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Aquatic plant communities in the catchment area of the Ipeľ river in Slovakia and Hungary

Part II. Class *Potametea*

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ABSTRACT: The author reports on the results of the studies on aquatic plant communities of the class *Potametea* in the catchment area of Ipeľ river in Slovakia and Hungary. In 1993–2000, 22 aquatic vegetation units were identified in this region. The synmorphology, synecology, synchorology characteristics of the detected aquatic plant communities are presented.

Keywords: *Potametea*, Ipeľ river, synchorology, synecology

This paper is a continuation of the article "Aquatic plant communities in the catchment area of the Ipeľ river in Slovakia and Hungary. Part I. Classes *Lemnetea* and *Charetea fragilis*" (HRIVNÁK 2002). The chapters "Introduction", and "Material and methods (Characteristics of study area, Phytosociological studies, Soil and water sampling and Nomenclature)" are referred to the above-mentioned citation.

Results and Discussion

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Potametea R. TX. et PREISING 1942
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Callitriche platycarpa community
Callitriche cophocarpa community

Characteristic of vegetation units

***Myriophyllum spicatum-Potamogeton natans* community**

This community grew in a gravel ditch and covered its surface. The water regime is fluctuating. The floating leaves of *Potamogeton natans* covered the surface of water, and the submerged species *Myriophyllum spicatum* and *Ceratophyllum demersum* formed a dense mass below it. Towards the water margins, it was replaced by the reed vegetation, *Typhetum latifoliae* mainly. The stands of this community are documented by the following phytosociological relevés:
SK; LK; Veľká nad Ipľom village, E; gravel ditch in the alluvium of Ipeľ river; 165; 25; 100; 5–40; S; S; 11.8.1997; RH; 169.
Myriophyllum spicatum 5, *Potamogeton natans* 2a, *Ceratophyllum demersum* +, *Typha latifolia* +.

***Trapetum natantis* V. KÁRPÁTI 1963 (Tab. 1, rel. 1–4)**

In the catchment area of Ipeľ river, *Trapetum natantis* belongs to non-native aquatic plant communities. The first information about the occurrence of *Trapa*

natans in this area was published by CVACHOVÁ (1988) from a fishpond near Zelené village. The fruit transport in water tubs during fish deliveries from South-eastern Slovakia (Východoslovenská nížina lowland) is considered the most probable way of the expansion of this species. Nevertheless, the present expansion within this region is possible through big water-fowl as well.

Trapetum natantis grows in the stagnating, eutrophic water, which is 30–150 cm deep. The water level is usually fluctuating during the vegetation period. In addition to the weather-conditioned fluctuations of the water level, the artificial water reservoirs are characterised by a special regime. It depends on the way of their management. However, the fruits of *Trapa natans* are able to survive even a several-month period with a full absence of water, and germinate again under the more favourable conditions in the subsequent year. In a terrain depression near Poltár (tab. 1, rel. 3) the neutral pH value was detected (6,84). The bottom is formed by gravel or fine inorganic material.

The stands of *Trapetum natantis* are poor in species. The dominating floating-leaved macrophyte, *Trapa natans*, covers the entire surface of water. The others species grow with less values of cover in the submerged layer mainly. Three floristical and ecological variants are separated in Table 1:

– the variant of mesotrophic biotopes with the presence of *Riccia fluitans* and *Utricularia australis* (tab. 1, rel. 1),

– the variant with the presence of lemnids (*Lemna minor*, *Spirodela polyrhiza*) and the other submerged water macrophytes (*Potamogeton crispus*, *P. pusillus*, *Utricularia vulgaris* agg.; tab. 1, rels 2–3),

– the variant of eutrophic biotopes with the presence of *Ceratophyllum demersum* (tab. 1, rel. 4).

In the catchment area of the Ipeľ river, the occurrence of *Trapetum natantis* was published by HRIVNÁK (1997, 1999) and OŤAHEĽOVÁ & al. (1998). On the territory of Slovakia, OŤAHEĽOVÁ (1995) presented the recent occurrence.

***Potametum natantis* VON SOÓ 1927 (Tab. 1, rels 5–12)**

This community was found in natural as well as artificial biotopes. The stands of *Potametum natantis* occurred most frequently in artificial biotopes, fishponds and gravel ditches. The water is stagnating, eutrophic, weakly translucent and 5–300 cm deep. In three localities, the moderately acid (5.91 and 6.32) and moderately alkaline (7.47) pH values were detected. In some localities, mainly fishponds, the water level is very fluctuating. This fact is related to their management. The bottom is formed by gravel, which is overlaid with a layer of inorganic materials with a changing thickness.

It is a relatively often community, with the domination of a floating-leaved macrophyte, *Potamogeton natans*. Other species, mainly aquatic macrophytes, are rare. This community is very poor in species. In one relevé, the mean number of species is three. In the catchment area of Ipeľ river, four floristical and ecological variants were detected:

– the typical variant, very poor in species (tab. 1, rels 6–10),

– the variant of eutrophic biotopes with the occurrence of submerged aquatic macrophytes – *Ceratophyllum demersum*, *Myriophyllum spicatum* and *Potamogeton pectinatus* (tab. 1, rel. 5),

– the variant with the presence of *Potamogeton acutifolius* (tab. 1, rel. 11),

– the variant with the species of *Oenanthion aquaticae* HEJNÝ ex NEUHÄUSL 1959, fixed on eutrophic, moderately alkaline biotopes with a fluctuating water level (tab. 1, rel. 12).

In the study area, KÁRPÁTI & KÁRPÁTI (1967), KOVÁCS & MÁTHÉ (1967), HRIVNÁK (1999), HRIVNÁK & al. (2001b) published the information on the occurrence of *Potametum natantis*. Phytosociological relevé published by KOVÁCS & MÁTHÉ (1967: p. 137) belongs to the typical variant, which has been described in this paper (tab. 1, rel. 6–10). OŤAHEĽOVÁ (1995) published the recent information on its occurrence in the Slovak Republic. In the Alföld phytogeographical region of Hungary, *Potametum natantis* belongs to rare plant communities (BORHIDI & SÁNTA 1999).

Polygonetum amphibii (*natantis*) VON SOÓ 1927 (Tab. 1, rels 13–16)

This community forms homogenous, non-closed stands, poor in species. *Persicaria amphibia* f. *natans* is a dominating species. Other species are rare, only lemnids (*Lemna minor*, *L. trisulca* and *Spirodela polyrhiza*) are present with a higher frequency.

HRIVNÁK (1997, 1999), HRIVNÁK & al. (1997a), OŤAHEĽOVÁ & al. (1998) mentioned *Polygonetum amphibii* (*natantis*) from study area. On the territory of Slovakia, OŤAHEĽOVÁ (1995) presented the occurrence of this community from the inundation area of the Danube, Morava and Tisa rivers, and the fishponds of Trnavská pahorkatina Mts. and Liptovská kotlina basin.

Nuphar lutea community (Tab. 1, rel. 17)

This community was found in the canalised water-course of Suchá brook near Šávoľ village. *Nuphar lutea* forms monodominant stands. This species was found in this locality in 1993 (cf. HRIVNÁK & al. 1997b). Floating leaf of *Nuphar lutea* covered the whole water-course of Suchá brook in 1993–1995. Later, the cover of *Nuphar lutea* decreased following terrestrialization of canal. In this place, the marsh species as *Sparganium erectum* or *Phragmites australis* dominated. The last fragment of *Nuphar lutea* community was registered in 1996.

In the catchment area of Ipeľ river, *Nuphar lutea* belongs to rare species. In the past, its occurrence was more frequent as nowadays (cf. SVOBODOVÁ 1966, 1967; KÁRPÁTI & KÁRPÁTI 1967; KOVÁCS & MÁTHÉ 1967). HRIVNÁK & al. (1997b, 2001b) published recent data from this area. KOVÁCS & MÁTHÉ (1967) presented 4 phytosociological relevés of *Nymphaeetum albo-luteae* from the surroundings of Drégelypalánk and Ludányhalászi villages in Hungary. DAVID & al. (1995) and DAVID (1990) presented the occurrence of this community in a river oxbow near Kubáňovo village.

Potametum lucentis (Tab. 2, rel. 1)

In the catchment area of Ipeľ river, *Potametum lucentis* is a very rare submerged aquatic plant community. It is poor in species. In the stands of a canal near the Ružiná water reservoir, *Potamogeton lucens* is a dominating species, and the other submerged aquatic macrophytes (*Myriophyllum spicatum*, *P. crispus* and *Zannichellia palustris*) are typical of the presented variant of this community (tab. 2, rel. 1). *Potamogeton lucens* grows in the Ružiná water reservoir too, but always as the accompanying species of others aquatic plant communities (e. g. *Najadetum marinae*).

In Slovakia, the centre of the occurrence of *Potametum lucentis* is in the western part – Borská and Podunajská nížina lowlands (cf. OŤAHEĽOVÁ 1995).

Potametum crispi (Tab. 2, rels 2–7)

Potametum crispi is a submerged community, poor in species, with the mean number of 5 species per one relevé. It grows in gravel ditches, canals, brooks and rivers, mainly in a stagnating or slowly flowing water, rarely in a medium-flowing water too. The maximum water level was approximately 150 cm. On the bottom, the gravel, sand, artificial and fine inorganic materials were detected.

Potamogeton crispus is the dominating species, some other aquatic macrophytes (e. g. *Potamogeton pusillus*, *P. trichoides* and *Zannichellia palustris*) are coodominating. The floristic variability of this community is in a close relationship with the ecological conditions of biotop, mainly the rapidity of flowing and the sediment class. Based on the achieved phytosociological data from the catchment area of Ipeľ river, the following floristical and ecological variants were defined:

– the variant with the presence of submerged aquatic macrophytes of mesotrophic and eutrophic biotopes (*Ceratophyllum demersum*, *Myriophyllum spicatum*, *Potamogeton lucens*, *P. trichoides* and *Zannichellia palustris*; tab. 2, rels 2–4),

– the variant with the presence of *Lemna trisulca* (tab. 2, rel. 5),

– the variant with the presence of *Callitriche palustris* agg. and *Potamogeton pusillus* (tab. 2, rel. 6),

– the variant with the dominance of *Potamogeton crispus* without any other species (tab. 2, rel. 7).

The phytosociological relevés (2–7, tab. 2) complete the information on the occurrence of *Potametum crispi* in Slovakia (cf. OŤAHEĽOVÁ 1995). By now, *Potametum crispi* was only known from Western and Eastern Slovakia (OŤAHEĽOVÁ l. c.).

Elodeetum canadensis (Tab. 2, rels 8–9)

Eleodea canadensis is a North American alien species, which was detected in Europe in 1836 (OŤAHEĽOVÁ 1995). It forms submerged stands, poor in species. *Elodeetum canadensis* grows in stagnant or slowly flowing, eutrophic and hypertrophic, shallow or deep water. The maximum depth of water level was

detected in a pool near the castle in Halič village (250 cm). HEJNÝ & HUSÁK (1978) and OŤAHEĽOVÁ (1995) considered 1–1.5 m the maximum water level in this community. The bottom is formed by a thick layer of inorganic and organic material. *Elodea canadensis* is the dominating species with the cover from 70 to 90 %. Two floristical and ecological variants were defined using a poor phytosociological material:

– the variant with the helophytes of eutrophic biotopes (*Alisma lanceolatum*, *Bidens frondosa* and *Sparganium erectum*; tab. 2, rel. 8),

– the variant with the presence of the other aquatic macrophytes (*Ceratophyllum demersum*, *Lemna minor* and *Trapa natans*; tab. 2, rel. 9).

In addition to two localities in Lučenec town and near Halič village, the fragments of *Elodeetum canadensis* grow in the canal of Suchá brook near Šávoľ village (cf. HRIVNÁK & al. 1997b).

In the catchment area of Ipeľ river, only one information on this community was published (cf. HRIVNÁK 1997). The recent occurrence of this community in Slovakia was presented by OŤAHEĽOVÁ (1995).

***Potametum pectinati* (Tab. 3, rels 1–4)**

This submerged community grows in the stagnant to quickly flowing eutrophic and hypertrophic water. The stands of this community grow in the brooks, canals and river oxbows. The types of bottoms depend on the flow classes, and may be formed by gravel, silt, and artificial or organic material. Water is weakly translucens and 10–60 cm deep.

The floristical variability of *Potametum pectinati* is in a relationship with the ecological conditions of the biotop. In the catchment area of Ipeľ river, two floristical and ecological variants were defined:

– the typical variant, poor in species (tab. 3, rels 1–2),

– the variant of shallow, stagnant or slowly flowing and eutrophic water-bodies, with the presence of species like *Butomus umbellatus*, *Ceratophyllum demersum*, *Chara vulgaris*, *Lemna minor*, *Riccia fluitans* (tab. 3, rels 3–4).

In the catchment area of Ipeľ river, the occurrence of this community was mentioned previously by HRIVNÁK (1998b, 1999). On the territory of Slovakia, the chorological data were documented by OŤAHEĽOVÁ (1995).

Parvopotameto-Zannichellietum palustris (Tab. 3, rels 5–6)

Parvopotameto-Zannichellietum palustris is a submerged community. In the catchment area of Ipeľ river, only one locality was found by now. *Zannichellia palustris* was recorded in the Ružiná water reservoir as well (cf. HRIVNÁK 1998a), where it grows in the stands of other aquatic macrophytes.

The stands of this community were mosaic like, but *Zannichellia palustris* was always the dominating species. They grew in the shallow and strongly eutrophic water. The water level is usually very fluctuating within a year. The gravel bottom was covered with the 5–10 cm layer of silt and organic material. According to HEJNÝ & HUSÁK (1978), *Parvopotameto-Zannichellietum palustris* is a community

of eutrophic and hypertrophic ponds with the intensive organogenous accumulation of hydatophyte remnants, confined to alkaline waters.

From the catchment area of Ipeľ river, HRIVNÁK (1997), HRIVNÁK & al. (1997a) and OŤAHEĽOVÁ & al. (1998) mentioned this community without the phytosociological relevé. MÁTHÉ (1956) mentioned this association from the Hungarian part of Novohrad region.

MUCINA & MAGLOCKÝ (1985) and HEJNÝ & HUSÁK (1978) published the occurrence of *Parvopotameto-Zannichellietum palustris* on the territory of Slovakia. OŤAHEĽOVÁ (1995) did not mention this community in the Review of vegetation of Slovakia, probably because of the absence of phytosociological relevés. Only one relevé is available from the Morava river inundation area (OŤAHEĽOVÁ et al. 1994).

Potametum trichoidis (Tab. 3, rels 7–8)

Potametum trichoidis is a submerged community, poor in species. It grows on the stagnating water and it occurs very rarely. In clay ditches near Gregorova Vieska village, *Potamogeton trichoides* forms monodominant stands. In the second locality near Nitra nad Ipľom village, the community forms stands, richer in species than the previous one. The gravel bottom is covered with a coat of the silt and mud and the water is slightly alkaline (cf. HRIVNÁK & al. 2001a). The occurrence of *Alisma plantago-aquatica*, *Ceratophyllum submersum*, *Echinochloa cruss-galli*, *Lemna minor*, *Nitella translucens* and *Typha latifolia* is due to eutrophic sediments, and a shallow and eutrophic water (tab. 3, rel. 8).

The informations on the occurrence of *Potametum trichoidis* are vague on the territory of Slovakia. This community was published within the Reviews of the vegetation of Slovakia (MUCINA & MAGLOCKÝ 1985) and Czech and Slovak Republic (HEJNÝ & HUSÁK 1978), respectively. On the other hand, it is not mentioned in the latest Review of the vegetation of Slovakia (OŤAHEĽOVÁ 1995). From the territory of Slovakia, only three phytosociological relevés were published from Jašteričie jazierko pool in Slovenský kras Mts. (HÁBEROVÁ & KARASOVÁ 1991).

Najadetum marinae (Tab. 3, rel. 9)

Najadetum marinae was observed only in the artificial water reservoir Ružiná. The stands of this community grew in the water depth from 0.3 to 3 m. The bottom is formed by sand with a thin layer of mud and other organic material. The water is eutrophic and considerably warms during the summer. OŤAHEĽOVÁ (1995) presented a similar information that *Najadetum marinae* is a thermophilous community of the mesothrophic as well as eutrophic water. *Najas marina* forms dense submerged stands along with other aquatic macrophytes (*Myriophyllum spicatum*, *Potamogeton crispus*, *P. lucens* and *Zannichellia palustris*). Similar stands were recorded by KLIMENT & al. (2000) in the water reservoir Teplý vrch, North of the Rimavská Sobota town. However, *Najas marina* grows here mostly with the linear-leaved species of *Potamogeton* (*P. pectinatus*, *P. pusillus* agg.).

In the catchment area of Ipeľ river, *Najas marina* belongs to non-native species. The first information on the occurrence of this species in the study area was published in 1990s (cf. HRIVNÁK & al. 1997b, BELLA & GAJDOŠ 1998). The last mentioned authors presented the close relationship between the high content of nutrients in the water and the massive occurrence of *Najas marina*. This species was probably brought by water-fowl. The water reservoir is the important migration area for them (KRIŠTÍN 1996).

From the other regions of Slovakia, the occurrence of this community was documented by OŤAHEĽOVÁ (1995). In this paper, she supposed the occurrence of *Najadetum marinae* in two other regions of Slovakia – Lučenská kotlina basin and Považie.

Potametum nodosi PASSARGE 1964 (Tab. 4, rels 4–6)

In the catchment area of Ipeľ river, *Potametum nodosi* belongs to very rare aquatic plant communities. It grows only in the Tuhársky potok brook. The water is eutrophic with a very strong anthropogenic pollution, and slowly or medium-flowing.

The dominating species *Potamogeton nodosus* and *Lemna minor* covered the natant layer, *Elodea canadensis*, *Myriophyllum spicatum* and *Potamogeton crispus* formed the submerged layer. Two floristical and ecological variants are separated in Table 4:

– the variant with the presence of submerged water macrophytes, *Elodea canadensis* and *Potamogeton crispus* (tab. 4, rel. 4),

– the variant of shallow water with the species of *Oenanthion aquaticae* alliance, such as *Alisma plantago-aquatica* and *Butomus umbellatus* (tab. 4, rel. 5).

The relevé Nr. 6 (tab. 4) represents the initial phase of *Potametum nodosi*, although *Myriophyllum spicatum* prevail.

Potametum nodosi was not mentioned from the study area by now. On the territory of Slovakia, it belongs to rare plant communities. The phytosociological relevés are available only from Východoslovenská, Podunajská and Borská nížina lowlands (OŤAHEĽOVÁ 1995).

Sparganium emersum community (Tab. 4, rels 1–3)

This community grows in a flowing water, which is medium-deep and relatively clear.

This community comprises the stands of submerged vegetation with the domination of *Sparganium emersum* or eventually, other aquatic macrophytes (e. g. *Lemna minor*, *L. trisulca*, *Potamogeton crispus,* and *P. trichoides*).

Note: Two plant communities with the dominance of *Sparganium emersum* are spread in the Central Europe – *Sparganietum ramosi* ROLL 1938 and *Sagittario-Sparganietum emersi* R. TX. 1953. In both of them, *Sparganium emersum* grows as the emerged ecomorphe with the presence of other marsh plants. In the phytosociological materials from the catchment area of Ipeľ river

(tab. 4, rels 1–3), *Sparganium emersum* grows as the submerged aquatic macrophyte with other ones.

***Myriophyllum spicatum* community (Tab. 4, rels 7)**

This community was detected in the flowing water of the Tuhársky potok brook. It grows in a mosaic of the communities of *Ranunculion fluitantis*. Similar stands were found in the Slatina river in the orographical region Zvolenská kotlina basin (HRIVNÁK ined.).

***Hottonietum palustris* R. TX. 1937 (Tab. 5, rels 1–4; tab. 6)**

The community was found in natural (river oxbow, terrain depression in the alluvium of the Ipeľ river) as well as artificial (canal) biotopes. *Hottonietum palustris* forms submerged stands in the stagnating, eutrophic, shallow or medium-deep water, with a fluctuating water regime. In the summer, the water level decreases under the surface of soil and *Hottonia palustris* forms the terrestrial ecomorpha. The neutral pH value (7.17) was detected in the river oxbow near Boľkovce village (tab. 5, rel. 4). The bottom is formed by gravel river deposit, which is covered with a layer of silt and organic material.

The stands are poor in species with 7 species per relevé on average. In addition to the dominant species, *Hottonia palustris*, only three species occur with a higher constancy (*Glyceria fluitans*, *Lemna minor,* and *Phellandrium aquaticum*). In the poor phytosociological materials from the catchment area of Ipeľ river, one floristical and ecological variant was detected. The stands of this variant are characteristic by the presence of the species of shallow eutrophic water and marsh biotopes (diagnostic species of alliances *Oenanthion aquaticae* and *Bidention tripartiti* NORDHAGEN 1940 em. R. TX. in POLI et J. TX. 1960), e.g. *Alopecurus aequalis* and *Phellandrium aquaticum* (tab. 5, rels 2–4). The relevé Nr. 1 (Table 5) is very poor in species and the occurrence of other species (without *Hottonia palustris*) is occasional.

In the catchment area of Ipeľ river, HRIVNÁK (1997, 1998b) and KOVÁCS & MÁTHÉ (1967) presented the occurrence of *Hottonietum palustris*. HRIVNÁK (1998b) published two phytosociological relevés from the surroundings of Boľkovce village in Slovakia and KOVÁCS & MÁTHÉ (1967) published other one from the marshlands between Ipolyszög and Újkóvár villages in Hungary. In the past, the nearest localities of *Hottonia palustris* community were known from Pokorádzke jazierka pools near Rimavská Sobota and from the river oxbow of Slaná river near Včelince village (CVACHOVÁ 1984, MAGIC 1985).

On the territory of Slovakia, the phytosociological relevé is available only from the Borská, Podunajská and Východoslovenská nížina lowlands (OŤAHEĽOVÁ 1995) by now. In Hungary, this community was classified endangered (BORHIDI & SÁNTA 1999).

***Potamo perfoliati-Ranunculetum circinati* SAUER 1937 (Tab. 5, rel. 15)**

In a locality near Malé Dálovce settlement, this community formed a non-continual stand, which grew in conjuct with stands of the *Hottonietum palustris*

and other marsh plant communities (*Glycerietum fluitantis* EGGLER 1933, *Glycerietum aquaticae* HUECK 1931 and *Butometum umbellati* (KONCZAK 1968) PHILIPPI 1973). In addition to aquatic macrophytes, a lot of helophytes grew in this community in consequence of the decrease of water level.

Ranunculetum aquatilis GÉHU 1961 (Tab. 5, rels 5–10)

This community was detected in the stagnating or slowly flowing water of river oxbows, water-courses, seepage canals and artificial ditches. It grows in the eutrophic, shallow or medium-deep water with a fluctuating water level. *Ranunculetum aquatilis* tolerates the periodic and seasonal drying. When the water level decreases under the soil surface for a longer time, the marsh vegetation covers gradually the entire area.

The stands are poor in species. *Batrachium aquatile* forms relatively dense submerged stands with floating leaves on the water surface. Besides the floating leaves of the dominant species, *Lemna minor* occurs frequently on the surface of the water. In the table 5, three floristic and ecological variants are presented:

– the variant with the species of the *Bidentetea tripartiti* class, fixed on the nutrient-rich and fluctuating water (tab. 5, rel. 5),

– the variant with the occurrence of both submerged aquatic and emerged marsh species, which grow in the medium-deep water (tab. 5, rels 6–7),

– the variant with the species of the biotopes with a deep layer of silt and organic materials, occurring in the shallow and eutrophic water (tab. 5, rels 8–10).

In the study area, HRIVNÁK (1998b) published three phytosociological relevés of *Ranunculetum aquatilis* from the surroundings of Boľkovce village, HRIVNÁK & al. (1997a) and OŤAHEĽOVÁ & al. (1998) mentioned the information on its occurrence on the sand-dune near Tešmak village. HRIVNÁK (1997) ranked *Ranunculetum aquatilis* to endangered aquatic plant communities. Within the Review of vegetation of Slovakia, only four available phytosociological relevés from Borská nížina lowland were used in the synoptic table (cf. OŤAHEĽOVÁ 1995).

Batrachium rhipiphyllum community (Tab. 5, rels 11–13)

The *Batrachium rhipiphyllum* community was found in shallow terrain depressions, in the eutrophic and fluctuating water. This community is poor in species; *Batrachium rhipiphyllum* is dominating. In the stands, which grow in the shallow water, the diagnostic species of *Phragmito-Magnocaricetea* class (mainly *Oenanthion aquaticae* alliance) are very often (*Alisma lanceolatum*, *Alopecurus aequalis*, *Eleocharis palustris*, *Glyceria fluitans*, *Phellandrium aquaticum*, *Ranunculus sceleratus*; and *Rumex maritimus*). On the other hand, only one aquatic macrophyte, *Lemna minor*, grew in these stands, apart from *Batrachium rhipiphyllum*. Two floristical and ecological variants were defined using a relatively poor phytosociological material:

– the variant with the presence of *Eleocharis palustris*, *Ranunculus sceleratus* and *Rumex maritimus*, which grows in eutrophic biotopes (tab. 5, rels 12–13),

– the variant with the presence of the species of *Oenanthion aquaticae* alliance, without the species of previous variant (tab. 5, rel. 11).

In the catchment area of Ipeľ river, HRIVNÁK (1998b) published one phytosociological relevés from the surroundings of Boľkovce village.

Note: *Ranunculetum peltati* SAUER 1947 is know from Germany (PREISSING & al. 1990, see SCHRATT 1993 too). It grows in a shallow, nutrient-rich and fluctuating water, fully exposed to the sunlight. These characteristics of the biotopes are very similar to those of the *Batrachium trichophyllum* community near Boľkovce and Rapovce villages. Because only a few phytosociological relevés are available from the catchment area of Ipeľ river, the stands with the dominance of *Batrachium rhipiphyllum* cannot be classified as *Ranunculetum peltati*.

***Batrachium trichophyllum* community (Tab. 5, rel. 14)**

This community was found in the canal of the alluvium of Ipeľ river near Tešmak village (cf. HRIVNÁK & al. 1997). The bottom is formed by silt and somewhere by a layer of organic material. The water was stagnating and eutrophic. The water regime of this locality is markedly fluctuating. In the spring, the water is almost 100 cm deep. On the other hand, the water level sinks bellow the soil surface in the second half of summer. The richest cover of *Batrachium trichophyllum* was observed in a shallow water (10–30 cm). Later, all the area of canal was covered with the communities of *Oenanthion aquaticae*. In the Table 5 (rel. 14), the variant with the pleustophytes (*Lemna minor*, *L. trisulca*, *Riccia fluitans*, and *Utricularia vulgaris* agg.) and the species of the *Oenanthion aquaticae* alliance (*Phellandrium aquaticum*, *Rorippa amphibia* and *Rumex maritimus*) is presented.

RYDLO (1999b) published similar phytosociological relevés from the Protected Landscape Area Křivoklátsko in the Czech Republic.

***Callitriche platycarpa* community (Tab. 5, rel. 16)**

The stands were found in the tributary area of a fishpond near Ábelová village, in the littoral and limosal ecophases. The bottom was formed by silt and organic material. The water regime was fluctuating in the dependence on the maintenance of the fishpond and the sum of precipitation. In addition to dominant species, *Callitriche platycarpa*, some marsh helophytes grew in the stands of this community.

In the catchment area of Ipeľ river, *Callitriche platycarpa* was found only in the mentioned locality near Ábelová village (cf. HRIVNÁK 1998a). In Slovakia, this species belongs to endangered species (FERÁKOVÁ & MAGLOCKÝ 1998). HOLUB (2000) classified *Callitriche platycarpa* as a case of the disappeared flora of the Slovak Republic requiring a further study.

***Callitriche cophocarpa* community (Tab. 5, rel. 17)**

The stands of this community grow in the littoral of a fishpond, in a stagnating and shallow water. The bottom is formed by silt and organic material. *Callitriche*

cophocarpa is a dominating species; the higher cover was detected for the submerged pleustophyte, *Utricularia australis*. In the shallow water or the limosal ecophase, the helophytes of the *Bidentetea tripartiti* class are presented as well. *Callitriche cophocarpa* forms the fruits mainly in the limosal ecophase.

The community with the dominance of this species has not been mentioned from Slovakia (cf. MUCINA & MAGLOCKÝ 1985, OŤAHEĽOVÁ 1995). From the Czech Republic, e. g. by RYDLO (1999b) the *Callitriche cophocarpa* community was published from the Protected Landscape Area Křivoklátsko (cf. tab. 5, column C_1).

Note: In the Central and Eastern Europe, *Batrachio trichophylli-Callitrichetum cophocarpae* (SOÓ 1927) PÓCS in PÓCS & al. 1958 is known from an oligo- and mesotrophic stagnating water (HEJNÝ & HUSÁK 1978, PASSARGE 1992). PASSARGE (1992) mentioned the *Lemno-Callitrichetum cophocarpae* Mierwals 1988 from Germany. From among the surrounding countries, *Batrachio trichophylli-Callitrichetum cophocarpae* was mentioned from Hungary and Czech Republic (HEJNÝ & HUSÁK 1978, HEJNÝ 1995, BORHIDI 1996).

Conclusion

The catchment area of Ipeľ river belongs to very interesting territories in terms of the occurrence of the aquatic vegetation of the *Potametea* class. Only a local and insufficient information on this vegetation (e. g. KOVÁCS & MÁTHÉ 1967, HRIVNÁK 1998b) has been available by now. In the study area, 14 associations and 8 vegetation units was detected during the last 8 years. They were documented by 60 phytosiological relevés. Some of them were not mentioned in the Review of vegetation of Slovakia (OŤAHEĽOVÁ 1995). *Nymphaeetum albo-luteae*, which was found in the surroundings of Drégelypalánk, Ludányhalászi and Kubáňovo villages (cf. KOVÁCS & MÁTHÉ 1967, DAVID 1990, DAVID & al. 1995) in the past, was not confirmed within this research. Only a fragment of the *Nuphar lutea* community was found in a new locality near Šávoľ village. Phytosociological relevés of *Batrachium rhipiphyllum*, *Callitriche platycarpa* and *C. cophocarpa* communities are first ones from the territory of Slovakia. An additional research of their synecology and synchorology will be necessary.

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Tab. 1 – 6 on next pages

Tab. 1. Plant communities of *Nymphaeion albae*

*	Number of relevé	1	2	3	4	C	Ca	5	6	7	8	9	10	11	12	C	Ca	13 6	14 5	15 1	16 2	C	Ca	17 2	C_1	Ca
	Number of species	4	4	8	3			4	4	2	2	3	2	5	5											
PO	*Trapa natans*	**4**	**5**	**5**	**5**	4	100	.	.	.	.	.	.	.	.	-	8	.	.	.	.	-	-	.	-	8
LE	*Riccia fluitans*	B	.	.	.	1	-	.	.	.	.	.	.	.	.	-	-	.	.	.	.	-	-	.	-	4
LE	*Utricularia australis*	B	.	.	.	1	-	.	.	.	.	.	.	.	.	-	-	.	.	.	.	-	-	.	-	-
LE	*Spirodela polyrhiza*	.	1	+	.	2	62	.	.	.	.	.	.	.	.	-	25	A	.	.	.	1	14	.	3	10
PO	*Potamogeton crispus*	.	+	.	.	1	-	.	.	.	.	.	.	.	.	-	8	.	.	.	.	-	14	.	2	6
LE	*Ceratophyllum demersum*	.	.	+	3	2	50	1	.	.	.	.	.	.	.	12	33	.	.	.	.	-	-	.	2	47
PO	*Potamogeton natans*	.	.	.	+	1	-	**4**	**5**	**4**	**5**	**5**	**5**	**5**	**5**	100	83	.	.	.	.	-	-	.	1	2
PO	*Potamogeton pectinatus*	.	.	.	.	-	-	+	.	.	.	.	.	.	.	12	8	.	.	.	.	-	-	.	1	4
PO	*Myriophyllum spicatum*	.	.	.	.	-	25	1	.	.	.	.	.	.	.	12	33	.	.	.	.	-	-	.	1	26
PO	*Potamogeton acutifolius*	.	.	.	.	-	-	.	.	.	.	.	.	A	.	12	-	.	.	.	.	-	-	.	-	-
PM	*Sagittaria sagittifolia*	.	.	.	.	-	-	.	.	.	.	.	.	.	r	12	-	.	.	.	.	-	-	.	-	-
PM	*Butomus umbellatus*	.	.	.	.	-	-	.	.	.	.	.	.	.	+	12	-	+	.	.	.	1	-	.	-	-
LE	*Lemna trisulca*	.	.	.	.	-	12	.	.	.	.	.	.	.	B	12	-	3	.	.	.	1	14	.	-	30
PO	*Persicaria amphibia*[x]	.	.	.	.	-	-	.	+	.	.	.	.	.	.	-	-	**3**	**4**	**5**	**4**	4	100	.	-	4
PO	*Nuphar lutea*	.	.	.	.	-	-	.	.	.	.	.	.	.	.	-	-	.	.	.	.	-	-	**4**	4	78
	Other species																									
LE	*Lemna minor*	1	+	+	.	3	50	.	.	.	.	.	A	+	+	38	58	+	+	.	.	2	42	.	-	32
PM	*Sparganium erectum*	.	.	+	.	1	-	.	.	.	.	.	.	.	.	-	-	.	+	.	.	1	-	+	-	-

Leg.: C – constancy, Ca – constancy according to OŤAHEĽOVÁ (1995), C_1 – constancy according to KOVÁCS & MÁTHÉ (1967)
* LE – *Lemnetea*, PM – *Phragmito-Magnocaricetea*, PO – *Potametea*; x – form *natans*

Tab. 2. Plant communities of *Potamion lucentis*

*	Number of relevé	1	Ca	2	3	4	5	6	7	C	Ca	8	9	C	Ca
	Number of species	5		5	5	4	5	7	1			7	4		
	Dominant and diagnostic species of the floristical and ecological variants														
PO	*Potamogeton lucens*	**5**	100	A	.	.	.	.	.	20	-	.	.	-	16
PO	*Potamogeton crispus*	+	12	**5**	**4**	**5**	**5**	**5**	**5**	100	100	A	.	1	33
PO	*Zannichellia palustris*	+	6	B	1	.	.	.	.	40	12	.	.	-	-
PO	*Potamogeton trichoides*	.	18	.	B	+	.	.	.	40	12	.	.	-	-
LE	*Lemna trisulca*	.	31	.	.	.	1	.	.	20	12	.	.	-	16
PM	*Butomus umbellatus*	.	-	.	.	.	r	+	.	40	-	.	.	-	-
PO	*Callitriche palustris* agg.	.	6	.	.	.	.	A	.	20	25	.	.	-	16
PO	*Potamogeton pusillus*	.	-	.	.	.	.	3	.	20	12	.	.	-	16
PO	*Elodea canadensis*	.	-	.	.	.	.	.	.	-	12	**5**	**4**	2	100
PM	*Alisma lanceolatum*	.	-	.	.	.	.	.	.	-	-	+	.	1	-
BI	*Bidens frondosus*	.	-	.	.	.	.	.	.	-	-	+	.	1	-
PM	*Sparganium erectum*	.	-	.	.	.	.	.	.	-	-	+	.	1	-
PO	*Trapa natans*	.	12	.	.	.	.	.	.	-	-	.	r	1	-
LE	*Ceratophyllum demersum*	.	43	.	+	+	+	.	.	60	62	.	3	1	33
	Other species														
PO	*Myriophyllum spicatum*	+	18	+	.	.	.	.	.	20	25	.	.	-	16
O	*Algae* fil.	A	-	1						20	-			-	-
LE	*Lemna minor*	.	43	.	A	+	+	+	.	80	12	1	1	2	33

Leg.: C – constancy, Ca – constancy according to OŤAHEĽOVÁ (1995)
* BI – *Bidentetea tripartiti*, LE – *Lemnetea*, O – others, PM – *Phragmito-Magnocaricetea*, PO – *Potametea*

Tab. 3. Plant communities of *Potamion pusilli*

*	Number of relevé	1	2	3	4	C	Ca	5	6	C	C_1	C_2	C_3	7	8	C	C_4	9	Ca
	Number of species	2	1	4	10			7	5					1	9			5	
	Dominant and diagnostic species of the floristical and ecological variants																		
PO	*Potamogeton pectinatus*	**4**	**5**	**5**	**5**	4	100	1	.	1	1	-	-	.	.	-	-	.	-
PM	*Butomus umbellatus*	.	.	r	+	2	8	.	.	-	-	-	-	.	.	-	-	.	-
LE	*Riccia fluitans*	.	.	+	.	1	-	.	.	-	-	-	-	.	.	-	-	.	-
CHA	*Chara vulgaris*	.	.	.	A	1	-	.	.	-	-	-	10	.	.	-	1	.	-
LE	*Lemna minor*	.	.	B	+	2	39	4	4	2	1	-	30	.	5	1	1	.	-
PO	*Zannichellia palustris*	.	.	.	.	-	13	**B**	**5**	2	1	100	90	.	.	-	-	.	-
LE	*Ceratophyllum demersum*	.	.	.	1	1	13	+	1	2	-	-	10	.	.	-	-	.	75
PO	*Potamogeton crispus*	+	.	.	.	1	26	B	+	2	1	40	10	.	.	-	-	+	-
PO	*Potamogeton trichoides*	.	.	.	.	-	-	B	1	2	-	-	-	**5**	**5**	2	3	.	-
LE	*Ceratophyllum submersum*	.	.	.	.	-	-	.	.	-	-	-	-	.	1	1	-	.	-
PM	*Alisma plantago-aquatica*	.	.	.	.	-	8	.	.	-	-	-	20	.	A	1	-	.	-
CHA	*Nitella translucens*	.	.	.	.	-	-	.	.	-	-	-	-	.	A	1	-	.	-
PO	*Najas marina*	.	.	.	.	-	-	.	.	-	-	-	-	.	.	-	-	**5**	75
PO	*Potamogeton lucens*	.	.	.	.	-	4	.	.	-	-	-	-	.	.	-	-	+	25
PO	*Myriophyllum spicatum*	.	.	.	.	-	8	.	.	-	-	60	-	.	.	-	-	A	25
	Other species																		
PM	*Typha latifolia*	.	.	.	+		-	.	.	-	-	-	-	.	+		-	.	-
PM	*Eleocharis palustris*	.	.	.	+		-	.	.	-	-	-	-	.	+		-	.	-

Leg.: C – constancy, Ca – constancy according to OŤAHEĽOVÁ (1995), C_1 – constancy according to OŤAHEĽOVÁ et al. (1994), C_2 – RYDLO (1999b), C_3 – RYDLO (1999a), C_4 – HÁBEROVÁ & KARASOVÁ (1991)
* CHA – *Charetea fragilis*, LE – *Lemnetea*, PM – *Phragmito-Magnocaricetea*, PO – *Potametea*

Tab. 4. Plant communities of *Ranunculion fluitantis*

*	Number of relevé	1	2	3	C	C_1	4	5	6	C	Ca	7	C_1
	Number of species	5	2	6			7	7	3			3	
	Dominant and diagnostic species of the floristical and ecological variants												
PO	*Sparganium emersum*	**4**	**4**	**4**	3	V	.	.	.	-	-	.	-
LE	*Lemna trisulca*	5	.	.	1	-	.	.	.	-	12	.	-
PO	*Potamogeton trichoides*	+	.	.	1	-	.	.	.	-	-	.	-
PO	*Potamogeton crispus*	.	B	B	2	I	A	.	.	1	25	.	I
PO	*Potamogeton nodosus*	.	.	.	-	-	**5**	**4**	**B**	3	100	.	-
PO	*Elodea canadensis*	.	.	.	-	-	4	.	.	1	12	.	-
PM	*Leersia oryzoides*	.	.	.	-	-	.	+	.	1	-	.	-
PM	*Alisma plantago-aquatica*	.	.	.	-	-	.	+	.	1	-	.	-
PM	*Butomus umbellatus*	.	.	.	-	-	.	1	.	1	12	.	-
PO	*Myriophyllum spicatum*	.	.	.	-	II	+	B	4	3	37	**5**	V
O	*Fontinalis antipyretica*	.	.	.	-	-	.	.	.	-	-	.	-
	Other species												
LE	*Lemna minor*	A	.	+	2	-	+	+	+	3	50	+	-
PM	*Phalaroides arundinacea*	.	.	+	1	-	r	.	.	1	12	.	-

Leg.: C – constancy, Ca – constancy according to OŤAHEĽOVÁ (1995), C_1 – constancy according to RYDLO (1993)
* LE – *Lemnetea*, O – others, PM – *Phragmito-Magnocaricetea*, PO – *Potametea*

Tab. 5. Plant communities of *Ranunculion aquatilis*

*	Number of relevé	1	2	3	4	C	Ca	5	6	7	8	9	10	C	Ca	11	12	13	C	14	15	Ca	16	17	C_1
	Number of species	4	12	7	6			5	7	10	7	7	4			5	13	9		9	12		7	11	
	Dominant and diagnostic species of the floristical and ecological variants																								
PO	*Hottonia palustris*	**5**	**4**	**3**	**4**	4	100	1	.	.	.	.	.	17	-	.	.	.	-	.	+	-	.	.	-
PM	*Phellandrium aquaticum*	.	r	1	r	3	20	.	+	+	+	.	.	50	-	r	+	+	3	1	.	-	.	.	-
BI	*Alopecurus aequalis*	.	.	1	1	2	-	A	.	.	.	.	+	33	-	B	+	.	2	.	.	-	.	1	14
PO	*Batrachium aquatile*	.	.	.	1	1	-	**4**	**5**	**B**	**4**	**B**	**5**	100	4	.	.	.	-	.	.	-	.	.	-
LE	*Lemna trisulca*	.	+	.	.	1	80	.	B	B	.	.	.	33	1	.	.	.	-	+	+	-	.	.	-
MA	*Agrostis stolonifera*	.	.	.	.	-	-	.	1	3	.	.	.	33	1	.	+	.	1	.	.	-	.	.	-
PM	*Lythrum salicaria*	.	.	.	.	-	-	.	.	+	A	A	.	50	-	.	+	.	1	.	.	-	.	.	-
O	*Solanum dulcamara*	+	.	.	.	1	-	.	.	.	r	+	.	33	-	.	.	.	-	.	.	-	.	.	-
PM	*Sparganium erectum*	.	.	.	.	-	-	.	.	.	+	+	+	50	-	.	.	.	-	.	.	-	.	.	-
PO	*Batrachium rhipiphyllum*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	**5**	**B**	**3**	3	.	.	-	.	.	-
PM, BI	*Ranunculus sceleratus*	.	+	r	.	2	-	+	.	.	.	.	.	17	-	.	1	+	2	.	+	-	.	+	-
PM	*Eleocharis palustris*	.	+	.	.	1	-	.	.	1	.	.	.	-	1	.	+	1	2	.	+	-	.	.	-
PM	*Rumex maritimus*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	.	+	1	2	+	.	-	.	.	-
PO	*Batrachium trichophyllum*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	.	.	.	-	**5**	.	-	.	.	-
LE	*Utricularia vulgaris* agg.	.	.	.	.	-	20	.	.	.	.	.	.	-	-	.	.	.	-	+	.	-	.	.	-
LE	*Riccia fluitans*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	.	.	.	-	+	.	-	.	.	-
PO	*Batrachium circinatum*	.	A	.	.	1	20	.	.	.	.	.	.	-	-	.	.	.	-	.	**4**	3	.	.	-
PO	*Callitriche platycarpa*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	.	.	.	-	.	.	-	**5**	.	-
PO	*Callitriche cophocarpa*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	.	.	.	-	.	.	-	.	**5**	100
	Other species																								
PM	*Glyceria fluitans*	+	+	.	A	3	-	A	+	+	.	.	.	50	-	A	1	1	3	.	.	-	.	.	29

Tab. 5. - continued

*	Number of relevé	1	2	3	4	C	Ca	5	6	7	8	9	10	C	Ca	11	12	13	C	14	15	Ca	16	17	C_1
LE	*Lemna minor*	A	+	+	.	3	80	.	1	.	A	B	.	50	1	.	1	+	2	+	+	1	.	+	57
O	*Alopecurus geniculatus*	.	+	.	.	1	-	.	.	1	.	.	.	17	-	.	.	A	1	.	A	-	.	.	-
PM	*Alisma plantago-aquatica*	.	+	.	.	1	20	.	.	.	.	.	.	-	-	.	.	.	-	.	+	-	+	.	14
PM	*Veronica anagallis-aquatica*	.	r	.	.	1	-	.	.	.	.	.	.	-	-	.	.	.	-	.	+	-	.	.	-
PO	*Callitriche palustris* agg.	.	1	.	.	1	-	.	.	.	.	.	.	-	-	.	.	.	-	.	1	-	.	.	-
MA	*Lysimachia nummularia*	.	.	+	.	1	-	.	.	.	.	.	.	-	-	.	.	.	-	.	.	-	.	.	-
PM	*Alisma lanceolatum*	.	.	.	+	1	-	.	.	.	.	+	.	17	-	.	A	.	1	.	r	-	.	.	-
LE	*Spirodela polyrhiza*	.	.	.	.	-	-	.	+	.	.	.	.	17	-	.	.	.	-	.	.	-	.	+	-
LE	*Utricularia australis*	.	.	.	.	-	-	.	.	A	.	.	.	17	-	.	.	.	-	.	.	-	.	A	14
PM	*Rorippa amphibia*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	+	.	.	1	A	.	-	.	.	-
PM	*Lysimachia vulgaris*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	.	.	.	-	.	.	-	+	.	-
BI	*Persicaria hydropiper*	.	.	.	.	-	-	.	.	.	.	.	.	-	-	.	.	.	-	.	.	-	+	1	-

Leg.:C – constancy, Ca – constancy according to OŤAHEĽOVÁ (1995), C_1 – constancy according to RYDLO (1999b)
* BI – *Bidentetea tripartiti*, LE – *Lemnetea*, MA – *Molinio-Arrhenatheretea*, O – others, PM – *Phragmito-Magnocaricetea*, PO – *Potametea*

Table 6: Physico-chemical characterics of the soil

DM	clay	dust	sand	pH	C_{OX}	N_T	P_M	K_M	Ca_M	Mg_M
98.63	3.4	20.0	76.6	5.97	1.31	0.19	23.7	58.1	539	110

Legend: Dry matter (DM) – expressed as a percentage of 2 g sample; clay, dust, sand, C_{OX}, N_T – % of DM and P_M, K_M, Ca_M and Mg_M – $mg.kg^{-1}$ of DM.

Appendix 1: Species in one relevé only

Note: Only the taxa which were not classified as the diagnostic species of the floristical and ecological variants are mentioned.

Legend:

Bl – *Bidentetea tripartiti* R. Tx. et al. in R. Tx. ex VON ROCHOW 1951, CH – *Charetea fragilis*, LE – *Lemnetea*, MA – *Molinio-Arrhenatheretea* R. Tx. 1937 em. R. Tx. 1970, PM – *Phragmito-Magnocaricetea*, PO – *Potametea* R. Tx. et PREISING 1942, O – Others.

Tab. 1:

Algae fil. (O) 14: 2b, *Alisma plantago-aquatica* (PM) 3: +, *Batrachium* cf. *aquatile* (PO) 11: +, *B. trichophyllum* (PO) 12: +, *B.* cf. *trichophyllum* (PO) 6: +, *Ceratophyllum submersum* (LE) 8: +, *Glyceria fluitans* (PM) 6: +, *Lythrum salicaria* (PM) 13: r, *Phragmites australis* (PM) 7: r, *Potamogeton pusillus* (PO) 3: +, *Salix fragilis* (O) 14: r, *Schoenoplectus lacustris* (PM) 11: r, *Typha angustifolia* (PM) 9: r, *T. latifolia* (PM) 16: +, *Utricularia vulgaris* agg. (LE) 3: +.

Tab. 2:

Phragmites australis (PM) 6: +, *Potamogeton nodosus* (PO) 8: +, *Solanum dulcamara* (O) 6: +.

Tab. 3:

Bidens frondosus (Bl) 4: +, *Echinochloa crus-galli* (O) 8: 1, *Potamogeton pusillus* agg. (PO) 4: +, *Rumex maritimus* (PM) 5: +, *Salix purpurea* (O) 8: 1, *Typha angustifolia* (PM) 4: 1.

Tab. 4:

Batrachium aquatile (PO) 3: 1, *Epilobium hirsutum* (PM) 1: +, *Persicaria hydropiper* f. *submersa* (Bl) 3: +, *P. lapathifolia* (Bl) 5: r, *Sparganium erectum* (PM) 4: +,

Tab. 5:

Algae fil. (O) 13: A, *Ceratophyllum demersum* (LE) 3: +, *Echinochloa cruss-galli* (O) 17: +, *Equisetum fluviatile* (PM) 16: +, *Glyceria maxima* (PM) 16: +, *Gratiola officinalis* (MA) 12: +, *Leersia oryzoides* (PM) 16: +, *Lycopus europaeus* (PM) 8: +, *Persicaria amphibia* (O) 14: +, *P. lapathifolia* (Bl) 18: 1, *Plantago major* (O) 13: +, *Potamogeton crispus* (PO) 10: A, *Rorippa palustris* (MA) 17: +, *R. sylvestris* (MA) 15: r, *Sium latifolium* (PM) 7: +, *Trapa natans* (PO) 17: +, *Typha angustifolia* (PM) 17: +, *T. latifolia* (PM) 9: +, *Veronica anagallis-aquatica* (PM) 12: 1.

Appendix 2: Localities of relevés

Note: 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 (Cerová vrchovina Mts. – CV, Ipeľská kotlina basin – IK, Ipeľská pahorkatina Mts. – IP, Krupinská planina Mts. – KP, Lučenská koltina basin – LK, O – Ostrôžky Mts., Revúcka vrchovina Mts. – RV); town or village; locality and habitat; altitude (m); relevé area (m^2); total cover (%); depth of water level (cm); flow classes (S – stagnant, LF – low flow < 30 $cm.s^{-1}$, MF – medium flow 30–70 $cm.s^{-1}$, HF – high flow > 70 $cm.s^{-1}$); sediment classes (R – rock, A – artificial material, S – sand or gravel, F – fine inorganic material, O – detritus and other organic material, ? – indeterminate); date; author(s) of relevé (PB – PAVOL BALÁŽ, AC – ALŽBETA CVACHOVÁ, RH – RICHARD HRIVNÁK, HO – HELENA OŤAHEĽOVÁ, MV – MILAN VALACHOVIČ); field number.

Tab. 1

1. SK; LK; Zelené village; fishpond; OŤAHEĽOVÁ et al. (1997: Fig. 3b).
2. SK; LK; Lučenec, town; pool in park; 185; 25; 100; 100–150; S; A & R & F; 1.9.1999; RH; 773.
3. SK; LK; Poltár town; terrain depression in the alluvium of Poltárica brook near railway; 230; 25; 100; 30–50; S; F; 22.7.1999; RH; 686.
4. SK; LK; Zelené village, NW; S margin of the gravel ditch; 225; 18; 100; 20–50; S; S & F; 21.8.1996; RH; -.
5. SK; LK; Veľká nad Ipľom village, E; gravel ditch; 165; 10; 80; 5–80; S; S; 11.8.1997; RH; 172.
6. SK; KP; Cerovo village; fishpond Malý Šiaš; 420; 25; 85; 100–130; S; F; 12.8.1999; RH; 746.
7. SK; LK; Podrečany village; abandoned sludge pit of water from magnesite mines, central part; 212; 25; 70; 100–200; S; F; 3.8.1999; RH; 705.
8. HU; -; Ludányhalászi village, N; river oxbow near railway bridge; HRIVNÁK et al. (2001: tab. 1, rel. 15).

9. SK; KP; Cerovo village; fishpond Veľký Šiaš; 420; 25; 100; 150–250; S; F; 12.8.1999; RH; 748.
10. SK; KP; Cerovo village; fishpond "Pri badluckej ceste"; 414; 25; 80; 200–300; S; F; 12.8.1999; RH; 751a.
11. SK; KP; Hrušov village, N; fishpond, NW margin; HRIVNÁK (1999: Fig. 3).
12. HU; -; Hugyag village, NE; river oxbow near destroyed bridge; HRIVNÁK et al. (2001: tab. 2, rel. 14).
13. SK; IK; Ipeľské Predmostie village; Nature reserve Ipeľské hony, central part; 130; 20; 70; 22–35; S; F & O; 29.5.1997; AC & RH; 32.
14. SK; KP; Horné Breziny village; water reservoir Dobrá Niva, litoral; 360; 6; 80; 5–35; S; F; 12.8.1999; RH; 736.
15. SK; LK; Kalinovo village, Briežky settlement, N; fishpond; 230; 11,5; 90; 100–200; S; F; 27.8.1999; RH; 765.
16. SK; LK; Veľká nad Ipľom village, E; gravel ditch; 165; 20; 65; 30–80; S; S; 10.9.1999; RH; 810.
17. SK; CV; Šávoľ village; Suchá brook, near road bridge; 181; 4,5; 70; SF; F; 15.8.1996; RH; -.

Tab. 2

1. SK; RV; Ružiná, NW; canal below the water reservoir; 235; 16; 90; 100–150; LF; A; 17.8.1997; RH; 187.
2. SK; RV; Ružiná, NW; canal below the water reservoir; 235; 25; 100; 100–150; LF; A; 17.8.1997; RH; 188.
3. SK; IK; Tešmak village; Veľké jazierko pool, W margin; OŤAHEĽOVÁ et al. (1998: Fig. 3d).
4. SK; LK; Rapovce village, NW; gravel ditch on the right bank of Ipeľ river; 167; 40; 100; 30–80; S; S; 20.5.1997; RH; 17.
5. SK; LK; Rapovce village, NW; gravel ditch on the right bank of Ipeľ river; 167; 24; 100; 10–105; S; S; 20.5.1997; RH; 18.
6. SK; LK; Lučenec town, Havaška; Slatinka brook near road bridge; 175; 22; 100; 30–45; LF; F; 7.7.1998; RH; 345.
7. SK; LK; Kalinovo village; Ipeľ river near road bridge; 203; 15; 90; 30–60; MF; S & F; 8.6.1998; RH; 295.
8. SK; LK; Lučenec town; Tuhársky potok brook near marked-place; 181; 14; 100; 1–30; SF; F & O; 23.8.1997 MF; RH; 194.
9. SK; LK; Halič village; pool at the park near castle; 240; 12; 100; 60–80; S; F; 6.9.1997; RH; 208.

Tab. 3

1. SK; LK; Lučenec town, Malá Ves; Krivánsky potok brook; 180; 30; 70; 25–45; HF; -; 7.7.1998; RH; 349.
2. SK; LK; Mikušovce village; Krivánsky potok brook; 174; 25; 95; 40–65; MF; -; 5.8.1998; RH; 441.
3. SK; LK; Boľkovce village, SW; river oxbow; HRIVNÁK (1998: tab. 1, rel. 6).
4. SK; LK; Veľké Dravce village; canal bellow the water reservoir; 192; 9; 95; 2–7; LF; O; 14.8.1997; RH; 179.
5. SK; IK; Tešmak village; Veľké jazierko pool, W margin; 126; 12; 90; 10–20; S; O; 25.6.1997; AC, RH, HO; 109.
6. SK; IK; Tešmak village; Veľké jazierko pool, W margin; 126; 25; 95; 15–25; S; S & O; 25.6.1997; AC, RH, HO; 110.
7. SK; LK; Gregorova Vieska village, SE; clay ditch; 206; 25; 95; 130–200; S; F;
8. SK; LK; Nitra nad Ipľom, gravel ditch on the right bank of Ipeľ river; HRIVNÁK et al. (2001: 15).
9. SK; RV; Divín village, SE; NW margin of water reservoir Ružiná; 252; 25; 100; 40–100; S; O & S; 1.9.1998; RH; 491.

Tab. 4

1. SK; LK; Veľká nad Ipľom village; canal in the alluvium of Ipeľ river; 164; 20; 100; 40–100; SF; ?; 10.9.1999; RH; 807.
2. SK; LK; Kalinovo village; water-course of Ipeľ river near road bridge; 203; 18; 70; 10–25; MF; S; 17.9.1999; RH; 810a.
3. SK; LK; Kalinovo village, S; water-course of Ipeľ river, near agricultural co-operative; 198; 24; 60; 60–70; SF; F; 10.8.2000; RH, MV; 941.
4. SK; LK; Lučenec town; Tuhársky potok brook, near Billa supermarket; 180; 20; 100; 15–40; SF; F & O; 7.7.1998; RH; 342. Note: Stand of *Potametum nodosi* was destroyed at the end of summer.

5. SK; LK; Lučenec town; Tuhársky potok brook, near market; 181; 30; 80; 5–15; SF & MF; A & O; 15.7.2000; RH; 937.
6. SK; LK; Lučenec town; Tuhársky potok, near park; 182; 30; 5–25; SF; S & F; 7.7.1998; RH; 341.
7. SK; LK; Lučenec town; Tuhársky potok, near park; 182; 20; 1–5; MF; S; 18.7.1998; RH; 379.

Tab. 5

1. SK; LK; Boľkovce village, N; river oxbow in the inundation area in the left side of Ipeľ river; 181; 14; 100; 20–50; S; S & F; 2.5.2000; AC, RH; 819.
2. SK; LK; Malá Dálovce settlement; canal in the alluvium of Ipeľ river, near the confluence of Mašková stream and Ipeľ river; 163; 24; 80; 5–20; S; F; 26.5.1999; RH; 550.
3. SK; LK; Boľkovce village, SE; river oxbow; HRIVNÁK (1998b: tab. 1, rel. 7).
4. SK; LK; Boľkovce village, NE; river oxbow in the inundation area in the left side of Ipeľ river; HRIVNÁK (1998b: tab. 1, rel. 8).
5. SK; LK; Boľkovce village, NE; river oxbow in the inundation area in the left side of Ipeľ river; HRIVNÁK (1998b: tab. 1, rel. 9).
6. SK; IK; Tešmak village; the ditch near "sand-dune"; 126; 6; 95; 30–80; S; S; 25.6.1997; AC, RH, HO; 114.
7. SK; IK; Tešmak village; the ditch near "sand-dune"; 126; 8; 95; 40–60; S; S; 25.6.1997; AC, RH, HO; 117.
8. SK; LK; Boľkovce village, SW; seepage canal; HRIVNÁK (1998b: tab. 1, rel. 10).
9. SK; LK; Boľkovce village, SW; seepage canal; HRIVNÁK (1998b: tab. 1, rel. 11).
10. SK; LK; Kalinovo village; Ipeľ river near road bridge; 203; 24; 100; 0–10; SF; F; 8.6.1998; RH; 296.
11. SK; LK; Rapovce village; terrain depression near railway; 168; 40; 95; 30–40; S; F; 20.5.1997; RH; 16.
12. SK; LK; Boľkovce village; marsh on the NNW margin of village; HRIVNÁK (1998b: tab. 1, rel. 12).
13. SK; LK; Boľkovce village; marsh on the NNW margin of village, terrain depression; 191; 10; 80; 2–15; S; F; 7.5.1999; RH; 519.
14. SK; IK; Ipeľské Predmostie village; canal in the part of "Ryžoviská"; 127; 16,5; 100; 1–8; S; F & O; 25.6.1997; AC, RH; 127.
15. SK; LK; Malé Dálovce settlement; canal in the alluvium of Ipeľ river, near the confluence of Mašková stream and Ipeľ river; 163; 20; 80; 5–15; S; F; 26.5.1999; RH; 549.
16. SK; O; Ábelová village, E; fishpond; CVACHOVÁ & HRIVNÁK (2001: tab. 1, rel. 16).
17. SK; LK; Zelené village; fishpond; 222; 9; 90; 10–25; S; F & O; 11.7.1997; AC, RH; 158.

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