THE PIONEER, HYGROPHILOUS VEGETATION OF VALEA IADULUI, WESTERN CARPATHIANS

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RESEARCH ARTICLE

Abstract

The aim of this paper is to carry out a floristic, phytosociological and ecological study of the hygrophilous vegetation built up by the phytocoenoses of the Cypero-Limoselletum association. To achieve the proposed goal, we conducted five phytosociological surveys on the phytocoenoses built by the population of Peplis portula, Limosella aquatica and Eleocharis acicularis species during the optimal vegetation period related to the serotinal season. In terms of results, the inventoried species were analysed according to the basic coenotaxa related criteria of association, alliance, order, and vegetation class being all included in a synthetic table. The ecological behaviour of cormophytes was described in terms of their relationship with ecological factors, edaphic moisture, air temperature and soil chemical reaction, as well as the classification of the species concerned by ecological categories of bioforms and geoelements was achieved by means of charts and histograms.

Keywords: phytocoenoses, coenotaxa, ecological behavior, vegetation, bioforms
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INTRODUCTION

The hygrophilous, pioneering vegetation of Valea Iadului, a left tributary of Crișul Repede river flowing through Western Carpathians, consists of the phytocoenoses of the association ***Peplido-Limoselletum*** Philippi 1968 (Syn: ***Heliocharito acicularis-Limoselletum aquaticae*** Wenderberger-Zelinka 1952; ***Cypero-Limoselletum*** Korneck 1960) from the former reservoir "Leșu". Ecological conditions are distinct due to different geological structures associated with diverse pedo-climatic conditions over the years. The "Leșu" reservoir is currently dry, due to the infiltration of water through the calcareous rock of the side walls present on the mountain slopes.

The goal of this paper is to conduct a floristic, phytosociological, and ecological study of the pioneer, hygrophilous vegetation built by *Peplis portula* and *Limosella aquatica*. To achieve the proposed goal, we set the following objectives: carrying out the floristic inventory of the phytocoenoses of the Peplido-Limoselletum association; running the study of the living soil cover as well as the classification of the species in the synthetic table of association by affinity to alliance, order, class of vegetation to which they are subordinated; making the ecological characterization of the phytotaxa in terms of distribution to the type of biform, phytogeographical element, belonging to the ecological categories i.e. soil moisture, air temperature and the chemical reaction of the soil.

MATERIAL AND METHOD

We carried out the research out in the meadow of the former "Leșu" reservoir, on Valea Iadului, Apuseni Mountains. The biological material consists of the phytocoenoses of the ***Peplido-Limoselletum*** association Philippi 1968, spread in the mountain floor on flat relief, on wet lands, in micro-depressions or negative relief where rainwater stagnates, shallow water puddles, with alluvial, sandy soils, silts, luvosoils, gleosoils, alluviosoils on clay-sand substrate, and alluvial, clay, sandy deposits.

In order to establish the living soil cover, we made use of the methods of the Central European School developed by Braun-Blanquet (1964) being tailored to the particularities of hygrophilous vegetation by Borza et Boșcaiu (1965), by the classical, practical methods developed by Ivan et Doniță (1975), Ivan et Spiridon (1983), Ivan (1992). According to Géhu et Rivas-Martinez (1981) we adopted the plant association as the coenotaxonomic unit.

Table 1

Plant association *Peplido-Limoselletum* Philippi 1968

Bio.	P.e.	M	T	R	Survey no.	1	2	3	4	5	K	ADm
					Altitude (mamsl)	544	536	542	540	542		
					Grassy layer coverage (%)	80	90	60	50	80		
					Surface (m^2)	8	6	4	6	8		
Th	E	4	3	0	As. *Peplis portula*	4	5	3	3	4	V	57.5
Th	Cosm	4.5	3	0	As. *Limosella aquatica*	+	+	+	+	+	V	0.5
H(Hh)	Cp	5.5	0	0	As. *Eleocharis acicularis*	1	1	1	1	1	V	5
Th	Eua	6	3	4	As. *Cyperus fuscus*	.	+	+	.	.	II	0.2
Nanocyperion, Nanocyperetalia et Isoëto-Nanojuncetea												
Th	Eua	5	3	4	*Gnaphalium uliginosum*	+	+	+	1	+	V	1.4
H	Eua	4	3	4	*Rorippa sylvestris ssp. sylvestris*	+	+	+	.	+	IV	0.4
H	Cp	5	3	5	*Alopecurus aequalis*	.	.	.	+	.	I	0.1
H	Eua	3	0	0	*Plantago uliginosa*	.	.	.	.	+	I	0.1
Th	Cosm	4	3	0	*Lythrum hyssopifolia*	+	.	.	.	.	I	0.1
Phragmitetea australis												
Hh	Cp	6	0	0	*Alisma plantago-aquatica*	1	1	1	1	1	V	5
G(Hh)	Cp	6	3	0	*Leersia oryzoides*	1	+	1	+	1	V	3.2
G(Hh)	Cosm	5	0	4	*Eleocharis palustris*	.	+	.	.	+	II	0.2
H(Hh)	Cp	4	3	0	*Lythrum salicaria*	.	+	+	.	.	II	0.2
H(Hh)	Cp-Bo	5	0	4	*Veronica anagallis-aquatica*	+	.	+	.	.	II	0.2
H	Eua	4	0	0	*Ranunculus repens*	.	.	+	.	.	I	0.1
Bidentetea tripartiti												
Th	Cosm	4	0	3	*Echinochloa crus-galli*	+	.	.	+	+	III	0.3
Th	Cp	4.5	3	4	*Polygonum hydropiper*	.	.	+	+	.	II	0.2
Th	Eua	4.5	3	0	*Bidens tripartita*	.	.	.	.	+	I	0.1
Th	Eua	5	3	4	*Rumex palustris*	.	.	.	.	+	I	0.1
Plantaginetea majoris												
G	Adv(Am.N)	3.5	3	4	*Juncus tenuis*	+	.	.	.	+	II	0.2
H(Ch)	Cp	4	3	3	*Sagina procumbens*	.	.	.	.	+	I	0.1
H	Eua	3	0	0	*Taraxacum officinale*	.	.	.	+	.	I	0.1
Variae syntaxa												
mPh	Eua	5	3	4.5	*Salix purpurea ssp.purpurea*	+	+	+	.	+	IV	0.4
Th	Eua	2.5	3	3	*Lapsana communis ssp.communis*	.	.	.	+	+	II	0.2
Th	P	2	4	4.5	*Anthemis austriaca*	.	.	+	.	.	I	0.1

Location and date of surveying: 1- 46°48ˡ534ˡˡN, 22°34ˡ943ˡˡE (3.10.2020); 4-46°48ˡ529ˡˡN, 22°34ˡ942ˡˡE Baraj Leșu Baraj Leșu (3.10.2020); 2-46°48ˡ525ˡˡN, 22°34ˡ947ˡˡE Baraj Leșu (3.10.2020); 5-46°48ˡ528ˡˡN, 22°34ˡ949ˡˡE Baraj Leșu (3.10.2020); 3-46°48ˡ525ˡˡN, 22°34ˡ946ˡˡE Baraj Leșu (3.10.2020)

Figure 1 **Peplido-Limoselletum association (original picture, Baraj Leșu, 3.10.2020)**

In order to reveal the floristic structure united in the ***Peplido-Limoselletum*** association, we conducted five phytocenological surveys (4-8m^2) in the former "Leşu" reservoir, at variable altitudes (536, 540, 542, 544m), the phytocenosis having a low coenotic cohesion due to the weak presence of the included species and the substrate coverage, during the optimal vegetation period. We selected the five sample areas since they are most representative for hygrophilous ecosystems. The sample areas were included in the analytical phytosociological table with the species ordered by coenotaxa to which they belong, with the assessment of the abundance-dominance indices (ADm), according to the Braun-Blanquet et Pavillard (1928) system corroborated with the constancy class indices (K=I-V), which suggests the degree of coenotaxa fidelity of a species to the environment of the phytocoenoses of an association (Cristea, 1991).

The belonging of the coenotaxa to the alliance, order, class of vegetation was made by consulting the classical, traditional ecological-floristic systems of the authors Tüxen (1955), Braun-Blanquet (1964), Soó (1964-1980), Borza et Boşcaiu (1965), Oberdorfer (1992), Mucina (1997), Rodwell et al. (2002), Pott (1995), Borhidi (1996), Sanda et al. (2008), Coldea et al. (2012), Chifu et al. (2014).

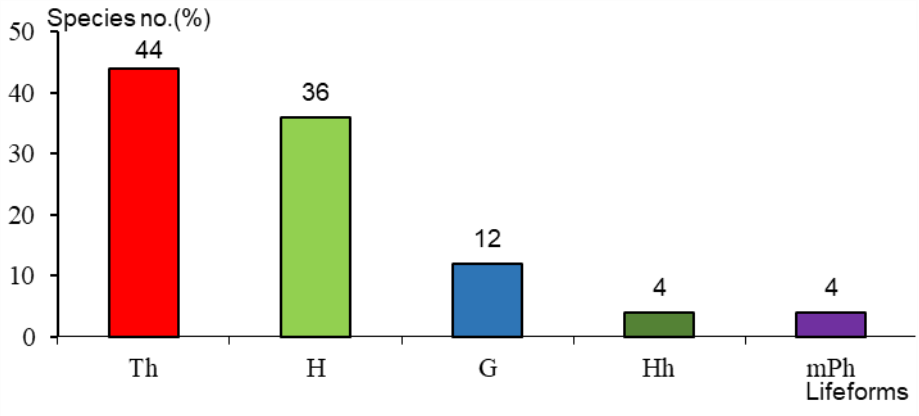

Figure 2. **Spectrum of lifeforms from the *Peplido-Limoselletum* association**

For the classification of phytotaxa by categories of bioforms, we used the system developed by Raunkier (1937) and improved by Braun-Blanquet (1964), Sanda et al. (2003), Burescu et Toma (2005), Ciocârlan (2009). We carried out the classification by phytogeographical categories according to Meusel et Jäger (1922), Sanda et al. (2003), Coldea et al. (2006), and we analyzed the distribution of cormoflora by categories of ecological indices of moisture (M), temperature (T), chemical reaction of the soil (R) according to Ellenberg (1979), Sanda et al. (2008).

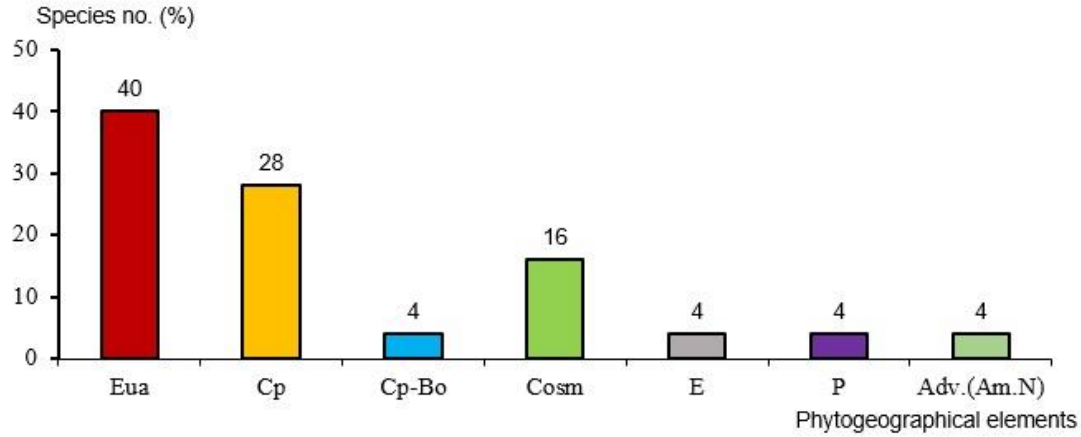

Figure 3. **Spectrum of phytogeographical elements from the *Peplido-Limoselletum* association**

We analysed and processed the research results through the lens of the synthetic association table that shows the ecological characteristics of each phytotaxon in the form of the floristic spectrum of bioforms,

phytogeographical elements in histograms as well as the diagram of ecological indices.

RESULTS AND DISCUSSIONS

The floristic inventory of the pioneer species gathered in the plant association ***Peplido-Limoselletum*** totals a small number of species i.e. 25, thus proving its ephemeral nature. The species that build and instill the physiognomy of the phytocenosis are *Peplis portula*, with a coverage of 57.5%, maximum constancy (K=V), *Limosella aquatica*, with a coverage of 0.5%, K=V, *Eleocharis acicularis* with a coverage of 5%, K=V, and *Cyperus fuscus* ADm=0.2%, K=II growing in the water of the puddles (see Table 1).

Along with the characteristic phytotaxa, five differential species for the coenotaxa, alliance, order, class ***Nanocyperion, Nanocyperetalia, Isoëto-Nanojuncetea*** i.e. *Gnaphalium uliginosum, Rorippa sylvestris ssp. sylvestris, Alopecurus aequalis, Plantago uliginosa, Lythrum hyssopifolia* also grow here. Transgressive species from the ***Phragmitetea australis*** class with six subordinate species, i.e. *Alisma plantago-aquatica, Leersia oryzoides, Eleocharis palustris, Lythrum salicaria, Veronica anagallis-aquatica, Ranunculus repens,* also entered the association. Four species come in the association from the class ***Bidentetea tripartite*** i.e. Echinochloa crus-galli, Polygonum hydropiper, Bidens tripartita, Rumex palustris, three species from the class ***Plantaginetea majoris*** i.e. *Juncus tenuis, Sagina procumbens, Taraxacum officinale*.

The spectrum of bioforms highlights the high share of annual therophytes (44%) followed by hemicryptophytes (36%), geophytes (12%), helohydatophytes on par with mesophanerophytes (4%) (see Figure 2).

After examining the phytocenoses from a chorological perspective, one may notice the predominance of Eurasian species (40%), followed by a share of circumpolar species cumulated with boreal ones (32%), then by cosmopolitan (16%), while the European, Pontic and adventive species from North America are present in a single specimen present in a share of 4% (see Figure 3).

In the composition of this plant association, the mesohygrophilic (40%), hygrophilic (28%), euryhydric (12%), mesophilic (12%), xeromesophilic (8%) species are dominant with regard to soil moisture (see Table 2)

The thermal conditions in which hygrophilous vegetation grows favor micromesothermic (64%), eurythermic (32%), and moderately thermophilic (4%) species (see Figure 4).

The edaphic preferences of the plants favour the development of euriionic species (44%) followed by weak acid-neutrophils (40%), acid-neutrophils (12%) and neutro-basiphils (4%) (see Figure 4).

Conservation and protection of biodiversity

This association has a high conservation value since it is part of the Habitats in Romania R2213 Danube communities with *Eleocharis acicularis* and *Littorella uniflora*, correspondence: NATURA2000:3130 Oligotrophic to mesotrophic standing waters with vegetation of the ***Littorelletea uniflorae*** and/or ***Isoëto-Nanojuncetea***; EMERALD:22.32 EuroSiberaian dwarf annual amphibians swards; PAL.HAB:22.32. Euro Siberian dwarf annual amphibians swards; EUNIS:C3.44 *Eleocharis acicularis* beds; Plant associations: ***Eleocharidetum acicularis*** W.Koch 1926 emend. Oberd. 1957 (Doniţă et al. 2005).

Table 2

Ecological indices for the *Peplido-Limoselletum* association

Ecological indices		2	2.5	3	3.5	4	4.5	5	5.5	6	0
M	Sp no.	1	1	2	1	7	3	6	1	3	-
	%	4	4	8	4	27	12	24	4	12	-
T	Sp no.	-	-	16	-	1	-	-	-	-	8
	%	-	-	64	-	4	-	-	-	-	32
R	Sp.no.	-		3		10		1		-	11
	%	-		12		40		4		-	44

M=Soil moisture, T=Air temperature, R=Chemical reaction of the soil

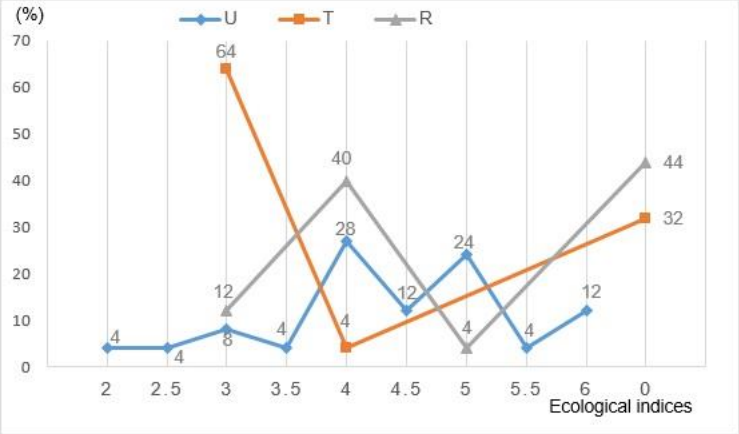

Figure 4. **Diagram of ecological indices for the *Peplido-Limoselletum* association**

CONCLUSIONS

The species gathered in the pioneer, hygrophilous association ***Peplido-Limoselletum*** gather a number of 25 phytotaxa, which belong to the ***Nanocyperion*** alliance, the ***Nanocyperetalia*** order, and the ***Isoëto-Nanojuncetea*** class.

The most representative bioforms are annual therophytes (44%) and hemicryptophytes (36%), proving the pioneering, ephemeral nature of this plant association.

Chorological analysis of the association shows the dominance of Eurasian (40%) and circumpolar (32%) species.

The steady conditions in which these phytocenoses evolve have favored the development of mesohygrophilous (40%), micromesothermic (64%) and euriionic (44%) species.

The association built by *Peplis portula* and *Limosella aquatica* has a high conservation value since it is included in a natural habitat of community interest European Habitat NATURA2000: 3130 Oligotrophic to mesotrophic standing waters with vegetation of the ***Littorelletea uniflorae*** and/or ***Isoëto-Nanojuncetea*** corresponding in Romania to R211 Danubian communities with *Cyperus fuscus* and *Cyperus flavescens* from the ***Cypero-Limoselletum (Peplido-Limoselletum)*** association.

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