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PHYTOSOCIOLOGICAL STUDY CONCERNING ASSOCIATONS WITH *LIGULARIA SIBIRICA* (L.) CASS. IN ROMANIA

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Abstract
The threatened taxon of community importance Ligularia sibirica (L.) Cass. is one of the many glacial relicts common in eutrophic and oligotrophic wetlands preserved in Romania. The aim of this paper is to make a brief description of the studied taxa, its taxonomic and coenotic framing in the two bioregions where is present in our country, respectively alpine and continental regions. Also was made the coenotaxonomical classification of association were Ligularia sibirica (L.) Cass. can be found, important for the next field studies of the relict.

Keywords: Ligularia sibirica, coenotic and coenotaxonomical classification

1. INTRODUCTION

Relict species *Ligularia sibirica* (L.) Cass. migrated during glaciation periods from Asia to Europe in Preboreal, where climatic conditions have allowed existence till now (Pop E., 1960). In Europe, *Ligularia sibirica* (L.) Cass. species is distributed throughout 12 states, Romania being one of the countries that is found in a pretty good conservative state, which is due of framing of relict in Natura 2000 community importance sites from continental and alpine bioregions (Brînzan, 2013).
Habitats Directive 92/43/EEC of May 1992 in Annexes II and IV, and the Berne Convention by Annex I legislative protect the taxon of community importance *Ligularia sibirica* (L.) Cass. (Sârbu, 2007; Popescu, 2012).
In Romania, *Ligularia sibirica* (L.) Cass., is present in habitats, like 7110* Active raised bogs, 7120 Degraded raised bogs still capable of natural regeneration, 7140 Transition mires and quarking bogs, 7210 * Calcareous fens with *Cladium mariscus* and *Caricion davallianae* species, 7230 Alkaline fens, 91D0* Bog woodland, 6430 Hydrophilous tall herb fringe communities of plain and of the montane to alpine levels, 7240* Alpine pioneer formations of *Caricion bicoloris – atrofuscae*, 3220 Alpine rivers and the herbaceous vegetation along their banks, R5410 South-Eastern Carpathian mesotrophic swamps with *Carex echinata* and *Sphagnum recurvum*, R5411 South-Eastern Carpathian eu-mesotrophic swamps with *Carex nigra* ssp. *nigra*, *Juncus glaucus* and *Juncus effusus* (Doniță et al., 2005; Brînzan, 2013).
Ligularia sibirica (L.) Cass. vegetates on varied soils that are temporarily or permanently flooded, such as clay-peat swamps soil, glee hydromorphic soil with a variable mixture of limestone, soils poor in nutrients, peaty soils with neutral to slightly alkaline reaction, soils reach in minerals, acidic brown soils, skeletal rendsinas soils, colluvial soils rich in humus.

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2. MATERIALS AND METHODS

Setting synonyms and coenotic integration of the studied species and also coenotaxonomic classification of the association in which *Ligularia sibirica* (L.) Cass. takes part, was made according to the following papers*: Categorii sozologice din cormoflora județului Argeş* (Alexiu, 2011), *Les associations végétales de Roumanie* (Coldea, 1997), *Manual de interpretare a habitatelor Natura 2000 din România* (Gafta, Mountford, 2008), *Habitatele din România* (Doniță et al., 2005) *Aspecte din vegetația Rezervației de mlaştină de la Hărman* (Morariu, 1964), *Breviar fitocenologic* (Sanda, 2006), *Fitocenozele din România* (Sanda et al., 2008). *Habitate şi situri de interes comunitar* (Schneider, Drăgulescu, 2005), *Răspândirea populațiilor relicte de Ligularia sibirica (L.) Cass.* (Stoicovici, 1982), *Flora Europaea* (Tutin et al., 1976), *Flora ilustrată a României* (Ciocârlan, 2009), *Phtosociological researches concerning habitats with Ligularia sibirica (L.) Cass. from Meridional Carpathians* (Neblea, 2009) and *Phytocoenotic surveys on some mesotrophic-eutrophic marshes in Eastern Romania* (Oprea, Sîrbu, 2010).

The abbreviations used in this paper: AG - Argeş, BV - Braşov, CJ - Cluj, CV - Covasna, DB - Dâmbovița, HD - Hunedoara, HR - Harghita, MM - Maramureş, NT - Neamț, PH - Prahova, SV - Suceava, VL - Vâlcea; Au – Austria, Bu – Bulgaria, Cz – Czech Republic, Est – Estonia, Fe – Finland, Fr – France, Hrv – Croatia, Lv – Latvia, Po – Poland, Rm – Romania, Rs – Russia, Sla – Slovakia, DD – Data Deficient.

3. RESULTS AND DISCUSSIONS

From taxonomical point of view, *Ligularia sibirica* (L.) Cass. species (Figure 1) is framed in Domain Eukaryota, Regnum Plantae, Subregnum Viridaeplantae, Phylum Tracheophyta, Subphylum Spermatophytina, Infraphylum Angiospermae, Class Magnoliopsida, Subclass Asteridae, Superorder Asteranae, Order Asterales, Family Asteraceae.The *Ligularia sibirica* (L.) Cass. relict is a perennial species, hemicryptophyte, Eurasian, mesohygrophilic, microtherm, acid-neutrophil, polyploid, threatened taxon of European community importance.

***Ligularia sibirica* (L.) Cass.**

Synonyms:

- *Cineraria cacaliiformis* Lam.
- *Cineraria sibirica* (L.) L.
- *Hoppea sibirica (*L.) Rchb.
- *Ligularia bucovinensis* Nakai
- *Ligularia lydiae* Minderova
- *Ligularia ucrainica* Minderova
- *Othonna sibirica* L.
- *Senecillis sibirica* (L.) Simonk.
- *Senecio cacaliifolius* var. *cebennensis* Rouy
- *Senecio cacaliifolius* Sch.Bip.
- *Senecio cacaliiformis* Rchb.f.
- *Senecio ligularia* Hook.f.
- *Senecio sibiricus* (L.) Clarke

Popular name: Curechiul de munte, Gălbinele
Geographical distribution: Eua
Romanian counties: AG, BV, CJ, CV, DB, HD, HR, MM, NT, PH, SV, VL
European area: Au, Bu, Cz, Est, Fe, Fr, Hrv, Lv, Po, Rm, Rs, Sla
Frequency in Romania: Sporadic

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Coenotic integration:

- *Phragmitetum vulgaris* Soó 1927
- *Scirpo – Phragmitetum* W. Koch 1926
- *Cladietum marisci* Allorge 1922 ex Zobrist 1953
- *Caricetum ripariae* (Soó 1928) Knapp et Stoffer 1962 *typicum*
- *Caricetum paniculatae* Wangerin 1916
- *Caricetum rostratae* Rübel 1912 (Syn.: *Carici rostratae-Sphagnetum* O. Rațiu 1965 non Zólyomi 1931)
- *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)
- *Caricetum diandrae* (Jonas 1932) Oberdofer 1957 (Syn.: *Carici-Menyanthetum caricetosum diandrae* Rațiu 1972)
- *Caricetum lasiocarpae* Koch 1926
- *Junco - Caricetum fuscae* R. Tüxen (1937) 1952
- *Sphagno - Caricetum rostratae* Steffen 1931 (Syn.: *Carici rostratae-Sphagnetum* O. Rațiu 1965 non Zólyomi 1931
- *Carici echinatae - Sphagnetum* Soó (1934) 1954 (Syn.: *Caricetum stellulatae* Csűrös et al. 1956; *Carici echinatae – Sphagnetum* (Balázs 1942) Soó 1955)
- *Calamagrostietum neglectae* Tengwal 1920
- *Orchido - Schoenetum nigricantis* Oberd 1957 (Syn.: *Schoenetum nigricantis* I. Pop et al. 1962; *Schoeneto-Armerietum barcensis* Morariu 1967)
- *Carici flavae - Eriophoretum latifolii* Soó 1944
- *Carici flavae - Blysmetum compressi* Coldea 1997
- *Carduo kerneri – Festucetum carpaticae* (Pușcaru et al. 1956) Coldea 1990
- *Asperulo capitatae - Seslerietum rigidae* (Zólyomi1939) Coldea 1991
- *Ligulario sibiricae - Ribetum petraei* Neblea et Alexiu 2003
- *Cirsio waldsteinii - Heracleetum transsilvanici* Pawl. et Walas 1949 (Syn.: *Cardueto-Heracleetum palmati* Beldie 1967; *Heracleetum palmati* auct. roman.; *Heracleo (palmati) - Rumicetum* alpini Oltean et Dihoru 1986)
- *Filipendulo – Geranietum palustris* Koch 1926
- *Angelico – Cirsietum oleracei* R. Tx. 1937
- *Scirpetum sylvatici* Ralski 1931 em. Schwich 1944
- *Deschampsietum caespitosae* Hayek ex Horvatić 1930 (Syn.: *Agrostio stoloniferae-Deschampsietum caespitosae* Ujvárosi 1947)
- *Telekio - Petasitetum hybridi* (Morariu 1967) Resmeriță et Rațiu 1974 (Syn.: *Petasitetum hybridi* auct. roman.; *Aegopodio-Petasitetum hybridi* auct. roman.; *Telekio-Petasitetum albae* Beldie 1967; *Petasitetum albae* Dihoru 1975; *Petasiteto-Telekietum speciosae* Morariu 1967)
- *Salicetum cinereae* Zólyomi 1931

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Figure 1. Ligularia sibirica (L.) Cass.

Coenotaxonomical classification of associations with relict species *Ligularia sibirica* (L.) Cass. in Romania:

1. *PHRAGMITETEA AUSTRALIS* R. Tüxen et Preising 1942

PHRAGMITETALIA Koch 1926

Phragmition communis Koch 1926

- *Phragmitetum vulgaris* Soó 1927
- *Scirpo-Phragmitetum* W. Koch 1926
- *Cladietum marisci* Allorge 1922 ex Zobrist 1953

MAGNOCARICETALIA ELATAE Pignatti 1953

Magnocaricion elatae Koch 1926

Caricenion gracilis (Neuhäusl 1959) Oberd. et al. 1967

- *Caricetum ripariae* (Soó 1928) Knapp et Stoffer 1962 *typicum*

Caricenion rostratae (Balatova-Tulackova 1963) Oberdorfer et al. 1967

- *Caricetum paniculatae* Wangerin 1916
- *Caricetum rostratae* Rübel 1912

II. *MONTIO-CARDAMINETEA* Br.-Bl. et R.Tüxen 1943

MONTIO-CARDAMINETALIA Pawlowski 1928

Cardamino-Montion Br.-Bl. 1926

- *Carici remotae - Calthetum laetae* Coldea (1972) 1978 *ligularietosum sibiricae* Alexiu et Stancu 2003

III. *SCHEUCHZERIO-CARICETEA FUSCAE* Tx. 1937

SCHEUCHZERIO-CARICETALIA FUSCAE Nordhagen 1937

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Caricion lasiocarpae Van den Berghen ap. Lebrun et al. 1949
- *Caricetum diandrae* (Jonas 1932) Oberdofer 1957
- *Caricetum diandrae* (Jonas 1932) Oberdofer 1957 *caricetosum nigrae* Coldea 1981
- *Caricetum lasiocarpae* Koch 1926

CARICETALIA FUSCAE Koch 1926
Caricion fuscae Koch 1926 em. Klika 1934
- *Junco - Caricetum fuscae* R. Tüxen (1937) 1952
- *Junco - Caricetum fuscae* R. Tüxen (1937) 1952 *calamagrostietosum neglectae* (Coldea 1981)
- *Sphagno - Caricetum rostratae* Steffen 1931
- *Carici echinatae - Sphagnetum* Soó (1934) 1954

Calamagrostidion neglectae Prsg. ap. Oberd. 1949
- *Calamagrostietum neglectae* Tengwal 1920

CARICETALIA DAVALLIANAE Br.-Bl. 1949
Caricion davallianae Klika 1934
- *Orchido - Schoenetum nigricantis* Oberd. 1957
- *Carici flavae - Eriophoretum latifolii* Soó 1944
- *Carici flavae - Eriophoretum caricetosum nigrae* Soó 1959
- *Carici flavae - Eriophoretum caricetosum gracilis* Gergely 1966
- *Carici flavae - Eriophoretum menthetosum longifolii* Rațiu F. 1972
- *Carici flavae - Blysmetum compressi* Coldea 1997

IV. *MULGEDIO-ACONITETEA* Hadać et Klika in Klika et Hadać 1944
ADENOSTYLETALIA ALLIARIAE Br.-Bl. 1931
Adenostylion alliariae Br.-Bl. 1925
- *Ligulario sibiricae - Ribetum petraei* Neblea et Alexiu 2003
- *Cirsio waldsteinii - Heracleetum transsilvanici* Pawl. et Walas 1949
- *Adenostylo alliariae - Doronicetum austriaci* Horvat 1956

V. *SESLERIETEA ALBICANTIS* Br.-Bl. 1948 em. Oberdorfer 1978
SESLERIETALIA ALBICANTIS Br.-Bl. in Br.-Bl. et Jeny 1926
Festuco saxatilis-Seslerion bielzii (Pawłowski et Walas 1949) Coldea 1984
- *Carduo kerneri – Festucetum carpaticae* (Puşcaru et al. 1956) Coldea 1990

Seslerion rigidae Zolyomi 1939
- *Asperulo capitatae - Seslerietum rigidae* (Zólyomi1939) Coldea 1991

VI. *MOLINIO-ARRHENATHERETEA* R. Tüxen 1937
MOLINIETALIA CAERULEAE Kock 1926
Molinion caerulae Koch 1926
- *Filipendulo – Geranietum palustris* Koch 1926

Calthion palustris R. Tüxen 1937
- *Angelico – Cirsietum oleracei* R. Tx. 1937
- *Scirpetum sylvatici* Ralski1931 em. Schwich 1944

DESCHAMPSIETALIA CAESPITOSAE Horvatić 1956
Deschampsion caespitosae Horvatić 1930
- *Deschampsietum caespitosae* Hayek ex Horvatić 1930

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VII. *GALIO-URTICETEA* Passarge 1967 em. Kopecký 1969

CONVOLVULETALIA SEPIUM R.Tüxen em. Mucina 1993

Petasition officinalis Sillinger 1933 em. Kopecký 1969

- *Telekio - Petasitetum hybridi* (Morariu 1967) Resmeriță et Rațiu 1974

VIII. *ALNETEA GLUTINOSAE* Br.-Bl. et Tx. 1943

ALNETALIA GLUTINOSAE Tx. 1937

Salicion cinereae T. Müller et Görs 1958

- *Salicetum cinereae* Zólyomi 1931

4. CONCLUSIONS

From coenotic integration of the *Ligularia sibirica* (L.) Cass. species, results its sporadic presence in 27 plant associations mainly in *Scheuchzerio-Caricetea fuscae* Tx. 1937, associations integrated in 8 classes of vegetation in Romania. The studied relict is a characteristic species in such associations as *Caricetum ripariae* (Soó 1928) Knapp et Stoffer 1962 *typicum*, *Caricetum paniculatae* Wangerin 1916, *Carici remotae - Calthetum laetae* Coldea (1972) 1978 *ligularietosum sibiricae* Alexiu et Stancu 2003, *Caricetum diandrae* (Jonas 1932) Oberdofer 1957, *Caricetum diandrae* (Jonas 1932) Oberdofer 1957 *caricetosum nigrae* Coldea 1981, *Caricetum lasiocarpae* Koch 1926, *Junco - Caricetum fuscae* R. Tüxen (1937) 1952, *Junco - Caricetum fuscae* R. Tüxen (1937) 1952 *calamagrostietosum neglectae* (Coldea Gh. 1981), *Sphagno - Caricetum rostratae* Steffen 1931, *Carici echinatae - Sphagnetum* Soó (1934) 1954, *Orchido - Schoenetum nigricantis* Oberd 1957, *Carici flavae - Eriophoretum latifolii* Soó 1944, *Carici flavae - Blysmetum compressi* Coldea 1997, *Ligulario sibiricae - Ribetum petraei* Neblea et Alexiu 2003, *Cirsio waldsteinii - Heracleetum transsilvanici* Pawl. et Walas 1949, *Adenostylo alliariae – Doronicetum austriaci* Horvat 1956, *Salicetum cinereae* Zólyomi 1931.

Ligularia sibirica (L.) Cass. vegetates from mountain till alpine level. Being characteristic of the plant groups which include nitrophilous synanthropic vegetation phytocoenosis (*Galio-Urticetea* Passarge 1967 em. Kopecký 1969), coenoses with mesophilic and mesohygrophilic vegetation (*Molinio-Arrhenatheretea* R. Tüxen 1937), hygrophilic vegetation (*Betulo-Adenostyletea* Br.-Bl. et R. Tüxen 1943), thermophilic vegetation (*Seslerietea albicantis* Br.-Bl. 1948 em. Oberdorfer 1978), meso-oligotrophic bogs phytocoenosis in the Carpathian Mountains area (*Scheuchzerio-Caricetea fuscae* Tx. 1937), phytocoenosis with great floristic conservation from the water springs and cold streams (*Montio-Cardaminetea* Br.-Bl. et R.Tüxen 1943), and in characteristic coenoses of eutrophic swamps conditioned by undeveloped hydromorphic soils (*Phragmitetea australis* R. Tüxen et Preising 1942).

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