

# PHYTOSOCIOLOGICAL STUDY CONCERNING HABITATS WITH *LIGULARIA SIBIRICA* (L.) CASS. FROM THE SALONCA AND DELNITA RIVER BASINS, HARGHITA COUNTY, ROMANIA

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## ABSTRACT

*Ligularia sibirica* (L.) Cass. is one of the most spectacular glacial relict species and rare species of Asteraceae family and one that suffered a significant decrease in Eurasia in the second half of the past century. *L. sibirica* dates from the Tardiglacial – early Postglacial period. It is of a great floristic, ecological, and phytogeographical importance (Paun and Popescu, 1971), being included in Annex II and IV of the Habitats Directive and in the IUCN Red List of Threatened Species as DD (data deficient) (Bernhardt et al. 2011).

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, including our study protected area – ROSCI0323 Ciucului Mountains. In the study area we identified a large number of well-developed populations with large number of individuals but varies depending on the type of habitat and of the variation eco-pedo-climatic conditions.

The populations of *L. sibirica* in this area are stable and well preserved. Following research in this area in the summer of 2019 found that: the soil humidity, nitrogen availability, temperature, and lighting are the ecological factors influencing the morphological features of *L. sibirica* populations.

In the Salonca and Delnita basins this species grows in the following habitats: 3220 - Alpine rivers and the herbaceous vegetation along their banks, CLAS. PAL.: 24.221 și 24.222; 7110\* Active raised bogs, CLAS. PAL.: 51.1; 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; 6510 - Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) CLAS. PAL.: 38.2; 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. (Mountford and Gafta, 2008; Niculescu, M., 2006).

## INTRODUCTION

*Ligularia sibirica* (L.) Cass. (Siberian groundsel) is an endangered species in Europe (included in Annexes II and IV of the EU Habitats Directive)

growing mainly in alluvial and paludified grasslands.

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family and one that suffered a significant decrease in Eurasia in the second half of the past century. *L. sibirica* dates from the Tardiglacial – early Postglacial period. It is of a great floristic, ecological, and phytogeographical importance (Paun and Popescu, 1971), being included in Annex II and IV of the Habitats Directive and in the IUCN Red List of Threatened Species as DD (data deficient) (Bernhardt et al. 2011).

In Romania, it is found through depressions, meadows, marshes, weeds, in swampy places in forests, in the mountain and subalpine area. The species has been identified in almost all the massive mountains of our country. In Europe, it occurs in Estonia, Latvia, Poland, Ukraine, Hungary, the Czech Republic, the Slovak Republic, Bulgaria, Romania, Croatia, Austria and France, being very rare in those countries (Hultén and Fries 1986; Hegi 1987; Lannie and Sammul, 2013).

From Romania was mentioned from the following locations:

- Maramures County - Sighet la Strunga Tiganului, Gutin Mountain, Piatra Mountain, Runc;
- Bistrita Nasaud County: Rodnei Mountains;
- Cluj County: Faget, in the Morii Valley;
- Harghita County: Lueta, Capalnița, Harghita Mountains, Borsec, Joseni, Lazareni; Borzontul Mic, Remetea, Voslobeni, Izvorul Mureșului, Tusnad, Sanraieni, Sumuonesti, between Siculeni and Ciceu, Jigodin, Barzava, Vrabia, Tusnad Village, Tusnadul Nou, Bixad, Nemirei Mountains;
- Covasna County: Dealu, Turia at Pucioasa, Casinul Mic, Comandau;
- Brașov County: Brasov at Stupini, Zagon, Prejmer, Harman;
- Valcea County: Capatanii Mountains in the Luncavat Valley, Buila Mountain in the Cheia Valley;

- Prahova County: Bucegi Mountains in the Jepilor Valley and Ialomitei Valley;
- Neamt County: Balanești; Bargaoni;
- Suceava County: Neagra Sarului, Dragoiasa, Poiana Stampei,
- Bosanci at Ponoare, Suceava at Cuntei;
- Bacau County: Nemira Mountain;
- Botosani: Lozna (Gh. Groza, 2008, M. Niculescu, 2006).

*Ligularia sibirica* is a 100–130 cm tall perennial plant from the family Asteraceae. It has erect stems with numerous yellow flower heads arranged in clusters, long-stalked kidney-shaped lower leaves and smaller, stalkless upper leaves. The species reproduces both sexually (seeds are dispersed mainly by wind) and vegetatively (forming short, thick rhizomes). *Ligularia sibirica* grows in open habitats and semi-open spots near trees and shrubs across a range of different wetland habitats including alluvial grasslands, paludified grasslands and mires (Kukk, 2003). Its main distribution area is the European part of Russia and the Siberian taiga zone (Hultén and Fries, 1986; Lannie and Sammul, 2013).

In Romania, *Ligularia sibirica* had been identified in coenotic environment of the next plant communities: *Caricetum diandrae* Görs 1968, *Caricetum diandrae caricetosum nigrae* Coldea 1981, *Junco-Caricetum nigrae* Rybnicek 1974, *Junco-Caricetum nigrae calamagrostetum neglectae* Coldea 1981, *Junco - Caricetum fuscae* R. Tüxen (1937) 1952; *Orchido - Schoenetum nigricantis* Oberd 1957 (Syn.: *Schoenetum nigricantis* I. Pop et al. 1962; *Schoeneto-Armerietum barcensis* Morariu 1967), *Sphagno-Caricetum rostratae* Rybnicek 1974, *Carici echinatae-Sphagnetum recurvi* Soó (1934) 1954 (Syn. *Caricetum stellulatae* Csűrös et al. 1956), *Carici flavae-Eriophoretum caricetosum nigrae* Soó 1957, *Carici flavae-Eriophoretum*

*caricetosum gracilis* (Gergely 1966) Coldea 1977, *Carici flavae-Eriophoretum menthetosum longifolii* (Rațiu F. 1972) Coldea 1977, *Carici blysmetum compresii* Coldea 1977, *Caricetum ripariae* (Soó 1928) Knapp et Stoffer 1962 *typicum*, *Cladietum marisci* Allorge 1922 ex Zobrist 1953, *Caricetum paniculatae* Wangerin 1916, *Phragmitetum vulgaris* Soó 1927, *Ligulario sibiricae - Ribetum petraei* Neblea et Alexiu 2003, *Angelico - Cirsietum oleracei* R. Tx. 1937, *Filipendulo-Geranium palustris* W. Koch 1926, *Adenostylo alliariae - Doronicetum austriaci* Horvat 1956, *Scirpetum sylvatici* Ralski 1931 em. Schwich 1944, *Deschampsietum caespitosae* Hayek ex Horvatić 1930 (Syn.: *Agrostio stoloniferae Deschampsietum caespitosae* Ujvárosi 1947), *Cirsio waldsteinii - Heracleetum transsilvanici* Pawl et Walas, *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), *Scirpo - Phragmitetum* W. Koch 1926, *Telekio speciosae- Petasitetum hybridum* (Morariu 1967 n.n.) Resmeriță et Rațiu, *Philonotido-Calthetum laetae* (Krajina 1933) Coldea 1991 (Syn. *Calthetum laetae* Krajina 1933), *Salicetum cinereae* Zólyomi 1931 (Neblea, M., 2009; Niculescu, M., 2006; 2014, Niculescu, L. et al, 2015; Matei, A. N., 2014).

## MATERIAL AND METHODS

### Study area:

The thematic area is situated in the Ciuc Mountains, in the Salonca and Delnita river basins and is part of the protected area – ROSCI0323 Ciucului Mountains.

The field research on the field was carried in the summer 2019 and having clearly defined itineraries. In order to identify the species we looked into: *Romanian Flora*, vol. I-XII (1952-1976); *Flora Europaea*, vol. I-V (Tutin, T. G. et al., 1964-1980). For the study of the plant

community, we have used methods of phyto-sociologic research characteristic to the Central European phyto-sociologic School. The monitoring actions of the species *Ligularia sibirica* were carried out in a standardized manner. The collection of field data followed the following elements: the abundance-dominance of the species in plant communities, the specific stational conditions in which the species develops, GIS data. The phytosociological studies of this species also noted variables related to the behavior of the species such as: periodicity of flowering, reproductive potential (number of floriferous strains, flowering period, annual plant density) (Niculescu, M., 2006, 2009).

## RESULTS AND DISCUSSIONS

Following studies on the protected species *Ligularia sibirica*, in the study area we identified a large number of well-developed populations with large number of individuals but varies depending on the type of habitat and of the variation eco-pedo-climatic conditions. The populations of *L. sibirica* in this area are stable and well preserved. Following research in this area in the summer of 2019 found that: the soil humidity, nitrogen availability, temperature, and lighting are the ecological factors influencing the morphological features of *L. sibirica* populations.

In the Salonca and Delnita basins this species grows in the following habitats: 3220 - *Alpine rivers and the herbaceous vegetation along their banks*, CLAS. PAL.: 24.221 și 24.222; 7110\* *Active raised bogs*, CLAS. PAL.: 51.1; 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; 6510 - *Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)*, CLAS. PAL.: 38.2; 91E0\* - *Alluvial forests with Alnus glutinosa and*

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

*Ligularia sibirica* has been identified in the plant communities care edifica aceste habitate. Among the plant communities in which the species *Ligularia sibirica* develops best we can mention: *Junco - Caricetum fuscae* R. Tüxen (1937) 1952, *Lythro salicariae-Juncetum effusi-inflexi* Todor et al 1971, *Carici echinatae-Sphagnetum recurvi* Soó (1934) 1954 (Syn. *Caricetum stellulatae* Csürös et al. 1956), *Telekio speciosae-Petasitetum hybridi* (Morariu 1967 n.n.) Resmeriță et Rațiu, *Filipendulo-Geranium palustris* W. Koch 1926, *Angelico - Cirsietum oleracei* R. Tx. 1937, *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), *Hieracio rotundati-Piceetum* Pawl. et Br.-Bl. 1939, *Telekio speciosae-Alnetum incanae* Coldea (1986) 1991 and *Salicetum fragilis* Passarge 1957; *Salicetum albae* Issler 1924 (Niculescu, M., 2006, 2014, 2015, 2016).

The plant community is found on the two valleys – Delnita and Salonca, installing on the substrate turbos, very acidic, at altitudes between 810-960 m.s.m. In the researched territory, such phytocenoses were analyzed in the following locations:

46°25'55.0"-25°53'52.9"; 46°25'52.7"-25°53'55.8"; 46°25'51.4"-25°53'28.8"; 46°25'22.7"-25°54'22.8"; 46°25'19.4"-25°54'23.4"; 46°25'13.5"-25°54'25.2"; 46°24'35.8"-25°55'05.7"; 46°24'37.9"-25°55'04.5"; 46°24'35.8"-25°55'05.7"; 46°24'58.2"-25°54'35.2"; 46°25'18.7"-25°32'9.01"; 46°25'24.4"-25°51'29.6";

46°25'20.3"-25°51'32.1"; 46°24'54.0"-25°52'45.7"; 46°25'20.3"-25°51'32.1"; 46°25'09.1"-25°51'55.1"; 46°25'08.6"-25°51'59.4"; 46°25'01.3"-25°52'09.8"; 46°25'17.0"-25°51'34.3"; 46°25'01.3"-25°52'10.9"; 46°25'28.8"-25°51'22.9"; 46°25'40.3"-25°50'22.2".

The most stable populations with the highest number of individuals were identified in the following plant community: *Junco - Caricetum fuscae* R. Tüxen (1937) 1952 (fig. 1).

In the floristic composition of the phytocenoses that build this plant community are encountered with a great abundance-dominance the following species: *Carex echinata*, *C. rostrata*, *Ligularia sibirica*, *Epipactis palustris*, *Veronica scutellata*, *Juncus filiformis*, *Comarum palustre*, *Menyanthes trifoliata*, *Carex flava*, *Galium palustre*, *Acrocladium cuspidatum*, *Juncus effusus*, *Equisetum palustre*, *Filipendula ulmaria*, *Myosotis palustris*, *Lysimachia numularia*. The layer of Bryophyta is very well developed, being represented by the following: *Sphagnum palustre*, *Sphagnum recurvum*, *S. acutifolium*, *S. russowii*, *Climacium dendroides*, *Drepanocladus revolvens*. Up to 2350 individuals have been identified in the floristic structure of this plant community, depending on the area that the plant community occupies and hence the habitat. The floristic structure of these phytocenoses is characterized by the presence of the numerous species: mesophyle, followed by meso-hygrophyle, hygrophyle, eurithermic, euriionic and acidophyle.

Another plant community in which *Ligularia sibirica* meets with great abundance-dominance is: *Lythro salicariae-Juncetum effusi-inflexi* Todor et al 1971 (fig. 2).

Along with the two edifying species of the plant community, the following species frequently participate in the composition of the plant carpet: *Juncus effusus*, *J. inflexus*, *J. conglomeratus*, *Lytrum salicaria*, *Festuca pratensis*, *Poa*

*trivialis*, *P. pratensis*, *Ligularia sibirica*, *Deschampsia caespitosa*, *Gratiola officinalis*, *Epilobium palustre*, *Myosotis scorpioides*, *Carex hirta*.

Also in this plant community up to 850 individuals have been identified in the floristic structure of this plant community, depending on the area that the plant community occupies and hence the habitat.

In the basin of the Salonca and Delnita we meet another plant community where this species is frequently found, and the number of individuals is considerable is edified by butterbur. Athis plant communitu prefer the places with fertile soils, often by rivers, streams and in wet meadows. The populations of *Ligularia sibirica* identified in the floristic structure of this plant community are stable, have between 50 and 350 individuals.

Also in the following plant communities *Scirpetum sylvatici* Ralski 1931 em. Schwich 1944 and *Deschampsietum caespitosae* Hayek ex Horvatić 1930 (Syn. *Agrostio stoloniferae* *Deschampsietum caespitosae* Ujvárosi 1947) we can meet important and stable populations of *Ligularia sibirica*.

So, in the phytocenoses of these plant communities the populations have large numbers of individuals, up to 1250, are stable and have relatively good conservation status. The only pressures and threats are represented by household waste and deforestation near the habitats of the species *Ligularia sibirica*. Compared to the plant communities in which the species has been identified, in Romania, from the territory studied we can mention the following communities of woody plants: *Telekio speciosae-Alnetum incanae* Coldea (1986) 1991 and *Salicetum albae* Issler 1924 (Syn. *Salicetum albae-fragilis* Tx. Ex Moor 1958).

In these plant communities, the species *Ligularia sibirica* forms smaller but stable populations at the edge or in

the clearings of these plant groups or in phytocenoses with weak coverage of 50-60%. These populations show a more stable state of conservation. In forest clearings or at the edge of the *Hieracio rotundati-Piceetum* Pawl. et Br.-Bl. 1939 plant community populations have a smaller number of individuals (fig. 3). But even though the number of individuals is small, the populations are stable and have a good state of conservation. The only threats are related only to the management of forestry works, to be done correctly, following the rules of forestry and biodiversity conservation. In this plant community in the floristic structure were identified between 5 and 260 individuals of *Ligularia sibirica*.



Fig. 1. *Ligularia sibirica* – in the *Junco - Caricetum fuscae* R. Tüxen (1937) 1952 plant community (Niculescu Mariana, 2019)



Fig. 2. *Ligularia sibirica* – in the *Lythro salicariae-Juncetum effusi-inflexi* Todor et al 1971 plant community, (Niculescu Mariana, 2019)



Fig. 3. *Ligularia sibirica* – in the 9410 forest habitat, (Niculescu Mariana, 2019)

### CONCLUSIONS

During our study, we identified the species *Ligularia sibirica* in the floristic composition of ten plant communities. The populations identified of the *Ligularia sibirica* in the researched territory are usually stable and consist of 5 to 2350 individuals.

In the woody plant communities the populations are smaller and less stable, sometimes affected by the vegetation dynamics of this area.

Compared to the plant communities in which the species was identified in Romania, from the territory studied we can also mention the following plant communities: *Telekio speciosae-Alnetum incanae* Coldea (1986) *Salicetum albae* Issler 1924 (Syn. *Salicetum albae-fragilis* Tx. Ex Moor 1958) and *Lythro salicariae- Juncetum effusi-inflexi* Todor et al 1971. The main threats and pressures are represented by household waste, forestry works and road network in the area. In order to keep these populations in a good state of conservation, it is recommended first of all to monitor existing populations and to comply with the rules for the protection of protected, rare, endemic species.

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