

## THE AQUATIC MACROPHYTES OF THE IŽIANSKY KANÁL CANAL NEAR THE KOMÁRNO TOWN (SOUTHERN SLOVAKIA)

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**Súhrn:** Vodné makrofyty Ižianskeho kanála v blízkosti Komárna (Južné Slovensko). V koryte Ižianskeho kanála sa v roku 2004 zistilo 56 druhov vodných makrofytov: 12 druhov hydrofytov, 7 amfifytov, 37 druhov helofytov a bližšie neurčené vláknité riasy. V skupine hydrofytov dominantnými druhmi boli *Myriophyllum spicatum*, *Potamogeton crispus* a *P. pectinatus*, medzi helofytmi prevládali *Phragmites australis*, *Typha angustifolia* a *T. latifolia*. Zistil sa i výskyt neofytu *Typha laxmannii* a ôsmych zraniteľných druhov: *Ranunculus rionii*, *Bolboschoenus maritimus*, *Butomus umbellatus*, *Carex distans*, *Najas marina*, *Potamogeton perfoliatus*, *Salvinia natans* a *Schoenoplectus tabernaemontani*. V práci sú spracované dáta vo forme relatívneho množstva rastlín, priemerného množstva rastlín jednotlivých druhov a ich index distribúcie.

**Key words:** drainage canal, species distribution, relative plant mass, average distribution of species, distribution index

### Introduction

Recently, still greater attention is devoted to the study of water vegetation and several studies on flora of natural and semi-natural water flows of Slovakia have been published. However, water flows that were constructed artificially, by man are not so well explored. Hejný (1960) investigated also flora of a canal system in the period of rice production in southern Slovakia. Ofaheľová and Husák (1992) concentrated on vegetation of drainage canals in the vicinity of Gabčíkovo-Slané jazero lake. Ofaheľová and Valachovič (2003) compared macrophyte flora in conditions of old Danube channel, of the anabranch system and of the artificial seepage canal of the Gabčíkovo hydropower station. Jursa (2003) dealt partially with flora of artificially constructed canal of the Hrušov reservoir. Dorotovičová-Juhászová (1992) and Dorotovičová (2002) presented a floristic description of an irrigation canal near Nová Osada village and morphometric data of *Typha laxmannii* Lepech from the same canal.

### Site description

Ižiansky canal belongs to the system of drainage and irrigation canals of the Podunajská rovina lowland in southern Slovakia. It is a tributary of the Patinský kanál canal and has a function of a drainage canal. It streams parallelly with Danube and collects water from the region along the Danubian protection dam as well as from the seepage canal near Danube. It flows through the Iža village, continues near the national nature protected area Bokrošské slanisko salt marsh towards the Patince village and falls into Patinský canal (by 2.2 rkm) near the Rímske jazero lake.

The overall length of the Ižiansky kanál is 14 km. The middle and lower part of the Ižiansky kanál canal of the length 8.3 km were surveyed. The geographic positions of borders of this area are from 47°45.041\_ N, 18°12.607\_ E (the end of the survey unit 34 – see Fig. 1.) to 47°45.148\_ N, 18°18.639\_ E (the beginning of the survey unit 1 – see Fig. 1.). The altitude is decreasing from 111.5 m to 108.8 m.

The width of the canal in the studied middle and lower reaches is constant – 11 m. Depth of the water gradually increases downstream. In the period of survey, we measured the values of the depth from 120 cm to 200 cm. There are no water gates on this canal, the water flows without artificial regulation. The flow speed is low, mostly unnoticeable.

## Material and methods

Investigation of aquatic macrophytes distribution in Ižiansky kanál canal was carried out in the year 2004. Semi-quantitative Kohler's method of macrophyte mapping (Kohler 1978) was used in the field work and survey. This method was adapted and renewed (Janauer et al. 1993, Kohler, Janauer 1995, Pall, Janauer 1995), and was tested and used in mapping of artificially constructed water flows as well (Sipos 2001).

The middle and lower part of the Ižiansky canal of the length 8.3 km was surveyed.

The canal was divided to survey units based on homogeneity of vegetation in individual units (Fig. 1.). The geographic position of survey units borders we measured using GPS GARMIN device. Number of investigated units was 34 (Map 1.). The most frequent lengths of units were 50 – 300 m. We were withdrawing samples of plants below the water surface using a small anchor.

„Assessment of abiotic parameters“ categories are used according to Janauer (2003).

Names of plant species were adopted from the „Species list“, used in the frame of the MIDCC project. „Species list“ is available at the internet site [www.midcc.at](http://www.midcc.at).

Occurrence of individual species of macrophytes in each analysed survey unit of the canal has been estimated by using a 5-grade scale (Kohler 1978, Kohler, Janauer 1995) (Tab. 1.). Distribution of macrophytes and their occurrence in individual survey units is shown in a distribution diagram. A semi-quantitative 5-grade scale for mass index of the plant species is in this diagram transformed to a 3-grade one (Kohler 1978) for better lucidity. For quantification of data numerical derivatives according to Pall, Janauer (1995), Janauer et al. (1993) were used: *relative plant mass* (RPM), *mean mass index* (MMI), *distribution index* (d). In the frame of the *mean mass index* (MMI) was estimated the *mean mass total* (MMT), i.e. mean mass of individual species in the overall surveyed length of the flow and the *mean mass occurrence* (MMO), i.e. mean mass of individual species only in those survey units, where the species was really present. These numerical derivatives were evaluated by the software of the University of Vienna in Austria, compiled for the MIDCC project „Multifunctional Integrated Study Danube Corridor and Catchment“, accessible at internet ([www.midcc.at](http://www.midcc.at)).

## Results

### *Physical habitat settings*

In the studied middle and lower reaches of the canal, 8.3 km long, following abiotic parameters were estimated:

The **connectivity type** was represented by running water with water body outside the

flood protection dam. The **bank structure** consisted of gravel (66%) and a mixed material from gravel and fine inorganic material (32%). The **sediment types** were gravel (31%), fine inorganic material (11%) and the mixture of the both materials (58%). The **flow velocity class** was low flow (100%). The **landuse type** was dominated by agricultural areas (73%) – arable land, heterogenous agricultural areas – followed by villages (13%), broad leaved forests (10%), scrubs and dump.

#### *Species composition*

In Ižiansky kanál canal 56 macrophyte species were found: 12 hydrophytes, seven amphiphytes, 37 helophytes, and not determined filamentous algae (Tab. 1.). Hydrophytes group was dominated by *Myriophyllum spicatum*, *Potamogeton crispus* and *P. pectinatus*. In group it was *Phragmites australis*, *Typha angustifolia* and *T. latifolia*. The neophyte *Typha laxmannii* was observed here.

Eight vulnerable plant species were found: the hydrophytes *Najas marina*, *Potamogeton perfoliatus*, *Ranunculus rionii*, *Salvinia natans* and the helophytes *Butomus umbellatus*, *Bolboschoenus maritimus*, *Carex distans* and *Schoenoplectus tabernaemontani*.

**Tab. 1.** List of macrophyte species found in the Ižiansky kanál during the field research in 2004

Genus	Species	Author	Abbreviation	Threat
<b><i>Hydrophytes</i></b>				
<i>Ceratophyllum</i>	<i>demersum</i>	L.	Cer dem	
<i>Myriophyllum</i>	<i>spicatum</i>	L.	Myr spi	
<i>Najas</i>	<i>marina</i>	L.	Naj mar	LR:nt
<i>Nymphaea</i>	sp.	no Author	Nym sp.	
<i>Potamogeton</i>	<i>crispus</i>	L.	Pot cri	
<i>Potamogeton</i>	<i>pectinatus</i>	L.	Pot pec	
<i>Potamogeton</i>	<i>perfoliatus</i>	L.	Pot per	LR:nt
<i>Ranunculus</i>	<i>rionii</i>	Lagger	Ran rio	LR:nt, §
<i>Ranunculus</i>	<i>circinatus</i>	Sibthorp	Ran cir	
<i>Salvinia</i>	<i>natans</i>	(L.) All.	Sal nat	LR:nt, §
<i>Spirodela</i>	<i>polyrhiza</i>	(L.) Schleid.	Spi pol	
<i>Zannichellia</i>	<i>palustris</i>	L.	Zan pal	
<b><i>Amphiphytes</i></b>				
<i>Agrostis</i>	<i>stolonifera</i>	L.	Agr sto	
<i>Alisma</i>	<i>plantago-aquatica</i>	L.	Ali pla	
<i>Butomus</i>	<i>umbellatus</i>	L.	But umb	VU
<i>Mentha</i>	<i>aquatica</i>	L.	Men aqu	
<i>Myosotis</i>	<i>scorpioides</i>	L.	Myo sco	
<i>Rorippa</i>	<i>palustris</i>	(L.) Besser	Ror pal	
<i>Veronica</i>	<i>anagallis-aquatica</i>	L.	Ver ana	
<b><i>Helophytes</i></b>				
<i>Alisma</i>	<i>lanceolatum</i>	With.	Ali lan	

**Tab. 1. continuation**

Genus	Species	Author	Abbreviation	Threat
<i>Alopecurus</i>	<i>aequalis</i>	Sobol.	Alo aeq	
<i>Bidens</i>	<i>frondosus</i>	L.	Bid fro	
<i>Bolboschoenus</i>	<i>maritimus</i>	(L.) Palla	Bol mar	EN
<i>Calamagrostis</i>	<i>epigejos</i>	(L.) Roth	Cal epi	
<i>Calystegia</i>	<i>sepium</i>	(L.) R. Br.	Cal sep	
<i>Carex</i>	<i>distans</i>	L.	Car dis	VU
<i>Carex</i>	<i>gracilis</i>	L.	Car gra	
<i>Carex</i>	<i>otrubae</i>	Podp.	Car otr	
<i>Carex</i>	<i>riparia</i>	Curtis	Car rip	
<i>Eleocharis</i>	<i>palustris</i> agg.	no Author	Ele pal	
<i>Equisetum</i>	<i>arvense</i>	L.	Equ arv	
<i>Equisetum</i>	<i>palustre</i>	L.	Equ pal	
<i>Eupatorium</i>	<i>cannabinum</i>	L.	Eup can	
<i>Galium</i>	<i>palustre</i>	L.	Gal pal	
<i>Glyceria</i>	<i>maxima</i>	(Hartm.) Holmb.	Gly max	
<i>Iris</i>	<i>pseudacorus</i>	L.	Iri pse	
<i>Juncus</i>	<i>articulatus</i>	L.	Jun art	
<i>Juncus</i>	<i>compressus</i>	Jacq.	Jun com	
<i>Lycopus</i>	<i>europaeus</i>	L.	Lyc eur	
<i>Lysimachia</i>	<i>nummularia</i>	L.	Lys num	
<i>Lysimachia</i>	<i>vulgaris</i>	L.	Lys vul	
<i>Lythrum</i>	<i>salicaria</i>	L.	Lyt sal	
<i>Phragmites</i>	<i>australis</i>	(Cav.) Trin.	Phr aus	
<i>Ranunculus</i>	<i>repens</i>	L.	Ran rep	
<i>Ranunculus</i>	<i>sceleratus</i>	L.	Ran sce	
<i>Rumex</i>	<i>crispus</i>	L.	Rum cri	
<i>Rumex</i>	<i>hydrolapathum</i>	Huds.	Rum hyd	
<i>Salix</i>	<i>alba</i>	L.	Sal alb	
<i>Salix</i>	<i>caprea</i>	L.	Sal cap	
<i>Salix</i>	<i>purpurea</i>	L.	Sal pur	
<i>Schoenoplectus</i>	<i>tabernaemontani</i>	(C.C.Gmel.) Palla	Sch tab	LR:nt
<i>Solanum</i>	<i>dulcamara</i>	L.	Sol dul	
<i>Symphytum</i>	<i>officinale</i>	L.	Sym off	
<i>Typha</i>	<i>angustifolia</i>	L.	Typ ang	
<i>Typha</i>	<i>latifolia</i>	L.	Typ lat	
<i>Typha</i>	<i>laxmannii</i>	Lepech.	Typ lax	
<b>Algae</b>				
<i>algae</i>	<i>filamentosae</i>	no Author	Alg fil	

Legend:

§ - protected in Slovakia

Categories of threat and rareness (Feráková, Maglocký & Marhold 2001): VU - vulnerable LR:nt - lower risk

### Species Distribution

Hydrophytes *Myriophyllum spicatum*, *Potamogeton crispus* and *P. pectinatus* were present almost in the whole studied area of the Ižiansky kanál (Fig. 2.). Less spread were three other species of hydrophytes: *Salvinia natans*, *Zannichelia palustris* and *Nymphaea* sp. occurred each only in one surveyed unit.

Helophyt *Phragmites australis* was present almost throughout the whole canal, but *Typha angustifolia* also belonged to enhanced species. Species *Schoenoplectus tabernaemontani*, *Glyceria maxima* and *Carex distans* had the narrowest distribution.

### Relative Plant Mass

Hydrophyte *Myriophyllum spicatum* had the highest ratio of relative plant mass in the Ižiansky kanál (32,49 %), so this species was dominant (Fig. 3.). Important species were also *Potamogeton pectinatus* and *P. crispus*. The Ižiansky kanál showed higher diversity of the aquatic plants, however nine species had very low relative plant mass, less than 1 %, together 9,86 % (residual).

### Average Distribution of Species

From the diagram of mean mass index (MMT/O) it follows, that only one species – *Myriophyllum spicatum* – achieved higher values of the mean mass total (MMT) and mean mass occurrence (MMO) than 3 in the Ižiansky kanál (Fig. 4.). *Potamogeton pectinatus* was a species with lower average distribution (MMT < 3) but with the most uniform distribution (distribution index  $d = 0.96$ ). Three hydrophytes (*Myriophyllum spicatum*, *Potamogeton pectinatus* and *P. crispus*) and two amphiphytes (*Agrostis stolonifera*, *Butomus umbellatus*) achieved distribution ratio  $d > 0.5$ , that means they were present in more than half of the length of the surveyed area of the Ižiansky kanál. *Ceratophyllum demersum* and *Najas marina* occurred in the Ižiansky kanál in clumps.

## Discussion

### Comments on species distribution

Hydrophytes *Myriophyllum spicatum*, *Potamogeton crispus* and *P. pectinatus* were present almost in the whole surveyed middle and lower reaches of the Ižiansky kanál canal. However, their mass significantly fluctuated over the whole flow. *Myriophyllum spicatum* and *Potamogeton pectinatus* together occupied broad bands along both banks, while a narrow central part was usually empty. *Potamogeton crispus* was present in a lower mass, closer to shores. But upstream, (in the survey units 32 – 34), this species began to predominate and reached into the central part of the canal as well. Particularly in this part the mass of *Potamogeton pectinatus* decreased. *Ceratophyllum demersum* was a dominant species in the short survey units (16 – 21), where it occupied almost the entire channel.

It was impossible to identify the species of *Nymphaea*, as there occurred only a few specimens in a single survey unit. Flowers and underside of the leaves were intensively pink-coloured, flowers at the base were more angled than by the species *N. alba*. These were probably cultivated decorative species, or hybrids with cultivated plants.

Most regular distribution of amphiphytes had the species *Agrostis stolonifera*, but it was present only in a small mass. Helophyte *Phragmites australis* was present almost everywhere in the Ižiansky kanál, and *Typha angustifolia* was also one of the wide-spread species.

Especially interesting was the higher mass of *Ceratophyllum demersum* and *Najas marina* in short survey units 16 – 21 and the fact, that species *Spirodela polyrhiza* occurred only in this part of the canal as well. This phenomenon, together with higher species mass in the survey unit 20, could be explained by the presence of a smaller adjacent canal flowing exactly in the survey unit 20. However, the conditions were more complex. Other factors, influencing this part of the Ižiansky kanál canal could be: soil composition of the nearby area (nature protected area salt marsh „Bokrošské slanisko“), eventually vicinity of an operated dump. Interesting is behavior of *Myriophyllum spicatum* around the survey unit 22, neighbouring the dump. The mass of *M. spicatum* towards this survey unit gradually decreases, in the survey unit 22 it is missing and then again increases.

#### *Floristic zonation*

Mentioned survey units 16 – 21 seemed to be to a certain degree a splitting section of the canal. Parts upstream and downstream from this section exhibited certain differences in the species occurrence. *Ceratophyllum demersum*, *Najas marina*, *Potamogeton perfoliatus*, *Bolboschoenus maritimus* and *Myosotis scorpioides* occurred only in these units and downstream from this part towards the mouth into the Patinský kanál canal (survey units 1 – 21). Other species were found only upstream from the splitting section (*Alopecurus aequalis*), in the middle flow; or their occurrences here was more uniform (*Butomus umbellatus*, *Mentha aquatica*). The mass of *Potamogeton crispus* was significantly higher upstream from the splitting section as well.

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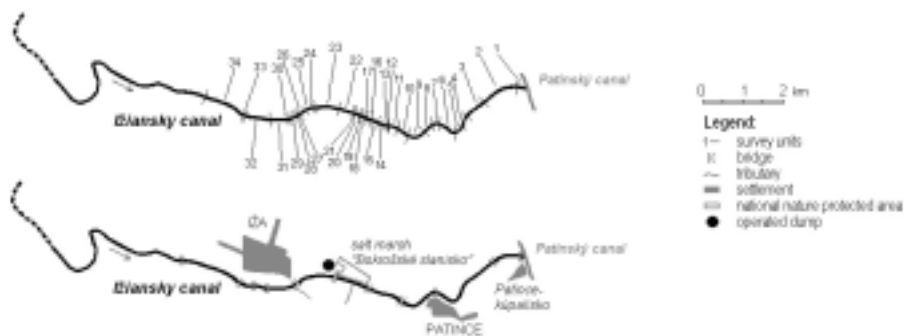
#### **References**

- DOROTOVIČOVÁ-JUHÁSZOVÁ, Cs., 1992: Flóra zavlažovacieho kanála pri Novej Osade. *Iuxta Danubium* – Spravodaj Podunajského múzea v Komárne, 10: 77 – 91.
- DOROTOVIČOVÁ Cs., 2002: *Typha laxmannii* Lepech. pri Komárne. *Bull. Slov. Bot. Spoločn.*, Bratislava, 25: 75 – 80.
- FERÁKOVÁ, V., MAGLOCKÝ, Š., MARHOLD, K., 2001: Červený zoznam papraďorastov a semenných rastlín Slovenska. In: Baláž, D., Marhold, K., Urban, P. eds., Červený zoznam rastlín a živočíchov Slovenska, *Ochr. Prír.* 20 (Suppl.): 48 – 81.
- HEJNÝ, S., 1960: Ökologische Charakteristik der Wasser- und Sumpfpflanzen in den slowakischen Tiefebene (Donau und Theissgebiet). Veda, Bratislava. 487 pp.
- JANAUER, G. A., 2003: Methods. In: Janauer, G. A., Hale, P., Sweeting, R. (eds.), Macrophyte inventory of the river Danube: A pilot study. *Arch. Hydr. Suppl.*, 147: 9 – 17 (Large River 14: 9 – 17).
- JANAUER, G. A., ZOUFAL, R., CHRISTOPF-DIRRY, P., ENGLMAIER, P., 1993:

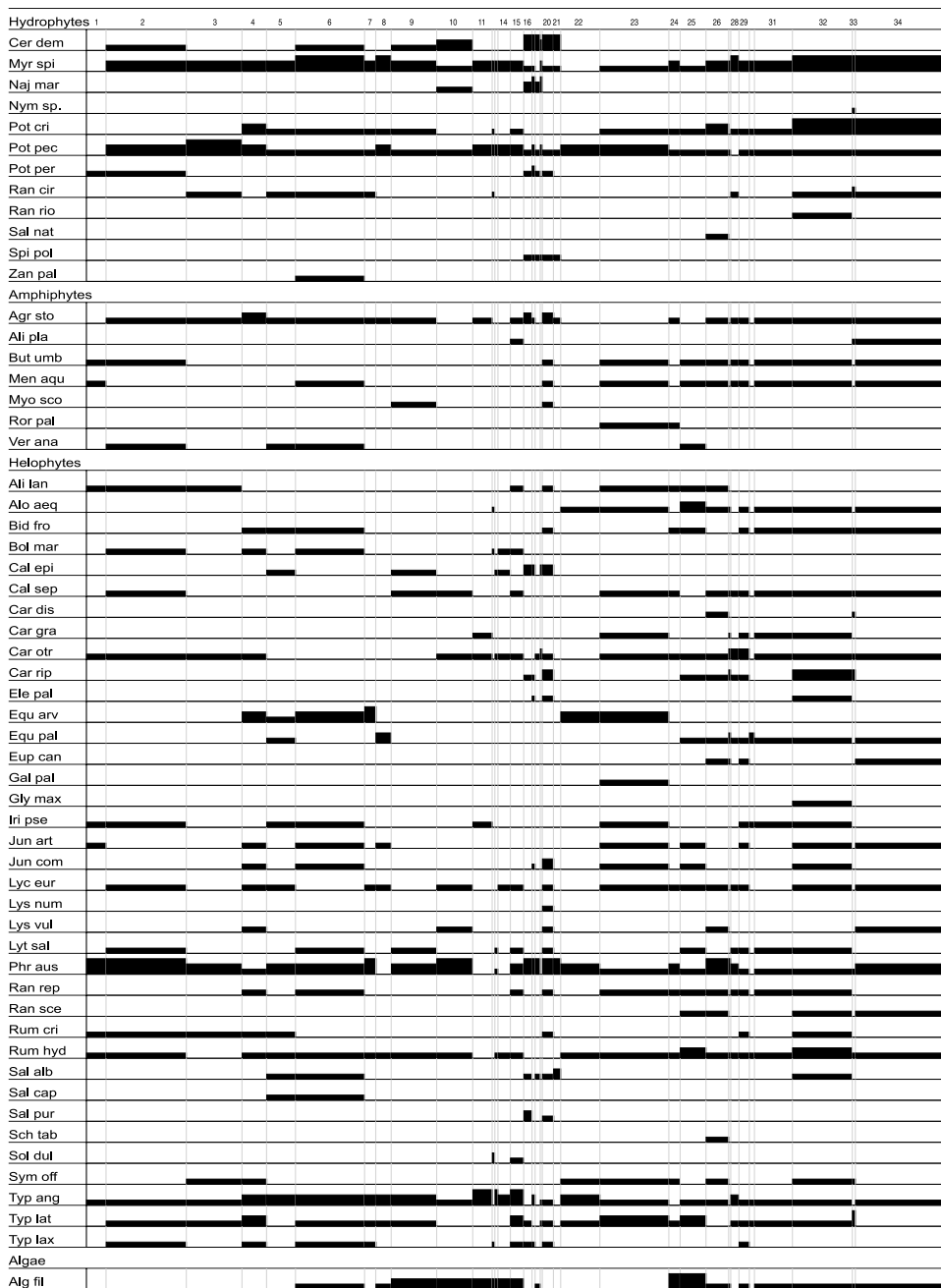
- Neue Aspekte der Charakterisierung und vergleichenden Beurteilung der Gewässervegetation. Ber. Inst. Landschafts- Pflanzenökologie Univ. Hohenheim 2: 59-70.
- JURSA, M., 2003: Zaujímavé nálezy makrofytov z troch vodných biotopov Bratislavy. *Bull. Slov. Bot. Spoločn.*, Bratislava, 25: 115-120.
- KOHLER, A., 1978: Methoden der Kartierung von Flora und Vegetation von Süßwasserbiotopen. *Landschaft + Stadt* 10:23-85.
- KOHLER, A., JANAUER, G.-A., 1995: Zur Methodik der Untersuchung von aquatischen Makrophyten in Fließgewässern. In: Steinberg, C., Berndhardt, H. & Klapper, H. (Hrsg.): *Handbuch Angewandte Limnologie*. Ecomed-Verlag. VIII-1.1.3: 1-22.
- MARHOLD K., HINDÁK F. (eds.), 1998: Checklist of non-vascular and vascular plants of Slovakia. Veda, Bratislava. 687 pp.
- OŤAHELOVÁ, H., HUSÁK, Š., 1992: Vegetácia odvodňovacích kanálov v okolí Gabčíkova-Slané jazero. *Ochr. Prír.* Bratislava 1: 95-105.
- OŤAHELOVÁ, H., VALACHOVIČ, M., 2003: Distribution of macrophytes in different water-bodies (habitats) influenced by the Gabčíkovo hydropower station (Slovakia) – present status. *Arch. Hydrobiol. Suppl.* 147/1-2, p. 97-115.
- PALL, K., JANAUER, G.-A., 1995: Die Makrophyten-Vegetation von Flußstauen am Beispiel der Donau zwischen Fluss-km 2552,0 und 2511,8 in der Bundesrepublik Deutschland. *Arch. Hydrobiol. Suppl.* 101, Large Rivers 9/2: 91-109.
- SIPOS, V. K., 2001: Makrophyten-Vegetation und Standorte in eutrophen und humosen Fließgewässern. Beispiele aus Hohenheim und Ungarn. *Dizert.práca – Ber. Inst. Landschafts-Pflanzenökologie Univ. Hohenheim, Beiheft* 13. 180 pp.

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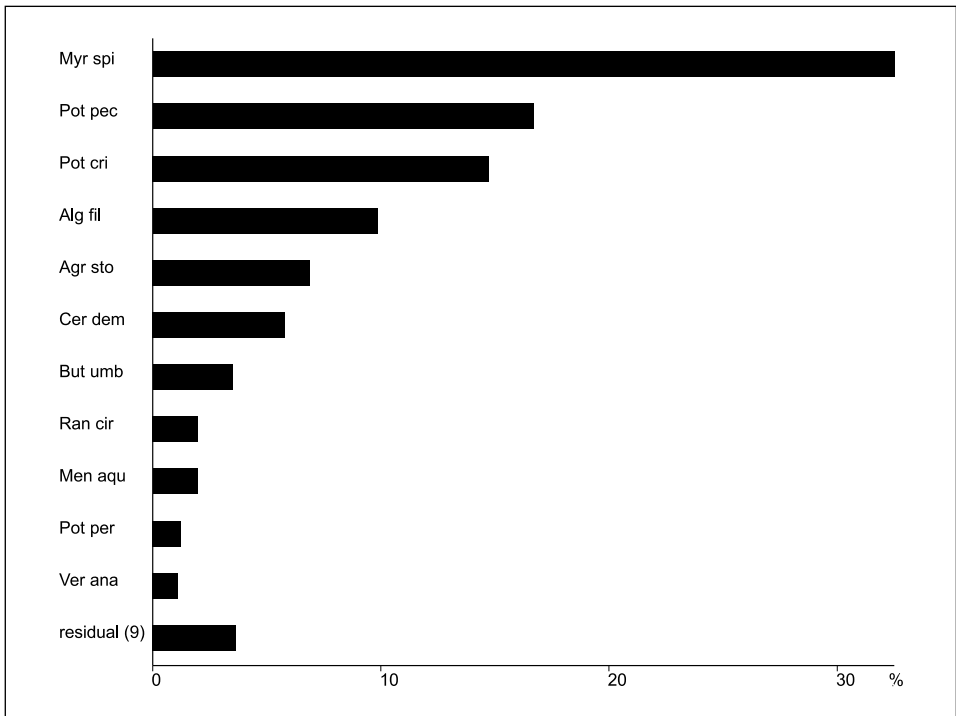
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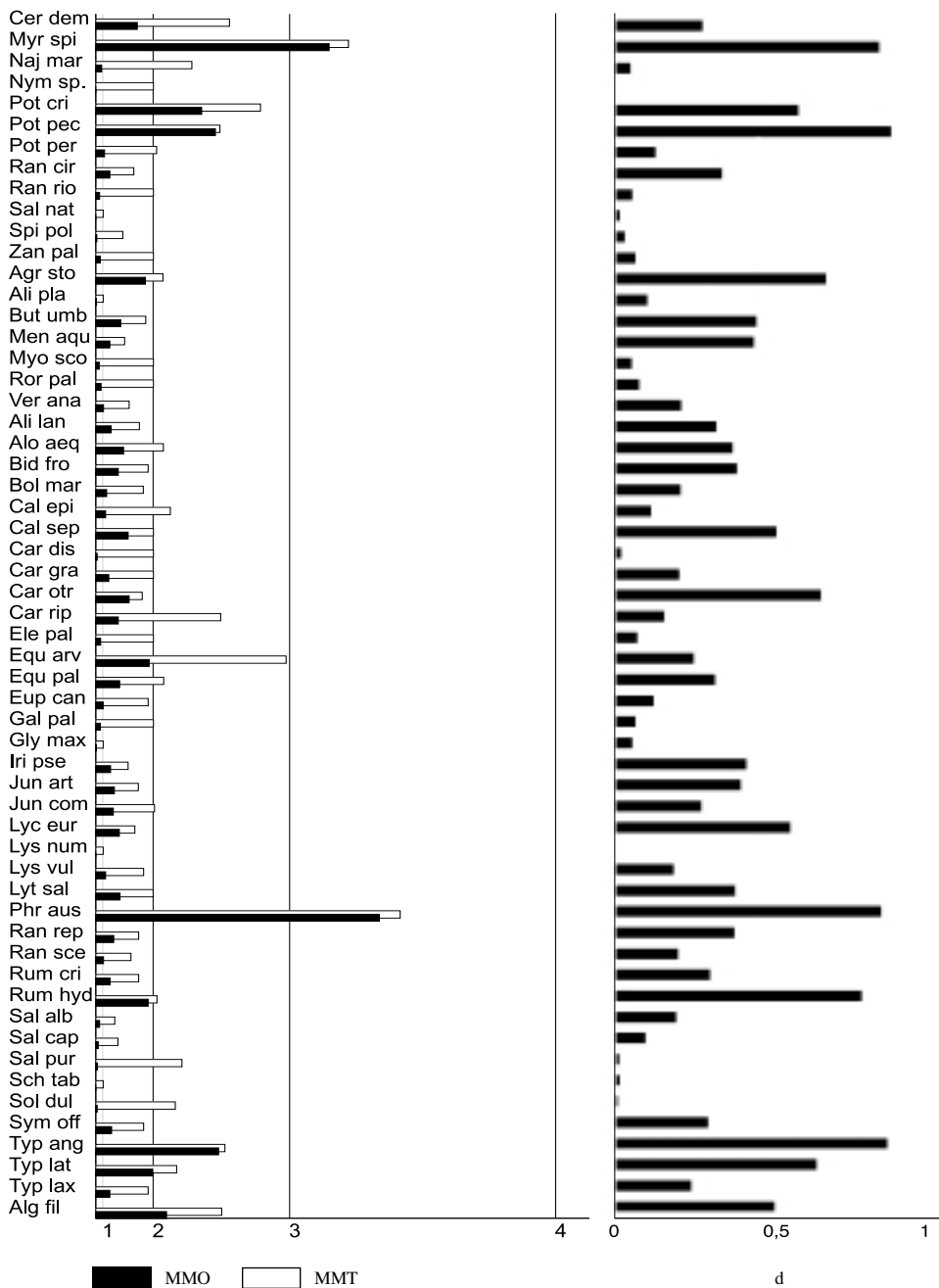
**Fig. 1.** Location of the survey units of the macrophytes along the Ižiansky kanál canal and position of ecologically important objects.



**Fig. 2.** Distribution diagram of aquatic macrophytes of the Ižianský kanál canal (location of the survey units 1-34 see Fig. 1.)



**Fig. 3.** Relative plant mass (RPM) diagram of aquatic macrophytes of the Ižianský kanál canal



**Fig. 4.** Mean mass index (MMT/O) and distribution index (d) diagram of aquatic macrophytes of the Ižianský kanál canal