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THE STANDS WITH THE *PHALAROIDES ARUNDINACEA* DOMINANCE IN THE IPEĽ RIVER CATCHMENT AREA (SLOVAKIA AND HUNGARY)

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The *Phalaridetum arundinaceae* Libbert 1931 and the *Rorippo-Phalaridetum arundinaceae* Kopecký 1961 associations were recorded in the Ipeľ River catchment area from 1997 to 2000. Four other plant communities not ranked into hierarchical system were detected, too. The synmorphology, synecology and synchorology characteristics of these communities are given in the paper. The characteristics and syntaxonomic note are added for the *Carici gracilis-Phalaridetum* (Kovács et Máthé 1967) Soó 1971 corr. Borhidi 1996 association, which was described from the studied area several decades ago. The floristical and ecological differentiation of these communities is included. The tabular synthesis, polythetic divisive classification (Twinspan) and indirect gradient analysis (DCA) methods were used for classification and ordination of the communities.

Key words: Central Europe, Ipeľ River, *Phalaroides arundinacea*, plant communities, synecology, syntaxonomy, wetlands

INTRODUCTION

Phalaroides arundinacea belongs to the frequent, dominant vascular plant species in the Ipeľ River catchment area. Within wetlands investigations Máthé (1956), Kovács and Máthé (1967), later Hrivnák (1998, 1999) and Hrivnák *et al.* (2001) studied stands with the dominance of this species. Their results are summarised and compared, as well as new information is added in this paper.

Several communities with the *Phalaroides arundinacea* dominance are known from the Central European phytocoenological literature. The most frequent is *Phalaridetum arundinaceae* Libbert 1931 association (ass.). *Carici gracilis-Phalaridetum* (Kovács et Máthé 1967) Soó 1971 corr. Borhidi 1996 is known from Hungary. Both of them grow within wetland complexes. Kopecký (1961) described Phalaridion arundinaceae Kopecký 1961 from the Czech Republic as a separate alliance. Three associations of littoral vegetation, *Rorippo-Phalaridetum arundinaceae* Kopecký 1961, *Chaerophyllo-Phalaridetum arundinaceae* Kopecký et Hejný 1965 (nom. invalid., Art. 3b), and *Caricetum buekii* Hejný et Kopec-

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ký in Kopecký et Hejný 1965 (*cf.* Kopecký 1961, 1967, Kopecký and Hejný 1965) were described within this alliance. Kopecký included the association of *Petasito-Phalaridetum arundinaceae* (Schwickerath 1933) Kopecký (1957) 1961 into the mentioned alliance, too (*cf.* Kopecký 1957, 1967). The latter name was considered by Jarolímek *et al.* (2002) as earlier homonym (Art. 32d) of *Phalarido-Petasitetum officinalis* Schwickerath 1933 emended by the authors.

The objectives of this paper are:

- to document and ecologically characterise stands with the *Phalaroides arundinacea* dominance in the Ipeľ River catchment area,
- to outline particular communities variability recorded in the studied area,
- to compare particular communities within wider geographical range.

MATERIAL AND METHODS

Communities with the *Phalaroides arundinacea* dominance were studied in the Ipeľ River catchment area, on the Slovak and Hungarian territory (Fig. 1). Phytosociological data were recorded during three years 1997–2000.

Both field investigations and later data analysis follow methods of Zürich-Montpellier approach (Braun-Blanquet 1964). The estimation abundance/dominance scale was used according to Barkman *et al.* (1964). Relevés were stored in TURBOVEG database program (Hennekens 1996*a*) and then

Fig. 1. Map of the studied area

classified by TWINSPAN (Hill 1979) program, using polythetic divisive classification method. Phytosociological tables were processed by MEGATAB program (Hennekens 1996*b*). For the indirect gradient analysis (Detrended Correspondence Analysis – DCA) CANOCO program (ter Braak and Šmilauer 1998) was used.

Names of syntaxa are presented in Tables 1 and 2 with the following abbreviations: A = Artemisietea vulgaris Lohmeyer *et al.* in R. Tx. 1950, B = Bidentetea tripartiti R. Tx. *et al.* in R. Tx. 1950, Con = Convolvuletalia sepium R. Tx. 1955, GU = Galio-Urticetea Passarge ex Kopecký 1969, MA = Molinio-Arrhenatheretea R. Tx. 1937 emend. R. Tx. 1970, Ph = Phalaridion arundinaceae Kopecký 1961, PM = Phragmito-Magnocaricetea Klika in Klika et Novák 1941. Within the characteristics of particular communities next abbreviations were used: ass. = association, Art. = article of Code of phytosociological nomenclature (Barkman *et al.* 1986), corr. = corexit, dif. = differential taxa, emend. = emendavid, lok. = local, s. lat. = sensu lato.

Nomenclature of vascular plants follows Marhold (1998). Scientific names of syntaxa are presented at the first mention with author's name and the year of description. The term ecophase is used according to Hejný (1960).

RESULTS AND DISCUSSION

From the Ipeľ River catchment area, three plant communities – *Carici gracilis-Phalaridetum* (Kovács et Máthé 1967) Soó 1971 corr. Borhidi 1996, *Phalaridetum arundinaceae* Libbert 1931 and *Rorippo-Phalaridetum arundinaceae* Kopecký 1961 – were published or observed by us. Four other observed plant communities – the *Phalaroides arundinaceae* community (Glycerio-Sparganion Br.-Bl. et Sissingh in Boer 1942), the *Phalaroides arundinaceae* community (Calthion R. Tx. 1937 emend. Bal.-Tul. 1978), the *Phalaroides arundinacea-Equisetum palustre* community and the *Phalaroides arundinacea-Typha latifolia* community (Phragmito-Magnocaricetea) – were not ranked into the hierarchical system.

Characteristics of vegetation units

Carici gracilis-Phalaridetum (Kovács et Máthé 1967) Soó 1971
corr. Borhidi 1996 (Table 2: column A)

Association is represented by relevés with not expressive dominance of *Phalaroides arundinacea*, which varies according to the flood height and duration. *Carex acuta* also achieves higher dominance values. The species with high

Table 1

The plant communities with dominance of *Phalaroides arundinaceae*

Relevé number		1	2	1	1	2	2	2	2	2	2	2	2	3	C	2	1	1	1	1	9	1	1	1	1	3	4	5	6	7	8	C
		6	0		5	1	7	8	3	4	2	5	6	9	0	10		8	7	9	4		0	1	2	3							16
Number of species		9	18	7	10	10	8	8	10	9	14	5	8	5	8	8.5	7	8	9	10	10	9	7	7	8	12	6	7	5	11	11	10	8.6
PM	*Phalaroides arundinacea*	5	5	5	5	5	5	5	5	5	5	5	5	5	5	100	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	100
Glycerio-Sparganion																																	
	Veronica beccabunga	+	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
	Glyceria fluitans	+	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
Calthion																																	
	Cirsium oleraceum	.	+	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
	Mentha longifolia	.	+	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
	Scirpus sylvaticus	.	+	.	.	.	.	.	.	.	+	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
	Cirsium canum	.	+	r	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
MA	*Equisetum palustre*	.	.	2a	.	.	.	.	.	+	.	.	.	.	.	10	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	6
Phragmition communis		.	.	.	.	.	.	.	.	.	.	.	.	.	.																		
	Typha latifolia	.	.	+	1	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	6
Rorippo-Phalaridetum arundinaceae																																	
A	*Cirsium arvense*	.	.	.	.	+	1	1	+	.	.	.	.	.	.	40	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	13
GU, Ph	*Urtica dioica*	.	.	.	.	.	2a	1	2b	2a	2a	2a	r	+	+	90	.	.	.	.	.	.	.	.	+	.	.	.	r	.	.	.	13
GU	*Galium aparine* agg.	.	.	.	.	.	.	.	1	1	+	.	.	.	.	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
B, Ph	*Persicaria hydropiper*	.	.	.	.	.	.	.	.	.	+	.	1	+	.	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
B	*Persicaria lapathifolia*	.	.	.	.	.	.	.	.	.	.	.	1	.	+	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
B	*Bidens frondosa*	.	+	.	+	.	.	.	.	.	.	.	.	r	+	20	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	13
B	*Atriplex prostrata*	.	.	.	.	.	.	.	.	.	.	.	.	.	1	10	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	6
Phalaridetum arundinaceae																																	
MA	*Ranunculus repens*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	+	+	.	+	.	.	.	.	.	.	.	.	.	+	.	.	25
PM	*Carex vulpina*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	+	+	+	+	.	.	.	.	.	.	.	.	.	1	.	31
MA	*Potentilla reptans*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	+	1	2a	.	.	.	.	.	.	.	.	.	.	.	.	19
PM	*Carex melanostachya*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	13
O	*Persicaria amphibia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	+	+	+	+	+	.	.	.	.	r	.	38
PM	*Lysimachia vulgaris*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	+	.	+	+	+	r	+	+	.	.	.	.	.	.	44
PM	*Carex acuta*	.	.	.	.	+	.	.	.	+	.	.	.	.	.	20	.	.	.	.	+	.	+	.	.	.	+	2a	.	+	+	+	44
PM	*Galium palustre*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	+	.	.	.	+	.	.	+	+	25
PM	*Iris pseudacorus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.	.	+	.	+	+	+	1	+	38
Phragmito-Magnocaricetea																																	
	Epilobium hirsutum	+	+	+	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
	Stachys palustris	.	r	.	.	r	.	r	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	+	.	.	r	.	13

	Relevé number	1	2	1	1	2	2	2	2	2	2	2	2	3	C	2	1	1	1	1	9	1	1	1	1	3	4	5	6	7	8	C
		6	0		5	1	7	8	3	4	2	5	6	9	10		8	7	9	4		0	1	2	3							16
	Number of species	9	18	7	10	10	8	8	10	9	14	5	8	5	8	8.5	7	8	9	10	10	9	7	7	8	12	6	7	5	11	11	10	8.6
	Lythrum salicaria	.	+	1	+	.	.	1	.	+	+	.	.	.	+	40	+	.	.	.	1	.	+	+	1	1	.	+	.	+	+	1	63
	Glyceria maxima	.	.	.	.	.	.	.	.	.	.	r	.	.	+	20	.	.	.	.	.	.	.	.	+	+	.	.	+	+	+	.	31
	Carex riparia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	.	.	+	.	.	.	.	.	.	.	.	**2a**	+	19
	Lycopus europaeus	.	.	.	.	.	.	.	.	.	.	.	.	+	.	10	.	.	.	.	.	+	.	.	.	**1**	.	.	.	.	.	+	19
Molinio-Arrhenatheretea																																
	Alopecurus pratensis	+	.	.	.	r	+	.	.	.	.	.	.	.	.	20	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	13
	Agrostis stolonifera	1	.	.	+	.	.	.	.	.	.	.	.	.	.	–	.	+	.	.	+	.	.	.	.	2b	.	.	.	.	.	.	19
	Carex hirta	.	1	.	.	1	.	.	.	.	+	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-
	Poa trivialis	.	+	.	.	1	.	.	2b	+	2b	2a	.	.	.	50	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	13
	Symphytum officinale	.	.	.	+	.	+	.	.	.	.	.	r	.	.	20	+	+	1	2a	+	+	.	.	.	.	+	+	.	.	.	.	50
	Vicia cracca	.	.	.	r	+	.	.	.	.	.	.	.	.	.	10	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	13
Ph	*Rorippa sylvestris*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	6
	Potentilla anserina	.	.	.	.	1	.	.	.	.	.	.	.	.	.	10	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
	Lysimachia nummularia	.	.	.	.	.	.	.	1	.	+	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	6
	Rorippa austriaca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–	.	.	.	1	r	.	.	.	.	.	.	.	.	.	.	.	.	13
Convolvuletalia sepium																																
	Calystegia sepium	.	1	2a	2a	.	1	.	2a	2a	.	1	2a	.	.	50	.	.	.	.	.	1	+	.	1	.	.	.	.	.	.	r	25
	Echinocystis lobata	+	.	.	.	.	.	.	.	.	.	.	.	.	+	10	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	6
Lemnetea																																
	Lemna minor	.	.	.	.	.	.	.	.	.	.	.	.	.	.	-	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	13
Other species																																
Ph	*Poa palustris*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	10	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	6
	Solanum dulcamara	.	.	.	.	.	.	.	.	+	.	.	+	.	.	20	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	13
	Elymus repens	.	.	.	+	.	.	.	+	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–
	Rumex crispus	.	.	.	.	.	.	+	.	.	.	.	.	.	.	10	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	6
	Galium rivale	.	1	.	.	.	.	1	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	–

Legends: C = constancy. Name of syntaxa: *Phalaroides arundinacea* community (*Glycerio-Sparganion*) (relevé 16); *Phalaroides arundinacea* community (*Calthion*) (relevé 20); *Phalaroides arundinaceae-Equisetum palustre* community (*Phragmito-Magnocaricetea*) (relevé 1); *Phalaroides arundinacea-Typha latifolia* community (Phragmito-Magnocaricetea) (relevé 15); *Rorippo-Phalaridetum arundinaceæ* (relevés 21–30); *Phalaridetum arundinaceae* (relevés 2–14, 17–19)

Table 2
Comparison the plant communities with dominance of *Phalaroides arundinacea*

Column		A	B	C	D	E	F	G	H	CH
Number of relevés		5	51	16	48	47	10	46	65	75
Dominant species										
PM, Ph	*Phalaroides arundinacea*	V	V	V	V	V	V	V	V	V
Carici-Phalaridetum										
PM	*Carex vesicaria*	V	.	I	I	.	.	.	.	.
PM	*Eleocharis palustris*	V	.	.	I	I	.	.	.	.
MA	*Angelica sylvestris*	IV	.	.	.	I	.	.	I	I
MA	*Potentilla reptans*	V	.	I	I	I	.	I	I	I
Phalaridetum arundinaceae										
PM	*Carex acutiformis*	I	I	.	I	I	.	.	.	.
PM	*Carex acuta*	V	I	III	III	I	I	I	I	II
PM	*Glyceria maxima*	I	I	II	III	I	I	II	I	I
PM	*Iris pseudacorus*	V	II	II	III	I	.	I	I	I
PM	*Typha latifolia*	.	.	I	I	.	.	.	.	.
PM	*Carex melanostachya*	.	.	I	I		.	.	.	.
MA	*Rorippa austriaca*	.	.	I	I		.	.	.	.
PM	*Carex riparia*	.	.	I	I	I	.	.	.	.
PM	*Carex vulpina*	.	.	II	I	I	.	.	.	.
Rorippo-Phalaridetum arundinaceae										
O, Ph	*Poa palustris*	V	II	I	I	III	I	V	V	V
GU, Ph	*Urtica dioica*	.	II	I	II	II	V	III	V	IV
GU	*Galium aparine* agg.	.	I	.	I	I	II	I	I	I
B	*Bidens frondosa*	.	.	I	I	I	I	II	I	I
MA	*Potentilla anserina*	.	.	I	I	II	I	I	I	I
O	*Rumex crispus*	.	.	I	I	II	I	I	II	I
B, Ph	*Persicaria hydropiper*	.	.	.	I	III	II	IV	IV	III
Other species										
MA, Ph	*Rorippa sylvestris*	II	.	I	I	II	I	I	III	.
O	*Persicaria maculosa*	II	.	.	.	I	.	I	I	.
MA	*Ranunculus repens*	II	I	II	II	III	.	IV	III	II
PM	*Lythrum salicaria*	V	I	IV	IV	I	II	I	II	III
PM	*Lysimachia vulgaris*	I	II	III	III	I	.	I	I	II
MA	*Lysimachia nummularia*	III	.	I	II	I	I	I	I	I
PM, Ph	*Mentha aquatica*	I	II	.	I	II	.	III	II	I
B	*Persicaria lapathifolia*	II	.	.	I	I	I	II	I	I
PM	*Alisma plantagoaquatica*	I	.	.	I	I	.	I	.	I
A	*Cirsium arvense*	.	I	I	II	II	II	.	.	.
GU	*Calystegia sepium*	.	I	II	II	II	III	I	I	II
PM	*Lycopus europaeus*	.	I	I	II	I	I	II	I	I
MA	*Poa trivialis*	.	II	I	I	I	III	I	II	I
PM	*Galium palustre*	.	II		II	I	.	II	II	II
MA	*Symphytum officinale*	.	II	III	III	II	I	.	I	I
O	*Persicaria amphibia*	.	II	II	II	.	.	II	I	I
MA	*Vicia cracca*	.	II	I	I	I	I	.	.	I
PM	*Scutellaria galericulata*	.	I	.	I	.	.	.	.	I
GU	*Echinocystis lobata*	.	.	I	I	I	I	.	.	.
B	*Atriplex prostrata*	.	.	I	I		I	.	.	.
O	*Solanum dulcamara*	.	.	I	I	I	I	I	I	.
MA	*Agrostis stolonifera*	.	.	I	II	II	.	I	I	.
MA	*Alopecurus pratensis*	.	.	I	I	I	I	I	I	I
PM	*Stachys palustris*	.	.	I	II	I	I	I	I	I
MA	*Equisetum palustre*	.	.	I	I	I	I	.	I	I
PM	*Sium latifolium*	.	.	.	I	I	.	.	.	.
PM	*Epilobium hirsutum*	.	.	.	I	I	.	.	.	.
A	*Elymus repens*	.	.	.	I	I	I	.	.	.
MA	*Carex hirta*	.	.	.	I	II	II	.	.	.
O	*Galium rivale*	.	.	.	I		I	.	.	.
MA	*Scirpus sylvaticus*	.	.	.	I	I	I	I	.	.

Legend (columns): A = Kovács and Máthé (1967, Table 11), B = Oberdorfer (1977, Table 45: column 16b), C = Hrivnák and Ujházy, hoc loco (Table 1, relevés 2–14, 17–19), D = Hrivnák (2001), E = Valachovič (2001), F = Hrivnák and Ujházy, hoc loco (Table 1, relevés 21–30), G = Kopecký (1967, Table 2: column A), H = Kopecký (1967, Table 2: column B), CH = Kopecký (1967, Table 2: column C). Name of syntaxa: A = *Carici-Phalaridetum* (Kovács et Máthé 1967) Soó 1971 corr. Borhidi 1996; – B, C, D = *Phalaridetum arundinaceae* Libbert 1931; – E, F, G, H, CH = *Rorippo-Phalaridetum arundinaceae* Kopecký 1971

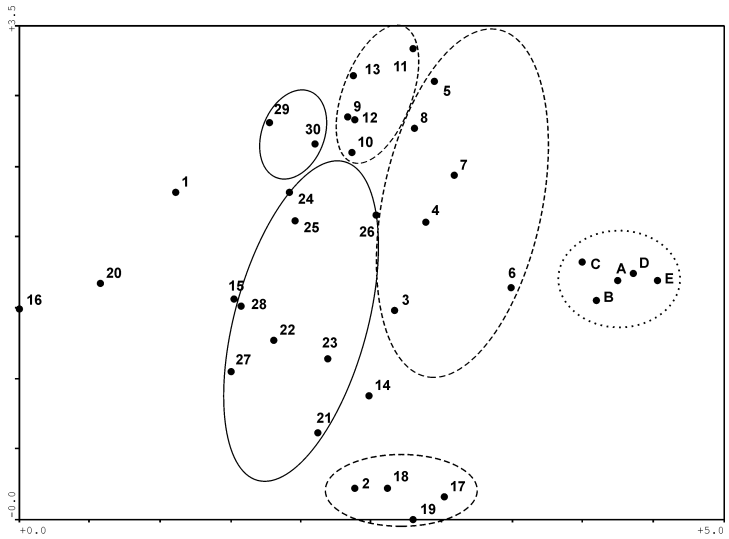

Fig. 2. DCA analysis according to the first two axes. Relevés of *Carici gracilis-Phalaridetum* are bounded with dotted line, variants of *Rorippo-Phalaridetum arundinaceae* with full line and of *Phalaridetum arundinaceae* with dashed line. Species percentage cover values was used, covers of *Phalaris arundinacea* were downweighted on 0.03. Total inertia: 6.62; eigen values: 0.72 (axis 1), 0.52 (axis 2); percentage variance of species data: 10.9 (axis 1), 7.8 (axis 2)

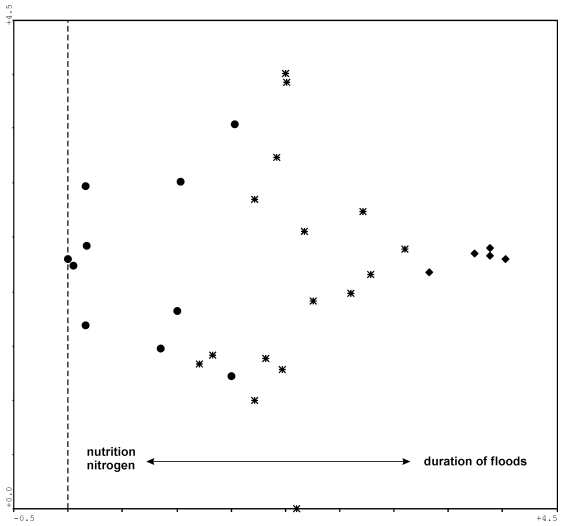

Fig. 3. DCA analysis of all relevés, according to the first two axes. Relevés of *Rorippo-Phalaridetum arundinaceae* are signed as circle = ●, *Phalaridetum arundinaceae* as asterisk = ✶ and *Carici gracilis-Phalaridetum* as square = ◆. Only species presence/absence was considered. Total inertia: 7.88; eigen values: 0.61 (axis 1), 0.46 (axis 2); percentage variance of species data: 7.7 (axis 1), 5.8 (axis 2)

constancy values are wetland tall species *Carex vesicaria*, *Eleocharis palustris*, *Iris pseudacorus* and *Lythrum salicaria,* as well as some meadow species, *Poa palustris* and *Potentilla reptans* (Kovács and Máthé 1967, Borhidi and Sánta 1999).

The stands were found at the Ipeľ River flood-plain and in littoral of open water biotopes. They occupy eutrophic habitats, regularly flooded. Water stagnation on the soil surface leads to clay soils formation. Stands of this community grew with contacting *Glycerietum aquaticae* Hueck 1931 (Kovács and Máthé 1967, Borhidi and Sánta 1999).

Relevés of this community were recorded by Kovács and Máthé (1967) in the surrounding of the Szécsény town.

The frequent occurrence of this community from the Alföld (Eupannonicum) and rare occurrence from submontane and montane regions of Hungary were published by Borhidi and Sánta (1999). The statement of its occurrence in Europe (Borhidi and Sánta 1999) is interesting, however, the community with this name is not mentioned in any vegetation survey of several (central) European countries (Balátová-Tuláčková *et al.* 1993, Hejný 1995, Solomacha 1995, Stefan and Coldea 1997, Oťaheľová *et al.* 2001).

Syntaxonomic note: Máthé (1956: 24) published the synoptic table of five relevés of "*Phalaridetum*" community from Novohrad region. The author ranked them into "Agrostion albae" alliance. In the published survey of the Pannonicum region plant communities (Soó 1957: 357), *Phalaridetum arundinaceae* (Koch 1926) Libbert 1932 (validly *Phalaridetum arundinaceae* Libbert 1931) is classified into the Agrostion albae Soó 1933 emend. Soó 1940 alliance. The next paper by Kovács and Máthé (1967: 152) presented a table of five relevés from the surroundings of Szécsény town (*l.c.,* Table 11) from the Ipeľ river catchment area. Despite of doubts (they noticed that it would be better to rank them into the Caricion gracilis (Neuhäusl 1959) Oberd. *et al.* 1967 alliance), the authors classified them as *Rorippo-Phalaridetum arundinaceae* Kopecký 1961. However, this classification is not correct. The syntaxonomic problems of *Phalaroides arundinacea* dominated communities solved Soó (1971). For these stands where meadow species predominate, Soó supposed to use the name *Agrostio-Poetum trivialis* Soó 1938 subass. *typhoidetosum* Soó 1971, alternatively "*Agrostio-Typhoidetum*" (Soó 1971: 138). The associations were ranked into the *Agrostion albae* alliance. For the stands with greater deal of tall reed grasses including Poiplie region relevés (Kovács and Máthé 1967: 152), Soó introduced the name *Carici-Typhoidetum* Soó 1971 as nomen novum at that time (Soó 1971: 133, Barkman *et al.* 1986: Art. 31). *Phalaridetum arundinaceae* Libbert 1931 was considered as the synonym (pro parte). The association was ranked into Caricion gracilis alliance. Soó stated, that the communities of *Rorippo-Phalaridetum arundinaceae* did not occur in Hungary (Soó 1971: 132). Later,

Borhidi (1996: 50) added the author's citation to the name of syntaxon (Barkman *et al.* 1986: Art 39), add species epithet of reed grass according to Art. 48 (Barkman *et al.* 1986) and substituted the name of the dominant taxon (*Typhoidetum* to *Phalaridetum*). The last correction based on the Art. 45 (Barkman *et al.* 1986) was not specified so the present name of the syntaxon is *Carici gracilis-Phalaridetum* (Kovács et Máthé 1967) Soó 1971 corr. Borhidi 1996.

According to the analyses presented in our paper, certain floristical and ecological differentiations between *Carici gracilis-Phalaridetum* and *Phalaridetum arundinaceae* (Table 2; Figs 2–3) appear. It is evident from the comparison to *Rorippo-Phalaridetum arundinaceae* (Table 2; Figs 2–3). However, it is based on five relevés from the Ipeľ River catchment area only (Kovács and Máthé 1967, Table 11). This is not enough for the serious conclusions. It is necessary to compare more numerous phytosociological data sets.

Note: The relevés in the paper of Máthé (1956: 24), Kovács and Máthé (1967: 152) are very similar in several aspects. In the older paper, the synoptic table of five relevés was published without exact localisation. Five relevés in the newer paper in analytic and synoptic forms are presented. These relevés were recorded in the surroundings of Szécsény on 17.06.1955. The species composition and number of species are almost identical. The only difference was found in the presence of *Agrostis stolonifera* and *Poa palustris* species. *Agrostis stolonifera* is present in the older paper of Máthé and absent in the newer one by Kovács and Máthé. Conversely, *Poa palustris* absent in Máthé's paper is present in the paper of Kovács and Máthé. The ranges of cover values of particular species are almost the same, differences were detected only for *Carex acuta*, *Iris pseudacorus* and *Potentilla reptans*. In the second paper (Kovács and Máthé 1967), the authors did not cite the previous one (Máthé 1956), however, some relevés in the paper of Kovács and Máthé are identical with the relevés from the paper of Máthé (e.g. Máthé (1956: 25) versus Kovács and Máthé (1967, Table 4: relevés 1–3; 1967: 165, *Glycerietum maximae*, relevés 1–3). These obscurities should be explained.

Phalaridetum arundinaceae Libbert 1931
(Table 1: relevés 2–14, 17–19; Table 2: column C)

The community forms species poor, closed stands with the dominance of *Phalaroides arundinacea.* Diagnostic species of Phragmito-Magnocaricetea such as *Carex acuta*, *C. vulpina*, *Glyceria maxima*, *Iris pseudacorus*, *Lysimachia vulgaris* and *Lythrum salicaria* are present with a higher constancy in the species composition. The last mentioned species is the most frequent one (in 63% of relevés). From the others, *Persicaria amphibia* (constancy 38%) and *Symphytum officinale* (50%) are also frequent. These facts completely correspond with this commu-

nity data used for prepared wetland vegetation survey of Slovakia (Hrivnák 2001) and also with community characteristics in vegetation survey of Austria (Balátová-Tuláčková *et al.* 1993).

The stands of *Phalaridetum arundinaceae* occur mostly on the natural biotopes, e.g. the river oxbows and terrain depressions (Hrivnák 2001). They are relatively well adapted for artificial biotopes, e.g. water reservoirs and ditches. The stands of this community usually grow within the larger marshes, where they occupy the relatively drier and shortly flooded places. The water regime of these biotopes is very heterogeneous. It is characterised by relatively short but high floods and long duration of terrestrial ecophase. In the Borská nížina lowland, the significant oscillation of water level in this community is mentioned (Balátová-Tuláčková 1968, 1976). The soils belong to the hydromorphic soils, they are clayey to loamy and humous (Hrivnák 2001).

In the Ipeľ River catchment area, *Phalaridetum arundinaceae* belongs to the relatively frequently occurring communities. It often creates large stands. They grow in the shallow or medium deep terrain depressions or on the upper littoral of the open water biotopes. In the hydrosere, this community most frequently follows large sedge communities (Caricenion gracilis). On the other hand, it was used to be successively replaced by wet meadow communities (Alopecurion pratensis Pass. 1964).

In several places (e.g. in the alluvium of Ipeľ River near Ipeľské Predmostie village in Slovakia, near Őrhalom village and Szécsény town in Hungary) the stands of *Phalaridetum arundinaceae* are subjected to the agricultural utilisation. They were used to be mowed at first and later, in the second half of summer they are grazed by cattle.

Three floristical and ecological variants were defined (α, β, γ) within the material from the Ipeľ River catchment area. They reflect mainly the influence of prevailing ecological factors of the habitat. The variant α (Table 1: relevés 3–8; see also Fig. 2) is differentiated by *Carex acuta*, *Galium palustre* and *Iris pseudacorus*. They occur in the longer flooded biotopes with relatively less oscillating water level. The littoral and limose ecophases together last approximately as long as the terrestrial ecophase. The stands grow on the relatively deep terrain depressions inside the complexes of wet meadows or in relatively higher places within the marshes, less frequently also in the littoral of open water biotopes. The contact zone of the stands of this variant is created by the other marsh plant communities, mostly by the stands of the large sedge communities.

The variant β (Table 1: relevés 9–13; see also Fig. 2) is differentiated by *Lysimachia vulgaris* and *Persicaria amphibia*. The typical marsh species *Carex acuta* or *Glyceria maxima* occurs also in the communities of the previous variant. The stands of this variant mostly grow on the relatively long and shallow

flooded biotopes with the long lasting seasonal decrease of water level below the soil surface. Duration of the littoral and limose ecophases as long as the terrestrial ecophase is similar to the previous variant. The stands were observed mainly in the littoral (supralittoral and upper littoral) of standing water, especially in artificial water reservoirs. The water regime is related to management of these water reservoirs as well as the regular decrease of the water level in summer.

In the alluvium of the Ipeľ River between Ipeľské Predmostie and Tešmak and in the Nature reserve (NR) Dálovský močiar, stands of the variant γ (Table 1: relevés 2, 17–19; see also Fig. 2) were recorded. In spring, both of them are flooded. The water level decreases in the end of spring and later available water occurs deep under the soil surface. This variant is differentiated especially with *Carex melanostachya*, *C. vulpina*, *Potentilla reptans* and *Ranunculus repens*.

The relevé Nr 14 (Table 1; see also Fig. 2) has the transition character between the variants β and α.

Rorippo-Phalaridetum arundinaceae Kopecký 1961
(Table 1: relevés 21–30; Table 2: column F)

Rorippo-Phalaridetum arundinaceae is two- or three-layer species poor community, with *Phalaroides arundinacea* dominance. It often forms stands of height 150–200 cm during the flowering period. The stands are built mainly by Galio-Urticetea and Bidentetea tripartiti species. Less frequent are diagnostic species of Phragmito-Magnocaricetea and Molinio-Arrhenatheretea classes. The following species composition was introduced for this community by Kopecký (1961): *Mentha aquatica*, *Phalaroides arundinacea*, *Poa palustris*, *Rorippa amphibia*, *R. sylvestris*, *R. palustris*, *Urtica dioica*, *Calystegia sepium* (dif., loc.), *Persicaria hydropiper* (dif.), *Rumex conglomeratus* (dif.) and *R. obtusifolius* (dif.). From the mentioned, the following species do not occur, or occur in a minimal rate in the Ipeľ River catchment area: *Mentha aquatica*, *Poa palustris*, species of genus *Rorippa* and *Rumex*. On the contrary, *Galium aparine* agg., *Lythrum salicaria* and *Poa trivialis* occur in high frequency. Stands with this species combination can be classified as subass. *typicum* Kopecký et Hejný 1965, phase *typicum* (Table 1: relevés 22–30). The more frequent occurrence of Bidentetea tripartiti species as *Atriplex prostrata*, *Bidens frondosa* and *Persicaria lapathifolia* in some localities is represented by relevés 29–30 (Table 1; see also Fig. 2). Relevé 21 (Table 1) represents the phase with *Rorippa sylvestris* from the mentioned association.

The stands of this community grow on the silt islands edges, river terraces and banks (Valachovič 2001). In the Ipeľ River catchment area, these stands were detected mostly on the banks of watercourses, natural or artificial

water biotopes. The stands grow less often on the edges of the eutrophic marshes or along line structures in the alluvium of rivers and streams. Regular but short time floods are typical for all biotopes. The terrestrial ecophase exists for the markedly longer time during vegetation period.

Note: In the paper from 1971, Soó (1971: 132) supposed that *Rorippo-Phalaridetum arundinaceae* does not occur within the Hungarian territory. This community is not noted in newer surveys of the Hungarian vegetation (Borhidi 1996, Borhidi and Sánta 1999) as well. However, we cannot document it with phytosociological relevé. We are sure that this community grows on the left riverside of Ipeľ. The relevés 26 and 29 come from the Slovak bank of the river. The same stands occur also on the opposite side, there is on the area of Hungary.

Phalaroides arundinaceae community (Glycerio-Sparganion Br.-Bl. et Sissingh in Boer 1942 alliance; Table 1: relevé 16)

The stand of this community grew in the deep silts on the margin of the watercourse of Ipeľ River. The watercourse is during longer part of year overflowing. The community can survive for a short time in limose ecophase, too. These factors are reflected in the occurrence of *Agrostis stolonifera*, *Glyceria fluitans*, *Sparganium erectum* and *Veronica beccabunga*.

Phalaroides arundinaceae community (Calthion R. Tx. 1937 emend. Bal.-Tul. 1978 alliance; Table 1: relevé 20)

This community was found in the upper littoral of the Ľadovo water reservoir. Stands of the Caricenion gracilis grew on the waterside of this one and wet meadow communities of the Calthion or Alopecurion pratensis Passarge 1964 were developed on the upper side. In addition to the diagnostic species of the Phragmito-Magnocaricetea (*Carex acutiformis*, *Lythrum salicaria*, *Phalaroides arundinacea*), floristical composition is created by the diagnostic species of Calthion and Molinio-Arrhenatheretea (*Carex hirta*, *Cirsium canum*, *C. oleraceum*, *Mentha longifolia*, *Scirpus sylvaticus*, *Poa trivialis* and *Symphytum officinale*). The locality is regularly mowed. This is favourable to the meadow species and it supports higher species diversity.

Phalaroides arundinacea-Equisetum palustre community
(Phragmito-Magnocaricetea class; Table 1: relevé 1)

The community is poor in species with more expressive presence of *Equisetum palustre*. It was detected only near Šíd village on the alluvium of the Čamovský potok stream.

Phalaroides arundinacea-Typha latifolia community
(Phragmito-Magnocaricetea class; Table 1: relevé 15)

This community is species poor and floristically nondescript alike as former ones. In addition to the dominating *Phalaroides arundinacea* and *Typha latifolia*, the diagnostic species of the Bidentetea tripartiti and Molinio-Arrhenatheretea (*Agrostis stolonifera*, *Bidens frondosa*, *Ranunculus sceleratus*, *Symphytum officinale*, *Vicia cracca*) are present. The aspect with *Calystegia sepium* is typical for these stands in the summer.

THE RESULTS OF THE TABULAR SYNTHESIS AND ANALYSIS

According the results of tabular synthesis, the significant floristical and ecological differentiation of communities studied in the Ipeľ River catchment area was proved.

In *Phalaridetum arundinaceae* and *Carici gracilis-Phalaridetum* stands grows mainly Phragmito-Magnocaricetea species, whereas in *Rorippo-Phalaridetum arundinaceae* occur mainly Molinio-Arrhenatheretea, Galio-Urticetea, Bidentetea tripartitae and Artemisietea species (Table 1).

The *Carici gracilis-Phalaridetum* association is differentiated from the *Phalaridetum arundinaceae* by *Angelica sylvestris*, *Carex vesicaria*, *Eleocharis palustris*, *Poa palustris* and *Potentilla reptans*. The common species of both associations are *Carex acuta*, *C. acutiformis*, *Glyceria maxima* and *Iris pseudacorus*. In the relevés of the surroundings of Szécsény town, species as *Galium palustre*, *Lycopus europaeus*, *Poa trivialis* or *Symphytum officinale* which is common in *Phalaroides arundinacea* dominated stands, are missing (Table 2).

The *Phalaridetum arundinaceae* association is differentiated from the *Rorippo-Phalaridetum arundinaceae* mainly by reed grasses (*Carex acuta*, *C. acutiformis*, *C. vesicaria*), *Glyceria maxima* and *Iris pseudacorus* (Table 2). Other reed grasses (*Carex melenostachya*, *C. riparia*, *C. vulpina*) as well as *Rorippa austriaca* sporadically occurs in the Ipeľ River catchment area (Table 1).

The *Rorippo-Phalaridetum arundinaceae* association is strongly differentiated from the previous communities by *Bidens frondosa*, *Galium aparine* agg., *Persicaria hydropiper*, *Potentilla anserina*, *Rumex crispus*, *Urtica dioica* and weakly also by *Poa palustris* (Table 2). Local differential value in the Ipeľ River catchment area seems to have also *Cirsium arvense* and *Persicaria lapathifolia* (Table 1).

Variability of particular communities with the *Phalaroides arundinacea* dominance in the catchment area was proved also by indirect gradient analysis (Fig. 2). The particular communities are ordered along the axis 1. On the left side of the figure the relevés without ranking in hierarchical system (relevés 16, 20, 1, 15) are grouped. Next to the right are those of *Rorippo-Phalaridetum arundinaceae* (relevés 21–30), next group was classified as *Phalaridetum arundinaceae* (relevés 2–14, 17–19) and on the right side are situated relevés of *Carici gracilis-Phalaridetum* (relevés A–E). The axis 2 represents internal variability of the communities.

Generally, the most important ecological factor influencing these communities is flooding. The key factor of their floristical differentiation seems to be the nutrient supply of habitats, especially the amount of available nitrogen for plants. This factor is closely related with a duration of floods. Short floods and rapid water decline deep below the soil surface, typical for *Rorippo-Phalaridetum*, enable microorganisms to transform nitrogen compounds (nitrification) to the form available for plants. On the contrary, in the case of *Phalaridetum arundinaceae* and *Carici gracilis-Phalaridetum*, floods are longer and water decline is significant only for a very short time at the end of summer. Long lasting floatation does not allow activation of nitrification. Just these factors explain well the variability of relevés along the axis 1 (Fig. 3).

Various ecological requirements of communities reflect in the type of habitat they colonise. The stands of *Rorippo-Phalaridetum arundinaceae* were observed mainly on the banks of flowing water. Terrain depressions and littoral of both natural and secondary open water biotopes are typical for the *Carici gracilis-Phalaridetum* and *Phalaridetum arundinaceae*.

*

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Appendix 1
Species in one relevé only (Table 1)

Alisma lanceolatum (PM) rel. 6: r, *Alopecurus geniculatus* (MA) rel. 16: +, *Caltha palustris* (MA) rel. 3: +, *Carex acutiformis* (PM) rel. 20: A, *C. vesicaria* (PM) rel. 6: +, *Chenopodium polyspermum* (BI) rel. 13: +, *Cucubalus baccifer* (Con) rel. 23: +, *Equisetum arvense* (O) rel. 22: 1, *Galeopsis speciosa* (O) rel. 20: r, *Glechoma hederacea* agg. (O) rel. 22: +, *Gratiola officinalis* (MA) rel. 18: +, *Humulus lupulus* (GU) rel. 27: A, *Lamium maculatum* (GU) rel. 22: r, *Lycopus exaltatus* (PM) rel. 14: +, *Myosoton aquaticum* (O) rel. 22: +, *Persicaria dubia* (BI) rel. 13: +, *Pseudolysimachion longifolium* (O) rel. 8: +, *Ranunculus acris* (MA) rel. 23: +, *R. auricomus* agg. (MA) rel. 6: +, *R. sceleratus* (BI) rel. 15: +, *Rubus caesius* (O) rel. 24: +, *R. hirtus* s. lat. (O) rel. 28: +, *Rumex obtusifolius* (GU) rel. 27: +, *Salix purpurea* (O) rel. 13: +, *Sanguisorba officinalis* (MA) rel. 20: 1, *Scrophularia nodosa* (O) rel. 20: r, *Thalictrum lucidum* (MA) rel. 17: r, *Trifolium repens* (O) rel. 2: +.

Appendix 2
Localities of relevés (Table 1)

For the published data, only the country, orographical unit, locality and the cited paper where the relevé was published are presented. For other relevés, the header data are listed in the following order: country (SK = Slovakia, HU = Hungary); orographical unit; locality and habitat; flow classes (S = stagnant, F = flow); depth of water level (cm); altitude (m); exposition (S = south, E = east, N = north; W = west); slope (°); relevé area (m^2); E_1 cover (%); average height of a stand (cm); proportion of death biomass (%); date; author(s) of relevé (Ac = A. Cvachová, Rh = R. Hrivnák, Ho = H. Oťaheľová).

1. SK; Cerová vrchovina Mts (Cer); Šíd village, WSW of village, alluvium of Čamovský potok stream, central part of alluvium; –; –; 205; –; –; 25; 100; 200–215; 15; 13.8.1999; Rh.

2. SK; Lučenská kotlina lowland (Luč); Veľké Dálovce village, NR Dálovský močiar; Hrivnák (1999, Table 2: relevé 16).

3. SK; Ipeľská kotlina lowland (IpeK); Bušince village, NNE; Hrivnák *et al.* (2001, Table 3: relevé 36).

4. SK; IpeK; Ipeľské Predmostie village, E, NR Ipeľské hony; –; –; 131; –; –; 25; 100; 210; –; 24.6.1997; Ac, Rh, Ho.

5. SK; Ipeľská pahorkatina lowland (IpeP); Kubáňovo village, S, littoral of Ipeľ River oxbow; S; 10–35; 114; –; –; 25; 100; 200; –; 3.9.1999; Rh.

6. SK; Luč; Hrabovo village, S, Ipeľ River oxbow near spring of mineral water; S; 5–15; 198; –; –; 15; 90; –; 110–130; –; 8.6.1997; Rh.

7. HU; –; Őrhalom village, NW, alluvium of Ipeľ River; Hrivnák *et al.* (2001, Table 3: relevé 38).

8. SK; IpeK; Trenč village, Ráros settlement, alluvium of Ipeľ River; –; –; 160; –; –; 25; 100; 180; –; 25.5.1999; Rh.

9. SK; IpeK; Tešmak village, E, alluvium of Ipeľ River; –; –; 127; –; –; 25; 100; 180; 40; 26.6.1997; Ac, Rh.

10. HU; –; Szécsény town, W, alluvium of Ipeľ River; Hrivnák *et al.* (2001, Table 3: relevé 37).

11. SK; Krupinská planina Mts (Kru); Kozí Vrbovok village, SW, littoral of artificial water reservoir; S; 25–40; 330; –; –; 25; 100; 200; –; 12.8.1999; Rh.

12. SK; Revúcka vrchovina Mts (Rev); Divín village, S, littoral of artificial water reservoir Ružiná; –; –; 255; NE; 1; 25; 100; 150; 40; 11.9.1998; Rh.

13. SK; IpeK; Veľká nad Ipľom village, ENE, margin of gravel-ditch; –; –; 165; –; –; 25; 90; 190–210; –; 30.8.1998; Rh.

14. SK; IpeK; Trenč village, E, alluvium of Ipeľ River; S; 0–2; 163; –; –; 25; 100; 180–210; –; 30.7.1999; Rh.

15. SK; IpeK; Ľuboreč village, SSW, SW margin of artificial water reservoir; –; –; 235; –; –; 24; 100; 140; –; 27.7.1998; Rh.

16. SK; Luč; Kalinovo village, silts in the watercourse of Ipeľ River below the road bridge; –; –; 200; SE; 2–3; 18; 100; 220–230; –; 8.6.1998; Rh.

17. SK; IpeK; Tešmak village, Surdocké lúky meadows, alluvium of Ipeľ River; –; –; 127; –; –; 25; 100; 160; –; 26.6.1997; Rh.

18. SK; IpeK; Ipeľské Predmostie village, Cúdenica, margin of river oxbow; –; –; 128; –; –; 25; 100; 160–180; –; 24.6.1997; Rh, Ho.

19. SK; IpeK; Ipeľské Predmostie village, Ryžovisko, alluvium of Ipeľ River; –; –; 130; –; –; 25; 100; 180; –; 25.6.1997; Ac, Rh.

20. SK; Luč; Lučenec town, W, littoral of artificial water reservoir Ľadovo; –; –; 210; –; –; 25; 100; 180–220; –; 9.6.1998, Rh.

21. SK; IpeK; Ipeľské Predmostie village, NR Ipeľské hony, NE margin; –; –; 130; –; –; 25; 100; 150–190; –; 23.6.1997; Rh.

22. SK; Luč; Lučenec town, bank of Tuhársky potok stream in the park; –; –; 190; S; 2–4; 25; 100; 200; –; 9.6.1998; Rh.

23. SK; Luč; Boľkovce village, marsh in the village; Hrivnák (1998, Table 2: relevé 9).

24. SK; Luč; Boľkovce village, SW, cannal at the left site of the dam of Ipeľ River; Hrivnák (1998, Table 2: relevé 10).

25. SK; Luč; Boľkovce village, bank of Ipeľ River near the road bridge; Hrivnák (1998, Table 2: relevé 11).

26. SK; IpeP; Kubáňovo village, S, bank of Ipeľ River near the railway bridge; –; –; 115; –; –; 28; 100; 130; –; 3.9.1999; Rh.

27. SK; IpeK; Lučenec town, under the road viaduct; N; 0–2; 192; –; –; 17,5; 100; 140–160; –; 2.6.1998; Rh.

28. SK; Luč; Poltár town, SSW, riparian vegetation of Poltárica stream; –; –; 230; –; –; 25; 100; 190–210; 30; 29.7.1999; Rh.

29. SK; Luč; Trenč village, Rároš settlement, opposite of the water tower on the bank of Ipeľ River; –; –; 161; –; –; 25; 100; 170–180; –; 25.5.1999; Rh.

30. SK; Luč; Rapovce village, N, near crossing of the railway and road, terrain depression; –; –; 171; –; –; 25; 100; 215; 20; 9.7.1998; Rh.