VEGETAL ASSOCIATIONS OF THE ORDER PHRAGMITETALIA KOKH 1926 IN BERZUNȚI MOUNTAINS, BACĂU COUNTRY

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Abstract. This study presents the results of the research done during 2008-2010 in the area of Berzunți Mountains, concerning the paludous vegetation. The two vegetal associations identified belong to the order Phragmitelalia KOCH 1926 and to the class Phragmiti-Magnocaricetea KLIKA in KLIKA et NOVÁK 1941. Each vegetal association is accompanied by a phytocenological table, a bioform spectrum, a floristic element spectrum and an ecological index spectrum.

Keywords: vegetal association, Phragmitetalia, bioforms, floristic elements, ecological indexes.

Rezumat. Asociații vegetale ale ordinului Phragmitetalia KOKH 1926 din Munții Berzunți, județul Bacău. Acest studiu prezintă rezultatele cercetărilor efectuate în perioada 2008-2010, în zona Munților Berzunți, cu privire la vegetația palustră. Cele 2 asociații vegetale identificate aparțin ordinului Phragmitelalia KOCH 1926 şi clasei Phragmiti-Magnocaricetea KLIKA în KLIKA et NOVÁK 1941. Fiecare asociație vegetală este însoțită de un tabel fitocenologic, de spectrul bioformelor, cel al elementelor floristice şi cel al indicilor ecologici.

Cuvinte cheie: asociație vegetală, Phragmitetalia, bioforme, elemente floristice, indici ecologici.

INTRODUCTION

Berzunți Mountains are completely situated within Bacău County; their central area overlaps the Berzunți, Poduri, Dofteana and Bârsăneşti communes, to which the vicinities of Dărmăneşti and Târgu-Ocna towns are added. They have the following borders: Tarcău Mountains to the north, Dărmăneşti Depression to the west, Tazlău Subcarpathians to the east and south. They are situated in the hydrographic basin of Trotuş river, between 46º28'04'' and 46º16'10'' northern latitude and 26º27'59'' and 26º38'41'' eastern longitude. After the research done in Berzunți Mountains area during 2008-2010 we identified two vegetal associations belonging to the order Phragmitetalia. The paludous vegetation specific to this order comprises phytocenoses with high individuals, which occupy depression areas with an excess of humidity. These phytocenoses also appear along water streams, in marshes or near pools with a fluctuant water level.

MATERIAL AND METHODS

The species nomenclature is in agreement by CIOCÂRLAN (2000), the bioforms and the floristic elements were taken from SANDA et al. (2003), the ecological indexes for each species identified in surveys were established according to the study CHIFU et al. (2006). For the vegetation study we used the method of the phytocenological school in Zürich–Montpellier, improved by J. Braun-Blanquet and J. Pavillard. Considering several phytosociological papers about nomenclature and classification: SANDA (2002), SANDA et al. (1997), SANDA et al. (2001), SANDA et al. (2008), the two paludous vegetal associations can be included in the following phytocenosystem:

Class PHRAGMITI – MAGNOCARICETEA KLIKA in KLIKA et NOVAC 1941
Order PHRAGMITETALIA KOCH 1926
Alliance *Phragmition communis* KOCH 2926
As. *Phragmitetum vulgaris* SOÓ 1927
As. *Typhetum latifoliae* LANG 1973

RESULTS AND DISCUSSIONS

1. As. ***Phragmitetum vulgaris*** SOÓ 1927

Syn.: *Scirpo-Phragmitetum* KOCH 1926, *Schoenoplecto-Phragmitetum communis* (KOCH 1926) EGGLER 1961, *Scirpeto-Phragmitetum medio-europaeum* (KOCH 1926) R.Tx. in R.Tx. et PREISSING 1942, *Scirpo-Phragmitetum phragmitetosum* SOÓ 1957

Cane association

Chorology and stationary conditions: The association *Phragmitetum vulgaris* SOÓ 1927 has already been cited in Berzunți Mountains area in Berzunți and Bârsăneşti villages (BARABAŞ, 1974; BARABAŞ, 1978; MITITELU & BARABAŞ, 1978) with the name *Scirpo–Phragmitetum* W. KOCH 26. During our research we identified phytocenoses of this association in the following villages: Plopu - Dărmăneşti, Larga - Dofteana, Cucuieți - Dofteana and Vermeşti-Comăneşti. The cane associations are situated on insular areas along the Trotuş river valley, but in these cases we cannot speak about genuine cane groups because they do not occupy very large areas. Sometimes these paludous associations are situated at the edge of the marshes with a variable water level constituting dense shrubs. They can vegetate on wet soils infiltrating even in agricultural fields.

Floristic composition and phytocenotic structure: The dominant species *Phragmites australis* forms long-lasting phytocenoses, sometimes almost pure, giving them a specific physiognomy. Besides cane, other species develop themselves proving the stability of the association, such as the ones specific to the alliance *Phragmition australis*, to the orders Phragmitetalia and Magnocaricetalia. We can also mention representatives of other classes: *Bidentetea tripartiti* and *Molinio–Arrhenatheretea* (Table 1).

Bioform spectrum: after the bioform analysis we notice the predominance of hemicryptophytes (H) with 66.65% of the total species composing this association, followed by helohydatophytes (HH) with 14.81%, then by geophytes (G) with 11.11% and annual terophytes (Th) with 7.40% (Fig. 1).

Floristic element spectrum: is dominated by the Eurasian element with 40.73% followed by the circumpolar species (Circ) with 37.03%, the cosmopolitan species (Cosm) and the European species (Eur) with 11.11% each (Fig. 2).

Ecological index spectrum: regarding the light-related preferences we notice a predominance of light-biased plants, which hardly accept shade (L_7 - 66.66% and L_8 - 22.22%). Analysing the temperature preferences we can say that the largest proportion belongs to the amphytolerant species, which support ample temperature variations (T_x - 40.74%). They are followed by the mesothermic species (T_5 - 33.33%). Regarding the spread area, the largest proportion belongs to the category of intermediate species to the subcontinental climate (C_5 - 29.62%), followed by the intermediate category (C_3) between the species preferring the ocean climate and the species in suboceanic climate areas; this category is equally represented with the indifferent species (C_x) with 25.92% each. Most of these prefer the moist-wet biased soils (U_8 - 29.62%) and moist-wet soils (U_9 - 18.51%), followed by the clammy-wet soils (U_7 - 14.81%) and then by the flooded soils (U_{10} - 7.40%). According to their preferences for the soil reaction, the largest majority is constituted by amphytolerant species (R_x - 44.44%), then plants growing in neutrals soils (R_7 - 29.62%), followed in fewer proportion by plants growing in acid and moderately less acid. Under the aspect of preferences for the nitrogen amount available in soil, we can notice that species grow in soils with mineral nitrogen varying from extremely scarce to moderate and rich (Fig. 3).

Table 1. The association *Phragmitetum vulgaris* Soó 1927.
Tabel 1. Asociația *Phragmitetum vulgaris* Soó 1927.

Geoelem.	Biof.	Ecological indexes						Number of survey	1	2	3	4
								Altitude (m)	250	300	450	280
								Herbaceous layer coverage (%)	85	90	100	90
		L	T	C	U	R	N	Survey area (m²)	100	100	100	100
								Number of species	6	7	10	8
Characteristic of assciation												
Cosm	HH	7	5	x	10	7	5	*Phragmites australis*	5	5	5	5
Phragmition australis												
Circ	H (HH)	8	6	3	10	x	7	*Berula erecta*	-	-	-	+
Eua	G (H)	8	6	5	6	7	3	*Calystegia sepium*	-	+	-	-
Eua	H-HH	7	6	5	9	x	7	*Lycopus europaeus*	-	-	-	+
Phragmitetalia												
Circ	H	7	x	x	9	3	3	*Epilobium palustre*	-	-	-	+
Circ	G	7	x	5	7	x	3	*Equisetum palustre*	+	-	-	-
Eur	H-HH	7	5	3	9	7	4	*Mentha aquatica*	-	+	-	-
Circ	H	7	5	5	9	7	6	*Scutellaria galericulata*	-	-	+	-
Circ	H-G	7	2	x	7	7	7	*Stachys palustris*	-	-	+	-
Magnocaricetalia												
Eua	H-HH	6	x	x	8	x	x	*Lysimachia vulgaris*	+	-	-	-
Circ	H-HH	7	5	5	8	7	x	*Lythrum salicaria*	-	-	+	-
Eua	H	7	x	5	8	x	5	*Myosotis scorpioides*	+	-	-	-
Bidentetea tripartiti												
Circ	H	8	x	3	8	x	2	*Juncus articulatus*	-	+	-	-
Circ	Th	7	5	x	8	4	5	*Polygonum hydropiper*	-	-	-	+
Molinio-Arrhenatheretea												
Circ	H	8	x	x	6	x	5	*Agrostis stolonifera*	-	-	+	-
Eua	H	6	x	5	6	6	7	*Alopecurus pratensis*	-	-	+	-
Cosm	H	7	5	3	6	x	4	*Holcus lanatus*	-	-	-	+
Eua	H	8	5	3	7	8	4	*Juncus inflexus*	+	-	-	+
Eua	H	7	6	8	8	7	x	*Lythrum virgatum*	-	+	-	-
Circ	HH-G	7	5	4	9	4	3	*Scirpus sylvaticus*	-	+	+	-
Eua	H	7	6	3	8	x	8	*Symphytum officinale*	-	-	+	-
Eur	Th (TH)	7	x	5	4	7	6	*Tragopogon orientale*	-	-	-	-
Variae syntaxa												
Eua	H	6	7	7	7	8	4	*Althaea officinalis*	-	-	-	+
Eua	H	7	x	x	8	x	4	*Filipendula ulmaria*	-	+	-	-
Cosm	HH	7	x	3	11	x	x	*Lemna minor*	-	-	+	-
Eua	H	8	5	7	3	9	3	*Medicago falcata*	-	-	+	-

Survey place and date: 1. Plopu – Dărmănești (July 27, 2009); 2. Larga-Dofteana (August 5, 2009); 3. Cucuieți – Dofteana (August 1, 2010); 4. Vermești-Comănești (August 21, 2010).

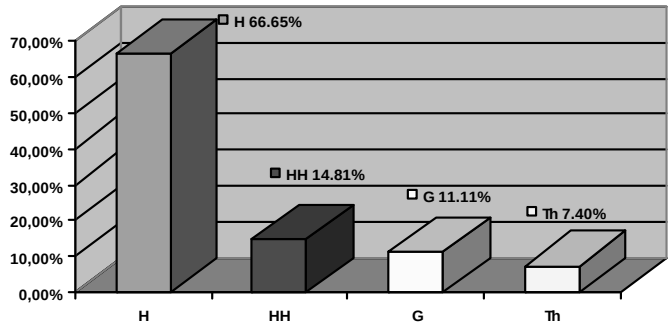

Figure 1. Bioform spectrum for the association *Phragmitetum vulgaris* SOÓ 1927.
Figura 1. Spectrul bioformelor asociaţiei *Phragmitetum vulgaris* SOÓ 1927.

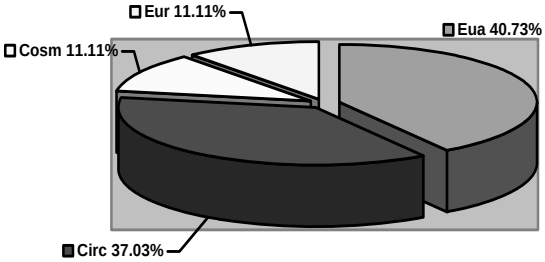

Figure 2. Floristic element spectrum of the association *Phragmitetum vulgaris* SOÓ 1927.
Figura 2. Spectrul elementelor floristice ale asociaţiei *Phragmitetum vulgaris* SOÓ 1927.

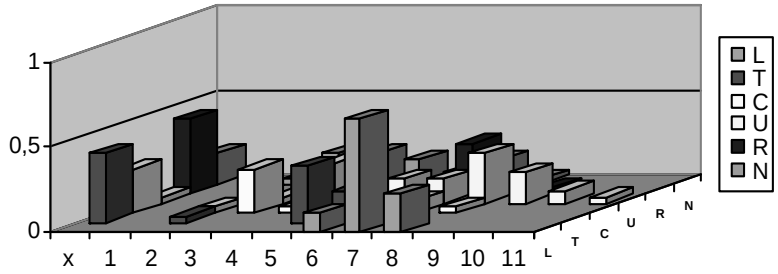

Figure 3. The ecologic indexes spectrum for the association *Phragmitetum vulgaris* SOÓ 1927.
Figura 3. Spectrul indicilor ecologici specific asociaţiei *Phragmitetum vulgaris* SOÓ 1927.

2. As. ***Typhetum latifoliae*** LANG 1973
Syn. *Typhetum latifoliae* SOÓ 1927, *Typhetum angustifoliae-latifoliae* SCHEMALE 1939
Bulrush groups

Chorology and stationary conditions. The association *Typhetum latifoliae* LANG 1973 has already been mentioned across Berzunţi Mountains in the villages Berzunţi and Bârsăneşti under the name *Typhetum angustifoliae-latifoliae* (EGGL) 33 Schmale 39 (BARABAŞ, 1978; MITITELU & BARABAŞ, 1978). During the research we identified phytocenoses of this association in the following villages: Berzunţi, Plopu - Dărmăneşti, Larga - Dofteana and on the Pipirig Hill. The bulrush groups in the researched area generally appear in shallow pools, in the microdepressions where rainfall water collects, in marshes, along water streams. These are spread at altitudes varying between 350 and 850 m, in unaired acid soils rich in organic matter.

Floristic composition and phytocenotic structure

Phytocenoses are required by the characteristic species *Typha latifolia*, which makes a coverage varying between 60% - 90%. Regarding the phytocenotic composition, besides the dominant species *Typha latifolia*, we can remark species characteristic to the alliance *Phragmition australis* and order Phragmitetalia. On the pool shores one can notice species belonging to classes Bidentetea and Molinio-Arrhenatheretea and among them species characteristic to the class Lemnetea (Table 2).

Bioform spectrum: after the bioform analysis we notice the dominance of hemicryptophytes (H) with 58.05% of the total species constituting this association, followed by geophyte elements (G) with 19.34%, helohydatophytes (HH) with 9.67%, annual and biannual terophytes (Th and TH) cumulating 9.67% and camephytes with 3.22% (Fig. 4).

Floristic element spectrum: is dominated by the Eurasian element (Eua) with 38.70%, followed by the circumpolar species (Circ) with 29.03%, the cosmopolitan species (Cosm) with 16.12% and the European (Eur) and Atlantic-Mediterranean (Atl-Med) elements, each having 3.22% (Fig. 5).

The ecological index spectrum: Regarding the light-related preferences, we notice the dominance of light-biased plants, which hardly accept shade (L_7 - 48.38% and L_8 - 25.80%). From the analysis of the temperature preferences, the largest proportion belongs to amphytolerant species (T_x - 41.93%); these are followed by species intermediate to sub-thermophilic (T_6 - 22.58%) and by mesothermic species (T_5 - 19.35%). Regarding the spreading area, the largest species proportion belongs to the intermediate category (C_3 - 32.25%) between the species preferring the oceanic climate and the species from the suboceanic climate areas. It is also well represented the group of species intermediate to subcontinental climate (C_5 - 22.58%) equal with the indifferent species (C_x). Most of them prefer soils towards moist-wet (U_8 - 29.03%) and moist-wet (U_9 - 19.35%), being followed, with the same percentage, by plants adapted to clammy-wet soils and flooded soils (U_7 and U_{10} with 16.12% each). From the analysis of species proportion according to the soil reaction preferences, the largest majority is constituted by amphytolerant species (R_x - 45.16%). The distribution in the other categories is the following: plants preferring neutral soils (R_7 - 22.58%) and intermediate plants between the neutral ones and the neutral and basic ones (R_8 - 19.35%), followed in smaller proportions by plants preferring moderately acid and acid soils. Regarding the preferences for the amount of nitrogen in the soil, we can notice the fact that species grow especially in soils with mineral nitrogen (N_5 - 35.48%); the other proportions vary from very scarce to moderate and rich (Fig. 6).

Table 2. The association *Typhetum latifoliae* LANG 1973.
Tabel 2. Asociația *Typhetum latifoliae* LANG 1973.

Geoelem.	Biof.	Ecological indexes						Number of survey	1	2	3	4	5	K
								Altitude (m)	350	550	250	550	550	
								Herbaceous layer coverage (%)	60	70	80	90	80	
		L	T	C	U	R	N	Survey area (m²)	10	10	10	10	10	
								Number of species	6	11	8	5	8	
Characteristic of associations														
Cosm	G (HH)	8	6	5	10	x	8	*Typha latifolia*	4	5	5	5	5	V
Phragmition australis														
Eua	H-HH	7	6	5	9	x	7	*Lycopus europaeus*	+	+	-	-	-	II
Phragmitetalia														
Circ	H	7	x	x	9	3	3	*Epilobium palustre*	+	-	+	-	-	II
Circ	H	6	x	3	9	x	4	*Galium palustre*	-	-	-	+	-	I
Eur	H-HH	7	5	3	9	7	4	*Mentha aquatica*	-	+	-	-	-	I
Cosm	HH	7	5	x	10	7	5	*Phragmites australis*	-	-	+	-	-	I
Circ	H-G	7	2	x	7	7	7	*Stachys palustris*	-	+	-	-	-	I
Magnocaricion														
Eua	G (HH)	7	7	3	9	7	4	*Carex riparia*	+	-	-	-	-	I
Cirsio- Bolboschoenion														
Cosm	H-G	8	x	7	10	8	5	*Bolboschoenus maritimus*	-	-	-	+	-	I
Circ	G	8	x	7	7	x	5	*Juncus gerardii*	-	-	-	-	+	I
Glycerio-Sparganion														
Eua	H	7	5	4	8	8	8	*Mentha longifolia*	-	+	+	-	-	II
Eua	H	7	x	5	8	x	5	*Myosotis scorpioides*	-	-	-	-	+	I
Eua	G (HH)	7	6	5	10	x	5	*Sparganium erectum* ssp. *neglectum*	-	-	+	-	-	I
Eua	H (HH)	7	x	3	10	7	6	*Veronica beccabunga*	-	-	+	-	-	I
Bidentetea tripartiti														
Circ	H	8	x	3	8	x	2	*Juncus atriculatus*	-	+	-	-	-	I
Eur(Med)	Th	7	6	3	8	x	7	*Polygonum mite*	-	-	-	-	+	I
Lemnion														
Cosm	HH	7	x	3	11	x	x	*Lemna minor*	+	-	-	-	-	I
Molinio - Arrhenatheretea														
Circ	H	8	x	x	6	x	5	*Agrostis stolonifera*	-	-	-	+	-	I
Eua	H	6	x	5	6	6	7	*Alopecurus pratensis*	-	-	-	-	+	I
Circ	H	7	x	x	8	x	x	*Caltha palustris*	+	-	-	-	-	I
Circ	G	5	7	2	8	8	5	*Equisetum telmateia*	-	+	-	-	-	I
Eua(Med)	TH	8	6	5	7	8	5	*Inula britanica*	-	+	-	-	-	I
Med	H	8	6	3	8	7	5	*Oenanthe silaifolia*	-	-	-	+	-	I
Eua	H	6	6	6	6	7	5	*Potentilla reptans*	-	-	-	-	+	I
Eua(Med)	H	6	x	x	7	x	x	*Ranunculus repens*	-	-	-	-	+	I
Circ	HH-G	7	5	4	9	4	3	*Scirpus sylvaticus*	-	+	-	-	-	I
Stelarietea mediae														
Cosm	Th	6	7	5	5	x	8	*Echinochloa crus-galli*	-	-	+	-	-	I
Epilobietea angustifoliae														
Eur	H	6	7	3	7	8	4	*Lysimachia punctata*	-	-	-	-	+	I
Variae syntaxa														
Eua(Med)	Ch-N	7	5	x	8	x	8	*Solanum dulcamara*	-	+	-	-	-	I
Atl-Med	H	5	5	2	8	6	5	*Carex pendula*	-	-	+	-	-	I
Eua	G	8	x	3	6	8	x	*Tussilago farfara*	-	+	-	-	-	I

Survey place and date: 1. Berzunți (July 24, 2008); 2. Larga-Dofteana (August 5, 2009); 3. Plopu-Dărmănești (July 27, 2009); 4, 5. Pipirig Hill (July 23, 2010).

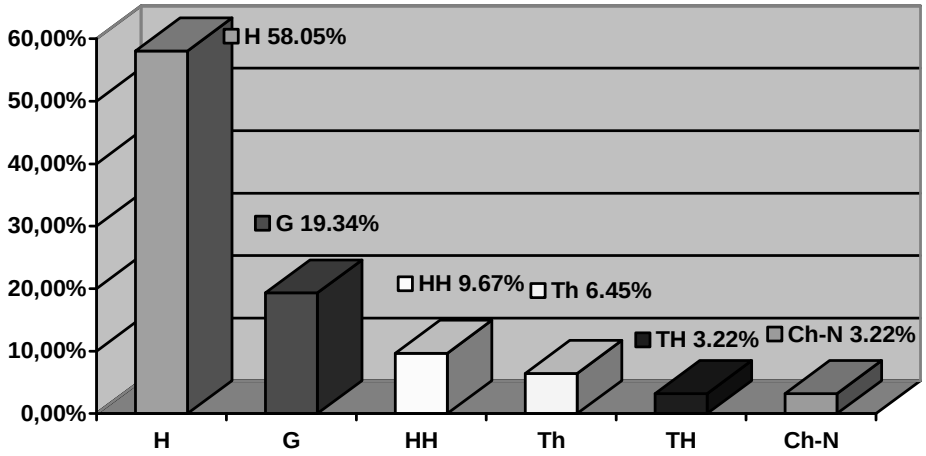

Figure 4. The bioform spectrum of the association *Typhetum latifoliae* LANG 1973.
Figura 4. Spectrul bioformelor asociației *Typhetum latifoliae* LANG 1973.

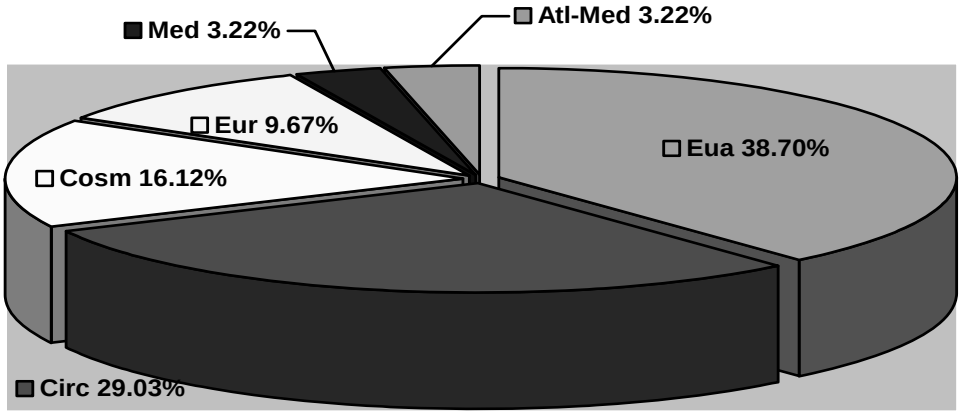

Figure 5. The floristic element spectrum of the association *Typhetum latifoliae* LANG 1973.
Figura 5. Spectrul elementelor floristice al asociației *Typhetum latifoliae* LANG 1973.

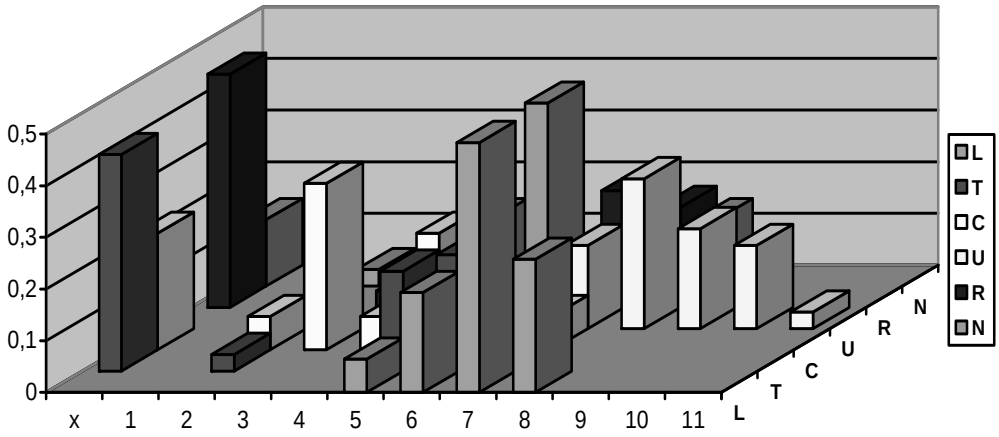

Figure 6. The ecological index spectrum specific to the association *Typhetum latifoliae* LANG 1973.
Figura 6. Spectrul indicilor ecologici specific asociației *Typhetum latifoliae* LANG 1973.

CONCLUSIONS

During 2008-2010 we identified 2 paludous vegetal associations: *Phragmitetum vulgaris* SOÓ and *Typhetum latifoliae* LANG 1973 belonging to the order Phragmitetalia KOCH 1926.

The percentages obtained with the spectrum of bioforms, floristic elements and ecological indexes for the two vegetal associations confirm the data rendered in the specialty literature.

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