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THE PHYTOSOCIOLOGICAL STUDY OF *SALICI PURPUREAE-MYRICARIETUM* MOOR 1958 ASSOCIATION IN LEAOTA MOUNTAINS (ROMANIA)

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Abstract
The paper realizes a characterization of Salici purpureae-Myricarietum Moor 1958 plant association from Leaota Mountains from the coenotic point of view as well as the bioforms, geoelements and ecological indices. There were made some observations concerning main pressures that affect the favorable state of conservation and also the conservation measures of these coenoses.

Keywords: Salici purpureae-Myricarietum, Leaota Mountains, Romania

1. INTRODUCTION

Alpine rivers with natural or at least near-natural morphology and dynamics have become rare and are highly endangered across Europe. The vegetation database of *Salici-Myricarietum* contains about 500 vegetation plots spatially including the main European mountain regions (Alps, Carpathians, Balkan, Appennine and Scandinavian Mountains) (Kudrnovsky and Kalnikova, 2015).
According to Gafta and Mountford (2008), *Salici purpureae-Myricarietum* Moor 1958 is affiliated to the 3230 natural habitat-Alpine rivers and their ligneous vegetation with *Myricaria germanica*.
There are a number of 23 SCIs in Romania that include in the standard form this type of habitat, such as: Apuseni, Bucegi, Bicaz-Hăşmaş Gorges, Ciucaş, Cozia, Nemira Ridge, Jiu Defile, North-Eastern Gorj, North-Western Gorj, Parâng, Penteleu, Piatra Craiului, Putna-Vrancea, Retezat, Siriu, Slănic, Iada Valley, Vânători Neamţ, Făgăraş Mountains, Rodna Mountains, Ciuc Mountains, Suceava River, Maramureş Mountains (Danci, 2014).
These coenoses have an important role in the fixation of alluvial deposits and their enrichment with scraps of plant material, which to the process of decomposition contributes to the soil formation (Sanda et al., 2001). It is a type of shrub vegetation that decisively contribute to reducing the flooding and regulate the flow of silt and erosion rate in the riverbed (http://infonatura2000.cndd.ro/documents/Catalog_Infonatura2000.pdf).
The Leaota Mountains are situated in the South part of Romania (Meridional Carpathians) being bordered by other important mountains massifs: Piatra Craiului, Bucegi and Iezer-Păpuşa. In this area, phytocoenoses with *Myricaria germanica* are fragmented along the streams from

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mountaineous level. The most representative and well developed vegetal coenoses are spread on Bădeni Valley and Baba Valley (Figure 1).

Figure 1. Salici purpureae-Myricarietum Moor 1958 association in Bădeni Valley (left) and Baba Valley (right)

2. MATERIALS AND METHODS

The analysis of *Salici purpureae-Myricarietum* Moor 1958 association was performed in 2016 as part of the research project concerning Biodiversity Studies – plant species and natural habitats from Leaota Mountains financed by Conservation Carpathia Foundation.

Therefore were made phytosociological surveys in the field according to Braun-Blanquet method of the Zürich-Montpellier School. The taxa were identified both in the field and in the laboratory using Flora of Romania and Illustrated Determinator of Vascular Plant by Sârbu et al. (2013). This plant association was characterized from the coenotic point of view as well as the bioforms, geoelements types and ecological preferences on the basis of specialty papers (Coldea, 1991; Cristea et al., 2004; Sanda et al., 2001, 2003, 2008; Chifu et al., 2006; Coldea et al., 2015).

3. RESULTS AND DISCUSSIONS

The phytocoenoses of *Salici purpureae-Myricarietum* Moor 1958 association were identified on stream gravels from mountaineous level at 721-1285 m altitude (Baba Valley, Ialomicioara Valley, Bădeni Valley, Brătei Valley) (Figure 2).

The edifying species are *Salix purpurea* and *Myricaria germanica* which have a coverage of 30-60% (Figure 1). The arborescent and shrub layer is formed by *Salix purpurea, S. silesiaca, S. triandra, S. alba, S. caprea, S. elaeagnos, Ulmus glabra, Populus nigra, P. alba, Acer pseudoplatanus, Sambucus nigra, Rubus idaeus, Rosa canina, Crataegus monogyna, Spiraea chamaedryfolia, Betula pendula* (Table 1).

There are also present characteristic species to *Salicion elaeagno-daphnoidis* alliance (*Chaerophyllum hirsutum, Angelica sylvestris, Petasites hybridus, Salix elaeagnos, Calamagrostis pseudophragmites*), *Salicetalia* order and *Salicetea purpureae* class (*Ranunculus repens, Glechoma hederacea, Salix triandra, Salix alba, Lysimachia nummularia*). The floristic composition is varied and rich in species with different coenotic preferences of *Querco-Fagetea* (*Geranium robertianum, Fragaria vesca, Stellaria nemorum, Stachys sylvatica, Ajuga reptans, Dryopteris filix-mas,*

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Moehringia trinervia), *Molinio-Arrhenatheretea* (*Achillea millefolium, Plantago major, Prunella vulgaris, Taraxacum officinale, Bellis perennis, Equisetum arvense, Mentha longifolia, Juncus effusus, Trifolium repens*), *Galio-Urticetea* (*Cardamine impatiens, Aegopodium podagraria, Alliaria petiolata, Galium aparine*) and *Stellarietea mediae* classes (*Erigeron annuus, Conyza canadensis, Rumex acetosella, Capsella bursa-pastoris, Viola arvensis*).

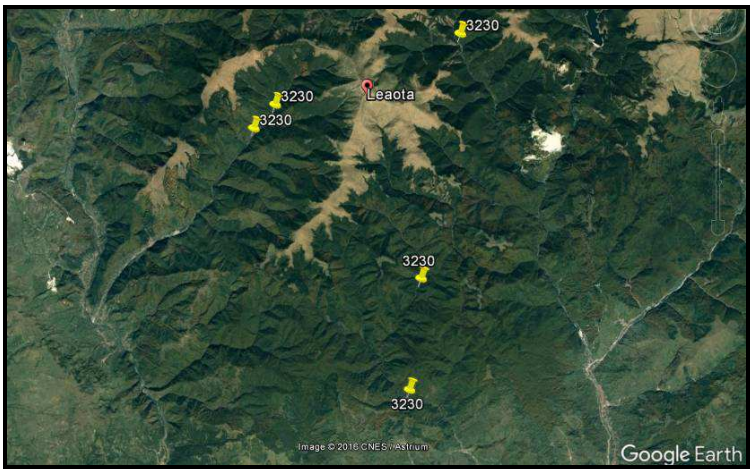

***Figure 2. Location of 3230 natural habitat-Alpine rivers and their ligneous vegetation with Myricaria germanica in Leaota Mountains* (https://www.google.com/earth/)**

This association has a good tendency of evolution in the future because of the presence of a numerous juveniles of *Myricaria germanica* on the stream gravel both on Bădeni Valley and Brătei Valley. There is a good regeneration of *Alnus incana* on Baba, Ialomicioara and Bădeni Valleys, that reveals a syndinamic evolution of these coenoses towards the ones belonging to *Alno-Ulmion* alliance. The vegetal layer of this association is contaminated by alien species such us *Erigeron annuus* and *Conyza canadensis* both on Baba Valley and Bădeni Valley. The bioforms spectrum reveals the dominance of the hemicryptophytes (52.29 %), followed by different types of phanerophytes (nanophanerophytes – 2.75 %; mesophanerophytes – 8.25 %; megaphanerophytes – 7.33 %), chamephytes (5.50 %) and geophytes (3.66 %). The terophytes (annual and biannual) have a high percentage of 20.17 % that highlights an important anthropozoogenic influence on cormoflora (Figure 3).

The vegetal layer is formed by various types of floristic elements with a principal nucleus represented by Eurasian (45.87 %), European (17.43 %) and Central European (9.17 %) species. The Cosmopolitan and Circumpolar elements present a significant percentage of 11.92 %, respectively 6.42 % (Figure 4).

The phytocoenoses of this association are edified by species with various ecological demands as follows: mesophilous (53.27 %), meso-hygrophilous (19.62 %), xero-mesophilous (15.88 %), micro-mesotherms (53.27 %), microtherms (26.16 %), euritherms (19.62 %), euriionic (38.31 %), acid neutrophilous (28.03%) and low acid neutrophilous (23.36 %) (Figure 5).

The main pressures affecting the good development of these phytocoenoses are:

- extraction of sand, gravel from stream beds. There is a gravel pit near the Bădeni village;
- depositing of waste from recreational, pastoral or forest exploitation activities;

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- the existence of fire hearths on the banks of streams, plastic materials result of the activities of shepherds, tourists, workers from forest exploitations during the summer, especially on Bădeni Valley;
- the presence of alien species (*Conyza canadensis*, *Erigeron annuus*).

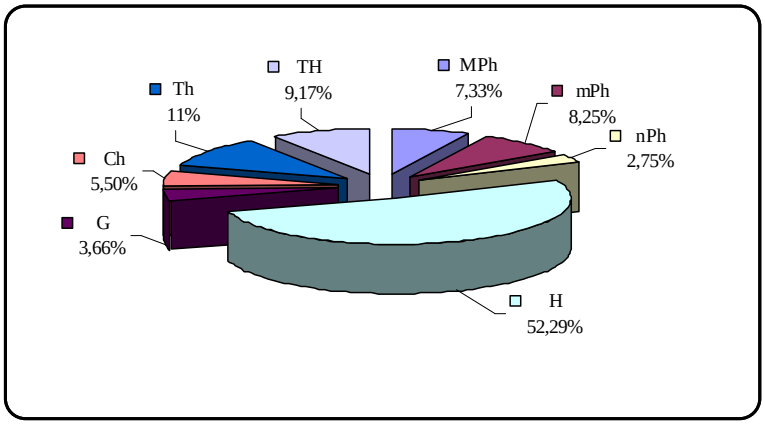

Figure 3. Bioforms spectrum of Salici purpureae-Myricarietum Moor 1958 association

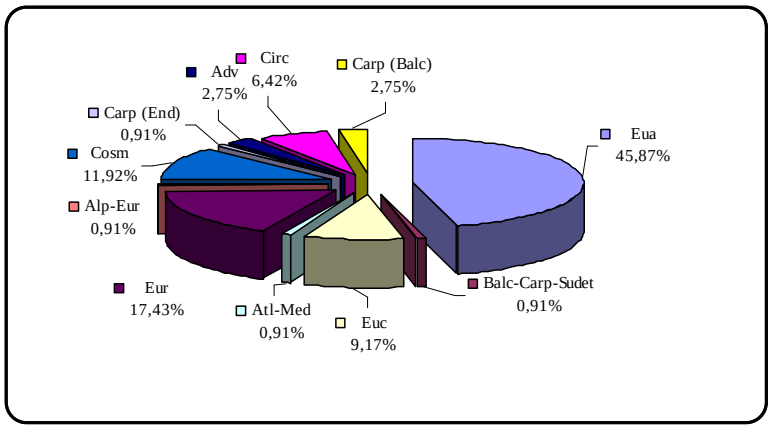

Figure 4. Geoelements spectrum of Salici purpureae-Myricarietum Moor 1958 association

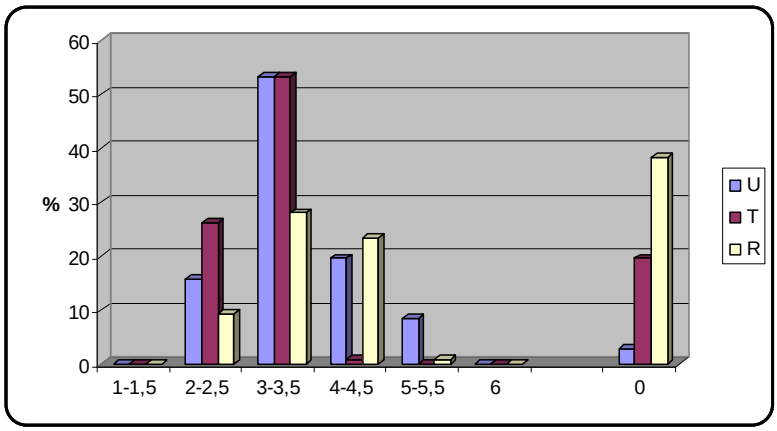

Figure 5. Ecological spectrum of Salici purpureae-Myricarietum Moor 1958 association

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Table 1. Salici purpureae-Myricarietum germanicae Moor 1958

Survey	1	2	3	4	5	
Altitude (m)	929	721	893	1047	1285	
Exposition	V	E	-	E	-	
Slope (degree)	5	5	-	10	-	
Surface (m^2)	200	200	200	200	100	
Coverage of the shrub and juvenile layer (%)	60	60	70	70	40	
Coverage of the herbaceous layer (%)	40	35	35	30	30	K
Char. ass.						
Myricaria germanica	2-3	1-2	3	3-4	2-3	V
Salix purpurea	+	1-2	1-2	1	1	IV
Salicion elaeagno-daphnoidis						
Alnus incana juv.	2-3	2-3	2	+1	+	V
Chaerophyllum hirsutum	+	-	+	-	-	II
Angelica sylvestris	+	+	-	-	-	II
Petasites hybridus	2	1	-	-	-	II
Salix elaeagnos	+	-	-	-	-	I
Calamagrostis pseudophragmites	-	-	-	-	1	I
Salicetalia purpureae et Salicetea purpureae						
Ranunculus repens	+	+	+	+	-	IV
Glechoma hederacea	+	+	+	-	-	III
Salix triandra	+	+	+	-	-	III
Salix alba	-	+	+	-	-	II
Lysimachia nummularia	+	+	-	-	-	II
Populus nigra	-	+	-	-	-	I
Urtica dioica	-	-	-	+	-	I
Populus alba	-	+	-	-	-	I
Solanum dulcamara	-	+	-	-	-	I
Querco-Fagetea s. l.						
Geranium robertianum	+	+	+	+	-	IV
Fragaria vesca	+	-	-	-	+	II
Ajuga reptans	-	-	+	-	-	I
Crataegus monogyna	-	+	-	-	-	I
Sambucus nigra	-	+	-	-	-	I
Scrophularia nodosa	-	+	-	-	-	I
Stachys sylvatica	-	-	-	+	-	I
Stellaria nemorum	-	-	-	+	-	I
Clematis vitalba	-	+	-	-	-	I
Dryopteris filix-mas	-	+	-	-	-	I
Moehringia trinervia	-	-	+	-	-	I
Molinio-Arrhenatheretea s. l.						
Achillea millefolium	-	+	+	+	+	IV
Plantago major	+	+	-	+	+	IV
Prunella vulgaris	-	-	+	+	+	III
Taraxacum officinale	+	-	+	+	-	III

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Bellis perennis	+	-	+	-	+	III
Equisetum arvense	+	-	+	+	-	III
Mentha longifolia	+	+	+	-	-	III
Juncus effusus	+	-	-	+	-	II
Trifolium repens	-	-	-	+	+	II
Deschampsia caespitosa	-	-	-	-	+	I
Holcus lanatus	-	-	-	+	-	I
Leucanthemum vulgare	-	-	-	-	+	I
Plantago lanceolata	-	-	+	-	-	I
Trifolium pratense	-	-	+	-	-	I
Galio-Urticetea s. l.						
Cardamine impatiens	-	+	+	-	-	II
Aegopodium podagraria	+	-	-	+	-	II
Alliaria petiolata	-	-	+	-	-	I
Galium aparine	-	-	+	-	-	I
Rumex obtusifolius	-	+	-	-	-	I
Sambucus ebulus	-	+	-	-	-	I
Stellarietea mediae s. l.						
Erigeron annuus	+	+	+	+	-	IV
Conyza canadensis	-	-	-	+	-	I
Capsella bursa-pastoris	-	-	+	-	-	I
Rumex acetosella	-	-	-	+	-	I
Viola arvensis	-	-	+	-	-	I
Variae syntaxa						
Veronica chamaedrys	+	+	+	+	-	IV
Myosotis sylvatica	+	+	+	-	+	IV
Cardamine amara	+	+	+	+	-	IV
Carduus personatus	+	+	-	+	-	III
Anthriscus sylvestris	+	-	+	+	-	III
Thymus pulegioides	-	-	+	+	+	III
Picea abies juv.	+	-	+	-	+	III
Salvia glutinosa	-	+	+	+	-	III
Tussilago farfara	-	-	+	+	+	III
Hypericum maculatum	-	-	+	+	+	III
Silene pusilla	-	-	+	+	+	III
Luzula luzuloides	-	-	+	+	+	III
Cerastium fontanum ssp. *fontanum*	-	-	+	+	+	III
Rubus idaeus	-	+	-	-	+	II
Galeopsis speciosa	-	-	-	+	+	II
Spiraea chamaedryfolia	-	-	+	+	-	II
Betula pendula	-	-	+	+	-	II
Athyrium filix-femina	-	-	+	+	-	II
Alchemilla xanthochlora	-	-	+	-	+	II
Euphrasia stricta	-	-	-	+	+	II
Leontodon autumnalis	-	-	-	+	+	II

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Juncus tenuis	+	-	-	-	-	I
Salix silesiaca	+	-	-	-	-	I
Carex pendula	+	-	-	-	-	I
Ulmus glabra	-	+	-	-	-	I
Barbarea vulgaris	-	+	-	-	-	I
Eupatorium cannabinum	-	+	-	-	-	I
Valeriana officinalis	-	+	-	-	-	I
Acer pseudoplatanus	-	+	-	-	-	I
Euphorbia cyparissias	-	+	-	-	-	I
Rosa canina	-	+	-	-	-	I
Pulmonaria rubra	-	-	+	-	-	I
Lamium galeobdolon	-	-	+	-	-	I
Cardaminopsis arenosa	-	-	+	-	-	I
Veronica officinalis	-	-	+	-	-	I
Veronica urticifolia	-	-	+	-	-	I
Viola tricolor	-	-	+	-	-	I
Verbascum phlomoides	-	-	+	-	-	I
Silene heuffelii	-	-	+	-	-	I
Salix caprea	-	-	+	-	-	I
Veronica serpyllifolia	-	-	+	-	-	I
Arabis turrita	-	-	+	-	-	I
Linum catharticum	-	-	+	-	-	I
Turritis glabra	-	-	-	+	-	I
Mycelis muralis	-	-	-	+	-	I
Gnaphalium sylvaticum	-	-	-	+	-	I
Rumex alpinus	-	-	-	+	-	I
Veronica beccabunga	-	-	-	+	-	I
Leucanthemum waldsteinii	-	-	-	+	-	I
Erigeron acris	-	-	-	+	-	I
Epilobium palustre	-	-	-	-	+	I
Luzula sylvatica	-	-	-	-	+	I
Carduus acanthoides	-	-	-	-	+	I
Juncus articulatus	-	-	-	-	+	I
Campanula patula ssp. *abietina*	-	-	-	-	+	I
Rumex alpestris	-	-	-	-	+	I
Lotus corniculatus	-	-	-	-	+	I
Place and data of the surveys: 1 – Baba Valley (22.05.2016); 2 – Ialomicioara Valley (22.05.2016); 3 – Bădeni Valley (24.05.2016); 4 – Bădeni Valley (13.08.2016); 5 – Brătei Valley (21.08.2016).						

4. CONCLUSIONS

The 3230 natural habitat-Alpine rivers and their ligneous vegetation with *Myricaria germanica* is an important natural habitat with a high conservation value, being protected under the Emerald Network and Natura 2000 Network.

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The favorable status of conservation of this habitat can be assured if there are respected some measures of conservation in the Leaota Mountains, as follows: limiting the extraction of mineral aggregates from the Bădeni riverbed; control the spread of alien species that can alter phytocoenoses from the structural point of view; prohibiting the watercourses regularization; prohibiting the cutting of trees and shrubs on the banks of streams; monitoring and limitation of anthropogenic activities.

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