n.) Resmeriță et Rațiu 1978. The populations identified in the studied territory are not stable and not well preserved. There is a very large anthropogenic impact on the entire biodiversity in the area. There is no control and no involvement of the local authorities, the municipality, the forestry staff in this area regarding the conservation of biodiversity, Natura 2000 species, both flora and fauna and implicitly on the protection of *Ligularia sibirica* populations.

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