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COENOLOGICAL STATUS OF THE IRIS MEADOWS IN HUNGARY

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Abstract - Species composition and vegetation structure by association and local diagnostic, constant and dominant species of *Iridetum sibiricae* was analysed from Hungary adjusting to the evaluation of European vegetation. Classification, ordination and statistical analyses was carried out to characterize and make distinction to some other wet meadow vegetation types. In the association habitat and management dependent subunits were formed.

Key words - Iridetum sibiricae, phytosociology, diagnostic species, subassociations

Introduction

The Carpathian basin and the territory of Hungary as well, is rich in semi-natural edaphic grasslands (Botta-Dukát *et al.* 2005). The Iris meadows characterized by the presence and mass of Siberian iris (*Iris sibirica* L.) have been earlier described with significant physiognomy, species composition and habitat conditions as a plant community in Europe. Descriptions and phytosociological data had been published from Austria, Bohemia, Croatia, Germany and Switzerland about Siberian iris dominated vegetation stands (Morton 1954, Philippi 1960, Korneck 1962, Ilijanic 1968, Balátová-Tulacková and Hübl 1985, Straka and Ellmauer 1990, Krewedl 1992, Mucina *et al.* 1993, Pott 1995, Bohner *et al.* 2001, Chytry 2007). Iridetum sibiricae as a tall herbs dominated community generally occurs in oceanic and suboceanic regions, but scattered in the subcontinental territories of East and Central Europe (e.g. Borhidi 2003).

It occurs in locations connected to the foothills around lakes on alluvial, nutrient rich surfaces. It has some characteristic narrow- and broad-leaved tall forbs, e.g. *Calamagrostis epigeios, Festuca arundinacea*, *Filipendula ulmaria, Iris pseudacorus, Phalaris arundinacea*, *Symphytum officinale*. Species composition is selected owing to round-shaped rhizome extending of *Iris sibirica*. Some subassociations were decribed with high constancy and abundance of *Carex gracilis, Molinia coerulea, Calamagrostis epigeios, Crepis paludosa*, *Viola elatior*, *Allium angulosum* and *Galium verum* as local or relative differential species of the associa-

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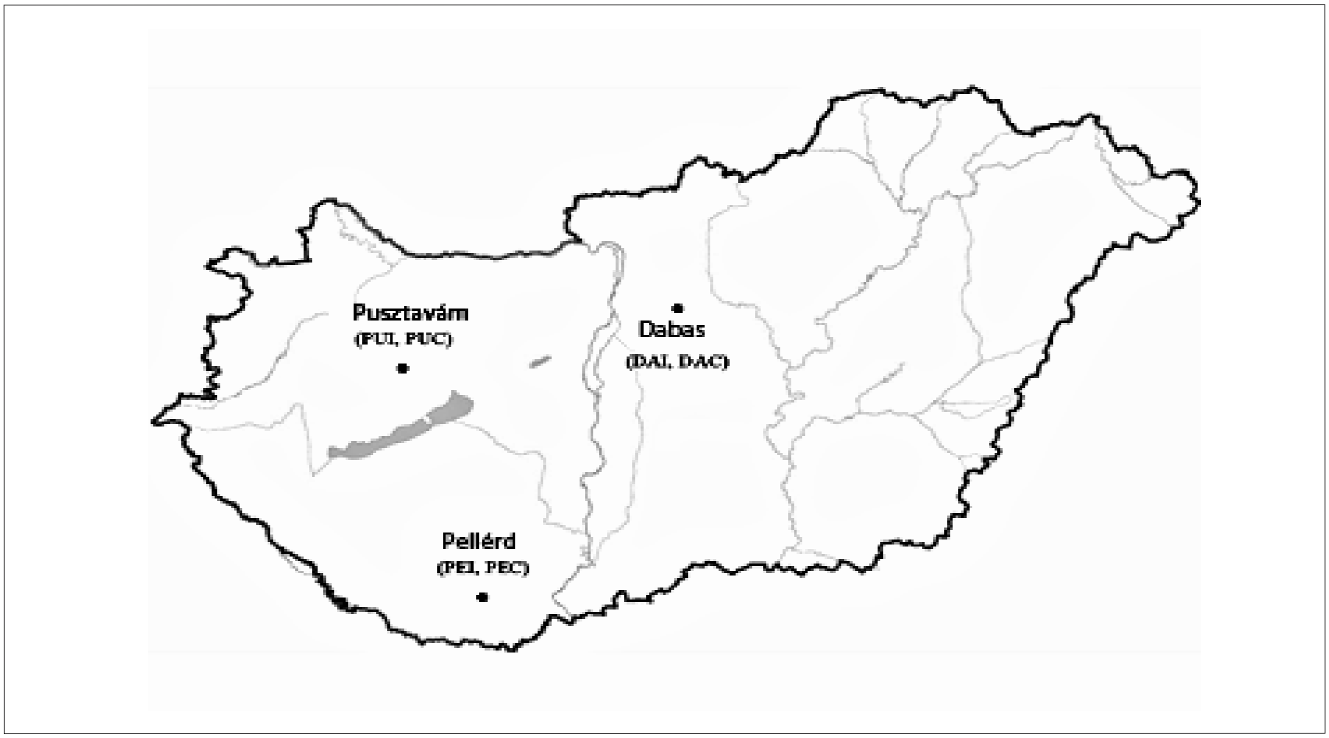

Fig. 1 – The map of studied areas in Hungary (Carpathian basin). Abbreviations see in chapter Material and methods.

tion. Moss species could sporadicly occur in the lowest vegetation layer, e.g. *Calliergion cuspidata*.

Iridetum sibiricae is introduced only in the last couple of years in the Hungarian syntaxonomic system adjusting to the classification of European vegetation (Borhidi, 2003). Otherwise, some tall herb associations (e.g. *Filipendulo-Geranietum palustris* Koch 1926) had been known and thoroughly described much earlier (e.g. Kovács 1962, 1963). In this study synoptic table and classifications based on coenological relevés are constructed for displaying species composition. In addition a structural analysis based on plant behaviour types and life forms was carried out. Our aim is to summarize knowledge about Siberian iris dominated meadows as *Iridetum sibiricae* association from Hungary.

Material and methods

The data set was collected between 2006 and 2008 in Iris rich and their contact vegetation stands according to recommendation of the Hungarian Phytosociological Database (Lájer *et al.* 2007). Samples originated from three main regions of Hungary representing several phytogeographical regions (Marosi and Somogyi 1990, Pócs 2000) as well: Pellérd from Praeillyricum in Transdanubia, Dabas from Pannonicum in the Great Hungarian Plain and Pusztavám from Bakonyicum in Transdanubian medium range (Fig. 1). Homogeneity of groups was previously examined by cluster analysis with a consistent sample selection. Occurred plant communities are *Iridetum sibiricae* Philippi 1960 (IRID) in Pellérd (PEI), Dabas (DAI) and Pusztavám (PUI), *Agrostio-Deschampsietum caespitosae* Újvárosi 1947 in Pellérd (PEC), *Cirsio cani-Festucetum pratensis* Májovsky & Ruzicková 1975 in Dabas (DAC) and *Succiso-Molinietum hungaricae* in Pusztavám (PUC) as contact vegetation types. Selected sites are situated in alluvial lowlands of the regions under local edaphic environmental conditions (see Table 1 in Salamon-Albert *et al.* 2009).

Coenological relevés were managed in TURBOVEG for Windows (Hennekens and Schaminée 2001) using enlarged Mid-European species list. The

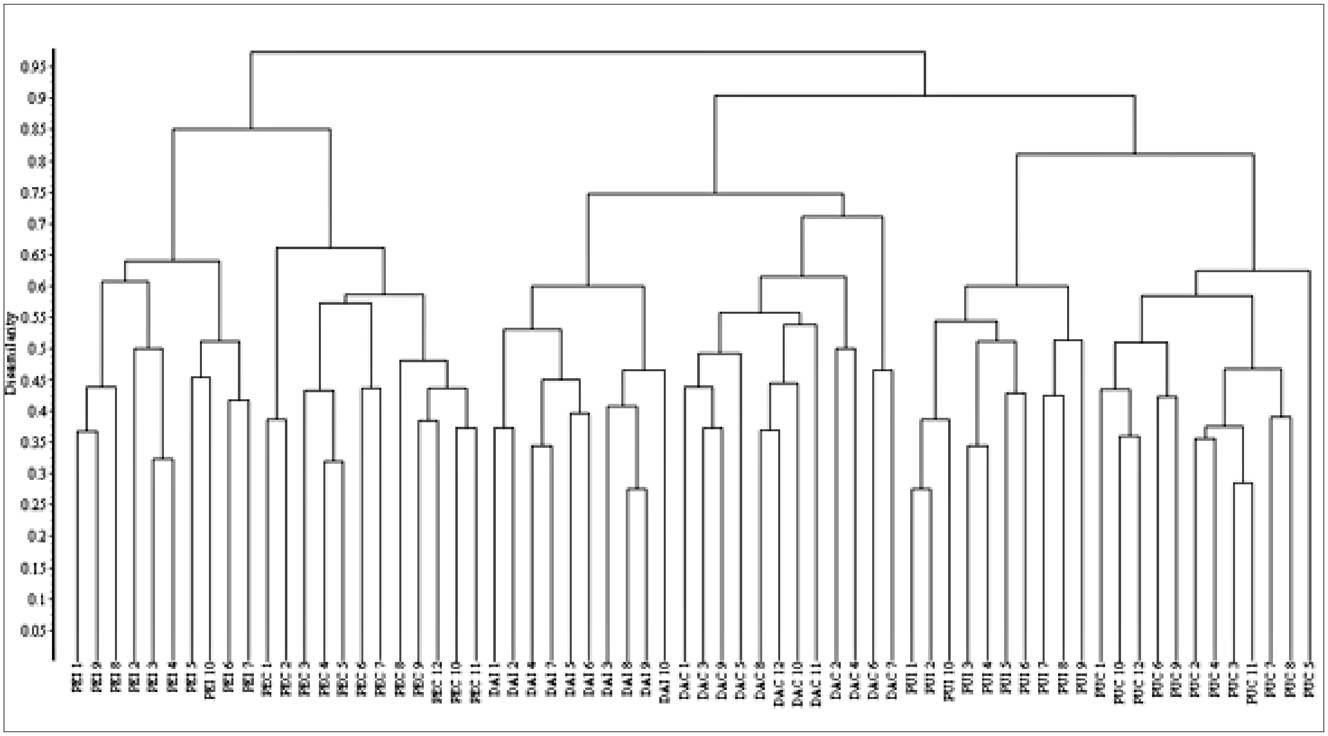

Fig. 2 – Numerical classification of vegetation stands belong to *Iridetum sibiricae* and contact vegetation types (Jaccard coefficient). Abbreviations see in chapter Material and methods.

synoptic table based on species percentage frequency containing diagnostic, constant and dominant species of *Iridetum sibiricae* that were constructed by JUICE software performance (Tichý 2002). Combined synoptic table shows the percentage frequency of the taxa ranked by decreasing frequency value for the communities and stands. Threshold values are for constant species 60 (frequency value), for diagnostic species 50 (fidelity value) and for dominant species up to 10 with *phi* coefficient according to P < 0.001 by Fisher's exact test. Complete coenological dataset based on the presence-absence data was used for the numerical classification and ordination for revealing the relationships between associations by SYNTAX 2000 program package (Podani 2001). Classification was performed by cluster analysis using Jaccard coefficient as a distance measure with complete link method. Ordination was executed by canonical correspondence analysis (CCoA) with symmetric weighting method on attributes of Raunkiaer's life form categories (Raunkiaer 1934) and social behaviour types (Borhidi 1993) as the two groups of variables for analyzing structural differencies. Syntaxonomical nomeclature has been unified according to Borhidi (2003), species attributes are according to Horváth *et al.* (2003).

Results and discussion

Iridetum sibiricae as a defined plant community ranged into the class *Molinio-Arrhenatheretea* within the alliance *Filipendulo-Petasition* Br-Bl. 1949 in the Hungarian syntaxonomical system. In the habitats it can connect to several wet meadows of alliance *Molinion coeruleae* Koch 1926 and/or *Deschampsion caespitosae* Horvatic 1931 em Soó 1941 as a narrow fringe vegetation. Due to the mainly overlapping species composition with the contact associations, analysing species composition and determining diagnostic, constant and dominant species is very important.

According to the classification of samples from *Iridetum sibiricae* and the contact vegetation types by species presence data, three main groups can be distinguished at high level of dissimilarity (Fig. 2). In

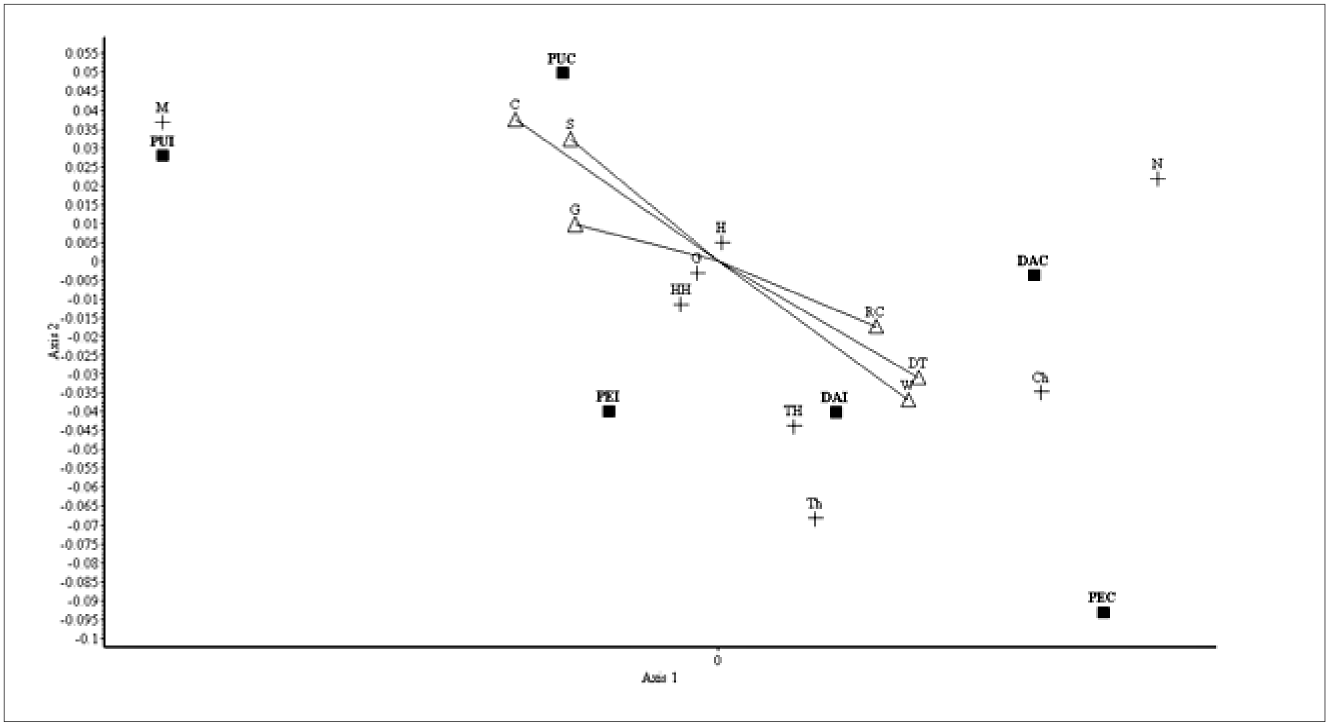

Fig. 3 Canonical correspondence analysis (CCoA) of vegetation stands (■) based on presence data with characteristic attributes of social behaviour types (Δ, running lines) and Raunkiaer's life form categories (+). Axes display 36 and 28 percentages of total variance. For abbreviations see chapter Material and methods, for species attributes see Table 1.

first step clusters had been formed by the localities (Pellérd, Dabas, Pusztavám), in second step they were grouped by the spatial adjoining associations (PEI-PEC, DAI-DAC, PUI-PUC). Heterogeneity of the main groups is slightly different, Pellérd has the highest dissimilarity value and a greater distance from the others, Dabas turned to be the less heterogenous habitat. Distinct separation and grouping of the associations may point out to have few or weak diagnostic species of *Iridetum sibiricae* as an association but could have significant habitat diagnostic sets.

In more detailed analyses synoptic table of constant, dominant and diagnostic species were constructed for *Iridetum sibiricae* and its stands, otherwise in comparison to contact vegetation types (Table 1). Evaluate the association (IRID) to the other wetland communities (PUC+PEC+DAC) it has 18 constant and 6 dominant plant species totally. It can be characterized by 4 diagnostic species: *Iris sibirica*, *Daucus carota* subsp. *carota*, *Inula salicina* and *Molinia arundinacea*, three of them are dominant ones as well. Besides them 14 constant species occur in the iris-rich meadows additionally. In the stands (PUI, PEI, DAI) several number of local diagnostic species can be defined. 7 species from Pusztavám, 16 species from Pellérd and 19 ones from Dabas were verified by the analyses. Among diagnostic species one or more can be selected to be a local diagnostic combination for the subassociations. In Pusztavám *Sesleria caerulea* is the appropriate constant and dominant diagnostic species with *Angelica sylvestris* and *Salix cinerea*. In Pellérd *Euphorbia paulstris*, *Betonica officinalis* and *Carex elata* could be the local diagnostic species combination. In Dabas a lot of species is characteristic for the subassociation, e.g. *Festuca pratensis*, *Poa angustifolia*, *Bromus inermis*, *Colchicum autumnale* or *Filipendula vulgaris*. Among diagnostic species the natural competitors (C) could be the most suitable for specifying the subassociation (for definitions see Table 1). According to previous results *Iridetum sibiricae* has habitat depend subunits: *seslerietosum caeruleae*, *caricetosum elatae* and *festucetosum pratensis* subassociations. Nomenclatural types of subassociations are Pu6=360 in Pusztavám, Pe2=320 in Pellérd and Da7=249 in Dabas (see Table 2. in Salamon-Albert *et al.* 2009). Diagnostic species of the subunits could indicate the previous successional stage as the potential origin of the vegetation from a *Caricion davallianae* (e.g. *Seslerietum caeruleae*), a *Magnocaricion* (e.g. *Caricetum elatae* vs. *acutiformis*) or a *Deschampsion caespitose* (e.g. *Cirsio cani-Festucetum* or *Carici vulpinae-Alopecuretum*) stand. Local differential species to contact vegetation types of the subunits are clearly defined by the specialists (S), generalists (G) and natural disturbance tolerants (DT) like *Galium mollugo* and *Angelica sylvestris* in *seslerietosum*, *Equisetum arvense* and *Euphorbia palustris* in *caricetosum, Ononis spinosa, Poa angustifolia* and *Equisetum* species in *festucetosum* subassociation. In two case of contact vegetation types (PUC and PEC) a well defined set of species can be shown as local diagnostic species combination to *Iridetum sibiricae* stands. *Carex panicea, Galium boreale* and *Peucedanum palustre* to *seslerietosum caeruleae*, *Agrostis stolonifera*, *Carex vulpina* and *Poa pratensis* to *caricetosum elatae* subunit. In the third subassociation at Dabas habitat, there are numerous characteristic but not significant diagnostic species in contact vegetation owing to the species selection of sandy soil. The only appropriate one is *Chrysopogon gryllus* as a constant and dominant species to *Iridetum sibiricae festucetosum pratensis*.

According to results of canonical correspondence analysis (CCoA) by groups of social behaviour types and life forms communities and stands display in different ways (Fig. 3). Among habitats of wet meadows – including *Iridetum sibiricae* – specialists (S), competitors (C) and generalists (G) form a separated group from weeds (W), disturbance tolerants (DT) and ruderal competitors (RC). Vegetation stands of Dabas (DAI, DAC) and Pellérd (PEI, PEC) is quite rich in ruderals according to natural disturbance and locally or periodically dry soil conditions. Habitats of Pusztavám (PUI, PUC) consist of competitors and stress tolerant species above all (S, C, G). In accordance with *Iridetum sibiricae* and contact vegetation types Iris rich meadows could have been under moderate disturbance regime. Contact vegetation types, especially Dabas and Pellérd, are rich in ruderals, that is explained by regular and permanent management and human disturbance e.g. the mowing or hay-making. In *Iridetum sibiricae* stands geophytes (G), therophytes (Th), hemi-terophytes (TH) and hydatophytes (HH) are more frequent than in contact vegetation types. These life forms indirectly indicate environmental extremities of the habitats.

Conclusion

In this paper we focused on vegetation characteristics of Siberian iris rich meadows and their contact vegetation types in the Carpathian basin from Hungary. In accordance with the analyses, diagnostic, dominant and constant species were revealed. *Iridetum sibiricae* has only few community diagnostic species, but there are several habitat dependent subassociations have been described by the local diagnostic species. Numerical classification and ordination by social behaviour types and life form categories supported that species composition directly depends on species set of the contact vegetation, on the natural disturbance regime connected to presumable habitat extremities (e.g. change and dynamics of water level). It is strongly recommended to confirm conservation and management of Iris meadows and their surroundings in the future.

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SBT	LF	association/stand number of relevés	1 30	2 10	3 12	4 10	5 12	6 10	7 12
S	G	Iris sibirica	**97**	**100**	*	**100**	*	**90**	*
DT	TH	Daucus carota	87	100	-	100	*	60	*
G	H	Inula salicina	**70**	*	-	**100**	-	**100**	*
C	H	Molinia arundinacea	**63**	**100**	-	**50**	-	*	*
DT	H	Galium verum	97	90	83	100	*	100	100
G	G	Carex flacca	93	100	92	90	*	90	92
C	H	Deschampsia caespitosa	**93**	100	83	80	**92**	**100**	**92**
G	H	Ranunculus acris	90	80	100	90	**100**	100	58
DT	H	Dactylis glomerata	77	*	83	80	*	100	100
G	H	Serratula tinctoria	73	70	92	*	*	**100**	**100**
G	G	Cirsium canum	70	*	**75**	60	60	**100**	67
DT	H	Festuca arundinacea	67	100	100	50	-	50	*
S	H	Sanguisorba officinalis	**67**	**100**	**100**	-	-	100	75
DT	H	Lotus siliquosus	63	100	92	-	-	90	92
C	H	Molinia caerulea	**63**	**100**	**100**	-	-	**90**	**100**
DT	HH	Lysimachia vulgaris	60	80	*	80	*	*	*
G	H	Succisa pratensis	60	100	100	60	-	*	*
DT	H	Vicia cracca	60	80	**100**	-	-	100	58
C	H	Sesleria caerulea	*	**100**	**100**	-	-	-	-
DT	H	Leontodon hispidus	*	80	-	-	-	*	75
C	M	Salix cinerea	*	80	*	*	-	-	-
G	H	Angelica sylvestris	*	70	92	-	-	-	-
G	H	Galium mollugo	*	70	-	-	-	-	-
G	HH	Lythrum salicaria	*	60	*	*	83	*	*
C	M	Salix rosmarinifolia	*	60	*	-	-	-	-
DT	H	Calystegia sepium	*	-	-	100	*	*	-
C	HH	Carex elata	*	*	*	100	*	*	-
DT	G	Equisetum arvense	*	*	-	100	67	*	-
DT	H	Lathyrus pratensis	*	60	-	100	100	-	-
DT	H	Ranunculus repens	*	*	*	100	**100**	*	*
G	H	Symphytum officinale	*	-	-	100	83	-	-
G	H	Lychnis flos-cuculi	*	-	-	90	100	-	-
G	H	Betonica officinalis	*	-	-	**80**	-	*	-
DT	TH	Inula britannica	*	*	*	80	**100**	*	*
C	H	Alopecurus pratensis	*	-	-	70	100	-	-
G	H	Euphorbia palustris	*	*	-	**70**	-	-	-
DT	H	Juncus inflexus	*	-	*	70	75	-	-
DT	G	Carex hirta	*	-	67	60	100	*	-
W	TH	Dipsacus laciniatus	*	-	-	60	-	-	-
C	M	Prunus spinosa	*	-	-	60	-	-	-
G	H	Scutellaria hastifolia	*	-	-	60	*	-	-
G	G	Colchicum autumnale	*	-	*	*	-	**100**	*
C	H	Festuca pratensis	*	-	75	*	*	**100**	92
G	H	Filipendula vulgaris	*	-	-	*	*	**100**	*
DT	H	Lotus corniculatus	*	-	67	-	*	100	**92**
DT	Ch	Ononis spinosa	*	-	*	-	-	**100**	**100**
DT	H	Poa angustifolia	*	*	*	*	*	100	92
DT	H	Achillea asplenifolia	*	-	100	-	*	90	100
G	G	Carex tomentosa	*	*	*	*	-	90	*
G	HH	Equisetum fluviatile	*	-	67	-	-	90	*
S	G	Equisetum variegatum	*	-	*	-	-	90	-
S	H	Koeleria javorkeae	*	-	-	-	-	90	*
DT	TH	Picris hieracioides	*	-	-	-	*	90	*
C	H	Bromus inermis	*	-	-	-	-	80	-
RC	G	Elymus repens	*	-	*	-	*	80	92
G	H	Euphorbia villosa	*	-	-	-	-	70	*
DT	H	Rumex acetosa	*	-	-	-	*	60	*
DT	Ch	Silene vulgaris	*	-	-	-	-	60	*
RC	G	Cirsium arvense	*	*	-	*	*	70	-
G	H	Briza media	*	*	75	*	-	100	75
G	H	Centaurea jacea	*	-	92	-	100	100	100
G	G	Carex panicea	*	-	100	-	*	*	*
G	H	Peucedanum palustre	*	*	**92**	*	*	-	-
G	H	Galium boreale	*	-	**75**	-	-	60	*
S	H	Scorzonera humilis	*	-	75	-	-	*	-
G	H	Holcus lanatus	*	-	-	*	**100**	-	-
C	H	Agrostis stolonifera	-	-	*	-	**100**	-	*
DT	HH	Carex vulpina	*	*	-	*	100	*	*
DT	H	Potentilla reptans	*	-	*	*	100	*	*
DT	H	Glechoma hederacea	*	-	-	*	92	-	-
DT	H	Trifolium pratense	*	-	*	*	92	*	83
G	HH	Carex cuprina	*	-	-	-	83	*	*
W	H	Plantago major	-	-	-	-	83	-	*
G	H	Poa pratensis	*	*	*	-	**75**	*	-
C	H	Chrysopogon gryllus	*	-	-	-	-	*	**83**
C	H	Brachypodium pinnatum	*	-	-	-	-	*	*

Table 1 - Synoptic table of diagnostic, constant and dominant species of Iridetum sibiricae and contact vegetation in Hungary with percentage frequencies based on presence data. Values highlighted grey belong to set of diagnostic species for subassociations, framed values belong to local differential species, both of them if fidelity is over 50. Bold figures represent dominant species with abundance up to 10. Associations are numbered as follows: 1=IRID (PUI+PEI+DAI), 2=PUI, 3=PUC, 4=PEI, 5=PEC, 6=DAI, 7=DAC – more details see chapter Material and methods. * = frequency value is under 60, - = absent species.