THE ECOLOGY IN DISTRIBUTION OF SUBMERGED MACROPHYTES IN THE CANAL NETWORK DANUBE-TISZA-DANUBE (S&CG)

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ABSTRACT

The first investigation of macrophytes vegetation in the the canal network Danube-Tisza-Danube (DTD, Voivodina, Serbia &Montenegro) were started several years ago. This investigation provided abundant data on the macrophytes communities, floristic composition, and ecological distribution in this anthropogenic ecosystem. The following submerged associations have been recorded: Potamogetono - Ceratophylletum demersi (Hild eh Rehnelt 65) Pass. 95 and Myriophyllo-Potametum Soó 34. The results of these investigation could be used in the identification of the current and future condition of the canal network Danube-Tisza-Danube and indicating the necessity of bio monitoring of its ecosystems.

***Key words**: canal network, submerged, macrophytes, vegetation*

1. INTRODUCTION

Within secondary aquatic biotopes, being under distinct antropogenic influence and in its function, distribution and ecology monitoring for aquatic vegetation is a basis for estimation of ecological properties of habitat, as well as for proposal of protection and sanation measures for water streams of channel type, i.e. maintenance of ecological balance in these biotopes. Since these are very dynamic and fragile ecosystems, where aquatic plants have invaluable role in maintenance of necessary oxygen level, anti-erosive, phyto-filtration and phytosanation processes (absorption of phenol, trace metal ions, pesticides, crude oil, accumulation of trace metals) which under certain conditions could have weed properties (by their overexpansion waterflow is slowing, light and thermic regime are changing and aquatic biotopes are overgrowing), which automatically brings disturbance of channels' basic function), it is clear that monitoring of ecological balance at vegetation level is the basis of maintainable development for channel-type biotopes.

2. METHODOLOGY

During three-month field investigations (at 19 localities*), standard floristical-phytocenological methods were used based on Swiss-France

school principles [12]. Determination of plant taxons has been done using standard and classical determination keys according to international Code of Botanical Nomenclature][2][3][4][5].

Nomination and syntaxonomic overview of plant associations are given according to review of Europe vegetation [9] review of Serbian vegetation [6] and Hungarian one [7]. Elements of flora are given after Gajic [1]. Life forms are given after Flora Srbije and floristic similarity with previous vegetation investigations of this part of channel network HS DTD detecting level of changes within decade period [10], [11] are tested using Sorensen similarity index.

* SITES

1.Šebeš fok	2. Siget most	3.Sombor	4.Prigrevica	5. S. Miletić
6. Odžaci	7.Vrbas-uzvodno	8.Vrbas-nizvodno	9.Turija	10.B.Gradište
11.Bečej	12.B.Petrovac	13.R.Krstur uzvodno	14.R.Krstur – nizvodno	15.Kucura-uzvodno
16.Kucura nizvodno	17.Zmajevo	18.Žabalj	19.N.Sad	

3. RESULTS

Within investigations of aquatic and semiaquatic flora and vegetation 31 plant species were detected, belonging to different life forms of aquatic macrophyta by their biological and ecological characteristics (submerged, floating, emerging,) and in 19 investigated localities are present with specific phytocenological indices.

Syntaxonic element SE 8.2, i.e. species characteristic for classis *Potametea* R. Tx. et Prsg. 1942, makes 42.8% of total taxons found in this aspect, with domination of SE 8.212, phytocenological elements of ordo *Potametalia* W.Koch 1926 and relation *Nymphaeion albae* Oberd. 1957, which point to sublitoral associations of submerged and floating plants in meso- and eutrophyc stagnant and slow-flowing waters. Phytocenological element 8.4 (species characteristic for classis *Phragmitetea* R. Tx. et Prsg 1942) has increased in comparison to previous period, and is present with somewhat lover percentage (37.5%) in comparison to previous vegetation group. Within this group edificators of associations *Phragmition communis* W. Koch 1926 are dominating - sublitoral, emerged vegetation of reed in stagnant and slow-flowing waters (8.4111), while characteristic species of eulitoral, submerged-emerged vegetation of smaller riverflows of association *Aparganio-Glicerion fluitantis* Br.-Bl. et Siss 1942 are present with only one taxon (3.57%).

Syntaxonomic element 8.1 (characteristic species from classis *Lemnetea* W.Koch et R. Tx. 1954, phytocenoses of free-floating flowering plants at water surface) are present with 14.28% and with highest frequency of edificators from order *Lemnetalia* W. Koch et R. Tx. 1954, i.e. association of floating flowering plants in stagnant and slow-flowing waters rich in nutrients (meso- and eutrophic waters - 8.11). Within accompanying species characteristic for these biotopes, in this stage of investigations presence of 15 plant taxons was found.

By analysis of syntaxonomical elements of taxons found in aquatic flora (SE- syntaxonomic - phytocenological elements, i.e. species characteristic for certain syntaxonomical categories - classes, ordi, relations and associations) presence of 3 classes of aquatic phytocenoses was found:

Potametea

Syntaxonic element SE 8.2, i.e. species characteristic for classis *Potametea* r. Tx. et Prsg. 1942, give more than 50% of total taxons found at investigated parts, with domination of SE 8.212, phytocenological elements from ordo *Potametalia* W.Koch 1926 and relation *Nymphaeion albae* Oberd. 1957, which detect sublitoral associations of submerged and floating plants.

Stands of plant associations in this classis are relatively rich (16 species, Tab. 1), where highest level of presence (V) has species *Ceratophyllum demersum*, an edification species of association *Ceratophyletum demersi*. Population of this plant species in its full development are the basic biomass in central parts of the channel, while in vertical profile they are distributed from the bottom to the surface of water, building so-called "underwater meadows" which directly disturbs water-economy function of the channel (slowing waterflow, decreasing currents, hindering navigation).

Somewhat lower but very significant level of presence of two endangered and protected species *Nymphaea alba* and *Nuphar lutea* (IV), edificators of association *Nymphaetum albo luteae*, having in mind relative oldness of this part of channel network, shows that these species, in situation when their autochthonous habitats are endangered, has found their secondary habitats in these human-caused biotopes.

The species with similar ecological demands, *Trapa longicarpa*, is expelled in certain measure and is present in lower presence level (III) and in smaller number of localities. This is to be expected in years of high peak of development for association *Nymphaetuym albo-luteae*.

With same presence level introduced (adventive) species *Elodea canadensis* (III) is present, but with a tendency of aggressive widening.
In life-forms specter, only hydrogeophyta are present (HydG 100%).

By review of ecological indices for characteristic species of these vegetation units, their ecological optimum is in moderately warm and light places (T 3-5, S 3-4), with neutral to slightly basic reaction (K 3-4), being characteristics for meso- and eutrophic waters (N 3-5)m except for two species: *Potamogeton gramineus* and *Nuphar lutea* (N2 - transition group towards indicators of oligotrophic waters). Having in mind high level of presence of *Nuphar lutea*, as well as even and stable distribution of this species in investigated localities, very favorable ecological conditions are indiced for hydrosystems of this type and purpose.

In specter of area types, highest percent participation have species of wide distribution, i.e. circumpolar groups of floristic elements - Eurasian, cosmopolitan, circumpolar and subcircumpolar (75%), while adventive (12.5%), middle European (6.5%) and submiddle European

(6.5%) species are much less present. Testing indices of floristic similarity during several decades period (Tab. 3), for this vegetation group high level of floristic similarity is obtained in comparison to investigations in previous period (85-90%), which repeatedly confirms stable ecological conditions within channel network in the last period of several years.

Tab.1 Phytocenological elements from clases *Potametea* R.Tx. et Prsg. 1942

	PH. E	SE	BILJNA VRSTA	LIFE FORM	PRES. VALUE	ecological indices				
						V	K	N	S	T
***Potametea* R.Tx. et Prsg. 1942**										
1	Subcirk.	8.2	*Myriophyllum spicatum* L.	rhiz sbmHydG	III	7	4	3	3	3
2	Adv.	8.2	*Elodea canadensis* L.	rhiz sbmHydG	III	7	-	-	-	-
3	Cirk.	8.2	*Potamogeton fluitans* Roth.	rhiznatHydG	II	7	3	3	3	3
4	Subcirk	8.2	*Polygonum amphibium* L.	rhiznatHydG	II	5	3	4	3	3
5	Cirk.	8.2	*Potamogeton gramineus* L.	rhiznatHydG	II	7	4	2	4	3
6	Cirk.	8.2	*Potamogeton lucens* L.	rhiz sbmHydG	II	7	4	4	3	3
7	Adv.	8.2	*Vallisneria spiralis* L.	rhiz sbmHydG	II	7	3	3	3	3
8	Kosm.	8.2	*Potamogeton perfoliatus* L.	rhiz sbmHydG	I	7	4	2	3	3
9	Kosm.	8.2	*Potamogeton pectinatus* L.	rhiz sbmHydG	I	7	4	4	3	3
***Potametalia* W.Koch 1926**										
10	Kosm.	8.21	*Ceratophyllum demersum* L.	ersbmHydG	V	7	4	5	3	4
11	Evr.	8.21	*Ranunculus circinatus* Sibth.	radsbmHydG	II	6	3	3	3	3
12	Evr.	8.21	*Nymphoides flava* Hill.	rhiznatHydG	I	6	3	4	4	5
***Nymphaeion albae* Oberd. 1957**										
13	Subse.	8.212	*Nymphaea alba* L.	rhiznatHydG	IV	6	3	3	4	4
14	Evr.	8.212	*Nuphar lutea* (L.) Sm.	rhiznatHydG	IV	6	2	2	4	3
15	Se.	8.212	*Trapa longicarapa* Jank.	stlnatHydG	III	6	3	4	4	4
***Rupietalia J.Tx*. 1960**										
16	Kosm	8.22	*Zanichellia palustris* L	radsbmHydG	I	6	4	4	3	3

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