

TEN-YEAR CHANGES IN COMMUNITY STRUCTURE,
SOIL AND HYDROECOLOGICAL CONDITIONS
OF THE VEGETATION IN THE PROTECTION AREA AT MÁRTÉLY
(S. HUNGARY)

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Abstract

The studies reported here were concentrated mainly on the Körtvélyes holm of the landscape protection area at Mártély. It was set as an aim to clarify the relationships among plant associations developed here, the physical structure and moisture supply of their soils, the accumulation of sodium salts as well as the degree and duration of flooding. The submerged aquatic plant communities of the backwaters of different ages perished completely after the introduction of the herbivorous silver carp (*Ctenopharyngodon idella*). In the deepest section of the holm, on the hardest alluvial soil least permeable to water and longest exposed to stagnant waters *Glycerietum maximae*, *Leucanthemo serotino-Plantaginifolii*, *Carici-Typhoidetum arundinaceae* developed. In the zone covered with stagnant water for a shorter period, *Carici melanostachyae-Alopecuretum*, and subsequent to it *Lythro virgatae-Alopecuretum pratensis* appeared. Between the terracelike formed dand dunes, in lastingly flooded zone, the weed community of *Echinochloo-Bidentetum* occurs, and on the alluvials of the riverside *Elatini-Eleocharitium ovatae* association grows. To elucidate their hydroecological conditions, each of the ten categories was divided into 3 subgroups by further improving the system proposed by ELLENBERG, and later that of ZÓLYOMI et al. In this way 30 intracategory subunits were separated by means of hydroecological graphs constructed for their species components. The species most sensitive to lasting flooding (2—4 m water depth) (duration: 2—4 weeks) is *Typhoides arundinacea*, while *Glycyrrhiza echinata* and in a lesser degree *Lythrum salicaria* can least tolerate the shading effect of small forests.

Introduction

The original vegetation of the Tisza valley has suffered great alterations since the construction of the flood protection dyke systems. Nowadays this area can be divided to the flood-plain inside the embankment and the protected parts of the previous flood-area outside it.

The flow rate of the passing flood restricted to a rather narrow flood-plain was greatly increased by the short cuts of river sections resp. the regulation of the river bed. The greatest part of the embanked area on the protected side of the dams became agricultural resp horticultural tillage. As a result of that, the ancient vegetation of marshes and meadows along the Tisza as well as the riverside gallery forests are now mostly things of the past. The composition of the plant cover in the flood-plain between the protecting dams has been exhibiting great changes. This pertains particularly to our experimental area, the Körtvélyes holm, which is one of the lowest-lying areas of the river valley. During periods of flooding, it is often covered by a

2—4 m high mass of water. At the same time, the floods occur at rather uncertain intervals. Sometimes there is no flood, and sometimes it occurs more than once during the vegetation period. These floodings affect the species composition of aquatic, meadow- and marsh-phytocenoses.

Our goal was to follow up these changes, to explore principally the physical, chemical and hydroecological conditions between them. Since the area surrounded by the river itself and the backwater is generally not exposed to anthropogenic effects, it was thought desirable to maintain it as a reservation. In this way the investigations reported here are also of interest from the aspect of nature conservation.

Materials and Methods

The main intention was to determine the communities occurring in this area, to tabulate and range them into the cenological system. Instead of the numerical listing of the percentages of D values in the tables, the graphical illustration of data was chosen to make the survey easy and fast.

To establish their phytomass production, experimental parcels were allocated. These contained the most important zones of vegetation. Earlier results in this field have already been reported (BODROGKÖZY and HORVÁTH 1977, 1979). Since here the different hydroecological effects of floods, resp. stagnant waters remaining behind after the flood waves manifest themselves, it was thought necessary to categorize the species of the single associations and their smaller units according to water demand resp. water tolerance. Moreover, it was also found desirable to range them into smaller groups inside the single categories. The generally adopted ELLENBERG system (1952) which was adapted to conditions existing in our country by ZÓLYOMI et al. (1967), was further improved in the interest of these investigations. After all, it became possible to differentiate 30 hydroecological varieties inside the 10 categories. To make the procedure more simple, the hydroecological categories were marked with their abbreviated names and the varieties with numbers. In the case of the latter the character species were marked with number 2, the species belonging to the former resp. next category with numbers 1 and 3 (hd 1 and sx 3 represent extreme values).

To make hydroecological determinations more exact, a hydroecological graph resp. curve was constructed for each species recovered during this study. This could be solved partly on the basis of results and experiences obtained during my 30-year investigations on the Tisza, partly on that of pertaining literary data, first of all Soó's work (1964—1980). The narrower the hydroecological demand of a species, the higher the percentual value indicated by the climactic point of its graph (generally in excess of 50%). The comparison of Figs. 1B and 12A well exemplifies this.

Of the environmental biological factors, the ecological situations of the soil of water supply indicator phytocenoses should also be cleared. The importance of this was pointed out by ESKUCHE (1963). It is essential to know the distribution of soil fractions principally influencing dead water content and water permeability. With a view to this, six fractions were separated by using the hydrometer technique. In this way we could determine the percentual ratios of two sand, two silt and two clay fractions.

The determinations of organic matter and CaCO_3 contents, pH, and the amount of sodium salts were performed parallel with these analyses. The seasonal changes of water supply in the soil profiles of the single communities were also investigated. In the course of that the changes were considered from 3 aspects: moisture content in the percentage of dry resp. wet soil weight and moisture content expressed in liter. dm^{-3} unit.

For the sake of a better survey, the results of the soil ecological investigations of the single plant communities are illustrated by monolithical, three-dimensional graphs.

Hydroecological categories

hydatophytes, growing in aquatic environment	hd	1 <i>Lemna</i> type 2 <i>Ceratophyllum</i> type 3 <i>Nymphaea</i> type
hydato-helophytes growing in aquatic, marshy environment	hhe	1 <i>Hottonia palustris</i> type 2 <i>Butomus umbellatus</i> type 3 <i>Iris pseudacorus</i> type
helophytes growing in marshy envi- ronment	he	1 <i>Carex gracilis</i> type 2 <i>Lysimachia vulgaris</i> type 3 <i>Teucrium scordium</i> type
helo-hygrophytes growing in damp environment	hhg	1 <i>Eleocharis palustris</i> type 2 <i>Carex melanostachya</i> type 3 <i>Thalictrum flavum</i> type
hygrophytes growing in fresh environment	hg	1 <i>Carex hirta</i> type 2 <i>Galium rubioides</i> type 3 <i>Poa trivialis</i> type
hygro-mesophytes growing in drying environment	hgm	1 <i>Alopecurus pratensis</i> type 2 <i>Chenopodium polyspermum</i> type 3 <i>Polygonum lapathifolium</i> type
mesophytes in medium dry envi- ronment	m	1 <i>Inula britannica</i> type 2 <i>Lolium perenne</i> type 3 <i>Chenopodium album</i> type
meso-xerophytes growing in dry habi- tat	mx	1 <i>Galium verum</i> type 2 <i>Poa angustifolia</i> type 3 <i>Euphorbia cyparissias</i> type
asteno-xerophytes growing in dryer habitat	ax	1 (<i>Poa bulbosa</i> type) 2 (<i>Bothriochloa ischaemum</i> type) 3 (<i>Thymus marschallianus</i> type)
steno-xerophytes growing in very dry habitat	sx	1 (<i>Potentilla arenaria</i> type) 2 (<i>Koeleria glauca</i> type) 3 (<i>Euphorbia seguieriana</i> type)

This implies that it became necessary to differentiate 10 categories in this system. Since each species can be ranged into one of these, the groups of indifferent species are no more of importance and can be eliminated. The single sub-groups can be also regarded as hydroecological types. Their type species occur along the Tisza. Since the asteno- and stenoxerophytes do not occur there, their name-giving species were put into parenthesis.

**Cenosystematics of the vegetation units in the landscape protection
district investigated**

(Compilation according to Soó's system, with allowance for conditions of zonation)

LEMNO-POTAMEA Soó 68

Hydrochari-Lemnetea OBERD. 68

Hydrocharietalia RÜBEL 33

(Syn.: Lemnetalia W. KOCH et TX ex OBERD. 57)

Lemnion minoris W. KOCH et TX ex OBERD. 57

(Syn.: Lemnion trisulcae DEN HARTOG et SEGAL 64)

1. *Wolffietum* MYAW. et TX 60
 - wolffietosum arrhizae, typicum
 - potamogetosum lucentis
 - polygonetosum amphibii
2. *Salvinio-Spirodeletum polyrrhizae* MAYAW. et TX 60
(Syn.: Lemno-Spirodeletum salvinietosum W. KOCH 54)

POTAMOGETONETEA TX et PRSC. 42

Potamogetonetalia W. KOCH 26

Ranunculion fluitantis NEUH. 59

(Syn.: Callitricho-Batrachion DEN HARTOG et SEGAL 64)

3. *Ranunculeto trichophylli-Callitrichetum cophocarpae* (Soó 27)

(Syn.: Batrachio trichophylli-Callitrichetum Soó/27/60

Ranunculetum trichophylli Soó 27/Soó/27/60

Potameto-Callitrichetum BALÁZS 42)

— — ranunculetosum typicum Soó 57)

Nymphaeion

4. *Trapetum natantis* MÜLL. et GÖRS 60

Magnopotamion WOLLMANN 47

5. *Potamogetonetum lucentis* HUECK 31

ISOËTO-NANOJUNCETEA BR.-BL. et TX 43

Cyperetalia fusci (KLIKA 35) MÜLL.-ST. et PIETSCH 61

Elatini-Eleocharition ovatae PIETSCH 73

6. *Dichostylidi-Gnaphalietum uliginosi* (HORVATIĆ 31) Soó et TIM. 47
(Syn.: Dichostyletum michelianaee Soó 40)
 - gnaphalietosum uliginosi, typicum
 - crypsidetosum aculeatae
 - heleochloetosum schoenoidis
7. *Cypereto-Juncetum bufonii* Soó et CSÜRÖS (44) 47
 - cyperetosum fusci, typicum
 - potentilletosum supinae
 - xanthietosum italici

CYPERO-PHRAGMITEA Soó 68

PHRAGMITETEA TX. et PRSC. 42

Phragmitetalia W. KOCH 26

Phragmition communis W. KOCH 26

8. *Scirpo-Phragmitetum austro-orientale* Soó 57

9. *Glycerietum maximae* HUECK 31
10. *Typhoidetum arundinaceae* EGGER 33
(Syn.: Phalaridetum arundinaceae
Baldingeretum arundinaceae Soó 47)
11. *Leucanthemo serotino-Phragmitetum* Soó 71
— phragmitetosum, typicum
— calystegietosum

Magnocaricetalia PIGN. 53

Magnocaricion elatae W. KOCH 26

B. *Caricion gracilis* BAL.-TUL. 63

12. *Carici gracilis-Typhoidetum arundinaceae* Soó 71
(non Agrostio-Typhoidetum, Phalaridetum ass.)
— typhoidetosum, typicum
13. *Caricetum gracilis* (ALM. 29; GRAEB. et HUECK 31) Tx. 37
(Syn.: Caricetum gracilis-nutantis Soó 40)
— caricetosum gracilis, typicum
— bolboschoenetosum maritimi

MOLINIO-ARRHENATHEREA Soó 68

Molinio-Juncetea BR.—BL. 49

Molinietalia W. KOCH 26

Alopecurion pratensis (PASSARGE 46) Soó 71

(Syn.: Agropyro-Alopecurion pratensis MORAVEC 64)

14. *Carici-Alopecuretum pratensis* Soó 71.
(Syn.: Alopecuretum pratensis hung. (Now. 28) Soó 57
Alopecureto-Festucetum pratensis UBR. 55)
— caricetosum melanostachyae, typicum
— bolboschoenetosum maritimi
— alopecuretosum pratensis
15. *Lythro virgatae-Alopecuretum pratensis* BODRK. 77
(Syn.: Alopecuretum pratensis hung. normale
Agrosteto-Alopecuretum pratensis UBR. 55)
— alopecuretosum pratensis, typicum
— glycyrrhizetum echinatae
— poetosum angustifoliae
16. *Poo angustifoliae-Alopecuretum pratensis* (EGGLER 59) BODRK. 62
(Syn.: Alopecuretum pratensis hung. poetosum angustifoliae BODRK. 62)

CHENOPODIO-SCLERANTHEA HADAČ 67

Secalietea BR.—BL. 31

Eragrostetalia J. TX. 61

Consolido-Eragrostion

17. *Digitario-Portulacetum oleraceae* (FELF. 42) TIM. et BODRK. 55

CHENOPODIETEA BR.—BL. 51

Chenopodietalia Tx. et LOHM. 50

Convolvulo-Agropyron repentis GÖRS. 66

18. *Agropyro-Convolvuletum arvensis* FELF. 43

— agropyretosum repentis
— rubetosum caesii

GALIO-URTICETEA Soó 71

Calystegietalia Tx. 50

Calystegion sepium TX. 47

19. *Bidenti-Calystegietum* FELF. 43

— calystegietosum, typicum

— bidentetosum tripartitae

BIDENTETEA TRIPATITAE Tx., Lohm. Prsg. 50

Bidentetalia Br.-Bl et Tx. 43

Bidention tripartitae NORDH. 40

20. *Echinochloo-Bidentetum tripartitae* Soó 71

— bidentetosum, typicum

— echinochloetosum

21. *Echinochloo-Heleochoetum alopecuroidis* (n. nov)

(Syn.: Cyperio-Spergularion: Heleochoetum alopecuroidis (RAPCS. 27) UBR. 48)

— heleochoetosum alopecuroidis

— agrostetosum stoloniferae

— portulacetosum oleraceae

Chenopodium rubri Br.-Bl.

22. *Echinochloo-Polygonetum lapathifolii* (UJV. 40) Soó et CsÜRÖS (40) 47

PLANTAGINETEA MAJORIS TX. et PRSG. 50

Plantaginetalia Tx. (47) 50

Agropyro-Rumicion crispi NORDH. 40

23. *Lolio-Alopecuretum pratensis* BODRK. 62

Detailed evaluation

1. *Wolffietum arrhizae* MYAM. et TX. 60

(Syn.: *Wolffio-Lemnetum gibbae* BERH. 43)

Occurrence: It forms large stands in some places in the backwaters of the landscape protection district. It often occurs among other floating resp. submerged aquatic plant stands delivered there by the waves. In this way, it does not occur only in the inner, deep-water sections of backwaters, but in the littoral, too, where it forms various stands of transitory nature. Since the introduction of herbivorous fish into these waters, this association together with the other aquatic plants has disappeared completely. In the last years after the fish were caught, it has regenerated.

Character species: *Wolffia arrhiza* and *Lemna gibba*. The latter is very rare in this area.

Subassociations:

— wolffietosum, typicum

It often forms pure stands in the deeper sections of the backwaters (FINTA 1979).

— potametosum lucentis

Its differential species is the *Potamogeton lucens* L. (hd 2 type). The occurrence is similar to the previous wolffietosum subassociation but in other places it shows transition to large aquatic plant communities.

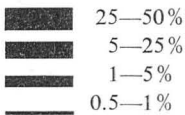
— polygonetosum amphibii

Differential species are *Myriophyllum spicatum* L., *Ceratophyllum demersum* L. (also belonging to the hd 2 type), but principally the *Polygonum amphibium* L. f. *aquaticum* LEYSS (hd 3 type). It occurs particularly in the drying sections of the backwaters. *Polygonum* can best adapt itself to drying (see other details in Table 1 and Fig. 1-A).

Table 1. *Wolffietum arrhizae*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Wolffietosum	Potamogetosum lucentis	Polygonetosum amphibii
Hydatophyta										
HH	R 0	T 0	F 5	N ?	hd 1	<i>Wolffia arrhiza</i>	Lemnion	■	■	■
HH	R 0	T 0	F 5	N ?		<i>Spirodela polyrrhiza</i>	Lemnion	■	■	
HH	R 0	T 0	F 5	N ?		<i>Lemna minor</i>	Lemno-Potametea	■		
HH	R 4	T 2	F 5	N ?	hd 2	<i>Myriophyllum spicatum</i>	Potamion	■		■
HH	R 4—5	T 5	F 5	N ?		<i>Ceratophyllum demersum</i>	Potametalia			■
HH	R 4	T 3	F 5	N ?		<i>Potamogeton lucens</i>	Potamion		■	■
HH	R 0	T 0	F 3—5	N 0	hd 3	<i>Polygonum amphibium</i> var. <i>aquaticum</i>	Phragmitetea	■		■
Hydato-helophyta										
HH	R 0	T 0	F 5	N 3	hhe 3	<i>Alisma plantago-aquatica</i>	Phragmitetea	■		■
HH	R 4—3	T 3	F 4—5	N 3		<i>Glyceria maxima</i>	Phragmition	■		■

Symbols: D-value



(The symbols apply to tables 1—14)

2. *Salvinio-Spirodeletum polyrrhizae* W. KOCH 54.

(Syn.: Lemno-Spirodeletum salvinietosum W. KOCH 54)

Occurrence: It is most frequent in the littoral zone of the backwaters in this district, when the zone of aquatic macrophytes is missing as a consequence of the increased culture effects, particularly industrial fishing. Its stands together with the former one are drifted away by inundations recurring more than once in one year. In flood-free periods, however, it regenerates rapidly.

Character species are *Salvinia natans* (L.) ALL., *Spirodela polyrrhiza* (L.) SCHLEIDEN, each of them belonging to the hd 1 type.

Subassociations:

— salvinietosum, typicum

Hd 1 species of Hydrocharition and species of Lemnion and Lemno-Potamea dominate. The other species occur individually, their contributions to cover is small.

— hydrocharetosum

Besides the previous species, the type hd 1 *Hydrocharis morsus ranae* L. is its differential species, but species of hd 3, hhe 2 and 3 types are also essential. Thus e.g. *Schoenoplectus lacustris* (L.) PALLA, *Bolboschoenus maritimus* (L.) PALLA also mingles with its stand, when drifted into the littoral zone (Table 2, Fig. 1-A).

Table 2. *Salvinio-Spirodeletum*

Life form	Acidity of soil	Temperature	Water demand	N-demans	Hydroecological character	Species	Character species	Salvinietosum	Hydrocharetosum
Hydatophyta									
HH	R 0	T 0	F 5	N ?	hd 1	<i>Salvinia natans</i>	Hydrocharicion	█	█
HH	R 0	T 0	F 5	N ?		<i>Spirodela polyrrhiza</i>	Lemnion	█	█
HH	R 3	T 3	F 5	N ?		<i>Hydrocharis morsus ranae</i>	Lemno-Potamea	█	█
HH	R 0	T 0	F 3—5	N 0	hd 3	<i>Polygonum amphibium</i> var. <i>aquatium</i>	Phragmitetea	█	█
HH	R 3—2	T 3—4	F 5	N ?		<i>Trapa natans</i>	Nymphaeion	█	█
Hydato-helophyta									
HH	R 3—4	T 0	F 4—5	N 2—3	hhe 2	<i>Schoenoplectus lacustris</i>	Phragmition	█	█
HH	R 0	T 3	F 5	N 3		<i>Butomus umbellatus</i>	Phragmitetea	█	█
HH	R 3—4	T 0	F 4	N 2	hhe 3	<i>Bolboschoenus maritimus</i>	Bolboschoenion	█	█
Helophyta									
HH	R 0	T 0	F 5	N 3	he 1	<i>Typha latifolia</i>	Phragmitetea	█	█
HH	R 3—4	T 0	F 0	N 3—4		<i>Phragmites australis</i>	Phragmitetea	█	█
HH	R 3	T 2—3	F 4	N 2—4		<i>Carex gracilis</i>	Magnocaricion	█	█
HH	R 0	T 3	F 5	N 2		<i>Oenanthe aquatica</i>	Phragmitetalia	█	█
HH	R 0	T 2	F 3—4	N 0—3	he 2	<i>Lysimachia vulgaris</i>	Molinio-Juncetea	█	█
HH	R 3—4	T 3	F 5	N 2—3		<i>Sium latifolium</i>	Phragmition	█	█

3. *Ranunculo trichophylli-Callitricetum cophocarpae* Soó (27) 60
 (Syn.: *Batrachio trichophyllo-Callitricetum* (Soó 27) 60
Ranunculetum trichophylli Soó 27
Potameto-Callitricetum BALÁZS 42)

Occurrence: It is found occasionally in the lower-lying areas with stagnant water in our district, in the place of the perished stands of *Carici-Typhoidetum*. It is carried there by floods. In other instances it forms the lower synusium of the stands of *Carici-Typhoidetum*. It is rare in the backwaters. After the drying of stagnant waters it can persist for a longer period on the damp alluvial soil in "terrestris" form.

Character species: hd 2 *Ranunculus radians* RÉVEL var. *godronii* A. et G., *R. trichophyllus* (CHAIX in VILL) V. D. BOSCH. Its stands consist generally of a few species which belong partly to Ruppion, Potametalia, resp. Lemno-Potamea.

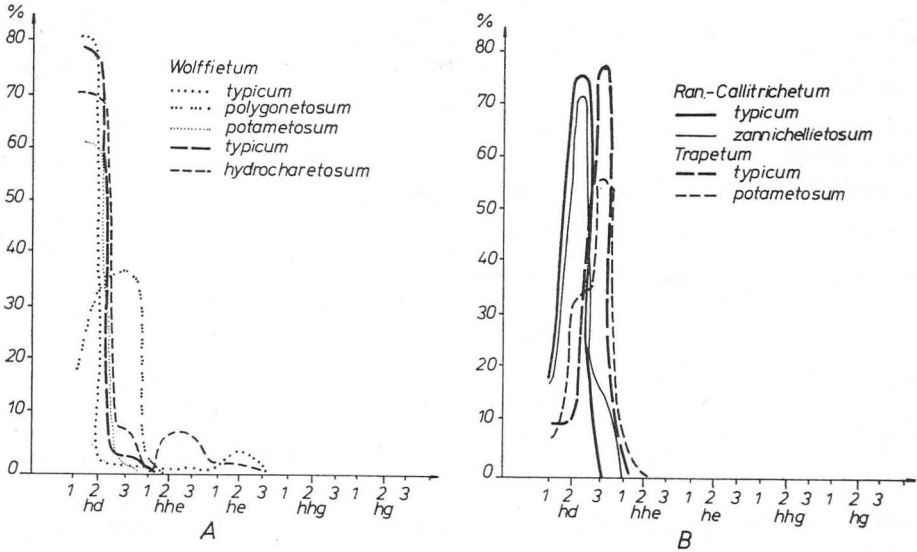


Fig. 1. Graphical illustration of the hydroecological conditions of four aquatic plant communities

Subassociations:

- *ranunculetum radiantis*, *typicum*
- *zannichellietosum*

Differential species: hd 2 *Zannichellia palustris* L. var. *pedicellata*. The contributions of the single species to cover are seen in Table 3. The percentual values for total cover according to hydrological categories are presented in Fig. 1-B.

4. *Trapetum natantis* MÜLL. et GÖRS 60
 (Syn.: *Nupharo-Castalietum trapetosum* TIM. 54)

Occurrence: It was the most frequent and common water plant community in the backwaters of the area before the introduction of herbivorous fishes. Today it is still sporadic, its considerable spread can be expected only in places where the sections of the backwaters are no more suitable for industrial fishery for sedimentation (lack

Table 3. *Ranunculo trichophyllo-Callitrichetum*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Ranunculetosum radiantis	Zannichellietosum
Hydatophyta									
HH	R 0	T 0	F 5	N ?	hd 1	<i>Cladophora glomerata</i>	Lemno-Potamea (?)	■	■
HH	R 2—4	T 3	F 5	N ?	hd 2	<i>Ranunculus radians</i> v. <i>godronii</i>	Ruppion	■	■
HH	R 0	T 2	F 5	N ?		<i>Ranunculus trichophyllus</i> ssp. <i>rionii</i>	Potametalia	■	■
HH	R 3—4	T 0	F 5	N 3		<i>Zannichellia palustris</i> var. <i>pedicellata</i>	Ruppion		■
HH	R 0	T 0	F 3—5	N 0	hd 3	<i>Polygonum amphibium</i> v. <i>aquatilis</i>	Phragmitetea	■	■
Helophyton and Helo-hygrophyton									
HH	R 3	T 2—3	F 4	N 2—3	he 1	<i>Carex gracilis</i>	Magnocari-cion		■
HH	R 0	T 0	F 4—5	N 2—3	hhg 1	<i>Eleocharis palustris</i>	Phragmitetea		■

of silver carp). In some undisturbed sections it forms a mosaic complex with stands of *Nymphaeetum albae*.

Character species: Type hd 3 *Trapa natans* L. and *Polygonum amphibium* L. f. *aquaticum* LEYSS.

Subassociations:

- trapetosum natantis, typicum
- potametosomea lucentis

Its differential species are the two species of Potamion, the *Potamogeton lucens* L. and *Lemna trisulca* L. both belonging to hd 2 type. It shows transition to Potametum lucentis, but is not identical with it (cf. Fig. 1-B in Table 4).

5. *Potametum lucentis* HUECK 31 (Syn.: Myriophyllo-Potametum lucentis Soó 57)

Occurrence: It is the most common submerged aquatic plant community not only in our area but also in the other standing waters of the valley of the Tisza. It thrives well also in the shallow clay-ditches along the temporarily drying out protecting dykes. It is resistant to the damaging effect of the gley soil.

Character species: type hd2 *Potamogeton lucens* L. and *Myriophyllum spicatum* L.

Table 4. *Trapa natans*

Life form	Acidity of soil	Temperature	Water demand	N-demans	Hydroecological character	Species	Character species	Trapetosum	Potamogetosum lucentis
Hydatophyta									
HH	R 0	T 2	F 5	N ?	hd 1	<i>Lemna minor</i>	Potamion	■	■
HH	R 4	T 0	F 5	N ?	hd 2	<i>Lemna trisulca</i>	Lemno-Potamea	■	■
HH	R 4	T 2	F 5	N ?		<i>Myriophyllum spicatum</i>	Potamion	■	■
HH	R 4	T 3	F 5	N ?		<i>Potamogeton lucens</i>	Potamion	■	■
HH	R 0	T 0	F 3—5	N 0	hd 3	<i>Polygonum amphibium</i> var. <i>aquaticum</i>	Phragmitetea	■	■
HH	R 3—2	T 3—4	F 5	N 0		<i>Trapa natans</i>	Nymphaeion	■	■
Hydato-helophyta									
HH	R 0	T 3	F 5	N 3	hhe 2	<i>Butomus umbellatus</i>	Phragmitetea	■	■
HH	R 3—4	T 3	F 5	N 3	hhe 3	<i>Sagittaria sagittifolia</i>	Phragmition	■	■
HH	R 0	T 0	F 5	N 3		<i>Alisma plantago-aquatica</i>	Phragmitetea	■	■
HH	R 4—3	T 2—3	F 4	N 2—3		<i>Glyceria maxima</i>	Phragmition	■	■
Helo-hygrophyta									
HH	R 0	T 0	F 4—5	N 2—3	hhg 1	<i>Eleocharis palustris</i>	Phragmitetea	■	■

Subassociations:

— potametosum lucentis, typicum

Its pure stands often occur together with a few accessory species.

— trapetosum natantis

Its stands form a transition to Trapedium community. Its differential species are *Trapa natans* L. (hd3), *Myriophyllum spicatum* L. and *Ceratophyllum demersum* L. (hd 3).

These floating and submerged aquatic plant communities living in standing waters, do not reveal great differences in the various sections of the Tisza valley (TIMÁR 1950, 1954, TIMÁR and BODROGKÖZY 1969); the richest and most beautiful stands occurred in backwaters near Tiszafüred before the construction of the Tisza II (Kisköre) Reservoir (BODROGKÖZY 1965).

6. *Dichostylidi-Gnaphalietum uliginosi* (HORVATÍC 31) Soó et TIM. 47
(Syn.: *Dichostyleto micheliana* Soó 40)

Occurrence: It is very common in the littoral zone of the river, not only in our investigation area but in other places, as well. It is a mud-living plant community with short growing season (TIMÁR 1950, TIMÁR and BODROGKÖZY 1969). Its stands

Table 5. *Potametum lucentis*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Potamogetosum lucentis	Trapotosum natantis
Hygatophyta									
HH	R 3	T 3	F 5	N ?	hd 1	<i>Hydrocharis morsus-ranae</i>	Lemno-Potamea	—	—
HH	R 0	T 0	F 5	N ?		<i>Spirodela polyrrhiza</i>	Lemnion	—	—
HH	R 4	T 3	F 5	N ?	hd 2	<i>Potamogeton lucens</i>	Potamion	—	—
HH	R 4	T 2	F 5	N ?		<i>Myriophyllum spicatum</i>	Potamion	—	—
HH	R 3—4	T 3	F 5	N ?		<i>Potamogeton perfoliatus</i>	Potamion	—	—
HH	R 4—5	T 2	F 5	N ?		<i>Ceratophyllum demersum</i>	Potamion	—	—
HH	R 0	T 0	F 3—5	N 0	hd 3	<i>Polygonum amphibium</i> var. <i>aquatilis</i>	Phragmitetea	—	—
HH	R 3—2	T 3—4	F 5	N ?		<i>Trapa natans</i>	Nymphaeion	—	—
Hydat-helophyton and helophyton									
HH	R 4—5	T 2	F 5	N ?	hhe 3	<i>Glyceria maxima</i>	Phragmition	—	—
HH	R 3—4	T 0	F 5	N 0	he 2	<i>Rorippa amphibia</i>	Phragmitetea	—	—

are made up mainly of ephemeral species. During recurring summer floods, however, the sandy alluvial soil of river banks remain without vegetation. Its seeds resp. fruits are delivered by river water to the shore in variable amounts and condition whereby the single mud plant communities may form mosaic-like complexes. Transition to *Cypero-Juncetum*, *Crypsidetum aculeatae* and *Chenopodietum rubri* can also occur.

Character species: *Dichostylis micheliana* (L.) NEES, *Potentilla supina* L., *Gnaphalium uliginosum* L., *Botrydium granulatum* L. belonging to the he 3 type.

Subassociations:

— gnaphalietosum uliginosi, typicum

Differential species: *Gnaphalium uliginosum* L., *Chlorocyperus glomeratus* (TORN) PALLA. — It is the most common variety of the association in our area. From hydroecological aspect its species belong almost exclusively to the he 3 type (Table 6).

— crypsidetosum aculeatae

It shows transition to *Crypsidetum aculeatae*, but is not identical with it. — Its differential species is the type hhg 1 *Crypsis aculeata*. The *Crypsidetum* has two ecotypes: (a) the *Halo-Crypsidetum aculeatae* BODRK. 67 occurring on slightly sodic solonchak soil and (b) *Crypsidetum aculeatae* BOJKO 32 growing on alluvial mud along the river with easily differentiable character species. In these stands the *Juncus effusus* L. (hhg 1) and *Ranunculus sceleratus* L. (hhg 2) are also characteristic.

Table 6. *Dichostylidi-Gnaphalietum uliginosi*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Gnaphalietosum uliginos	Crypsidetosum	Heleochloetosum schoenoidis
Helophyta										
HH R 0	T 2	F 4—5	N 2	he 2	<i>Veronica anagallis-aquatica</i>	Cyp.-Spergularion				
Th R 2—3	T 0	F 3—4	N 2	he 3	<i>Gnaphalium uliginosum</i>	Nanocyperion	■	■	■	
Th R 3	T 3—4	F 4	N 2—3		<i>Dichostylis micheliana</i>	Nanocyperion	■	■	■	
Th R 3—2	T 3	F 5	N 2—3		<i>Potentilla supina</i>	Nanocyperion	■		■	
H R 3	T 3—4	F 4	N ?		<i>Chlorocyperus glomeratus</i>	Nanocyperion	■			
					<i>Botrydium granulatum</i>	Nanocyperion	■			
Helo-hygrophyta and Hygrophyt										
Th R 4	T 4	F 2—4	N 1	hhg 1	<i>Crypsis aculeata</i>	Cyperio-Spergularion		■		■
H R 2—3	T 0	F 4	N 3		<i>Juncus effusus</i>	Juncio-Molinieta		■		
H R 3	T 2—3	F 4	N 3	hhg 2	<i>Alopecurus geniculatus</i>	Agrostion				■
Th R 0	T 1	F 5	N 4		<i>Ranunculus sceleratus</i>	Bidention		■		
Th R 0	T 0	F 3	N 3—4		<i>Chenopodium rubrum</i>	Bidentetea		■		■
H R 3	T 2	F 4—5	N 2	hhg 3	<i>Veronica beccabunga</i>	Glyc.-Sparganion	■			
Th R 4	T 4	F 2—4	N 1		<i>Heleochloa schoenoides</i>	Cyperio-Spergularion		■		■
Th R 0	T 3	F 3—4	N 3—4		<i>Bidens tripartita</i>	Bidentetea		■		■
H R 0	T 3—4	F 4	N 3	hg 1	<i>Mentha pulegium</i>	Agr.-Rumicion		■		
Th R 0	T 3	F 3	N 3	hg 3	<i>Polygonum mite</i>	Bidentetea	■	■		■

While the former subassociation occurs principally on sandy alluvial soil, the latter one is found on surface alluvial mud of high colloid content, but still devoid of sodium salts.

— *heleochloetosum schoenoidis*

It is found in very similar situations to the former subassociation, which means that the hhg 3 *Heleochloa schoenoides* (L.) Host figuring here as differential species can become association-forming on the drying sodic mud-covered depressions of slightly solonchak soil; *Halo-Heleochloetum schoenoidis*, its other ecotype occurs on muddy, non-sodic alluvial soil along the streams and shows transition to the *Dichostylidi-Aloperuretum geniculatae*.

7. *Cypereto-Juncetum bufonii* Soó et CSÜRÖS (44) 47

Occurrence: It is less frequent than the former association. It is much rather the stand of the muddy alluvial soil in areas covered with stagnant water than that of the mud vegetation along the river. It will survive until it is supplanted by other associations rich in hemicryptophytes.

Character species: They are also the character species of its subassociations

— cyperetosum fuscii, typicum

Its differential species are the *Cyperus fuscus* L., and *Juncus bufonius* L. (both hhg 2).

— potentilletosum supinae

Differential species are he3 *Potentilla supina* L., *Chlorocyperus glomeratus* (TORN) PALLA. The occurrence of hg 2 *Echinochloa crus-galli* (L.) P. B. is suggestive of the area getting weedy in places.

— xanthietosum italicii

Table 7. *Cypereto-Juncetum bufonii*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Cyperetosum fuscii	Potentilletosum supinae	Xanthietosum italicii
Helophyta										
HH R 3—4	T 0	F 0	N 3—4	he 1	<i>Phragmites australis</i>	Phragmitetea				
Th R 3—2	T 3	F 5	N 2—3	he 3	<i>Potentilla supina</i>	Nano-cyperiori				
Th R 3	T 3—4	F 4	N ?		<i>Chlorocyperus glomeratus</i>	Nano-cyperion				
Helo-hygrophyta										
Th R 0	T 3	F 4	N 3	hhg 2	<i>Cyperus fuscus</i>	Nano-cyperion				
Th R 3—2	T 0	F 3	N 3—4		<i>Juncus bufonius</i>	Nano-cyperetalia				
Th R 0	T 3	F 3—4	N 3—4	hhg 3	<i>Bidens tripartita</i>	Nano-cyperion				
Hygrophyton and Hygro-mesophyta										
Th R 0	T 0	F 3	N 3—4	hg 2	<i>Echinochloa crus-galli</i>	Chenopodietea				
H R 0	T 0	F 3—5	N 0	hgm 1	<i>Polygonum amphibium</i> var. <i>terrestris</i>					
Th R 0	T 3—4	F 3	N 3—4		<i>Xanthium italicum</i>	Phragmitetea Bidentetea				
Th R 0	T 3	F 3—4	N 4	hgm 2	<i>Chenopodium polyspermum</i>	Pol.-Chenopodion				

The most frequent form of *Cypereto-Juncetum* in the district. Its differential species is the hgm 1 *Xanthium italicum* MORETTI possessing a wide hydroecological adaptability. The prickly fruit of this plant is uniformly spread by flooding water. A species belonging to the hgm 2 type is *Chenopodium polyspermum* L. — Facies-forming is *Polygonum amphibium* L. f. *terrestre* LEYSS. (cf. Table 7). The places in the hydroecological categories of the two mud plant associations are nearly identical. Thus the graphs for their contributions to total cover according to categories culminate between he 3 and hhg 3. Owing to their narrow ecological amplitude these highest points can even attain the level of 60—80% (Fig. 2). PIETSCH (1965, 1973) who is well acquainted with the conditions in Hungary has analyzed the Isoeto-Nanojuncetea communities in Europe with special regard to their proper place in the cenological system.

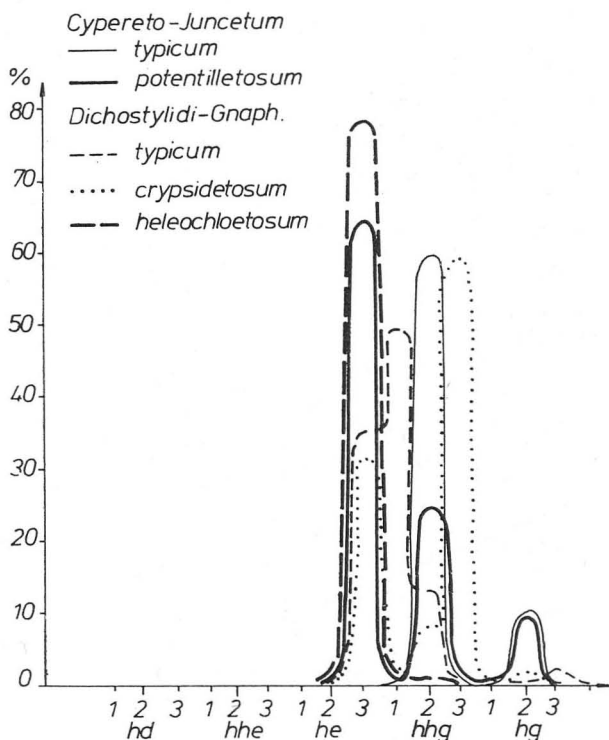


Fig. 2. Comparative graphical illustration of the hydroecological conditions of two mud plant communities.

8. *Scirpo-Phragmitetum austro-orientale* Soó 57

(Syn.: *Scirpo-Phragmitetum* W. KOCH 26 medioeuropaeum Tx. 41)

Occurrence: Common in the littoral of backwaters.

Character species in our area are hhe 2 *Butomus umbellatus* L., *Schoenoplectus lacustris* (L.) PALLA, he 2 *Sium latifolium* L. and *Rorippa amphibia* (L.) BESS.; when

passing from the shore the hd 3 *Polygonum amphibium* L. f. *aquaticum* LEYSS. can become more abundant in its stands. The species composition of these reeds is generally poor, which is likely to be due to the low nutrient status of the sediment.

9. *Glycerietum maximae* (NOWINSKY 28) HUECK 31
 (Syn.: Scirpo-Phragmitetum W. KOCH 26 glycerietosum aquaticae Soó 57)

Occurrence: It is found principally beyond the reeds or replacing them in the area of the Körtvélyes holm. It often forms pure stands also in shallow backwaters. In other places it forms a mosaic complex with *Schoenoplectetum lacustris*, resp. *Typhetum latifoliae* and *Typhoidetum arundinaceae*; occasionally its forms of transition can be observed. Similar *Glycerietum* communities were found in the region of Central Hessen (KNAPP and STOFFER 1962).

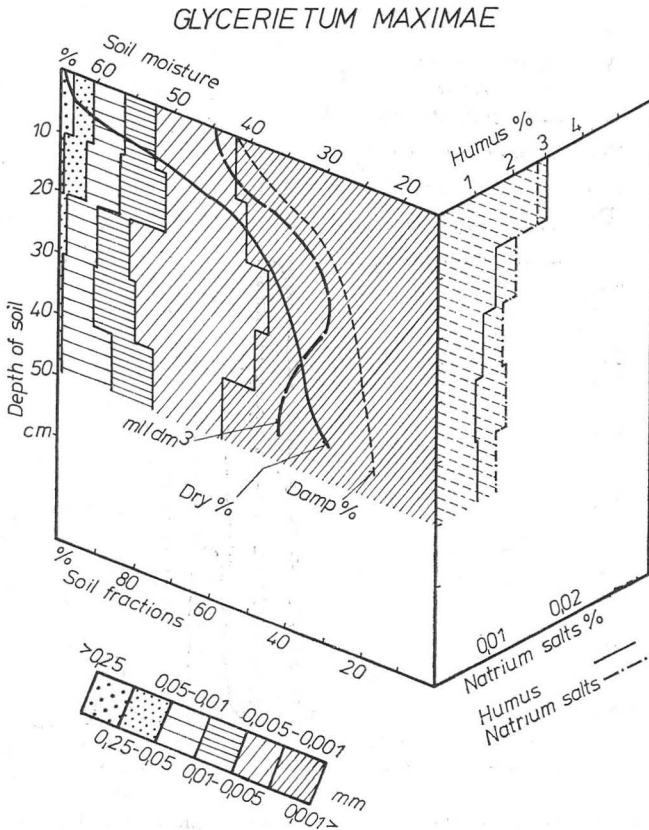


Fig. 3. Parameters of soil conditions and water supply of the *Glycerietum*-community in the autumnal aspect.

10. *Typhoidetum arundinaceae* EGGLEER 33
 (Syn.: Phalaridetum arundinaceae LIBBERT 31. Baldingeretum arundinaceae Soó 47)

Occurrence: In the shallow backwaters it forms larger or smaller patches behind the *Glycerietum* stands in the littoral zone. Its transition to the more rich *Carici gracilis-Typhoidetum arundinaceae* was often observed. The rapid spread of the

species of *Typhoidetum* and *Glycerietum* during lasting floodings can be explained also by their vegetative reproduction (KOPECKÝ 1960, 1965). Its spread in Central Europe and its zonation conditions were investigated by KOPECKÝ (1967a, 1976).

11. *Leucanthemo serotini-Phragmitetum communis* Soó (57) 71
(Syn.: *Chrysanthemo serotini-Phragmitetum* Soó 57)

Occurrence: Just as in the other areas of the valley of the Tisza, it is found in the flat water-covered depressions, and sections filled temporarily with stagnant water in the landscape protection district, forming larger or smaller stands there. On the

Table 8. *Leucanthemo serotino-Phragmitetum*

Life form	Acidity of soil	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Phragmitetosum	Calystegietosum
Hydato-helophyta									
HH	R 3—4	T 0	F 3	N 3	hhe 2	<i>Typhoides arundinacea</i>	Glycerio-Sparganion	—	—
HH	R 0	T 3	F 5	N 3		<i>Butomus umbellatus</i>	Phragmitetea	—	—
HH	R 3—4	T 0	F 4	N 2	hhe 3	<i>Bolboschoenus maritimus</i>	Bolboschoenion	—	—
HH	R 0	T 2	F 4—5	N 3		<i>Iris pseudacorus</i>	Phragmitetea	—	—
HH	R 4—5	T 3	F 4—5	N 3		<i>Glyceria maxima</i>	Phragmitetea	—	—
Helophyta									
HH	R 3—4	T 0	F 0	N 3—4	he 1	<i>Phragmites australis</i>	Phragmitetea	—	—
HH	R 0	T 0	F 5	N 3		<i>Typha latifolia</i>	Phragmitetea	—	—
HH	R 3	T 2—3	F 4	N 2—3		<i>Carex gracilis</i>	Magnocari-cion	—	—
HH	R 3—4	T 3	F 4—5	N 3	he 2	<i>Lycopus exaltatus</i>	Phragmitetea	—	—
HH	R 3—4	T 3	F 4—5	N 3		<i>Mentha agnatica</i>	Phragmitetalia	—	—
H	R 3—4	T 2	F 5	N 3		<i>Stachys palustris</i>	Phragmitetea	—	—
Helo-hygrophyta and Hygrophyta									
H	R 0	T 0	F 3	N 2—3	hhg 3	<i>Agrostis stolonifera</i>	Agr.-Rumicion	—	—
H	R 4—5	T 4	F 4	N 2		<i>Thalictrum flavum</i>	Molinietalia	—	—
H	R 3	T 4	F 3—4	N 2—3	hg 1	<i>Leucanthemum serotinum</i>	Mol.-Juncetea	—	—
H	R 3	T 3	F 4	N 3	hg 2	<i>Calystegia sepium</i>	Phragmitetea	—	—
Th	R 3—2	T 3—4	F 3—4	N 3	hg 3	<i>Polygonum hydropiper</i>	Bidentetea	—	—
Hgro-mesophyton									
H	R 0	T 0	F 3—5	N 0	hgm 1	<i>Polygonum amphibium</i> var. <i>terrestre</i>	Phragmitetea	—	—

basis of its species, it can be well differentiated from the reeds of the backwaters. Character species: *Leucanthemum serotinum* (L.) STANKOV (hg 1) and in the case of weediness as a consequence of absence of permanent cutting the hg 1 *Glycyrrhiza echinata* L.

Subassociations

— phragmitetosum, typicum

Its species belong to the groups of hydato-helophytes and helophytes. In addition to the 1 *Phragmites communis*, the hhe 3 *Glyceria maxima* (HARTM.) HOLMBG and *Iris pseudacorus* L. also have a great share in cover, though some the 2 species also play a role (Table 8).

— calystegietosum sepii

It is found primarily in sections of standing waters after the clear-felling of *Populus canadensis* forest stands. Therefore, it shows transition to *Bidenti-Calystegietum* FELF. 43.

Differential species: *Calystegia sepium* (L.) R. BR (hg 2) and *Polygonum hydro-piper* L. (hg 3). The latter is the member of Bidentetea. — If the stand is not mown regularly, *Glycyrrhiza echinata* L. can be also here facies-forming. Fig. 4 shows the contribution to total cover according to hydroecological categories.

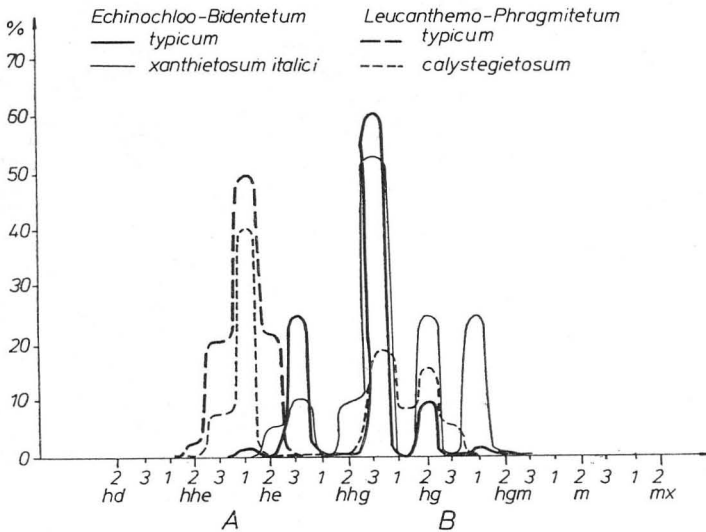


Fig. 4. Hydroecological graphs for a mud plant community (A) and a marshy meadow plant community (B).

12. *Carici gracilis-Typhoidetum arundinaceae* Soó 71

Occurrence: This community is often found in marshy habitats or where stagnant waters occur. Thus besides the flats of the flood-plain in the valley of the Tisza, similar stands were reported also from the south-west part of Slovakia. (under the name of *Phalaridetum*) (BALÁTOVÁ—TULÁČKOVÁ 1968), from North-Yugoslavia (BALÁTOVÁ—TULÁČKOVÁ and KNEŽEVIC 1975), from the valley of the Danube (VICHEREK 1962).

Its stands in the Austrian section of the valley of the Danube became known on the basis of the paper by BALÁTOVÁ—TULAČKOVÁ and HÜBEL (1974).

In our landscape protection district, the stands of *Carici-Typhoidetum* do not develop in the backwaters, just like those of reeds. Mass occurrence of this association was found in deeper-lying marshy areas. In the last years, however, the flood waves recurred more than once in the vegetation period. The high stage of 2—4 m lasted for a longer period. This caused the *Typhoides arundinacea* to perish from the zone at this level. Its stands were further damaged by the warming in summer of stagnant waters remaining behind, which caused the great amount of phytomass

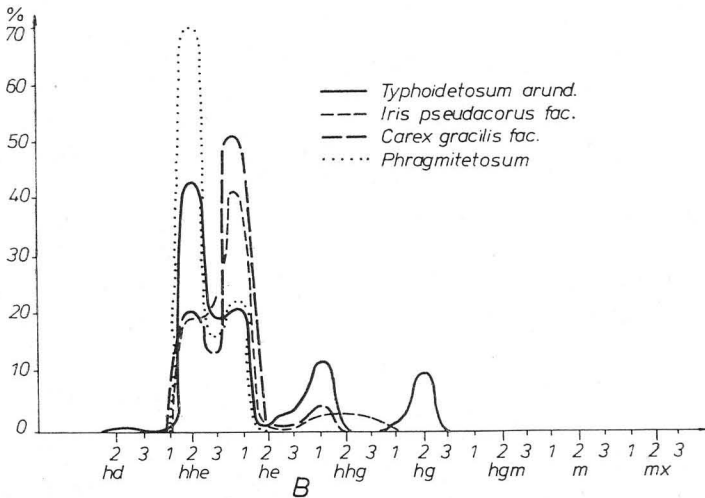
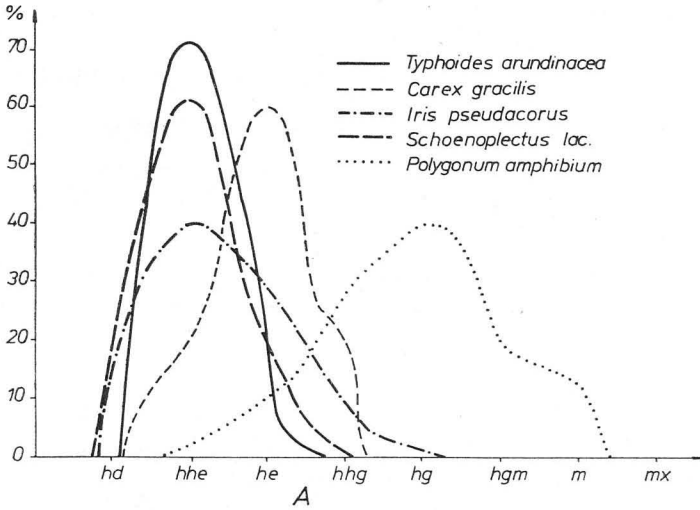


Fig. 5. Hydroecological parameters of (A) character species and (B) subunits of *Carici-Typhoidetum*-association.

Table 9. *Carex gracilis*-*Typhoidetum arundinaceae*

Life form	Temperature	Water demand	N-demans	Hydroecological character	Species	Character species	Phragmitetum	Typhoidetum	Iris pseudacorus fac.	Carex gracilis fac.
Hydatophyton and Hydato-helophyta										
HH	T 2	F 4—5	N 2	hd 2	<i>Ranunculus trichophyllus</i>	Potametalia	■	■		
HH	T 0	F 3	N 3	hhe 2	<i>Typhoides arundinacea</i>	Cyperio-Sparganion	■	■	■	■
HH	T 0	F 4—5	N 2—3		<i>Schoenoplectus lacustris</i>	Phragmition	■	■		
HH	T 3	F 5	N 3		<i>Butomus umbellatus</i>	Phragmition	■	■		
HH	T 2	F 4—5	N 3	hhe 3	<i>Iris pseudacorus</i>	Phragmitetea	■	■	■	■
HH	T 3	F 4—5	N 3		<i>Glyceria maxima</i>	Phragmition	■	■		
HH	T 0	F 4	N 2—3		<i>Bolboschoenus maritimus</i>	Bolboschoenion	■	■	■	■
HH	T 0	F 5	N 3		<i>Alisma plantago-aquatica</i>	Phragmitetea	■	■		
HH	T 3	F 5	N 3		<i>Sagittaria sagittifolia</i>	Phragmition	■	■		
Helophyta										
G	T 2—3	F 4	N 2—3	he 1	<i>Carex gracilis</i>	Magnocaricion	■	■	■	■
HH	T 0	F 0	N 2—3		<i>Phragmites australis</i>	Phtagmition	■	■		
H	T 2	F 5	N 3	he 2	<i>Stachys palustris</i>	Phragmitetea	■	■		
HH	T 2	F 3—4	N 0—3		<i>Lysimachia vulgaris</i>	Phragmitetea	■	■		
K	T 3	F 4	N 2—3		<i>Euphorbia lucida</i>	Molinion	■	■		
Helo-hygrophyta										
H	T 2	F 4	N 2—3	hhg 1	<i>Lythrum salicaria</i>	Mol. - Juncetea	■	■	■	■
G	T 0	F 4—5	N 2—4		<i>Eleocharis palustris</i>	Mol. - Juncetea	■	■		
G	T 3	F 4	N 3	hhg 3	<i>Juncus compressus</i>	Agrostion	■	■		
Hygrophyta and hygro-mesophyton										
H	T 2	F 4—5	N 3—4	hg 1	<i>Symphytum officinale</i>	Molinietalia	■	■		
H	T 4	F 3—4	N 2—3		<i>Glycyrrhiza echinata</i>	Calystegion	■	■		
H	T 3	F 4	N 3	hg 2	<i>Calystegia sepium</i>	Calystegion	■	■		
H	T 3	F 3—4	N 2	hg 3	<i>Thalictrum lucidum</i>	Molinietalia	■	■		
G	T 0	F 3—5	N 0	hgm 1	<i>Polygonum amphibium v. terreste</i>	Agr.-Rumicion	■	■	■	■

produced to decompose under anaerobic condition. This led to hydrogen sulphide production. *Glyceria maxima* growing under similar situations proved to be more sensitive and withdrew to a higher-lying zone.

Subassociations:

— typhoidetosum arundinaceae, typicum

The contribution of the name-giving species of the hhe 3 type to cover is great; besides this species, the other members of hydathelophytes can also attain high values of dominance. Of the helophytes the name-giving species of the association *Carex gracilis* of the he 1 type and *Lythrum salicaria* L. of the hhg 1 type can also attain high D values.

The suspension of the regular mowing of the stands results in the growth and facies-formation of *Glycyrrhiza echinata* L. and *Lythrum salicaria* L. The former has a wide hydroecological adaptability. The lasting high stage caused by floods, on the other hand was favourable for the growth of *Iris pseudacorus* and *Carex gracilis* taking the place of *Typhoides*. At the same time the number of species decreased essentially (Table 9).

CARICI (GRACILIS)- TYPHOIDETUM
LYTHRUM SALICARIA FAC.

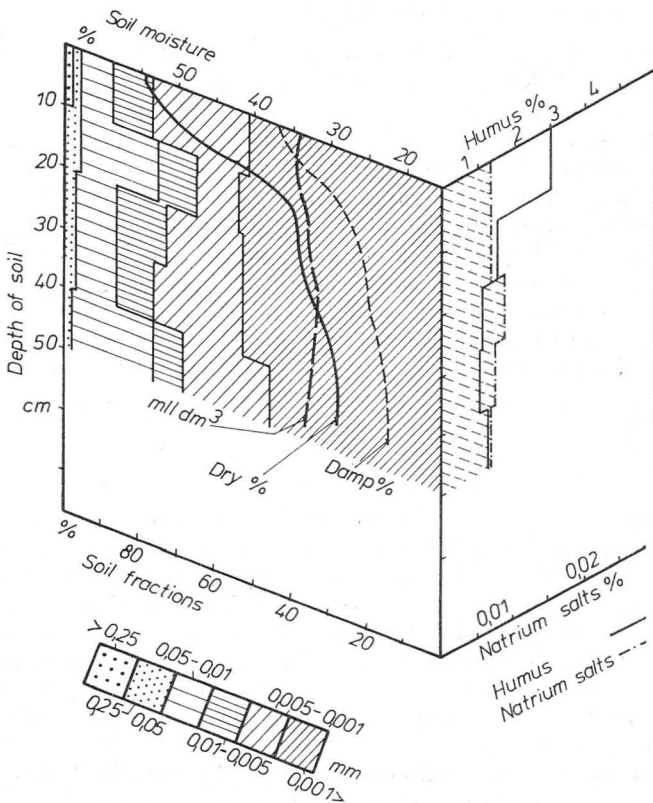


Fig. 6. Parameters for the soil ecology of *Carici-Typhoidetum* association in the autumnal aspect.

— phragmitetosum

The spread of the type hhe 2 species, primarily the gaining ground of *Phragmites* can lead to the developing of stands forming transition to marshy meadow reed stands. During the hydroecological evaluation of results — as in the case of the former stands — hydroecological graph was constructed for each species according to the method described. It is conspicuous that e.g. *Typhoides* shows one category difference relative to the 1 *Carex gracilis* CURT and that the adaptability of *Iris pseudacorus* rests on essentially broader foundations (Fig. 5-A).

The differences in moisture demand of the single subunits of association are well reflected by their different contributions to total cover within the single categories (Fig. 5-B). The colloid mass that sediments during lasting inundations impresses its character on the formation of soil in these depressions of stagnant water. The distribution of soil fractions in the soil of the river section at Körtvélyes is also in support of this (Fig. 6), since the fine clay fraction can even attain 50%, while the sand one is hardly demonstrable. The permeability to water seems to be related to that. In Fig. 6 the slope of curves plotted on the basis of moisture contents determined at the end of the vegetation period also show that. The presence of sodium salts are already demonstrable, but their amounts are still below the lowest for sodaic soils (0.01%).

13. *Caricetum gracilis* (ALM. 19, GRAEBNER et HUECK 31) Tx. 37
(Syn.: *Caricetum gracilis-nutantis* Soó 40).

Occurrence: It is found not only in the marshes of alluvial soil of the landscape protection district of Mártély and the other sections of the valley of the Tisza, but it is known to be common in other areas in Europe as well. Because of that, its stands of similar composition were reported from the valley of the Danube in Austria (BALÁTOVÁ—TULÁČKOVÁ and HÜBEL 1974, VICHEREK 1962). Its stands described from Comitatus Nógrád and other more favourable situations in Hungary (KOVÁCS 1957) contain more species. In the valley of the Tisza, due to the backwater effect of river barrages, the lower-lying flood-plains are more frequently and lastingly inundated. Thus, in the course of the last ten years, the species composition of *Caricetum gracilis* has exhibited negative changes and its spread a very positive one.

Character species: Only the hydato-helophytes which can tolerate the extreme hydrographic situation in this area survived in its stand. Thus, besides the 1 *Carex gracilis* CURT, *Lythrum salicaria* L., *Lysimachia vulgaris* L. and *Iris pseudacorus* L.

Subassociations:

— bolboschoenetosum maritimi

It has been repeatedly verified that this component conceivable as a differential species here, has some kind of property which is indicative of sodaic processes. In its soil profile in Körtvélyes, the sodium salt content amounted to 0.02% in the surfacenear level. This value is inside the lower limit for sodaic soils. Nevertheless, its damaging effect is compensated by its ample water supply. The greater accumulation of salts is prevented by the flushing effect of the regularly recurring floods.

Differential species: Besides *Bolboschoenus maritimus* (L.) PALLA the hhe 3 pseudohalophyte *Alisma lanceolatum* WITH., hhg 1 pseudohalophyte *Eleocharis palustris* (L.) R. et SCHH.

Fig. 7-A, B, illustrate the hydroecological graphs and distribution according to categories for the most important species of *Caricetum gracilis*.

— caricetosum gracilis, typicum

Its stands are dominant, and more rich in species than the previous unit. Its soil is less sodaic, usually below the lower limit of sodaic state.

Differential species: hhg 1 *Lythrum salicaria* L., hhe 3 *Iris pseudacorus* L., he 2 *Euphorbia lucida* W. et K. The latter sp. can be facies-forming in poorer stands (Table 10).

Table 10. *Caricetum gracilis*

Life form	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Bolboschoenotum	Caricetosum gracilis	Euphorbia lucida fac.
Hydato-helophyta									
HH	T 0	F 3	N 3	hhe 2	<i>Typhoides arundinacea</i>	Glycerio-Sparganion	—	—	—
HH	T 3	F 5	N 3		<i>Butomus umbellatus</i>	Phragmition	—	—	—
HH	T 0	F 4	N 2	hhe 3	<i>Bolboschoenus maritimus</i>	Bolboschoenion	■	—	—
HH	T 0	F 5	N 3		<i>Alisma plantago-aquatica</i>	Phragmitetea	—	—	—
HH	T 2	F 4—5	N 3		<i>Iris pseudacorus</i>	Phragmitetea	—	■	■
HH	T 0	F 5	N 3		<i>Alisma lanceolatum</i>	Phragmitetalia	—	—	—
Helophyta									
G	T 2—3	F 4	N 2—3	he 1	<i>Carex gracilis</i>	Magnocaricion	■	■	■
HH	T 2	F 3—4	N 0—3	he 2	<i>Lysimachia vulgaris</i>	Phragmitetea	—	■	—
H	T 3	F 4	N 2—3		<i>Euphorbia lucida</i>	Molinion	—	■	■
Helo-hygrophyta									
H	T 2	F 4	N 2—3	hhg 1	<i>Lythrum salicaria</i>	Molinio-Juncetea	■	■	—
HH	T 0	F 4—5	N 2—3		<i>Eleocharis palustris</i>	Molinio-Juncetea	—	—	—
H	T 3	F 4	N 2—3	hhg 3	<i>Lythrum virgatum</i>	Agrostion	—	—	—
Hygrophyton and Hygro-mesophyton									
H	T 3	F 3—4	N 2	hg 3	<i>Thalictrum lucidum</i>	Molinetalia	—	—	—
G	T 0	F 3—4	N 0	hgm 1	<i>Polygonum amphibium v. terrestre</i>	Agr.-Rumicion	■	—	—
H	T 2—3	F 3	N 3		<i>Alopecurus pratensis</i>	Mol.-Arrhenatheretea	—	—	—

Concerning the hydroecological situations of the association, it can be said that while in the former subassociation the graphs for units inside hhe 2 and he 1 categories culminated at about 40%, in this type culmination occurred at he 1 and hhg 1 and remained below 30% (Fig. 7-B).

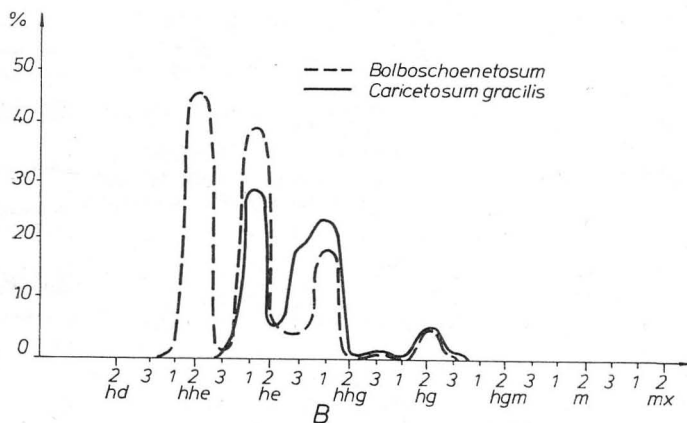
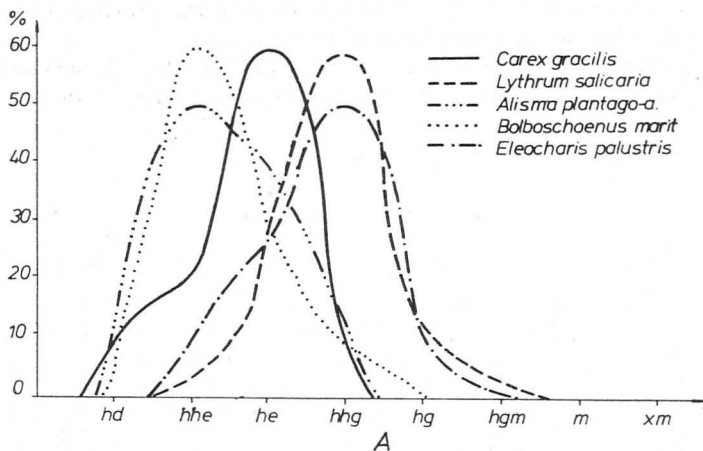


Fig. 7. Moisture demand of the species (A) and subassociations (B) of *Caricetum gracilis*-ass.

14. *Carici melanostachyae-Alopecuretum pratensis* SOÓ 71
 (Syn.: *Alopecuretum pratensis hungaricum* (Now. 28) Soó 57
Agrostideto-Alopecuretum pratensis UBR. 55)

Occurrence: It can be regarded as a transitory association among typical flood-plain marshy meadows and sedge meadows. Its spread has increased recently in the landscape protection district.

Character species: The hhg 2 *Carex melanostachya* WILLD., hhg 3 *Thalictrum flavum* L., hg 2 *Rorippa silvestris* L. var. *kernerii* (MENYH.) SOÓ, hg 2 *Euphorbia lucida* W. et K. and hg 3 *Thalictrum lucidum* L. (cf. BODROGKÖZY and HORVÁTH 1979).

Subassociations:

— *caricetosum melanostachyae*, typicum

It is the richest subgroup of association. Hydroecologically its species belong to the groups of hydato-helophytes and hygromesophytes and exhibit a wide scale of adap-

tability. The hg 1 *Carex hirta* L. has the smallest amplitude, but *Alopecurus pratensis* L. of the hgm 1 type can be regarded as a species with great adaptability. It was often found on the embankment among dominant mx species (Fig. 8-A).

With allowance to their contributions to total cover inside the hydroecological categories, the climactic points of graphs of these species occur at hhg 2 (Fig. 8-B).

— *bolboschoenetosum maritimi*

It is also found in the depressions of slightly sodaic alluvial soils with stagnant water cover. Its differential species is the hhe3 stenohalophyte *Bolboschoenus maritimus* (L.) PALLA. The species number of its stands is smaller compared to the former sub-association. For their hydroecological characterization it should be mentioned that their percentual contributions to total cover culminate within the hhe2 category (Fig. 8-B), and approximates the value of 40%.

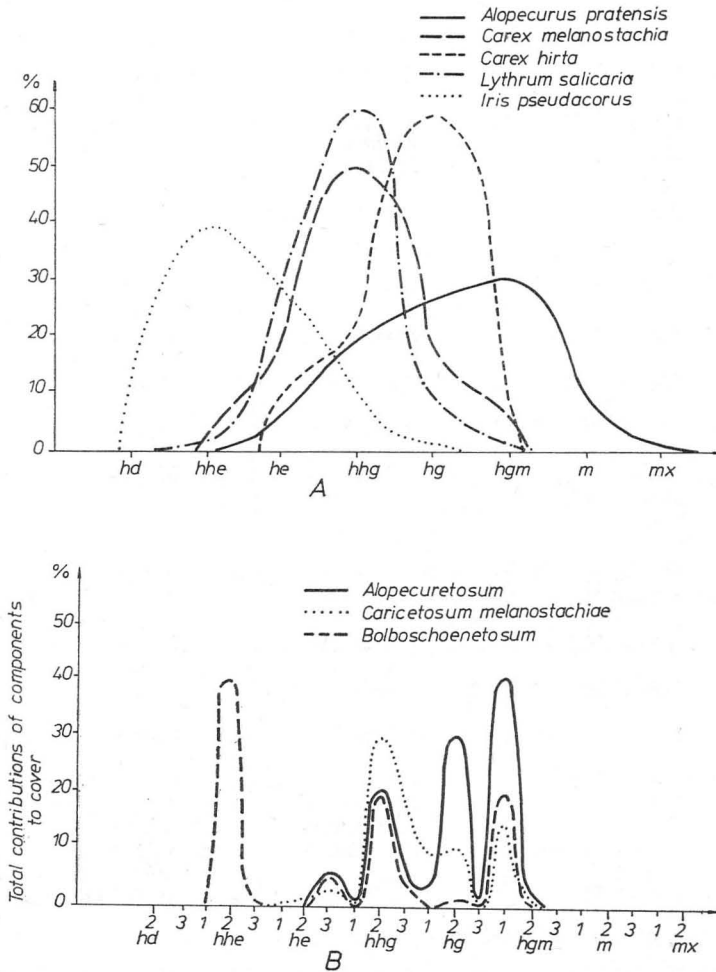


Fig. 8. Hydroecological distribution of character species (A) and subassociations (B) of foxtail meadows of transitory nature.

Table 11. *Carici melanostachyae-Alopecuretum pratensis*

Life form	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Bolboschoenetosum	Caricetosum melanostachyae	Carex gracilis facies	Alopecuretosum pratensis
Hydato-helophyta										
HH	T 0	F 4	N 2—3	hhe 3	<i>Bolboschoenus maritimus</i>	Bolboschoenion	■			
HH	T 2	F 4—5	N 3		<i>Iris pseudacorus</i>	Phragmitetea	■	■	■	■
Helophyta										
G	T 2—3	F 4	N 2—3	he 1	<i>Carex gracilis</i>	Magnocari-cion			■	
H	T 3	F 4	N 2—3	he 2	<i>Euphorbia lucida</i>	Molinion	■	■		
HH	T 2	F 3—4	N 0—3		<i>Lysimachia vulgaris</i>	Phragmitetea	■	■		
H	T 3	F 4—5	N 3		<i>Mentha aquatica</i>	Phragmitetalia				
H	T 2	F 5	N 3		<i>Stachys palustris</i>	Phragmitetea		■		
Helo-hygrophyta										
H	T 2	F 4	N 2—3	hhg 1	<i>Lythrum salicaria</i>	Molinio-Juncetea	■	■	■	■
HH	T 0	F 4—5	N 2—3	hhg 1	<i>Eleocharis palustris</i>	Molinio-Juncetea			■	
HH	T 3	F 4	N 2	hhg 2	<i>Carex melanostachya</i>	Magnocari-cion	■	■	■	■
H	T 0	F 3	N 2—3	hhg 3	<i>Agrostis stolonifera</i>	Agr.-Rumicion		■		■
H	T 4	F 4	N 2		<i>Thalictrum flavum</i>	Molinieta	■			
G	T 3	F 4	N 3		<i>Juncus compressus</i>	Agrostion		■		
Hygrophyta										
H	T 4	F 3—4	N 2—3	hg 1	<i>Glycyrrhiza echinata</i>	Calystegion				■
G	T 2—3	F 3—4	N 3		<i>Carex hirta</i>	Agr.-Rumicion		■		■
H	T 4	F 3—4	N 2—3		<i>Leucanthemum serotinum</i>	Molinio-Juncetea		■		■
H	T 1	F 4—5	N 2—3	hg 2	<i>Ranunculus repens</i>	Agr.-Rumicion		■		■
Th	T 0	F 3	N 3—4		<i>Echinochloa crus-galli</i>	Chenopodieta			■	
H	T 3	F 4	N 3		<i>Calystegia sepium</i>	Calystegion	■			■
H	T 4	F 3	N 2		<i>Rorippa silvestris</i> v. <i>kernerii</i>	Agr.-Rumicion		■		■
H	T 2	F 3—4	N 3—4	hg 3	<i>Poa trivialis</i>	Mol.-Arrhenatheretea				■
H	T 3	F 3—4	N 2		<i>Thalictrum lucidum</i>	Molinieta	■			■
Meso-hygrophyta										
H	T 2—3	F 3	N 3	hgm 1	<i>Alopecurus pratensis</i>	Mol.-Arrhenatheretea	■	■	■	■
H	T 3—4	F 4—5	N 3		<i>Rorippa austriaca</i>	Agr.-Rumicion				■

— alopecuretosum pratensis

It occurs in the marshy meadows of Körtvélyes holm covered with standing water for longer or shorter periods. Here *Alopecurus* becomes more competitive. Thus principally the hygrophytes prevail. Its differential species are: hg 1 *Glycyrrhiza echinata* L., *Carex hirta* L. and hg 2 *Ranunculus repens* L., *Leucanthemum serotinum* (L.) STANKOV also occurs here. During the summer, when floods recurrently occur and inundation is more lasting, the type he 1 *Carex gracilis* CURT. can be facies-forming (Table 11).

With regard to the places of its components inside the hydroecological categories and on the basis of their percentual contributions to total cover the climactic point obtained shows a gradually increasing tendency in the direction of hgm (Fig. 8-B).

The report on studies performed between 1974 and 1977 in connection with the seasonal changes of its phytomass production according to species was published earlier (BODROGKÖZY and HORVÁTH 1979).

In addition to the height and lastingness of the water cover, the situation of the underground water level can also influence the seasonal changes of species composition of marshy and marshy meadow communities, as has been verified earlier by BALÁTOVÁ—TULAČKOVÁ (1965, 1968). In our area, however, the ground water has never risen above soil surface, because the extremely high colloid content of soil prevents surface waters from seeping into the soil. Soil profile analyses performed in a period of lasting water cover by means of pipe-liner verified that.

15. *Lythro virgatae-Alopecuretum pratensis* BODRK. 77

(Syn.: *Alopecuretum pratensis* hung. normale
Agrostideto-*Alopecuretum pratensis* UBR. 55)
Alopecuretum pratensis normale BODRK. 62)

Occurrence: It was the most frequent marshy meadow community in the middle and upper sections of the flood-plain in the valley of the Tisza before the construction of the river barrages and power stations (BODROGKÖZY 1962). The frequent floodings occurring as a consequence of these impoundings have caused this community to suffer ever increasing damages. Thus, in our area, too, it was gradually transformed into *Carici gracilis-Alopecuretum*, moreover in some places *Caricetum gracilis* during the last 10 years. On the other hand, *Typhoides* became immigrant species in this zone and more than once facies-forming element. Thus, the richly coloured hayfields of foxtail type have also disappeared from a large part of the district. The same could be observed earlier in the region of Tokaj at Bodrogzug.

Character species: *Lythrum virgatum* L. of the hh 3 type, hg 1 *Symphytum officinale* L., hg 3 *Poa trivialis* L. and hgm 3 *Mentha arvensis* L.

Subassociations:

— alopecuretosum pratensis, typicum

Differential species: he 2 *Lysimachia vulgaris* L., hg 1 *Gratiola officinalis* L. and hg 3 *Poa trivialis* L.

It is characteristic of the situations in its habitat that after the retirement of the flood of shorter duration and smaller extent less colloid settles down. Thus the permeability to water of the silty alluvial soil is more favourable and the stagnant waters left behind will not produce harmful effect.

This explains the much greater species number in this community relative to

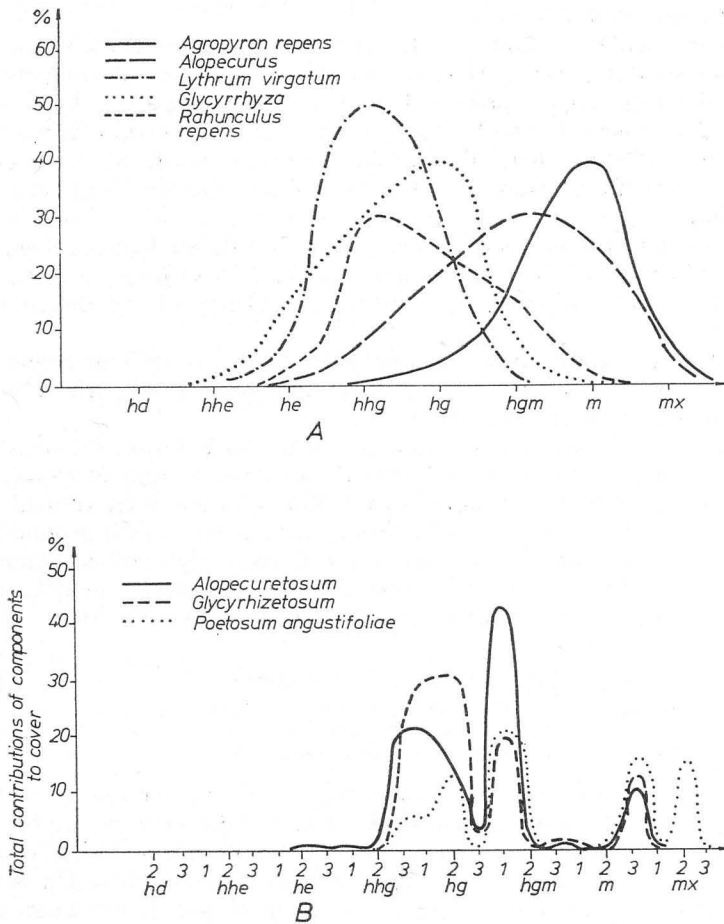


Fig. 9. Hydroecological conditions of typical foxtail meadows (A, B).

that of the previous association. Moreover, the hydroecological adaptability of these components is also much wider (Fig. 9-A).

The hydroecological plots drawn on the basis of the contributions of these species to total cover exhibit two culminations, but the values of these is not higher than 20%; namely, in the case of hg 3 and hgm 1 subgroups (Fig. 9-B).

— *glycyrrhizetosum echinatae*

Differential species is hg 1 *Glycyrrhiza echinata* L. It is found generally in such situations when the yield of the hayfields is of sour hay nature, and therefore their regular mowing and the gathering of hay is no more economical. *Carex melanostachya* WILLD. is facies-forming, *Lythrum virgatum* L., occasionally *L. salicaria* L. increase and the community assumes lilac colour in the late aestival aspect. In the lower herb stratum, *Potentilla reptans* L. (hg 2) exhibits a high D value (Table 12).

— *poetosum angustifoliae*

(Syn.: *Alopecuretum pratensis poetosum angustifoliae*)

Table 12. *Lythro virgatae-Alopecuretum pratensis*

Life form	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Alopecuretosum	Potentilla reptans fac.	Glycyrrhizetosum	Poëtosum angustifoliae
Helophyta										
H	T 3	F 4—5	N 3	he 2	<i>Mentha aquatica</i>	Phragmitetalia				
HH	T 2	F 3—4	N 0—3		<i>Lysimachia vulgaris</i>	Phragmitetea	—			
Helo-hygrophyta										
H	T 2	F 4	N 2—3	hhg 1	<i>Lythrum salicaria</i>	Molinio-Juncetea				
H	T 3	F 4	N 2—3	hhg 3	<i>Lythrum virgatum</i>	Agrostion	—	—	—	—
H	T 4	F 4	N 2		<i>Thalictrum flavum</i>	Molinietaalia	—	—	—	—
H	T 0	F 3	N 2—3		<i>Agrostis stolonifera</i>	Agr.-Rumicion	—	—	—	—
Hygrophyta										
H	T 4	F 3—4	N 2—3	hg 1	<i>Glycyrrhiza echinata</i>	Calystegion	—	—	—	—
H	T 2	F 4—5	N 3—4		<i>Symphytum officinale</i>	Molinietaalia	—	—	—	—
H	T 4	F 3—4	N 2—3		<i>Leucanthemum serotinum</i>	Molinio-Juncetea				
H	T 2	F 4	N 2		<i>Griatiola officinalis</i>	Molinion	—	—	—	—
H	T 3	F 3—4	N 2—3	hg 2	<i>Potentilla reptans</i>	Agr.-Rumicion	—	—	—	—
H	T 1	F 4—5	N 2—3		<i>Ranunculus repens</i>	Agr.-Rumicion	—	—	—	—
H	T 3	F 4	N 2—3		<i>Euphorbia lucida</i>	Molinion	—	—	—	—
H	T 2	F 3—4	N 3—4	hg 3	<i>Poa trivialis</i>	Mol.-Arrhenatheretea	—	—	—	—
Hygro-mesophyta										
H	T 2—3	F 3	N 3	hgm 1	<i>Alopecurus pratensis</i>	Mol.-Arrhenatheretea	—	—	—	—
H	T 1	F 2—3	N 0		<i>Vicia cracca</i>	Mol.-Arrhenatheretea	—	—	—	—
H	T 0	F 3—4	N 3—4		<i>Mentha arvensis</i>	Molinietaalia	—	—	—	—
Mesophyta										
Th	T 3—4	F 3	N 3—4	m 2	<i>Setaria lutescens</i>	Agr.-Rumicion	—	—	—	—
G	T 0	F 2—3	N 3—4	m 3	<i>Agropyron repens</i>	Agr.-Rumicion	—	—	—	—
Th	T 3	F 0	N 3		<i>Vicia tetrasperma</i>	Secalietea	—	—	—	—
Meso-xerophyta										
H	T 2	F 2	N 3	mx 2	<i>Poa angustifolia</i>	Festuco-Brometea	—	—	—	—
G	T 3	F 2—3	N 2		<i>Carex praecox</i>	Festuco-Brometea	—	—	—	—
H	T 0	F 3	N 2—3		<i>Plantago lanceolata</i>	Agr.-Rumicion	—	—	—	—

It could be observed in those years when the floods did not occur, or lasted for a shorter period, and this zone of the flood-plain was not flooded for a longer time. It exhibited transition to *Poo angustifoliae-Alopecuretum* covering a dryer marshy meadow zone.

Its differential species are mx 2 *Carex praecox* SCHREB. and mx 3 *Poa angustifolia* L. with wide hydroecological adaptability.

16. *Poo angustifoliae-Alopecuretum pratensis* BODRK. 62
(Syn.: *Alopecuretum pratensis* hung. *poetosum angustifoliae*)

In the flood-plains of greater elevation in the valley of the Tisza, the drying foxtail marshy meadows are getting gradually eclipsed. In our landscape protection district it occurs only sporadically. In other places, for a more favourable nutrient supply and less lasting water cover, it forms more rich and richly coloured stands (BODROG-KÖZY 1961, 1962). Compared with its other stands in our country, the foxtail meadows of Transdanubia and the plain in Northwestern Hungary, named "Kis Alföld" seems to be related with the association in respect to the number of species; thus, the meadows in Comitát Baranya (HORVÁTH 1960), the hayfields along the river Rába (JEANPLONG 1960) or those in the plain "Kis Alföld" in Northwestern Hungary (BORHIDI 1956) and in the eastern part of the Great Hungarian Plain (SIMON 1960). From the eulittoral — epilittoral zone of the valley of the Danube, VICHEREK (1962) described similar stands. They are known from the northern part of the central range of mountains on the basis of investigations and reports by MÁTHÉ (1956) and MÁTHÉ—KOVÁCS (1960). In our area it has fallen victim principally to the increased cultivation of hoed plants.

17. *Digitario-Portulacetum oleraceae* (FELF. 42) TIM. et BODRK. 55

Development: It occurs in the most elevated areas on the terrace-like arranged dunes by the Tisza in the landscape protection district of Mártély. This elevated zone is seldom or never flooded. Because of that, it is suitable also for the cultivation of hoed plants. For this reason the original *Cynodonto-Poëtum angustifoliae* (RAPCS. 26) SOÓ 57 pastures were broken up and utilized mainly as maize-field. The regular cultivation on loose alluvial-type sandy soil favours the development of *Digitario-Portulacetum*.

On the basis of its species composition, this association is similar to the weed communities reported from hoed plant cultures in the area between the Danube and the Tisza. Its character species are: mx 3 *Portulaca oleracea* L., m 3 *Digitaria sanguinalis* (L.) SCOP., m 3 *Agropyron repens* P. B. as well as mx 3 *Ambrosia elatior* L. greatly spreading in our area.

Ecological conditions of soil: Soil profile analyses showed the physical clay fraction to constitute only in the upper layers 20% of the soil. The fine sand fraction predominates. The moisture supply of soil is small in the autumnal aspect. The organic matter content is similarly low. The calcium carbonate content, however, can increase to 3—4% which is not frequent in the valley of the Tisza (Fig. 10).

18. *Agropyro-Convolutum arvensis* FELF. 43
(Syn.: *Agropyretum repentis* FELF. 42)

Development: It also formed on the more elevated sand dunes after the great flood in 1970, where fruit gardens had flourished for about a century. As a consequence of lasting floods of high water stage, all fruit and grape species perished except the

DIGITARIO -PORTULACETUM
ZEA KULT. CONSOC.

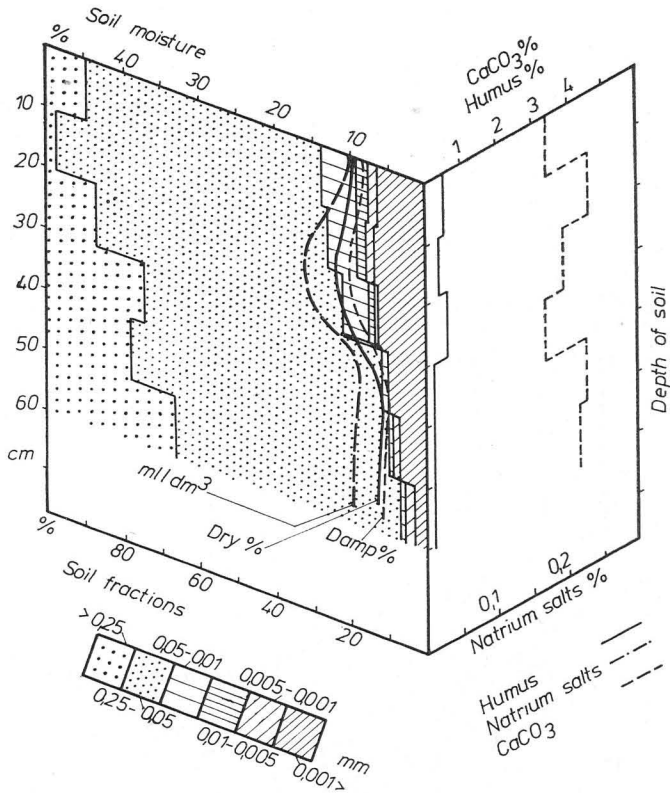


Fig. 10. Soil ecological parameters of the weed ocmuni tiesof hoed plant cultures on sandy soil.

pear one. This weed community which is the variety of *Agropyro-Convolvuletum agropyretosum* and calamagrostidetosum developed on this soil left in its greatest part uncultivated. The original community must have also been *Cynodonto-Poëtum angustifoliae*. Today it is *agropyretosum*, typicum.

In the lower parts among the dunes, however, the original vegetation must have been *Poo angustifoliae-Alopecuretum pratensis* for the more favourable water supply. Today the variety *Agropyro-Convolvuletum rubetosum caesii* is common here. Its soil is essentially harder than that of the type, because of its high fine clay (0.001 mm fraction) content. Towards deeper layers, however, the amount of this fraction diminishes. This is obviously due to the sedimentation of silt-clay caused by the changed water course after the construction of the protecting dam system along the Tisza. The accumulation of sodium salts is already demonstrable here (Fig. 11).

— *rubetosum caesii*

Differential species: *Ranunculus repens* L., *Glechoma hederacea* L. of the hg 2 type each, hgm 1 *Xanthium italicum* MORETTI. *Amorpha fruticosa* L. and *Fraxinus pennsylvanica* MARSH often forming impenetrable thickets can be facies-forming in both subassociations.

AGROPYRO-CONUOLVULETUM
(AGROPYRETUM REPENTIS)
RUBUS CAESIUS SUBASS.

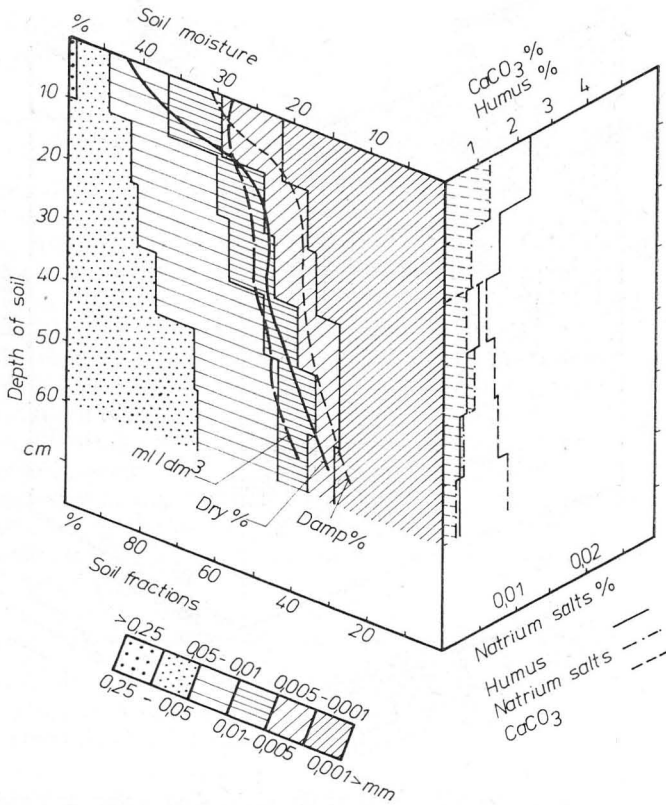


Fig. 11. Physical and chemical parameters of the soil of a weed community dominated by couch.

19. *Bidenti-Calystegietum sepii* FELF. 43

Development: During the last 30 years large tracts of the landscape protection district were planted with Canadian poplar. In the place of the wood stands felled in cutting age so called cutting vegetation has developed and occupied increasingly greater areas in the district. Their characteristic stands develop within a few years. Character species: hg 2 *Calystegia sepium* (L.) R. BR., hg 3 *Polygonum hydropiper* L., hg 1 *Carex hirta* L., hgm 3 *Aristolochia clematidis* L., hg 3 *Poa trivialis* L. and hhg 3 *Myosoton aquaticum* (L.) MÖNCH.

For the appearance of differential species characteristic of the changed hydrographical situation, the following subassociations could be differentiated:

— calystegietosum sepii, typicum

It can be expected to occur in medium moist habitats, often together with the *Amorpha fruticosa* facies.

— caricetosum gracilis

Forms stands in marshy habitats at lower-lying places. Differential species are *Carex gracilis* CURTIS, *Iris pseudacorus* L. and *Echinochloa crus-galli* (L.) P. B., occasionally *Stachys palustris* L., too.

20. *Echinochloa-Bidentetum tripartitae* (W. KOCH 26) Soó 71.
 (Syn.: *Bidentetum tripartiti* (W. KOCH 26) LIBBERT 32
Polygonum hydropiper-Bidens tripartitus ass. LOHM. 50)

Occurrence: It is the mud weed community in the clay-pits, earth mines of the embankments along the rivers. During the last 60—80 years, these pits have been filled in such a degree that now they contain water only for a very short time. Thus they are favourable habitats for Bidentetion stands. Similar associations were reported also from the other sections of the Tisza valley (TIMÁR 1950). The Bidentetion mud-plant societies in Croatia became known on the basis of MARKOVIC's investigations (1975). It was reported on from West Europe by LOHMEYER (1950) and in European relations by POLI and TÜXEN (1960).

Character species: *Bidens tripartita* L. and *Polygonum minus* HUDS. of the hhg 3 type each; hg 3 *P. mite* SCHRANK, hhg 3 *Myosoton aquaticum* (L.) MÖNCH. and the similar *Rorippa palustris* (L.) BESS.

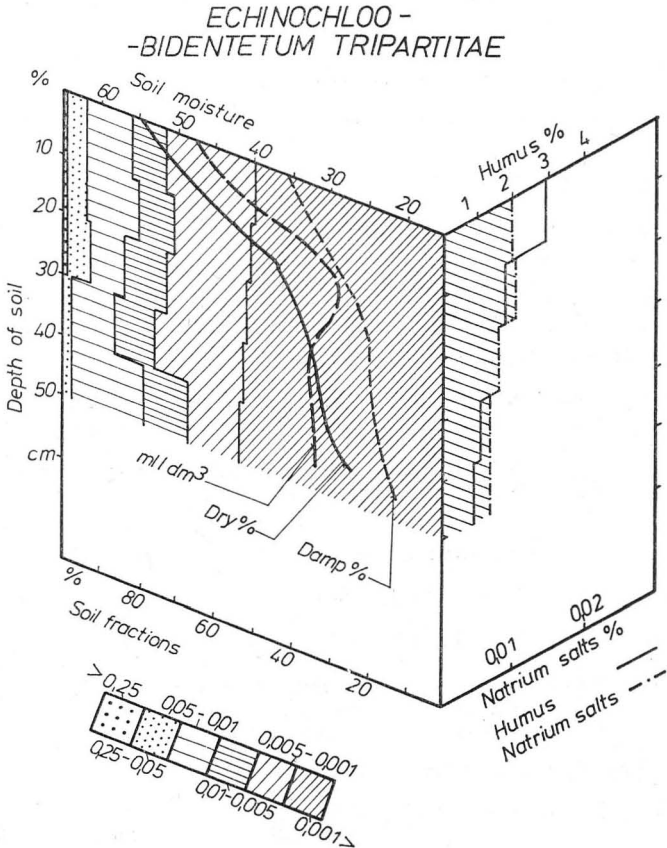


Fig. 12. Physical and chemical conditions of the soil of weed community on muddy alluvial soil in the littoral.

Subassociations:

— bidentetosum, typicum

One of the most frequent mud-plant weed cenoses of the valley of the Tisza. Though it is principally composed of helo-hygrophytes, single individuals of hhe 3 *Glyceria maxima* (HARTM.) HOLMG., he 1 *Oenanthe aquatica* (L.) Poir. and he 3 *Potentilla supina* L. forming the lower herb stratum also occur here. The latter can be facies-forming.

— xanthietosum italicum

It develops in pits on soils somewhat dryer than the former ones, i.e. in places not flooded before and in other similar devastated places. Differential species are: hg 3 *Polygonum mite* SCHRANK, hg 2 *Echinochloa crus-galli* (L.) P. B., but chiefly hgm 1 *Xanthium italicum* MORETTI forming large stands (Table 13).

Soil ecology: There is plenty of time for the colloids to settle in the stagnant waters. Thus the soil is very hard: the physical clay fraction can amount to 80% and in it the fine clay component dominates.

Since the soil is less permeable to water, the water cover lasts longer and the lower soil layers are moistened in a lesser degree (Fig. 12). Accumulation of sodium salts is also considerable, though these are not harmful in diluted state.

Table 13. *Echinochloa-Bidentetum tripartiti*

Life form	Acidity of soil	Temperature	Water demand	N-demans	Hydroecological character	Species	Character species	Bidentetosum	Xanthietosum italicum
Hydato-helophyta and Helophyta									
HH	R 3—4	T 3	F 4—5	N 3	hhe 3	<i>Glyceria maxima</i>	Phragmition	—	—
HH	R 0	T 3	F 5	N 2	he 1	<i>Oenanthe aquatica</i>	Phragmitetalia	—	—
HH	R 3—4	T 3	F 4—5	N 2—3	he 2	<i>Rorippa amphibia</i>	Phragmitetea	—	—
Th	R 2—3	T 3	F 5	N 2—3	he 3	<i>Potentilla supina</i>	Nanocyperion	—	—
Helo-hygrophyta									
Th	R 0	T 0	F 3	N 3—4	hhg 2	<i>Chenopodium rubrum</i>	Bidentetea	—	—
Th	R 0	T 3	F 3—4	N 3—4	hhg 3	<i>Bidens tripartita</i>	Nanocyperion	—	—
Th	R 2—3	T 0	F 4—5	N 3		<i>Rorippa palustris</i>	Bidentetea	—	—
Th	R 2—3	T 3	F 3—4	N 2—3		<i>Polygonum minus</i>	Bidention	—	—
Th	R 0	T 2	F 3	N 3—4		<i>Myosoton aquatica</i>	Calystegion	—	—
Hygrophyta and Hygro-mesophyta									
Th	R 0	T 0	F 3	N 3—4	hg 2	<i>Echinochloa crus-galli</i>	Chenopodieta	—	—
Th	R 0	T 3	F 3	N 3	hg 3	<i>Polygonum mite</i>	Bidentetea	—	—
Th	R 0	T 3—4	F 3	N 2—3	hgm 1	<i>Xanthium italicum</i>	Bidentetea	—	—

21. *Echinochloo-Heleochloetum alopecuroidis* (n. nov)

(non Cyperio-Spergularion: *Heleochloetum alopecuroidis* (RAPCS 27) UBR. 48).

Occurrence: When the flood-plain of the Tisza and thus the higherlying parts of the agricultural tillages of the landscape protection district are lastingly flooded during the summer, the cultivated plants perish. In their place mud vegetation growing on loose soil and content with shorter vegetation period appears. Concerning its species it can be easily differentiated from the former association.

Character species: They have a wide hydroecological adaptability. In the place of the original *Digitario-Portulacetum Zea* culture consociation principally the hygrophytes grow. Thus, besides the name-giving species and in addition to hg 2 *Potentilla anserina* L. the hg 2 *Calystegia sepium* (L.) R. BR; moreover, some mesophytes can also thrive there as hgm 3 *Plantago major* L. and even mx 3 *Portulaca oleracea* L. of wide adaptability (Fig. 13-A).

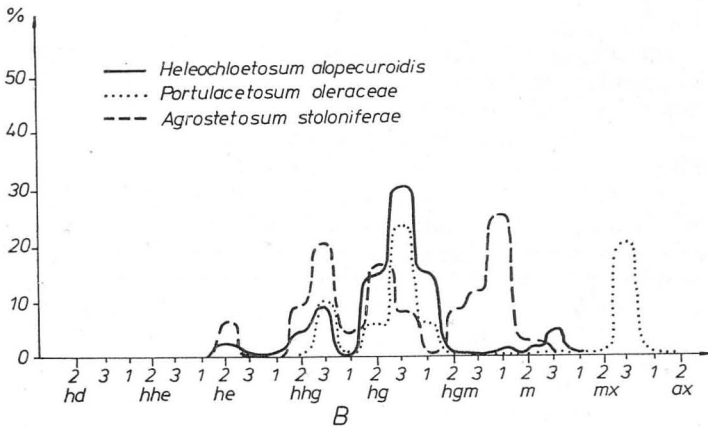
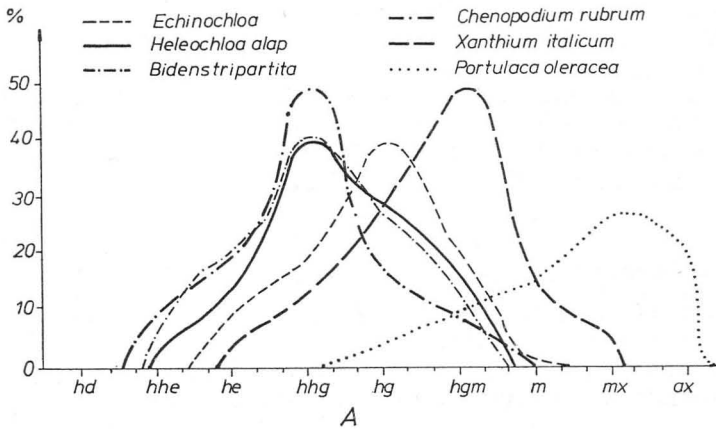


Fig. 13. Hydroecological conditions of the species (A) and stands (B) of the association of *Heleochloa alopecuroides*.

Subassociations:

— *heleochloetosum alopecuroidis*, *typicum*

It occupies the lower-lying zone of flatter sand dunes located in terrace-like pattern and covered with water for the longest time. Its species number is low. Differential species are hhe 3 pseudohalophyte-type *Alisma lanceolatum* WITH. and he 2 *Lycopus exaltatus* L.

— *agrostetosum stoloniferae*

It the lasting water cover in summer recurs for more than one year, several hemikryptophytes will join the society. For the suspension of the devastating agrotechnical effects, species number increases.

Differential species: hhg 3 *Agrostis stolonifera* L., hhg 3 *Rorippa sylvestris* (L.) BESS, hg 2 *Calystegia sepium* (L.) R. BR., hgm 3 *Polygonum lapathifolium* L. and hhg 2 *Chenopodium rubrum* L.

— *portulacetosum oleraceae*

It is found in elevated places of flat sand dunes where the water cover lasts for a shorter period. Thus among its differential species mx 3 *Portulaca oleracea* L. as the character species of the original *Digitario-Portulacetum*, where its share is highly dominant, can occur in great quantities. Besides mx 1 *Polygonum aviculare* L. is also found here (see further details in Table 14).

The hydroecological plots of the single subunits of association illustrate their water demand, and the degree of their adaptabilities (Fig. 13-B).

22. *Echinochloo-Polygonetum lapathifolii* (UJV. 40) SOÓ ET CSÜRÖS (40) 47.

(Syn.: *Polygonum lapathifolium* ass. UJV. 40, *Junceto-Polygonetum* Soó 43)

Occurrence: The areas covered by *Lythro-Alopecuretum*, but much rather by *Poo-Alopecuretum* below the dunes peris if the area is ploughed up and permanently covered with water in the interest of hoed plant cultures. In their place the mud vegetation of hard alluvial soils appears. It often forms only clearings among the maize-fields.

Character species: hgm 3 *Polygonum lapathifolium* L., hg 1 type *Symphytum officinale* S., m 2 *Setaria lutescens* (WEIGEL) HUBBARD and hgm 1 *Rubus caesius* L.

Subassociations:

— *echinochloetosum*

In the most damp depressions of cultivated soil it forms luxuriant stands.

Differential species are *Echinochloa crus-galli* (L.) P. B. and *Bidens tripartita* L.

— *polygonetosum lapathifolii*, *typicum*

Occurs on tillages less covered with stagnant waters.

Differential species besides the name-giving one are: hgm 1 *Xanthium italicum* MORETTI, *Setaria lutescens* (WEIG.) HUB. and hgm 3 *Aristolochia clematitis* L.

The texture of soil in this subassociation is similar to that of *Poo angustifoliae-Alopecuretum*. 80% of the decantable part of soil consists of equal amounts of coarse silt (0.05–0.01 mm) and fine colloidal clay fraction (0.001 mm). The amount of sodium salts bounded to this adsorption complex approximates the lower limit of sodic condition (0.01%). This is, however, not evident yet from the species composition of the community (Fig. 14).

23. *Lolio-Alopecuretum pratensis* BODRK. 62

Occurrence: It is found everywhere in the foxtail meadows under grazing. In the "Barci-rét" of our landscape protection district it has developed principally by the

Table 14. *Echinochloo-Heleochloetum alopecuroidis*

Life form	Temperature	Water demand	N-demand	Hydroecological character	Species	Character species	Agrostetosum	Heleochloetosum alopecuroidis	Portulacetosum
Hydato-helophyton and Helophyta									
HH	T 0	F 5	N 3	hhe 3	<i>Alisma lanceolatum</i>	Phragmitetalia	—	—	—
H	T 2	F 5	N 3	he 2	<i>Stachys palustris</i>	Phragmitetea	—	—	—
HH	T 3	F 4—5	N 3		<i>Lycopus exaltatus</i>	Phragmitetea	—	—	—
HH	T 2	F 3—4	N 0—3		<i>Lysimachia vulgaris</i>	Phragmitetea	—	—	—
Helo-hygrophyta									
Th	T 0	F 3	N 3—4	hgg 2	<i>Chenopodium rubrum</i>	Bidentetea	—	—	—
H	T 1	F 4—5	N 4—5		<i>Potentilla anserina</i>	Agr.-Rumicion	—	—	—
H	T 4	F 3	N 2	hgg 3	<i>Rorippa sylvestris</i>	Agr.-Rumicion	—	—	—
Th	T 3	F 3—4	N 3—4		<i>Bidens tripartita</i>	Bidentetea	—	—	—
H	T 0	F 3	N 2—3		<i>Agrostis stolonifera</i>	Agr.-Rumicion	—	—	—
Th	T 0	F 2—4	N 1		<i>Heleochloa alopecuroides</i>	Cyperio-Spergularion	—	—	—
Hygrophyta									
H	T 4	F 3—4	N 2—3	hg 1	<i>Glycyrrhiza echinata</i>	Calystegion	—	—	—
Th	T 0	F 3	N 3—4	hg 2	<i>Echinochloa crus-galli</i>	Chenopodietea	—	—	—
H	T 3	F 4	N 3		<i>Calystegia sepium</i>	Calystegion	—	—	—
Hygro-mesophyta									
Th	T 3—4	F 3	N 3—4	hgm 1	<i>Xanthium italicum</i>	Bidentetea	—	—	—
H	T 0	F 3—4	N 3—4		<i>Mentha arvensis</i>	Molinietalia	—	—	—
H	T 0	F 2—3	N 3	hgm 3	<i>Plantago major</i>	Plantaginetea	—	—	—
Th	T 0	F 3—4	N 3—4		<i>Polygonum lapathifolium</i>	Pol.-Chenopodion	—	—	—
G	T 4	F 3	N 3		<i>Aristolochia clematitis</i>	Calystegion	—	—	—
H	T 0	F 2—3	N 2—3		<i>Rumex crispus</i>	Agr.-Rumicion	—	—	—
G	T 2	F 3—4	N 3—4		<i>Equisetum arvense</i>	Secalietea	—	—	—
H	T 0	F 2—3	N 2		<i>Glechoma hederacea</i>	Mol.-Arrthenatheretea	—	—	—
Mesophyta									
Th	T 0	F 2—3	N 3	m 1	<i>Sonchus asper</i>	Pol.-Chenopodion	—	—	—
Th	T 3—4	F 3	N 3—4	m 2	<i>Setaria lutescens</i>	Pol.-Chenopodietaia	—	—	—
Th	T 3—4	F 3	N 4		<i>Malva neglecta</i>	Polygonion	—	—	—
G	T 3	F 0	N 3		<i>Convolvulus arvensis</i>	Chen.-Scleranthea	—	—	—
Th	T 3	F 2—3	N 4—5		<i>Amaranthus retroflexus</i>	Chenopodietea	—	—	—
Th	T 0	F 0	N 4—5		<i>Chenopodium album</i>	Chenop.-Scleranthea	—	—	—
Meso-xerophyta									
H	T 0	F 3	N 2—3	mx 1	<i>Polygonum aviculare</i>	Chen.-Scleranthea	—	—	—
Th	T 0	F 2	N 3—4	mx 3	<i>Portulaca oleracea</i>	Pol.-Chenopodietaia	—	—	—

ECHINOCHLOO - POLYGONETUM
ZEA KULT. CONSOC.

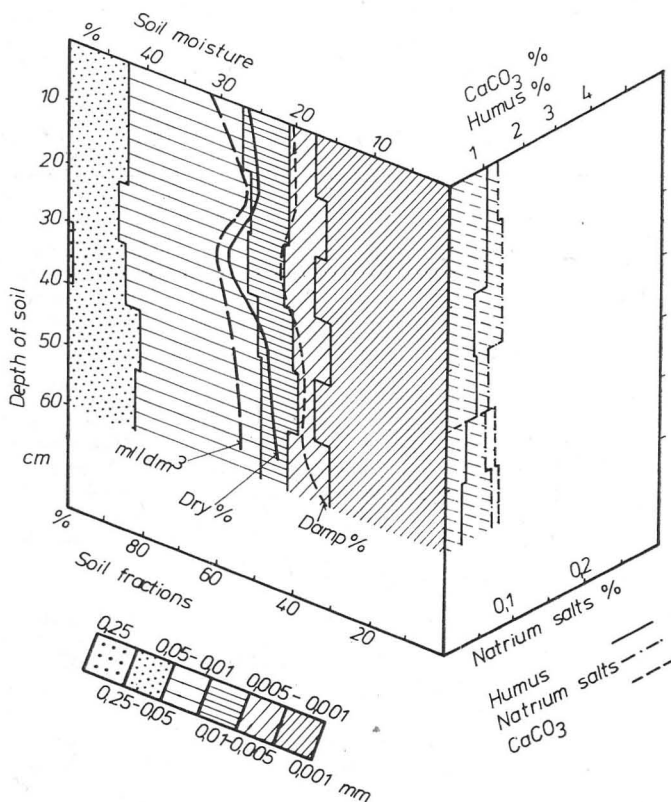


Fig. 14. Parameters of the soil of *Echinochloa-Polygonetum*-association.

transformation of the original *Lythrum virgatae-Alopecuretum* which was caused by regular grazing.

Its species composition is nearly identical with those reported from other pastures in the valley of the Tisza (BODROGKÖZY 1962).

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A Mártélyi Tájvédelmi Körzet növénytakarója társulás talaj- és hidroökológiai viszonyainak változása az utolsó tíz év folyamán

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Kivonat

E vizsgálatok főleg a Körzet Körtvélyes szigetére összpontosultak. Feladata az itt kialakult, főleg lágyszárú növénytársulások valamint talajuk fizikai felépítése, nedvességállottsága, a nátriumsók esetleges felhalmozódása és a különböző mérvű árvízborítottság és annak tartóssága közötti összefüggések tisztázása. — A különböző korú holt ágak közepesen gazdag vízínövény társulásai, a növényevő halak néhány évvel ezelőtt történt betelepítése után teljesen kipusztultak.

A sziget leghosszabb pangóvíz borítású, legkötöttebb öntéstalaján *Glycerietum maximae*, *Leucanthemo serotino-Alopecuretum pratensis*, *Carici-Typhoidetum arundinaceae* alakult ki. A rövidebb ideig pangóvízes zónában *Carici melanostachyae-Alopecuretum pratensis* s ezt követően a *Lythro virgatae-Alopecuretum pratensis* jelentkezett. A terasz-szerűen kialakult homok-

dűnék tartósan vízborította zónájában *Echinochloo-Bidentetum*, a folyópart öntéstalaján Elatini-Eleocharition ovatae asszociációk lelhetők fel.

Hydroökológiai viszonyaik tisztázására az Ellenberg, hazai viszonylatban Zólyomi és mt.ai rendszerét tovább fejlesztve a tíz kategórián belül 3-3 alegységet, így összesen 30 kategórián belüli egységet sikerült elkülöníteni, fajkomponenseik hidroökológiai görbéinek megszerkesztése révén.

Promene cenotičkih, pedoloških i hidroekoloških prilika biljnog pokrivača zaštićenog okruga Mártély u toku poslednjih deset godina

BODROGKÖZY GY.

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Abstrakt

Ova istraživanje unutar zaštićenog okruga su se uglavnom usredsredila na ostrvo Körtvélyes, sa zadatkom da razjasne međuzavisnost između lokalno nastale, uglavnom zeljaste biljne zajednice s jedne strane, i fizičkih osobina tla, vodnog režima, eventualnog nagomilavanja natrijumovih soli kao i različitih vodostaja i njihovog vremenskog trajanja s druge strane. Osrednje biljne zajednice mrtvaja različite starosti, nakon introdukcije biljojedih riba od pre nekoliko godina, potpuno su isčezle.

Na najvezanijoj plavnoj podlozi ostrva, gde se voda najduže zadržava, razvila se *Glycerietum maximae*, *Leucanthemo-serotino-Alopecuretum pratensis*, *Carici-Typhoidetum arundinaceae* zajednica. U zoni sa kraćim zadržavanjem vode javlja se *Lythro virgatae-Alopecuretum pratensis* nakon *Carici melanostachyae-Alopecuretum pratensis* zajednice. U trajno poplavljenoj zoni terasastih peščanih dina nalazi se *Echinochloo-Bidentetum*, dok je obala pod Elatini-Eleocharition ovatae asociacijom.

Na osnovu konstrukcije hidroekoloških krivulja pojedinih vrsta, razradjivanjem sistema ELLENBERG-a odnosno ZÓLYOMI at al., uspelo nam je ukupno izdvojiti 30 unutarkategorijskih jedinica, odnosno izdvajanje od po 3 unutar 10 kategorija.

СМЕНЫ В ПОЧВЕННЫХ И ГИДРОЭКОЛОГИЧЕСКИХ ОТНОШЕНИЯХ РАСТИТЕЛЬНЫХ СООБЩЕСТВАХ ПРИРПДНО-ОХРАННОГО РАЙОНА МАРТЕЙ В ПОСЛЕДНЕМ ДЕСЯТИЛЕТИИ

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Резюме

Исследования в основном концентрировались на острове Кёртвейеш. Задачи исследования заключались в основном, выяснении образования здесь травянистых растительных сообществ, физической структуры почв, состояния влаги и накопления в ней натриевых солей, а также причин происхождения разнообразных водных разливов и взаимосвязи между ними.

В разновозрастных старицах, в связи с засилением пару лет тому назад травоядных рыб, прежние растительные сообщества полностью были уничтожены.

В самой долговременной застойной воде острва, в вязкой почве образовались растительные сообщества: *Glycerietum maximae*, *Leucanthemo serotino* — *Alopecuretum pratensis*, *Carici* — *Typhoidetum arundinaceae*.

В коротко временно застойной воде встречаем *Carici melanostachyae* — *Alopecuretum pratensis* ~ а за ним следующего *Lythro virgatae* — *Alopecuretum pratensis*.

В длительно заливной зоне, в террасах песчаных дюн появляется потом *Echinochloo-Bidentetum*, ~, а на прибрежной насыпной почве *Elatini* — *Eleocharition ovatae* сообщество.

Для выяснения гидроэкологических отношений Элленберга — в местных отношениях систем Зольомия и др. — внутри 10 категории удалось отделить 3-3 подкатегории, всего 30 внутрикатегорных единицы — путем составления видокомпонентных и гидро экологических кривых.