

## WATER PLANT AND SWAMP VEGETATION OF VIROVI IN POSAVINA (CROATIA)

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In this work the results of phytosociological analysis of the water plant and swamp vegetation in the locality of Virovi in Slavonia (Croatia) are given. The analysis includes associations from the class *Lemnetea*, the order *Hydrocharietalia* (*Hydrocharitetum morsus-ranae*) and the order *Utricularietalia minoris* (*Lemno-Utricularietum vulgaris*), from the class *Potametea*, the order *Potametalia* (*Ceratophylletum demersi* and *Nymphaetum albo-luteae*) and from the class *Phragmiti-Magnocaricetea*, the order *Phragmitetalia* (*Typhetum angustifoliae*).

**Key words:** waterplant vegetation, swamp vegetation, Croatia

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U radu se navode rezultati fitocenološke analize vegetacije vodenjara i močvara na lokalitetu Virovi u Slavoniji (Hrvatska). Analizirane su asocijacije iz razreda *Lemnetea*, reda *Hydrocharietalia* (*Hydrocharitetum morsus-ranae*) i reda *Utricularietalia minoris* (*Lemno-Utricularietum vulgaris*), iz razreda *Potametea* i reda *Potametalia* (*Ceratophylletum demersi* i *Nymphaetum albo-luteae*), te iz razreda *Phragmiti-Magnocaricetea* i reda *Phragmitetalia* (*Typhetum angustifoliae*).

**Ključne riječi:** Vodenjarska vegetacija, močvarna vegetacija, Hrvatska

### INTRODUCTION

In a continuation of water plant and swamp vegetation phytosociological and syntaxonomical research in the lowlands of the Republic of Croatia, this vegetation was studied in the area of Virovi in Eastern Slavonia. As is known, the first data on water plant and swamp vegetation in Slavonia were published by HORVATIĆ (1931), but his relatively fragmentary data refer mostly to the part of Slavonia along the Drava River. As for the Drava River area (cf. TRINAJSTIĆ & FRANJIĆ, 1999), there are not very numerous recent data on the phytosociological features and floristic com-

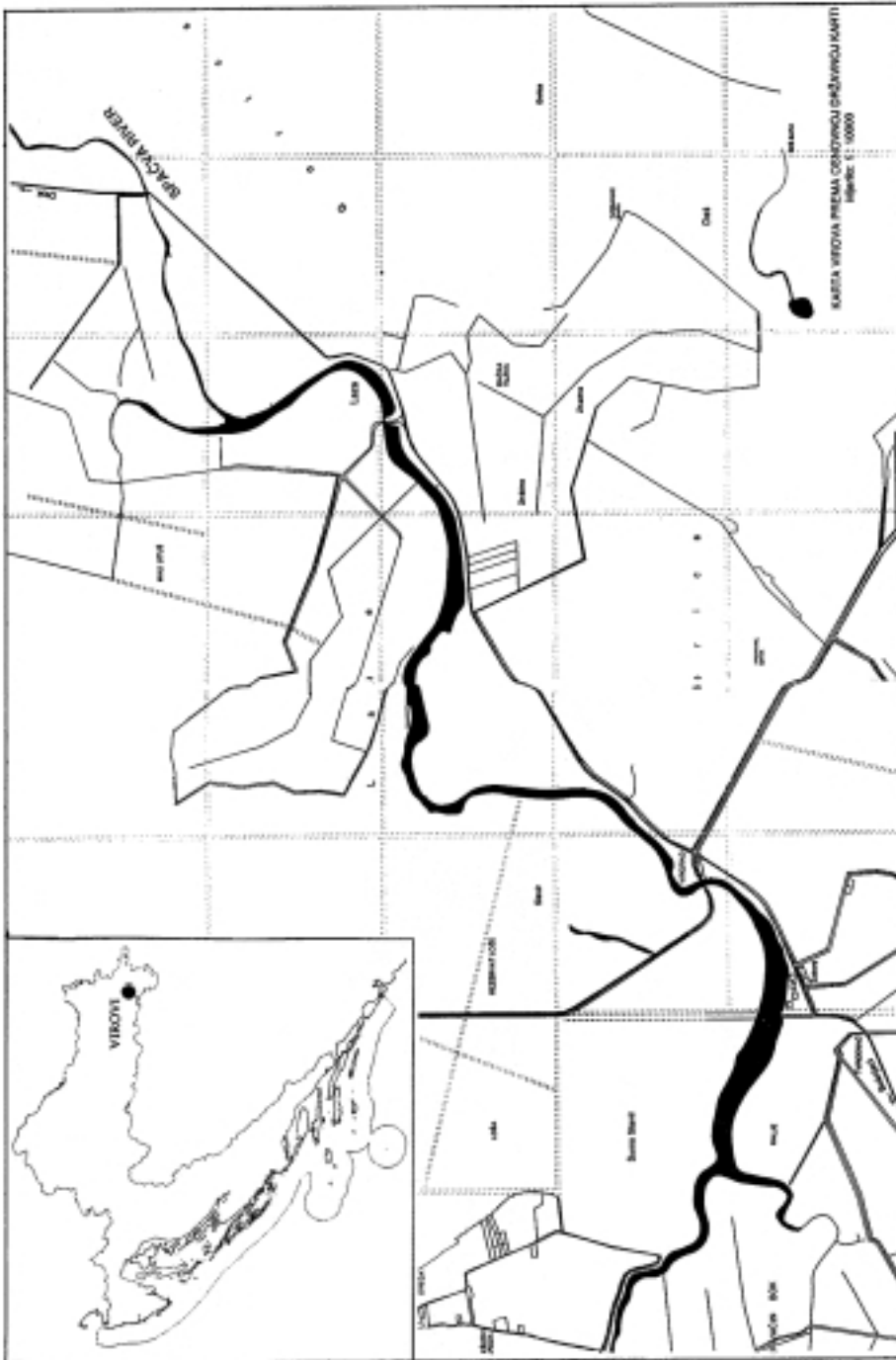


Fig. 1. Geographical position of the Virovi River

position of regional water plant and swamp vegetation with respect to the part of Slavonia along the Sava River either (cf. RAUŠ *et al.*, 1978; TRINAJSTIĆ & ZI. PAVLETIĆ, 1991; TRINAJSTIĆ *et al.*, 2000).

### Description of the study area

According to the brief topographical and hydrological description of Virovi given by ŠARČEVIĆ (1997), the area of Virovi is situated in the Spačva basin not far from Županja, between the villages of Bošnjaci and Otok (Fig. 1). This is an old Sava River backwater approximately 7 km long, 60 m wide and between 2 and 7 m deep. The Virovi is supplied with water from the Bosut River and Spačva River catchment areas as well as from the Virovi, Lubnja and Studva streams. The Virovi River differs from these streams by its specific hydrological conditions due to which at low water level a marshy aspect predominates while in spring and autumn during the rainy season when the water level is considerably higher, the Virovi basin is connected by a water flow with the Spačva River and further with the Bosut and Sava Rivers. The Virovi owes its name to several springs («whirlpools», Croatian »virovi») through which groundwater comes out into the Virovi basin. For this reason this water is very clear and relatively cold.

### METHOD

For making vegetation relevés, the standard combined evaluation floristic method of the Zürich-Montpellier School was used. Due to the limited space available in the tables because of the small number of species the following abbreviations are used in the syntaxonomic analysis of species characteristic of individual syntaxa:

- Ass. = Characteristic species of the association
- All. = Characteristic species of the alliance
- O. = Characteristic species of the order
- Cl. = Characteristic species of the class
- Co. = Companions

### SYNTAXONOMICAL REVIEW OF VEGETATION UNITS INVESTIGATED

On the basis of research carried out so far in the locality of Virovi, the following associations, classified into respective syntaxa, have been registered:

#### **CLASS LEMNETEA Bolós et Masclans 1955**

ORDER HYDROCHARIETALIA Rübel 1933

##### **All. *Hydrocharition* Rübel 1933**

1. Ass. *Hydrocharitetum morsus-ranae* Van Langendock 1935

ORDER UTRICULARIETALIA MINORIS Den Hartog et Segal 1964

**All. *Utricularion vulgaris* Pasarge 1964**2. Ass. *Lemno-Utricularietum vulgaris* Soó (1928) 1938**CLASS POTAMETEA R. Tx. et Preising 1942**

ORDER POTAMETALIA W. Koch 1926

**All. *Ranunculion fluitantis* Neuhäusel 1969**3. Ass. *Ceratophylletum demersi* Hild 1956**All. *Nymphaeion albae* Oberdorfer 1957**4. Ass. *Nymphaetum albo-luteae* Nowinski 1928**CLASS PHRAGMITI-MAGNOCARICETEA Klika in Klika et Nývák 1941**

ORDER PHRAGMITETALIA W. Koch 1926

**All. *Phragmition communis* W. Koch 1926**5. Ass. *Typhetum angustifoliae* Pignatti 1953

## SHORT DESCRIPTION OF STUDIED ASSOCIATIONS

**1. Ass. *Hydrocharitetum morsus-ranae* Van Langendock 1935**

This is the first time that this association has been studied in the part of Slavonia along the Sava River. Its floristic composition is shown in Tab. 1, on the basis of 3 relevés.

**Tab. 1.** Ass. *Hydrocharitetum morsus-ranae* Van Langendock 1935

No. of vegetation relevé:	1	2	3	Σ
Date:	16.7.1999.			
Size of vegetation relevé (m <sup>2</sup> ):	1	1	4	
No. of species/relevé:	5	5	6	5.3
Ass.:				
<i>Hydrocharis morsus-ranae</i> L.	2.3	4.4	3.3	3
All.,O.,Cl.:				
<i>Salvinia natans</i> (L.) All.	+	+	+	3
<i>Lemna trisulca</i> L.	2.3	.	+	2
<i>Spirodela polyrhiza</i> (L.) Schleid.	.	+	.	1
<i>Utricularia vulgaris</i> L.	.	.	+	1
Co.:				
<i>Ceratophyllum demersum</i> L.	4.4	4.4	5.5	3
<i>Polygonum amphibium</i> L.	+	+	.	2
<i>Typha angustifolia</i> L.	.	.	+3	1

Stands of the association *Hydrocharitetum morsus-ranae* in Virovi are somewhat poorer in respect to the number of species than those in the Drava River area (cf. TRINAJSTIĆ & FRANJIĆ, 1999). In Virovi a total of 8 species has been registered compared to 15 species registered in the Drava River area, but mostly in the group of accompanying plants.

## 2. Ass. *Lemno-Utricularietum vulgaris* Soó (1928) 1938

On this occasion, this association also has been registered for the first time in the part of Slavonia along the Sava River. Its floristic composition is shown in the following vegetation relevé. The relevé covers a surface of 1 m<sup>2</sup>.

Ass.:	
<i>Utricularia vulgaris</i> L.	2.3
All.,O.,Cl.:	
<i>Lemna trisulca</i> L.	1.3
<i>Hydrocharis morsus-ranae</i> L.	1.2
<i>Salvinia natans</i> (L.) All.	+2
<i>Lemna minor</i> L.	+
Co.:	
<i>Ceratophyllum demersum</i> L.	5.5

During the research in the summer of 1999, this association was relatively poorly developed, so only one vegetation relevé was analysed. Six species were registered and according to the floristic composition, the syntaxonomic structure is well pronounced, since among characteristic species five species were registered and among accompanying plants only one species. In the Drava River area stands (cf. TRINAJSTIĆ & FRANJIĆ, 1999), among characteristic species three species were registered and among accompanying plants also three species.

## 3. Ass. *Ceratophylletum demersi* Hild 1956

This association occupies practically the largest areas in the researched district, covering the basin bottom in all places where the depth of water is such to provide sufficient light. It consists of a small number of species, and its floristic composition is very homogenous, so two relevés only have been analysed (Tab. 2).

Tab. 2. Ass. *Ceratophylletum demersi* Hild 1956

No. of vegetation relevé:	1	2
Date:	16.7.1999.	
Size of vegetation relevé (m <sup>2</sup> ):	5	1
Ass.,All.,O.,Cl.:		
<i>Ceratophyllum demersum</i> L.	5.5	5.5
Co.:		
<i>Utricularia vulgaris</i> L.	+	1.2
<i>Hydrocharis morsus-ranae</i> L.	.	+

In the said relevés, the poverty of the floristic composition is clearly noticeable, and as a curiosity it can be said that not a single species of the genus *Myriophyllum* has been registered, so according to the research conducted so far the ass. *Caratophylletum demersi* in the Virovi area can be considered as fragmentarily developed.

#### 4. Ass. *Nymphaetum albo-luteae* Nowinski 1928

According to the area occupied by this association in the locality of Virovi, it is the second water plant association by frequency. It has already been studied in the part of Slavonia along the Sava River (cf. RAUŠ *et al.*, 1978; TRINAJSTIĆ & ZI. PAVLETIĆ, 1991). The floristic composition of ass. *Nymphaetum albo-luteae* is shown in Tab. 3, on the basis of 5 relevés.

Tab. 3. Ass. *Nymphaetum albo-luteae* Nowinski 1928

No. of vegetation relevé:	1	2	3	4	5	Σ
Date:	16.7.1999.					
Size of vegetation relevé (m <sup>2</sup> ):	50	200	100	20	20	
No. of species/relevé:	3	4	6	6	5	4.8
Ass.:						
<i>Nymphaea alba</i> L.	3.4	3.4	2.3	3.3	4.4	5
<i>Nuphar lutea</i> (L.) Sm.	.	.	2.3	+2	+2	3
All.,O.,Cl.:						
<i>Ceratophyllum demersum</i> L.	4.4	3.4	4.4	4.4	4.4	5
<i>Polygonum amphibium</i> L.	.	.	+3	+3	+3	3
Co.:						
<i>Hydrocharis morsus-ranae</i> L.	+	+	+2	+	+	5
<i>Typha angustifolia</i> L.	.	+2	+2	+2	.	3

In our phytosociological literature this association used to be known under the name of »*Myriophyllo-Nupharetum*« or »*Nymphaeo-Nupharetum*« (cf. HORVATIĆ, 1931; RAUŠ *et al.*, 1978; TRINAJSTIĆ & ZI. PAVLETIĆ, 1991); however according to the latest European standpoints based on the valid Syntaxonomic Code (BARKMAN *et al.*, 1986) it has been designated ass. *Nymphaetum albo-luteae* Nowinski 1928 (cf. SCHRATT, 1993).

#### 5. Ass. *Typhetum angustifoliae* Pignatti 1953

So far, from the part of Slavonia along the Sava River only one relevé of ass. *Typhetum angustifoliae* (cf. TRINAJSTIĆ & ZI. PAVLETIĆ, 1991) has been published, in the form in which it is differentiated synecologically from the complex *Scirpo-Phragmitetum* as understood by W. KOCH (1926). The floristic composition of ass. *Typhetum angustifoliae* is shown in Tab. 4, on the basis of 2 relevés.

**Tab. 4.** Ass. *Typhetum angustifoliae* Pignatti 1953

No. of vegetation relevé:	1	2	Σ
Date:	16.7.1999.		
Size of vegetation relevé (m <sup>2</sup> ):	50	50	
No. of species/relevé:	6	9	7.5
Ass.:			
<i>Typha angustifolia</i> L.	4.4	5.5	2
All.,O.,Cl.:			
<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	1.2	+	2
<i>Lycopus europaeus</i> L.	+	.	1
Co.:			
<i>Ceratophyllum demersum</i> L.	4.4	4.4	2
<i>Hydrocharis morsus-ranae</i> L.	+2	+3	2
<i>Utricularia vulgaris</i> L.	+	+2	2
<i>Salvinia natans</i> (L.) All.	.	+	1
<i>Lemna trisulca</i> L.	.	+	1
<i>Lemna minor</i> L.	.	+	1
<i>Spirodela polyrhiza</i> (L.) Schleid.	.	+	1

## DISCUSSION

Unfortunately, research into water plant and swamp vegetation in the lowlands of Croatia, in the area between the two large rivers the Sava and the Drava, has not been given adequate attention, and thus the said vegetation for the most part remained rather unknown to us. For this reason, a reliable comparison with the relatively well-studied analogue vegetation in Central Europe is generally impossible. The phytosociological features of water plant and swamp vegetation, represented in fresh water basins with stagnant water, in addition to their importance for theoretical knowledge are an important water quality indicator that can be used for practical purposes. Unfortunately, no systematic chemical analyses of water from fresh water basins in lowlands of Croatia have been made either, so the ecological features of regional vegetation forms are usually estimated qualitatively only, generally on the basis of Central European phytosociological literature.

## CONCLUSION

In the continuation of phytosociological and syntaxonomical research into water plant and swamp vegetation in the lowland region of the Republic of Croatia, the water plant and swamp vegetation in the locality of Virovi in the Spačva basin in Eastern Slavonia (Croatia) has been analysed.

Within the water plant vegetation of the class *Lemnetea*, the orders *Hydrocharietalia* with the alliance *Hydrocharition* (ass. *Hydrocharitetum morsus-ranae*) and *Utricularietalia minoris* and with the alliance *Utricularion vulgaris* (ass. *Lemno-Utricularietum vulgaris*) are represented. Within the class *Potametea* and the order *Potametalia* two alliances *Ranunculion fluitantis* (ass. *Ceratophylletum demersi*) and *Nymphaeion albae* (ass. *Nymphaetum albo-luteae*) are represented.

Within the swamp vegetation of the class *Phragmiti-Magnocaricetea*, of the order *Phragmitetalia* and of the alliance *Phragmition communis*, the ass. *Typhetum angustifoliae* has been analysed.

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## SAŽETAK

### Vodenjarska i močvarna vegetacija Virova u Posavini (Hrvatska)

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U nastavku fitocenološko-sintaksonomskih istraživanja vodenjarske i močvarne vegetacije u nizinskome dijelu Republike Hrvatske, analizirana je vodenjarska i močvarna vegetacija na lokalitetu Virovi u bazenu Spačve u istočnoj Slavoniji (Hrvatska).

Lokalitet Virovi nalazi se u bazenu Spačve nedaleko od Županje, između sela Bošnjaci i Otok. On predstavlja stari mrtvi rukav rijeke Save dug oko 7 km i širok



oko 60 m, dok se dubina vode kreće između 2–7 m. Virovi svoju vodu dobivaju od slivnoga područja rijeka Bosut i Spačva, te potoka Virovi, Lubnja i Studva. Od navedenih rijeka i potoka Virovi se razlikuju specifičnim hidrološkim prilikama, pa za niskog vodostaja prevladava močvarni aspekt, dok za vrijeme kišnoga razdoblja tijekom proljeća i jeseni vodostaj se znatno podigne i tada Virovi uspostavljaju protočnu vezu s rijekom Spačvom a preko nje s Bosutom i Savom. Virovi su svoje ime dobili po nekoliko izvora (»virova«) preko kojih podzemne vode izlaze u bazen Virova. Zbog toga je voda bistra i razmjerno hladna.

U sklopu vodenjarske vegetacije razreda *Lemnetea* zastupljeni su redovi *Hydrocharietalia* sa svezom *Hydrocharition* (as. *Hydrocharitetum morsus-ranae*) i *Utricularietalia minoris* i sa svezom *Utricularion vulgaris* (as. *Lemno-Utricularietum vulgaris*). U sklopu razreda *Potametea* i reda *Potametalia* zastupljene su dvije sveze *Ranunculion fluitantis* (as. *Ceratophylletum demersi*) i *Nymphaeion albae* (as. *Nymphaeetum albo-luteae*).

U sklopu močvarne vegetacije razreda *Phragmiti-Magnocaricetea*, reda *Phragmitetalia* i sveze *Phragmition communis* analizirana je as. *Typhetum angustifoliae*.