

Aquatic and marsh plant communities of an inundation area of the Ipeľ River (rkm 96–119)

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Introduction

The Ipeľ River and surrounding countryside have been under permanent human impact during the previous millennium, which has resulted into heavy changes in the character of landscape and vegetation cover. Especially, the wetlands (wet meadows, swamps, and oxbows) represent the most affected habitats in the inundation area. At present, only fragments of them have remained.

In the past, several phytosociological studies concerning wetland plant communities were done by KOVÁCS (1957, 1968), KOVÁCS – MÁTHÉ (1967), MÁTHÉ (1956) and SVOBODOVÁ – ŘEHOŘEK (1972). Beside this, KÁRPÁTI – KÁRPÁTI (1967) prepared some ecological studies of hydrophytes and presented also relations of species to the syntaxonomic units. Within a study of distribution of associations *Caricetum melanostachyae* and *Caricetum buekii*, also data from the Bušince village were used (cf. HRIVNÁK 2000).

Study Area and Methods

The area studied extends along both banks of Ipeľ River, which is a natural and also political border between Slovakia and Hungary. All localities are situated in the inundation of river between Malý Kiarov and Bušince villages (southern Slovakia), and Órhalom and Nógrádszakál villages in northern Hungary (Fig. 1). From the phytogeographical point of view, the area belongs to the xerothermic flora of *Matricum*, representing a part of the region of Pannonic flora (*Pannonicum*).

The well-preserved localities were visited and studied during 1996–2000.

The phytosociological relevés were made according to Zürich-Montpellier approach and we used the adapted Braun-Blanquet's scale (BARKMAN et al. 1964). All relevés are stored in database programs TURBO(VEG) (HENNEKENS 1985).

The nomenclature of vascular and non-vascular plants follows MARHOLD & HINDÁK (1998) and phytosociological units follow OĽAHELOVÁ (1995a, b) and OĽAHELOVÁ et al. (2001). The term ecophase is used according HEJNÝ (1960).



Fig. 1. Map of studied area

The threat and endangerment of plant communities is evaluated according of national Red Data Lists and Red Data Books (cf. BORHIDI – SÁNTA 1999, VALACHOVIČ 2001).

Abbreviations:

BI – *Bidentetea tripartiti*, LE – *Lemnetea*, PM – *Phragmito-Magnocaricetea*,
 CH – *Charetea fragilis*, MA – *Molinio-Arrhenatheretea*, PO – *Potametea*,
 HU – Hungary, O – others, SK – Slovakia.

Note: The name of authors of phytosociological relevés are arrange by alphabetically order.

Results and Discussion

Survey of vegetation units

Lemnetea de Bolós et Masclans 1955

Lemnetalia minoris de Bolós et Masclans 1955

Lemnion minoris de Bolós et Masclans 1955

Lemnetum minoris Oberd. ex T. Müller et Görs 1960

Lemno minoris-Spirodeletum polyrhizae Koch 1954

Lemno-Utricularietalia Passarge 1978

Utricularion vulgaris Passarge 1964

Lemno-Utricularietum vulgaris Soó 1947

Hydrocharitetalia Rübél 1933

Hydrocharition Rübél 1933

Ceratophylletum demersi Hild 1956

Ceratophylletum submersi von Soó 1928

Potametea R. Tx. et Preising 1942

Potametalia Koch 1926

Nymphaeion albae Oberd. 1957

Potametum natantis von Soó 1927

Phragmito-Magnocaricetea Klika in Klika et Novák 1941

Phragmitetalia Koch 1926

Phragmition communis Koch 1926

Phragmitetum vulgaris von Soó 1927

Scirpetum lacustris Chuard 1924

Typhetum angustifoliae Pignatti 1953

Typhetum latifoliae Lang 1973

Sparganietum erecti Roll 1938

Glycerietum aquaticae Hueck 1931

Acoretum calami Schultz 1941

Iris pseudacorus community

Magnocaricion elatae Koch 1926

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

Caricetum gracilis Almquist 1929

Caricetum vesicariae Chouard 1924

Galio palustris-Caricetum ripariae Balátová-Tuláčková et al. 1993

Caricetum melanostachyae Balázs 1943

Phalaridetum arundinaceae Libbert 1931

Nasturtio-Glycerietalia Pignatti 1953

Berula erecta community

Phalaridion arundinaceae Kopecký 1961

Caricetum buekii Kopecký et Hejný 1965

Oenanthetalia aquaticae Hejný in Kopecký et Hejný 1965

Oenanthion aquaticae Hejný ex Neuhäusl 1959

Oenantho aquaticae-Rorippetum amphibiae Lohmeyer 1950

Eleocharitetum palustris Ubrizsy 1948

Bolboschoenetum maritimi Egger 1933

Phellandrium aquaticum community

Tab. 1. Aquatic plant communities (*Lemnetum minoris* - 1, *Lemno minoris-Spirodeltum polyrhiza* - 2-7, *Ceratophyllum demersi* - 8-10, *Ceratophyllum submersi* - 11-12, *Lemno-Utricularietum vulgaris* - 13, *Potamoetum natantis* - 14-15)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of relevés	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Area analyzed (m ²)	7.5	25	25	25	16	18	25	25	15	10	25	15	12	20	25
Altitude (m)	160	145	153	145	148	145	150	145	146	145	145	144	144	145	153
Cover (%)	85	100	100	100	100	100	100	100	100	100	100	100	100	90	95
Total number of species	2	6	2	4	5	6	3	4	4	9	5	5	5	5	2
Deep of water level	30-50	20-40	20-40	40-80	10	60-100	100	60-80	40-60	20-45	20-50	5-35	40	40-80	45-65
Date	7.7.99	28.5.97	14.6.00	13.6.00	20.8.96	13.6.00	14.6.00	13.6.00	13.6.00	13.6.00	13.6.00	28.7.97	20.8.96	13.6.00	14.6.00
<i>Lemnetum</i> and <i>Potamoetum</i>															
<i>Lemna minor</i>	5	2b	1	4	4	4	5	2b	4	.	3	2a	2b	.	.
<i>Spirodela polyrhiza</i>	.	4	5	3	3	3	3	1	1	.	.	.	+	.	.
<i>Ceratophyllum demersum</i>	.	.	.	.	.	+	2b	5	5	5	5	5	1	.	.
<i>Ceratophyllum submersum</i>	.	.	.	.	.	.	.	.	.	.	5	5	5	.	+
<i>Utricularia vulgaris</i> agg.	.	+	.	.	.	.	.	.	.	1	.	1	5	.	.
<i>Potamoetum natantis</i>	.	.	.	.	.	.	.	.	.	+	.	.	1	.	5
<i>Lemna trisulca</i>	.	3	.	.	.	.	.	.	1	3	+	1	1	2b	.
<i>Potamoetum trichoides</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Potamoetum crispus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Phragmito-Magnocaricetea</i>															
<i>Butomus umbellatus</i>	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+
<i>Sagittaria sagittifolia</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.
<i>Sparanium erectum</i>	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.
Other															
<i>Persicaria amphibia</i>	.	r	.	.	.	.	.	.	.	.	+	.	.	.	.

In one relevés only:

Batrachium sp. (PO) 14: +, *Batrachium trichophyllum* (PO) 5: +, *Chara fragilis* (CH) 10: 1, *Glyceria maxima* (PM) 6: +,
Phellandrium aquaticum (PM) 2: +, *Phragmites australis* (PM) 6: 1, *Typha latifolia* (PM) 1: +

Localities of relevés:

1. SK, Bušince, NNE, ditch with standing water, Hrivnák (RH)
2. SK, Kováčovce village, marsh in southwestern margin of village, standing water, Cvachová (AC) & RH
3. HU, Ludányhalászi village, N, near railway bridge, river oxbow, standing water, RH
4. HU, Szécsény town, W, terrain depression, standing water, Balázs (PB) & RH
5. SK, Kováčovce village, marsh in southwestern margin of village, standing water, RH
6. HU, Hugyag village, W, river oxbow, standing water, PB & RH
7. HU, Ludányhalászi village, Halászi, W, river oxbow, standing water, PB & RH
8. HU, Hugyag village, W, river oxbow, central part of river oxbow, standing water, PB & RH
9. HU, Szécsény town, NW, channel, slowly running water, RH
10. HU, Hugyag village, NE, near destroyed bridge over Ipeľ River, river oxbow, standing water, RH
11. HU, Hugyag village, NE, Sovány rét, terrain depressions, standing water, RH
12. SK, Malý Kiarov village, NR Kiarovský močiar Marsh, channel in southern part of NR, standing water, RH
13. SK, Malý Kiarov village, NR Kiarovský močiar Marsh, channel in southern part of NR, standing water, RH
14. HU, Hugyag village, NE, near destroyed bridge over Ipeľ River, river oxbow, standing water, PB & RH
15. HU, Ludányhalászi village, N, near railway bridge, oxbow, standing water, PB & RH

Aquatic plant communities (Tab. 1)

During the field research, six various aquatic communities of the class *Lemnetea* were recorded. The occurrence of these structurally simple coenoses of pleustophytes is characteristic for periodically flooded depressions with stagnant or slowly flowing water bodies. The typical community, *Lemnetum minoris* (Tab.1, rel. 1) grows only in one artificial hollow at small places between swards of *Typha latifolia* and *Glyceria maxima*, but duckweed (*Lemna minor*) itself is a common species in various aquatic communities. The most frequent aquatic plant community in the area was the *Lemno minoris-Spirodeletum polyrhizae* (rels 2–7). Abundant stands were found in shallow water oxbows with a high degree of humification, less also in the littoral zone of deep river branches. The community is poor in species with dominant *Spirodela polyrhiza* and *Lemna minor*. It has the optimal conditions in eutrophic and stagnant water bodies.

The association *Lemno-Utricularietum vulgaris* (rel. 13) was recorded only in a canal of nature reserve Kiarovský močiar marsh. *Utricularia vulgaris* dominated in the submersed layer. The growths of association *Ceratophylletum submersi* (rels 11–12) were found later in the next years at the same area (rel. 12). This community prefers relatively shallow waters. A submerged pleustophyte *Ceratophyllum submersum* has overgrown the whole water column and other species can be present only rarely. The natant layer is also throughout densely covered with duckweed. A similar character has also the community of *Ceratophylletum demersi* (rels 8–10), which is one of the common representatives of aquatic vegetation in the Ipeľ River inundation.

BORHIDI (1996) include both associations *Ceratophylletum demersi* and *Ceratophylletum submersi* into an independent alliance *Ceratophyllion demersi* Soó 1927 nom. nudum. In a later work (BORHIDI – SANTA 1999), the name of *Ceratophyllion* Den Hartog et Segal 1964 alliance was used. According to the Code of Phytocenological Nomenclature (BARKMAN et al. 1976, Art. 8), neither the second name was published validly. Therefore we accept provisionally their ranking among the *Hydrocharition* (cf. SCHRATT 1993a, HEJNÝ 1995, OŤAHELOVÁ 1995a), although typical communities of this alliance prefer waters with higher content of nutrients (*Ceratophylletum demersi*) or salts (*Ceratophylletum submersi*) (cf. SCHRATT 1993a, OŤAHELOVÁ 1995).

From the *Potametea* communities, characteristic for habitats with permanent water (deeper oxbows), only *Potametum natantis* was found (rels 14–15). For the general physiognomy of this community, floating leaves of *Potamogeton natans* are characteristic, however the community is very poor in species.

In the past, also *Nymphaetum albo-luteae* has been recorded (KOVÁCS – MÁTHÉ 1967, KÁRPÁTI – KÁRPÁTI 1967) near Ludányhalászi village. At present, no other stands were observed and the community can be considered as extinct in area studied. Only some exemplars of *Nuphar lutea* were found in the year 2000 in the gravel pit near Szécsény and oxbows West of Ludányhalászi village. Similarly, some exemplars were found in hollows eastern from the vicinity of Bušince village (HRIVNÁK et al. 1997), all probably washed out from upper parts of Ipeľ River.

Tab. 2. Red bed communities *Phragmites communis* (*Phragmites vulgaris* – 16–17, *Scirpium lacustris* – 18–19, *Typheta angustifolia* – 20, *Typheta latifolia* – 21–23, *Spartanium erectum* – 24–26, *Glycerium aquaticum* – 27–30, *Iris pseudacorus* community – 31, *Acoretum calami* – 32)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Number of relevé	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Area analyzed (m ²)	25	25	25	25	18	21	25	25	21	25	25	25	25	25	12	16	25
Altitude (m)	150	144	150	145	150	148	159	145	146	145	145	145	144	159	140	145	145
Cover (%)	100	100	90	100	100	90	100	100	90	100	80	100	100	95	78	95	98
Total number of species	10	4	6	5	5	5	6	11	9	5	5	10	5	5	8	9	23
Deep of water level	-	-	-	30–60	70–80	2–4	2–10	-	-	-	60–100	-	-	5–15	5–10	-	-
Date	14.6.20	27.8.97	13.6.20	13.6.20	14.6.20	29.7.98	7.7.99	29.7.98	29.7.98	29.7.20	13.6.20	29.7.98	27.8.97	7.7.99	13.6.20	28.5.97	29.7.98
<i>Phragmites-Macrocetetea</i>																	
<i>Phragmites australis</i>	5	5	4	5	1	+	.	.	.	.	.	.	.	.	.	.	.
<i>Schoenoplectus lacustris</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Typha angustifolia</i>	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.
<i>Typha latifolia</i>	.	.	.	.	.	5	5	4	.	.	.	.	.	.	.	.	.
<i>Spartanium erectum</i>	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Glyceria maxima</i>	.	.	.	.	.	.	1	+	2b	.	.	5	5	5	4	4	4
<i>Iris pseudacorus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
<i>Acorus calamus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex riparia</i>	.	2a	.	2a	2b	.	.	.	.	.	.	.	.	.	.	.	.
<i>Lysimachia vulgaris</i>	.	+	.	.	.	.	.	.	.	.	.	.	2a	.	.	2a	+
<i>Phellandrium aquaticum</i>	.	.	1	.	.	.	.	2m	2a	+	.	2m	1	+	.	.	+
<i>Lythrum salicaria</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Butomus umbellatus</i>	.	.	.	.	.	.	.	+	+	+	.	.	.	.	2a	.	.
<i>Alisma plantago-aquatica</i>	.	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.
<i>Lycopus europaeus</i>	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	1
<i>Carex acuta</i>	.	.	.	.	.	.	.	2b	.	.	.	.	.	.	.	.	.
<i>Galium palustre</i>	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	+
<i>Stium latifolium</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
<i>Rorippa amphibia</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
<i>Alisma lanceolatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sagittaria sagittifolia</i>	.	.	.	.	.	.	.	.	.	.	2a	.	.	.	.	.	.
<i>Veronica anagallis-aquatica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Lemnetea</i>																	
<i>Lemna minor</i>	.	.	.	.	3	4	.	.	.	.	.	.	.	+	2b	+	.
<i>Ceratophyllum demersum</i>	.	.	.	.	.	2b	.	.	.	.	.	.	.	.	.	.	.
<i>Spirodela polyrrhiza</i>	.	.	.	.	3	.	.	.	.	.	.	.	.	.	2a	.	.
<i>Bidentea</i>																	
<i>Persicaria hydropiper</i>	1	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	+

Tab. 2. (cont.)

Number of relevé	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
<i>Bidens frondosus</i>	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	2m	2b
<i>Persicaria lapathifolia</i>	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.
Others																		
<i>Calystegia sepium</i>	2b	2b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Agerostis stolonifera</i>	+	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	2a
<i>Plantago major</i>	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.
<i>Persicaria amphibia</i>	.	.	+	.	.	.	.	.	1	.	.	.	2a	.	.	.	.	+
<i>Salix fragilis</i>	.	.	r	.	.	.	.	.	r	.	.	.	.	.	.	.	.	+

In one relevés only:

E₂: *Negundo aceroides* (O) 31: 1

E₁: *Artemisia vulgaris* (O) 16: r, *Atriplex prostrata* (BI) 16: +, *Bidens tripartitus* (BI) 27: 1, *Carex vulpina* (PM) 32: +, *Ceratophyllum submersum* (LE) 19: 3, *Equisetum flavivatile* (PM) 22: 2b, *Gleditschia triacanthos* (O) 32: +, *Himnulus lupulus* (O) 16: 1, *Juncus inflexus* (O) 27: r, *Lemna trisulca* (LE) 26: 3, *Lycopus europaeus* (PM) 32: 1, *L. exaltatus* (LE) 32: +, *Lysimachia nummularia* (O) 32: 1, *Mentha arvensis* (O) 32: 1, *Persicaria maculosa* (BI) 32: 1, *Phalaroides arundinaceae* (PM) 16: 2b, *Populus x canadensis* (O) 32: r, *Potamogeton crispus* (PO) 26: 3, *Rumex maritimus* (PM) 24: +, *Solanum dulcamara* (O) 22: 3, *Urtica dioica* (O) 16: +.

Localities of relevés:

16. HU, Ludányhalászi village, Halászi, W, river oxbow, PB & RH
 17. SK, Malý Kiarov village, NR Kiarovský močiar Marsh, RH
 18. HU, Szécsény town, W, floodplain area of Ipeľ River, PB & RH
 19. HU, Hügyag village, NE, Sovány rét, terrain depressions, standing water, RH
 20. HU, Ludányhalászi village, Halászi, W, river oxbow, standing water, PB & RH
 21. SK, Kováčovce village, E, sand-pit, standing water, RH, HO & MV
 22. SK, Bušince village, E, margin of floodplain area of Ipeľ River, terrain depression, standing water, RH
 23. SK, Kováčovce village, marsh in southwestern margin of village, RH, Oľahelová (HO) & Valachovič (MV)
 24. SK, Kováčovce village, floodplain area of Ipeľ River, RH, HO & MV
 25. SK, Kováčovce village, marsh in southwestern margin of village, RH, HO & MV
 26. HU, Hügyag village, NE, near destroyed bridge over Ipeľ River, river oxbow, standing water, RH
 27. SK, Kováčovce village, marsh in southwestern margin of village, RH, HO & MV
 28. SK, Malý Kiarov village, NR Kiarovský močiar Marsh, RH
 29. SK, Bušince village, E, margin of floodplain area of Ipeľ River, terrain depression, standing water, RH
 30. HU, Óhthalm village, NW, floodplain area of Ipeľ River, PB & RH
 31. SK, Kováčovce village, marsh in southwestern margin of village, AC & RH
 32. SK, Kováčovce village, marsh in southwestern margin of village, RH, HO & MV

Reed bed communities of alliance *Phragmition communis* (Tab. 2)

Swamps with swards of *Phragmition communis* are relatively well developed in the whole area. They occupied a littoral of river branches and deeper depressions of natural as well as artificial origin. The waters are stagnant, or very slowly floating, but regularly eutrophic. Some of the communities need a permanent littoral ecophase and a relatively small oscillation of water level, such as *Phragmitetum vulgaris*, *Scirpetum lacustris*, and *Typhetum angustifoliae*. Another communities are able to grow in the periodically flooded depressions, where the water level descends under soil surface during summer (e.g. *Typhetum latifoliae*, *Glycerietum aquaticae*). Nevertheless, a typical feature of these communities is monodominance and species poorness. If the time of drought is longer as customary, the vitality of the dominant species is reduced and more xerophilous and synantropic plants penetrate into the community.

The most common coenoses in the study area are *Phragmitetum vulgaris* (rels 16–17), *Glycerietum aquaticae* (rels 27–30) and *Typhetum latifoliae* (21–23). These communities build very frequently scattered stands like *Phragmitetum vulgaris* near Kiarovský močiar marsh, or *Glycerietum aquaticae* and *Typhetum latifoliae* in vicinity of Kováčovce village. The community *Scirpetum lacustris* (rels 18–19) prefers deeper parts of water bodies with permanent inundation which occurs on both banks of Ipel' River. The *Typhetum angustifoliae* (rel. 20) has similar ecological demands. On the muddy grounds, in the silt of river, oxbows and depressions, grow stands of *Sparganietum erecti* (rels 24–26).

The species *Iris pseudacorus* forms small stands, sometimes pure, but more often mosaic stands with other swamp communities (rel. 31). The neophyte *Acorus calamus* (rel. 32) has occurred in the marsh near Kováčovce village, and the locality (an abandoned garden of village curia) indicate the origin from a former culture. The species had before been planted as an ornament and medicinal herb. In Hungary, no similar stands were found, although *Acorus calamus* occurs here commonly as accompanying species. In 2000, it was recorded at three localities – in a littoral of oxbow situated W from Huguag village, in depressions near the road Szécsény – Litke and directly near Szécsény, and W from Ludányhalázi village, where the community was earlier recorded by KOVÁCS and MÁTHÉ (1967). Also several other of above mentioned plant communities have been noted by Hungarian authors. MÁTHÉ (1956) noted the occurrence of *Scirpo-Phragmitetum* and *Glycerietum aquaticae* from the surroundings of Szécsény and Balassgyarmat, and KOVÁCS – MÁTHÉ (1967) found plant communities such as *Glycerietum maximae*, *Scirpo-Phragmitetum medioeuropaeum* and the mentioned *Acoretum calami*. KOVÁCS (1968) studied also selected features of population ecology in the *Phragmitetum vulgaris* and *Glycerietum aquaticae* at the localities near Őrhalom and Szécsény.

Large sedge communities of alliance *Magnocaricion elatae* (Tab. 3)

In the whole area, only stands classified into suballiance *Caricinion gracilis* were found. All habitats are eutrophic. Various large sedges dominate in highly abundant but species-poor stands. The number of species varied between 5–13. If the water regime is disturbed the stands are more open with reduced vitality. The proportion of diagnostic species of class *Phragmito-Magnocaricetea* is lower and the content of synantropic weeds has increased.

Caricetum gracilis (rels 33–34) is spread over the whole study area although the relevés were done only from the Slovak bank of Ipel' River (Bušince and Kováčovce villages). Most common and overspread plant communities are *Phlaridetum arundinaceae* (rels 36–38) and *Galio palustris-Caricetum ripariae* (rels 39–42). The stands of the first mentioned association are regularly mowed as fodder and litter for cattle. They occupy alluvia, where the flood is short-run but water rich. KOVÁCS – MÁTHÉ (1967) published from surrounding of Szécsény the occurrence of *Rorippo-Phalaridetum arundinaceae* Kopecký 1961, which was later reclassified as *Phalaridetum arundinaceae*. This community represents the last stage in the hydroseries in contact with meadows. On the other hand, *Galio palustris-Caricetum ripariae*, together with *Caricetum vesicariae* (rel. 43) belong to the most water-consuming communities. Therefore, this community, as well as *Caricetum melanostachyae* (rel. 35), is relatively rare and small in extent. Larger stands were found on the western edge of Szécsény. Dominant sedge, *Carex melanostachya*, accompanies only some prostrate species such as *Potentilla reptans*. HRIVNÁK (2000) mapped the occurrence of association on the Slovak bank of Ipel' River, namely in vicinity of villages Veľké Dálovce, Malé Dálovce, Bušince, Ipel'ské Predmostie and Tešmak.

About *Caricetum elatae* as a common association in Ipel' River alluvium, refer KOVÁCS (1957), KOVÁCS – MÁTHÉ (1967), and KOVÁCS (1968). In the Slovak part of area SVOBODOVÁ and ŘEHOŘEK (1972) considered as common sedge communities *Caricetum gracilis* and *Caricetum vulpinae*.

Tab. 3. Large sedge communities *Caricenion gracilis* (*Caricetum gracilis* – 33–34, *Caricetum melanostachyae* – 35, *Phalaridetum arundinaceae* – 36–38, *Galio palustris*-*Caricetum ripariae* – 39–42, *Caricetum vesicariae* – 43)

Number of relevé	33	34	35	36	37	38	39	40	41	42	43
Area analyzed (m ²)	25	20	25	25	25	20	15	16	21	24	16
Altitude (m)	160	145	146	161	145	142	141	145	159	145	145
Cover (%)	95	95	100	100	100	100	100	95	98	90	100
Total number of species	13	6	11	6	7	11	10	9	5	9	8
Deep of water level	-	-	-	-	-	-	-	-	1–6	0–30	-
Date	7.7.98	28.5.9	13.6.2	7.7.98	13.6.2	13.6.2	13.6.2	28.5.9	7.7.98	13.6.2	28.5.9
<i>Phraemito-Maenocaricetea</i>											
<i>Carex acuta</i>	4	5	2a	+	+	+	+	.	.	.	.
<i>Carex melanostachya</i>	.	.	5	.	.	.	.	.	.	.	.
<i>Phalaris arundinacea</i>	.	.	.	5	5	5	2a	.	.	.	.
<i>Carex riparia</i>	.	.	.	.	.	2a	5	5	5	5	.
<i>Carex vesicaria</i>	.	.	.	.	.	.	.	.	.	+	5
<i>Lythrum salicaria</i>	2a	.	+	.	+	+	+	+	r	r	.
<i>Glyceria maxima</i>	+	r	.	.	.	+	.	+	+	.	.
<i>Carex vulpina</i>	1	+	1	.	.	1	.	.	.	.	1
<i>Iris pseudacorus</i>	+	.	.	.	.	1	1	r	1	.	.
<i>Lysimachia vulgaris</i>	+	.	.	.	+	.	.	+	+	.	.
<i>Rorippa amphibia</i>	.	+	.	.	.	.	.	.	.	.	r
<i>Eleocharis palustris</i>	.	.	1	.	.	.	.	.	.	+	.
<i>Galium palustre</i>	.	.	.	.	.	+	.	.	.	.	+
<i>Molinio-Arrhenatheretea</i>											
<i>Symphytum officinale</i>	1	.	.	+	.	.	1	.	.	.	.
<i>Potentilla reptans</i>	.	.	3	.	.	.	+	.	.	.	.
<i>Bidentetea tripartiti</i>	.	.	.	.	.	.	.	.	.	.	.
<i>Persicaria amphibia</i>	.	.	.	.	+	r	+	.	.	.	.
<i>Bidens tripartitus</i>	.	+	.	.	.	.	.	+	.	.	.
<i>Bidens frondosus</i>	.	.	.	.	+	.	.	.	.	.	+
Others											
<i>Poa palustris</i>	+	.	.	+	.	.	.	.	.	.	.
<i>Calystegia sepium</i>	.	.	.	.	+	.	.	r	.	.	.

In one relevés only:

Agrostis stolonifera (MA) 35: +, *Alisma plantago-aquatica* (PM) 42: +, *Alopecurus pratensis* (MA) 35: +, *Althaea officinalis* (O) 34: +, *Atriplex prostrata* (BI) 39: r, *Caltha palustris* (MA) 36: +, *Carex acutiformis* (PM) 43: 1, *C. sp.* (O) 40: +, *Ceratophyllum submersum* (LE) 42: 3, *Echinocystis lobata* (O) 36: r, *Equisetum palustre* (O) 34: +, *Gratiola officinalis* (MA) 34: +, *Juncus effusus* (O) 42: +, *Lemna minor* (LE) 42: 1, *Persicaria hydropiper* (BI) 33: +, *P. lapathifolia* (BI) 40: 2a, *Phellandrium aquaticum* (PM) 35: +, *Potentilla anserina* (MA) 43: +, *Ranunculus repens* (MA) 35: 3, *Rorippa x armoracioides* (MA) 35: r, *R. sylvestris* (MA) 38: r, *Scutellaria galericulata* (PM) 34: +, *Stachys palustris* (PM) 38: r, *Stellaria graminea* (MA) 43: r, *Teucrium scordium* (PM) 34: 1, *Typha latifolia* (PM) 42: +, *Vicia cracca* (MA) 39: +

Localities of relevés:

33. SK, Bušince village, NNE, floodplain area of Ipeľ River, RH
 34. SK, Kováčovce village, marsh in southwestern margin of village, RH
 35. HU, Szécsény town, W, floodplain area of Ipeľ River, PB & RH
 36. SK, Bušince village, NNE, floodplain area of Ipeľ River, RH
 37. HU, Szécsény town, W, floodplain area of Ipeľ River, PB & RH
 38. HU, Őrhalom village, NW, floodplain area of Ipeľ River, PB & RH
 39. HU, Őrhalom village, NW, floodplain area of Ipeľ River, PB & RH
 40. SK, Kováčovce village, marsh in southwestern margin of village, RH
 41. SK, Bušince village, NNE, floodplain area of Ipeľ River, standing water, RH
 42. HU, Húgyag village, NE, Sovány rét, terrain depressions, standing water, PB & RH
 43. SK, Kováčovce village, marsh in southwestern margin of village, RH

Tab. 4. Medium-tall waterside communities of orders *Nasturtio-Glycerietalia* and *Oenathetalia aquatica* (*Carecetum buekii* – 44, *Oenanthe aquatica*-*Rorripetum amphibiae* – 45, *Eleocharitetum palustris* – 47, *Bolboschoenetum maritimi* – 48–49, *Phellandrium aquaticum* community – 46, *Berula erecta* community – 50)

Number of relevé	44	45	46	47	48	49	50
Area analyzed (m ²)	15	17	25	12	20	25	16
Altitude (m)	143	145	150	146	144		148
Cover (%)	100	95	75	95	90	100	98
Total number of species	11	7	5	12	20	19	11
Deep of water level	-	-	-	-	-	-	2–3
Date	13.6.20	29.7.20	13.6.20	13.6.20	27.7.97	14.6.20	29.7.98
<i>Phragmito-Maenocaricetea</i>							
<i>Carex buekii</i>	5	.	.	.	.	.	.
<i>Phellandrium aquaticum</i>	.	5	3	+	.	.	.
<i>Rorippa amphibia</i>	.	+	.	.	.	.	.
<i>Eleocharis palustris</i>	.	.	.	5	.	+	.
<i>Bolboschoenus maritimus</i>	.	.	.	.	4	5	.
<i>Berula erecta</i>	.	.	.	.	.	.	5
<i>Glyceria maxima</i>	.	2a	1	.	+	.	.
<i>Iris pseudacorus</i>	.	.	+	r	.	.	.
<i>Carex riparia</i>	.	.	.	+	1	.	.
<i>Carex acuta</i>	.	.	.	1	2a	.	.
<i>Lysimachia vulgaris</i>	.	.	.	.	+	.	+
<i>Lycopus exaltatus</i>	.	.	.	.	1	2a	.
<i>Stachys palustris</i>	.	.	.	.	+	1	.
<i>Typha latifolia</i>	.	.	.	.	+	+	.
<i>Sparganium erectum</i>	.	+	.	.	+	.	.
<i>Alisma lanceolatum</i>	.	.	.	.	.	1	+
<i>Molinio-Arrhenatheretea</i>							
<i>Ranunculus repens</i>	.	.	.	1	+	2a	.
<i>Potentilla anserina</i>	.	.	.	.	+	+	.
<i>Juncus articulatus</i>	.	.	.	.	+	+	.
<i>Symphytum officinale</i>	r	.	.	.	.	+	.
Others							
<i>Althaea officinalis</i>	r	.	.	.	+	.	.
<i>Agrostis stolonifera</i>	.	.	.	.	3	+	.
<i>Plantago major</i>	.	.	.	.	+	+	.
<i>Calystegia sepium</i>	.	.	.	.	+	1	+

In one relevés only:

Alopecurus aequalis (BI) 45: +, *A. geniculatus* (MA) 47: +, *Angelica sylvestris* (MA) 50: +, *Aristolochia clematidis* (O) 44: r, *Bidens frondosus* (BI) 50: +, *Butomus umbellatus* (PM) 46: 2b, *Cardamine pratensis* (MA) 47: +, *Carex melanostachya* (PM) 47: +, *Clematis integrifolia* (MA) 44: r, *Colchicum autumnale* (MA) 44: +, *Echinocystis lobata* (O) 50: r, *Elytrigia repens* (O) 49: +, *Equisetum arvense* (O) 44: +, *Galium boreale* (MA) 44: r, *G. palustre* (PM) 48: 1, *Glyceria fluitans* (PM) 47: +, *Juncus compressus* (O) 49: +, *Leersia oryzoides* (PM) 50: +, *Lysimachia nummularia* (MA) 50: +, *Lythrum salicaria* (PM) 48: 2a, *L. virgatum* (MA) 49: +, *Persicaria amphibia* (O) 46: 2a, *P. hydropiper* (BI) 50: +, *P. lapathifolia* subsp. *pallida* (BI) 45: r, *Phalaroides arundinacea* (PM) 47: +, *Poa palustris* (MA) 44: +, *Potentilla reptans* (MA) 48: +, *Prunus spinosa* (O) 44: +, *Rorippa sylvestris* (MA) 49: 1, *Rumex crispus* (O) 49: +, *R. maritimus* (PM) 45: +, *Scutellaria galericulata* (PM) 48: +, *Solanum dulcamara* (O) 50: +, *Veronica anagallis-aquatica* (PM) 49: +, *V. scutellata* (MA) 47: +, *Vicia cracca* (MA) 44: r.

Localities of relevés:

44. HU, Őrhalom village, NW, higher part of floodplain area of Ipel' River, PB & RH
 45. SK, Kováčovce village, marsh in southwestern margin of village, RH, HO & MV
 46. HU, Szécsény town, W, floodplain area of Ipel' River, obnažené dno, PB & RH
 47. HU, Szécsény town, W, floodplain area of Ipel' River, obnažené dno, PB & RH
 48. SK, Malý Kiarov village, NR Kiarovský močiar Marsh, RH
 49. HU, Ludányhalászi village, Ludány, W, floodplain area of Ipel' River, PB & RH
 50. SK, Peťov village, channel near Ipel' River, standing water, RH, HO & MV

Medium-tall waterside communities of orders *Nasturtio-Glycerietalia* and *Oenanthetalia aquatica* (Tab. 4)

The first order is represented by dense stand with *Berula erecta* (rel. 50) occurring in a canal with slowly floating water. The bottom is muddy and full of litter from willow leaves. Lacking phytosociological data in the Ipeľ River area do not allow to classify it into the definitive syntaxon, anyway it represents another unit as the traditional *Beruletum submersae* Roll 1938. (cf. SCHRATT 1993b).

In Germany ROLL (1938) described *Beruletum angustifoliae submersae* with characteristic species such as *Berula erecta*, *Nuphar lutea*, *Sparganium erectum*, *Callitriche autumnalis*, *Butomus umbellatus*, *Glyceria fluitans*, *Ranunculus repens*, *Lycopus europaeus*, and *Mentha aquatica*, all species in submerged forms. Sauer (sec. ROLL 1938: 190), from slowly running water, described the association *Glycerio-Sparganietum neglecti* a facies with *Berula erecta*, where *Berula* built emergent forms. TUROŇOVÁ (1985) described in N-Bohemia a new association *Cardamino-Beruletum erecti* Turoňová 1985 with characteristic species *Berula erecta* (dom), *Mentha aquatica*, *Cardamine amara*, and *Myosotis palustris* agg.

The second alliance of orders – *Phalaridion arundinaceae*, associates phytoceonoses on banks of running waters, streams, in the colline to montane belts. Only one relevé depicted the association *Caricetum buekii* (rel. 44). In fact, these outstanding stands of a dark green dominating sedge *Carex buekii* occurs in the study area on both banks more frequently, especially on banks of canals and streams. It covers drier habitats without direct flooding. On the Slovak bank, it is very frequent near villages Bušince and Trenč (HRIVNÁK 2000). LÁJER (1998) reported about the occurrence of *Caricetum buekii* community from the inundation area of Ipeľ River between Ipolytarnóc and Litke villages.

Communities of the alliance *Oenanthion aquaticae* are well developed in standing or slowly running waters with oscillating water level. The association *Oenantho aquaticae-Rorippetum amphibiae* (rel. 45) occupies the littoral zone and optimal development achieved during limose ecophase. This community forms two physiognomically different aspects. *Rorippa amphibia* dominates in the spring, while *Phellandrium aquaticum* dominates during the late summer. On relatively large patches of Ipeľ River alluvium, e.g. in Hungary and also in Slovakia, stands without *Rorippa amphibia* were met during the whole period, therefore the stands are described here as community with *Phellandrium aquaticum* (rel. 46).

Stands of association *Eleocharitetum palustris* (rel. 47) overgrow shallow depressions and periodical puddles. KOVÁCS – MÁTHÉ (1967) and KOVÁCS (1968) referred about this association from the surrounding of Szécsény (suggest as *Alismati-Eleocharitetum* and ordered into alliance *Phragmition communis*).

Other wet sites are occupied by stands of *Bolboschoenetum maritimi* (rels 48–49), often with a mosaic of other wetland communities. In addition to dominant *Bolboschoenus maritimus*, there are present typical plants of marches and some hydrophytes, on the other hand, halophytes are absent.

This is important because *Bolboschoenetum maritimi* has very often been considered a halophilous community of alliance *Cirsio brachycephali-Bolboschenion* (Passarge 1978) Mucina 1993 (cf. BALÁTOVÁ-TULÁČKOVÁ et al. 1993, BORHIDI 1996, COLDEA et al. 1997). However, EGGLEER (1933) originally described this association without the presence of halophytic species. OĽAHELOVÁ et al. (2001) on the base of synthesis of existing relevés from Slovakia reclassified stands with dominating *Bolboschoenus maritimus* into two units – *Bolboschoenetum maritimi* (from alliance *Oenanthion aquaticae*) without halophytes, and *Astero pannonici-Bolboschoenetum compacti* Hejný et Vicherek ex OĽaheľová et al. 2001 (from alliance *Cirsio brachycephali-Bolboschenion*). This differentiation is visible also on the taxonomic level. Ecological studies of populations of *Bolboschoenus* species in central Europe (HROUDOVÁ et al. 1999) showed relations of *Bolboschoenus maritimus* subsp. *compactus*, (partly also *B. planiculmis*) to halophytic habitats, while nominate taxon *B. maritimus* subsp. *maritimus* occupies the typical swamp biotopes (cf. HROUDOVÁ et al. 1999).

Threats to aquatic and marsh plant communities

A survey of endangered and rare plant communities of Hungary with criteria and categories were published by BORHIDI – SÁNTA (1999). The evaluation of endangerment and rarity of aquatic plant communities in Slovak Republic follows OĽAHELOVÁ (1995a, b) and OĽAHELOVÁ et al. (2001), with the system of categories using MORAVEC (eds, 1995). For marsh plant communities, new criteria were tested by VALACHOVIČ (ed. 2001).

Within aquatic plant communities occurring in area studied, *Ceratophylletum submersi* belongs to rare and actually endangered by human activity ones (category 2a) and *Lemno-Utricularietum vulgaris* represents the most vulnerable community (3b) (cf. OĽAHELOVÁ 1995a). Three of marsh communities e.g. *Acoretum calami*, *Caricetum gracilis*, and *Caricetum vesicariae* are considered vulnerable (OĽAHELOVÁ et al. 2001). To

the potentially vulnerable associations on the Hungarian bank of Ipeľ River belong *Potametum natantis*, *Sparganietum erecti*, *Glycerietum aquaticae*, *Typhetum angustifoliae*, *Phragmitetum vulgaris*, *Scirpetum lacustris*, *Eleocharitetum palustris*, *Caricetum melanostachyae*, *Caricetum gracilis*, *Galio palustris-Caricetum ripariae* (cf. BORHIDI – SÁNTA 1999).

Generally, the majority of aquatic and marsh plant communities can be ordered to potentially endangered because the wetlands are under permanent pressure and their are progressively disappearing by increasing human activities.

Conclusion

Despite a strong anthropogenous influence, the aquatic and marshland biotopes in the Ipeľ River alluvium have persisted. It is partly due to the fact that the most valuable areas in both states are under nature conservation. Large wetlands exist still in the flooding area in Hungary. A part of them are preserved in the Duna-Ipoly National Park, some others are suggested for control management or future natural conservation (Judik in verb.).

The most valuable wetlands in Slovakia, a part of the Ipeľ inundation area situated between the villages Ipeľské Predmostie and Tešmak, were accepted in 1998 as Ramsar locality of international importance (cf. CVACHOVÁ et al. 2000). Some smaller localities are preserved as Nature Reserves (NR), such as NR Kiarovský močiar marsh, NR Dálovský močiar marsh, NR Ipeľské hony, or they are proposed as new areas for nature conservation (old rise fields Ryžoviská, meanders of Ipeľ River near Vrbovka and Bušince villages). Especially the impressive meandering river parts deserve attention of naturalists and state policy. From the point of view of biodiversity of higher plant species, the most valuable are NR Kiarovský močiar marsh, marsh near Kováčovce village, and above all extensive wetlands in the surroundings of Szécsény and Őrhalom. Many oxbows, marches, and various hollows represent wetland habitats with a wide scale of plant communities, habitats for rare and endangered plant species and, at the same time, biotopes for aquatic fauna, mostly amphibians and birds.

The research of wetland plant communities in the study area, realised in the last years cannot be considered as completed. Nevertheless, this small contribution may be a good initiative for the future research of biota in the Ipeľ River inundation.

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Summary

During years 1996–2000 the authors performed a preliminary research of variability and distribution of aquatic marsh plant communities in the inundation of Ipeľ River. The study area included a part of territory between Malý Kiarov and Bušince villages (southern Slovakia), and Őrhalom and Nógrádszakál villages in northern Hungary. Total 50 phytocoenological relevés characterise 6 aquatic and 19 marsh plant communities. For each of them short description and notes about endangerment and distribution are added. One of the aims of the paper was also evaluating the study area from the point of view of nature protection.

Összefoglalás

Az Ipolynek és árterületének vízi, mocsári és lápi növénytársulásai a 96–116 folyamkilométer között
R. HRIVNÁK – H. ŐTAHELOVÁ – M. VALACHOVIČ – A. CVACHOVÁ – P. BALÁZS

A cikk szerzői az 1996–2000 közötti időszakban az Ipoly és ártere vízi, mocsári és lápi növénytársulásait tanulmányozták. A vizsgált terület Szlovákia területén Malý Kiarov (Kiskér) és Bušince (Bussa) között, Magyarország területén Őrhalom és Nógrádszakál települések között található. 50 növénytársulástani felvétel dokumentálja a 6 vízi és a 19 mocsári és lápi társulást. A társulások jellemzése mellett megadják természetvédelmi értéküket is. Részletesebben foglalkoznak néhány társulás syntaxonómiai értékelésével.

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