Acta Bot. Neerl. 31(5/6), November 1982, p. 391–416.

SYNTAXONOMIC STATUS OF THE JUNCO-MENTHETUM LONGIFOLIAE LOHMEYER 1953, THE JUNCO-MENTHETUM ROTUNDIFOLIAE OBERDORFER (1952) 1957 AND THE CARICETUM VULPINAE NOWINSKI 1927

K. V. SÝKORA

Botanisch Laboratorium, Afdeling Geobotanie, Toernooiveld, 6525 ED Nijmegen

SUMMARY

A survey is given of the syntaxonomic status and the internal differentiation of the *Junco-Menthetum longifoliae* (and *rotundifoliae*) and the *Caricetum vulpinae* in Europe. The following conclusions can be drawn:

A. *Junco-Menthetum longifoliae*

1. Vegetation stands containing *Mentha longifolia* do not belong to one association but are conglomerates i.e. mixtures of fragments.
2. *Mentha longifolia* is not characteristic of the *Lolio-Potentillion* but its epharmony is comparable to that of the *Filipendulion* species. The tall-forb character of the conglomerates is conspicuous.
3. The *Plantaginetea* element is of only minor importance under extensive grazing but increases with intensification of this factor.

B. *Junco-Menthetum rotundifoliae*

1. The status of this association as a separate association is insufficiently founded.

C. *Caricetum vulpinae* Tüxen 1947

1. Contrary to the suggestion of WESTHOFF & VAN LEEUWEN (1966) and WESTHOFF & DEN HELD (1969), *Carex vulpina* is not a character species of the *Lolio-Potentillion*. The preponderance of *Magnocaricion* and *Phragmitetea* species justifies the assignment of the *Caricetum vulpinae* to these syntaxa.
2. On a European scale no subassociations can be distinguished.
3. The main internal differentiation is expressed by a gradual increase of the weight of the *Molinio-Arrhenatheretea* and the *Scheuchzerio-Caricetea* species as the dynamics of the hydrology decreases.

1. INTRODUCTION

In previous papers (SÝKORA 1980, 1982a, 1982b, 1982c) the syntaxonomy and synecology of the *Lolio-Potentillion anserinae* Tx. 1947 in the northern part of the Atlantic domain have been discussed. In this paper a survey is given of the *Junco-Menthetum longifoliae* Lohmeyer 1953 and the *Caricetum vulpinae* Nowinsky 1927. Furthermore the syntaxonomic position of the *Junco-Menthetum rotundifoliae* Oberdorfer 1952 is discussed. The first community is usually considered to belong to the *Agropyro-Rumicion crispi* Nordh. 1940 em. Tx. 1950, the alliance in which Tüxen combined the communities occurring on organic

drift material along the coasts of the northern part of Europe (*Agropyro-Rumicion crispi* Nordh. 1940) with communities from inundated pastures (*Lolio-Potentillion anserinae* Tx. 1947). According to Sýkora (1980) this combination is unjustified, however.

According to LIPPERT (1966) and CREDARO & PIROLA (1975), the systematic position of the *Junco-Menthetum longifoliae* is unclear and of dubious interpretation. From the *Junco-Menthetum rotundifoliae* only very few relevés have been published (RUNGE 1980, TÜXEN 1976). In structural and chorological respect as well as in its floristic assemblage, this community has much resemblance to the *Junco-Menthetum longifoliae; Mentha longifolia* and *Mentha rotundifolia* are epharmonically closely related.

WESTHOFF & VAN LEEUWEN (1966) suggested that *Carex vulpina* is a characteristic species of the *Agropyro-Rumicion crispi*. In 1969 WESTHOFF & DEN HELD classified the *Caricetum vulpinae* into this alliance. Other authors, however, consider it a *Magnocaricion* community (tall sedge communities).

2. METHODS

In the relevant literature both separate relevés and synoptic tables of the *Junco-Menthetum* and the *Caricetum vulpinae* have been published. For the construction of *tables 1* and *5*, 68 *Junco-Menthetum* and 96 *Caricetum vulpinae* relevés were gathered from literature, mentioned in chapter 3 and on p. 413.

The rough tables were structured by means of the Tabord program (VAN DER MAAREL et al. 1978, VAN DER MAAREL 1979), using similarity ratio (WISHART 1969) to measure similarities between relevés and clusters. After summarizing the results in synoptic tables the synoptic clusters as presented in the literature were added. The final tables represent a total of 91 relevés of the *Junco-Menthetum longifoliae* (inclusive the *Junco-Menthetum rotundifoliae* with 11 relevés) and about 194 relevés of the Caricetum vulpinae. In order to determine the importance of the phytosociological elements in each column the systematic group value was calculated (TÜXEN & ELLENBERG 1937), for which I used the formula

$$Dx = Gx^2 \cdot 100/t.n$$

in which Dx = the systematic group value for species group x, Gx^2 = the squared sum of the presence class values for all species forming part of a group x, t = the sum of all presence class values of all species in the column under consideration and n = total number of species in species group x. Thus the proportion of the species group is multiplied by the average presence class value in order to diminish the effect of the species with low presence class values. The more accidental species with a low presence occur in the column, the lower the systematic group value will be. The systematic group values of the *Junco-Menthetum longifoliae*, the *Junco-Menthetum rotundifoliae* and the *Caricetum vulpinae* are presented in *tables 2* and *3*. The phytosociologic status of each species was determined from OBERDORFER (1979), ELLENBERG (1978), WESTHOFF & DEN HELD (1969) and SÝKORA (1982a, b and c).

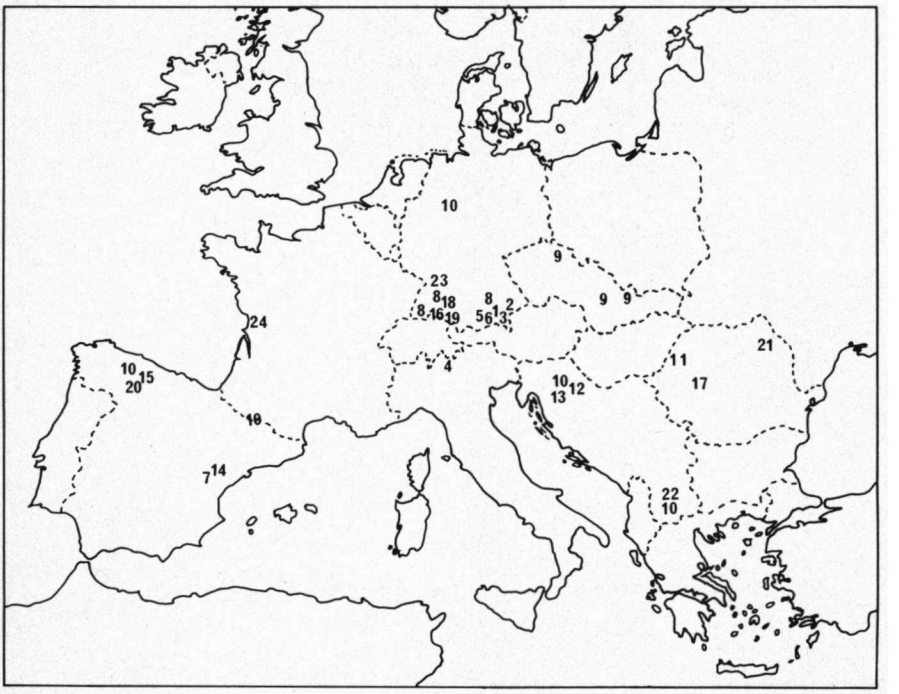


Fig. 1. Distribution of the conglomerates of *Mentha longifolia*. Numbers on the map correspond with the column numbers in *table 1*.

For a principal components ordination of the *Caricetum vulpinae* (*fig. 3*) I used the Ordina Program (ROSKAM 1971). In this analysis the presence class values of the species in each column were used. The localities of the relevés on which the *tables 1* and *5* are based, are indicated in *figs. 1* and *2*.

Species nomenclature follows Flora Europaea (TUTIN et al. 1964–1980) for phanerogams and LANDWEHR (1966) for bryophytes.

3. MIXTUM COMPOSITUM OF MENTHA LONGIFOLIA *(table 1)*

3.1. *Table 1* in which the *Junco-Menthetum* communities gathered from literature have been combined, is markedly heterogeneous. The floristic composition of the columns is very distinct. Based on these results I conclude that a *Juncus inflexus-Mentha longifolia* association as a unit does not exist, and that the combination of local units containing *Mentha longifolia* is a mixtum compositum. This position will be elucidated in the following sections. In the table structured by means of the Tabord Program, only few relevés have been relocated. The only cluster composed of relevés from different localities (different papers) is cluster 10, a combination of relevés from Germany, Jugoslavia and Spain. As

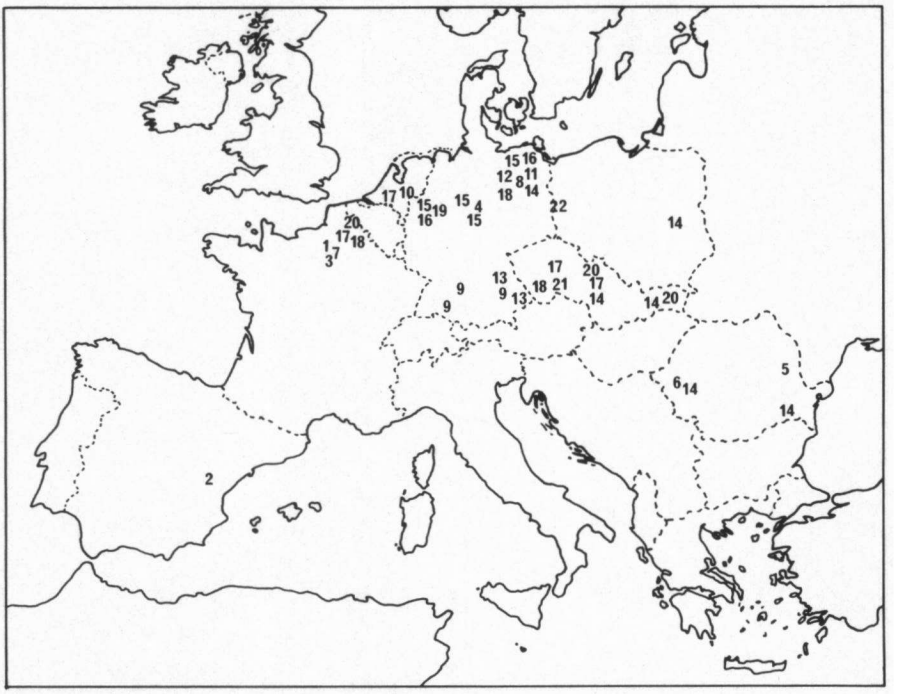


Fig. 2. Distribution of the *Caricetum vulpinae*.
Numbers on the map correspond with the column numbers in *table 5*.

the separate columns represent mixtures of fragments i.e. mixtures of communities that lack sufficient diagnostic species to be able to describe them as associations, the term conglomerate (devised by Westhoff, personal communication) has been introduced in this paper.

3.1.1. Conglomerate of Mentha longifolia and Rumex alpinus (columns 1, 2 and 3)

The conglomerate of *Mentha longifolia* and *Rumex alpinus* refers to a tall forb vegetation floristically forming a transition between the *Molinio-Arrhenatheretea* Tx. 1937 and the *Rumicion alpini* (Rübel 1933) Klika 1944. The *Molinio-Arrhenatheretea* species have the greatest systematic group value, followed by the *Artemisietea vulgaris (table 2)*. In this conglomerate the species of the Plantaginetea are of minor importance only. The conglomerate is differentiated by the *Molinio-Arrhenatheretea* species *Chaerophyllum hirsutum, Carum carvi, Veronica chamaedrys, Alchemilla xanthochlora* and *Poa alpina. Chaerophyllum hirsutum* is a character species of the *Chaerophyllo-Ranunculetum aconitifolii* Oberd. 1952, a montane association belonging to the *Calthion palustris* Tx. 1936 and occurring in meadows along swiftly running water. It is also frequent in tall forb communities of the *Filipendulion* (Runge 1980, Oberdorfer 1979).

Other differential species such as *Lamium maculatum, Rumex alpinus* and *Veratrum album* belong to the *Artemisietea. Veratrum album* and *Rumex alpinus* have their optimal occurrence in the strongly nitrophilic *Rumicetum alpini* Beg. 1922. This association forms a tall forb community occurring everywhere in the Alps between 900 and 2640 m near shepherd's huts where dung hills have been cast, liquid manure is seeping or where rubbish has been thrown. It is avoided by cattle (RUNGE 1980). *Urtica dioica* and *Rumex obtusifolius* occurring with presence class IV and III respectively are *Artemisietea* species too. Further differential species are *Poa supina (Plantaginetea), Epilobium alpestre* and *Senecio nemorensis* (characteristic of the arctic-alpine tall herb communities of the *Betulo- Adenostyletea* Br. Bl. & Tx. 1943, and, with low presence class, *Impatiens noli-tangere, Chrysosplenium alternifolium* and *Ranunculus nemorosus* (*Alno-Padion*).

Columns 1–3 consist of relevés made by LIPPERT (1966) in the southeastern part of Germany (Berchtesgaden) at 600 m (relevés 1 and 2) and 860–1720 m (column 3). In columns 1 and 2 (one relevé each) *Plantaginetea* species are almost absent while *Molinio-Arrhenatheretea* species are preponderant and *Fagetalia* and *Artemisietea* species, though considerably less important, follow next (*table 2*). By the presence of *Oxalis acetosella (Fagion)*, the *Alno-Padion* species *Lysimachia nemorum, Stachys sylvatica, Brachypodium sylvaticum, Salvia glutinosa* (*Fagetalia*, also *Alno-Padion*), *Ranunculus nemorosus* (*Calthion*, also *Alno-Padion*) and the *Origanetalia vulgaris* Th. Müller 1961 species *Clinopodium vulgare, Origanum vulgare* and *Geranium sylvaticum* the forb fringe (scrub-grassland boundary zones) character of both relevés is indicated. The high coverage of *Rubus caesius* in relevé 1 expresses a very low grazing pressure. Lippert (1966) proposed to assign these *Mentha longifolia* communities to the *Chenopodietea*. As species of this class are absent this proposal is unfounded.

3.1.2. Conglomerate of Mentha longifolia and Epilobium palustre (column 4)

The conglomerate of *Mentha longifolia* and *Epilobium palustre* consists of 4 relevés made by CREDARO & PIROLA (1975) in Italy between 780 and 1650 m. According to these authors this *Mentha longifolia*- dominated vegetation has a

Table 1. Synoptic table of the mixtum compositum of *Mentha longifolia* conglomerates. In columns 1, 2, 13, 18–21 the cover-abundance values are indicated; in the other columns the presence class is given in Roman numerals (relevés more than 5) or in Arabic numerals (relevés less than 5). Besides the cover-abundance values have been presented when available. Locality: G = Germany, I = Italy, S = Spain, J = Yugoslavia, Cz = Czechoslovakia, R = Rumania. Syntaxonomic status: Ag = Agropyretea, Ar = Arrhenatheretalia, A.v. = Artemisietea vulgaris, B.A. = Betulo-Adenostyletea, Bi = Bidentetea, Ch. = Chenopodietea, Ep = Epilobietalia, Fa = Fagetalia, F.B. = Festuco-Brometea, FB/Ar = Festuco-Brometea/Arrhenatheretalia, G.S. = Glycerio-Sparganion, Ho = Holoschoenion, I.N. = Isoeto-Nanojuncetea, L.P. = Lolio-Potentillion, M.A. = Molinio-Arrhenatheretea, M.c. = Magnocaricion, M.C. = Montio-Cardaminetea, Mo = Molinietalia, Na = Nardetalia, Ph = Phragmitetea, Pl = Plantaginetea, Q.F. = Querco-Fagetea, SC = Scheuchzerio-Caricetea, T.G. = Trifolio-Geranietea. For additional infrequent taxa see appendix.

Table 1. Legend on preceding page.

	Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Number of relevés	1	1	5	4	3	3	5	7	18	7	7	5	1	2	2	2	3	1	1	1	1	1	6	4
	Locality	G	G	G	I	G	G	S	G	G	GJS	R	J	J	S	S	G	R	G	G	S	R	J	G	F
	Mentha longifolia	+	4	V3-4	4 3-5	1		V+-2	V4-5	IV+-3	V2-4	V+	V2-5		2 1-2		2 2-4	2 +		3		1	+		
	Differential species 1																								
Ar	Euphrasia rostkoviana	+																							
TG	Origanum vulgare	1																							
Fa	Oxalis acetosella	1																							
Fa	Ranunculus aconitifolius	1																							
	Differential species 2																								
QF	Brachypodium sylvaticum	+	+																						
TG	Clinopodium vulgare	+	1																						
Av	Geranium robertianum	+	1																						
Fa	Salvia glutinosa	+	1																						
Mo	Valeriana officinalis	+	+							I															
	Differential species 3																								
Mo	Chaerophyllum hirsutum			V+-2														2 +							
Ar	Carum carvi	+	1	V+-1						III+															
Pl	Poa supina	+	+	IV+-2																					
Ar	Veronica chamaedrys	+	1	IV+-2							I+														
Ar	Alchemilla xanthochlora	r	+	IV+-3	3 +													2 +							
Av	Lamium maculatum		+	III+-1																					
Ba	Epilobium alpestre			III+-1																					
Ar	Poa alpina			III+																					
Av	Rumex alpinus			III+-2																					
Av	Veratrum album			IIIr-1																					
BA	Senecio nemorensis			II+-2																					
Fa	Impatiens noli-tangere			IIr-+																					
Fa	Chrysosplenium alternifolium			II+-2																					
Fa	Ranunculus nemorosus	+	+	II+-1																					
	Differential species 4																								
SC	Epilobium palustre				4 +-1					I+								2 +							
BA	Chaerophyllum villarsii				1																				
	Differential species 5																								
Pl	Juncus tenuis					2																			
Mo	Carex acuta					3					I														
	Differential species 6																								
MA	Alopecurus pratensis						2			I															
	Lolium multiflorum						2																		
	Differential species 7																								
MA	Trifolium pratense	+	+	II+		3		V+-2		II+-1	I+				2 +-2										
MA	Holcus lanatus				3 +-1	2	1	IV+	I	I+					2 +-2				+						
Mo	Deschampsia media							III1-2																	
Mo	Lotus uliginosus							III+							1 +										
FB/Ar	Ranunculus bulbosus							III1							1 1			2 +							
Ar	Leontodon autumnalis					1	1	III+	I	I+-1	I+			+	2 +										
FB/Ar	Briza media							III+		I+-1															
Mo	Carum verticillatum							II+-1																	
Av	Barbarea stricta							II+-1																	
FB/Ar	Plantago media	+				1		II+																	
	Differential species 8																								
Av	Senecio cordatus								III																
Av	Cirsium arvense								III	I+	I+													II	3
	Differential species 9																								
Ag	Equisetum arvense								I	V+-3	II+													II	2
	Calliergonella cuspidata									IV1-4															
Mo	Hypericum tetrapterum							I+		IV+-2					1 1					+					
	Blysmus compressus									III+-2															
Mo	Mentha arvensis									III+-2															
GS	Glyceria plicata									III+-1															
Mo	Caltha palustris								I	III+-2								3 +-1							
MA	Cerastium fontanum			II+		2				IV+-1														II	
MA	Poa trivialis			II+-1		3	3	I1	II	V+-3	I2			1				2 +				+			
Mo	Scirpus sylvaticus						2			III+-2							1 2			1					
MA	Rumex acetosa									II+															
	Cratoneuron decipiens									II+-2															
Mo	Carex paniculata									II+-2															
SC	Carex flava									II+-1															
	Brachythecium rutabulum									II+-2															
Ag	Tussilago farfara									II+-1										+				I	
	Mnium affine									II+-1															
SC	Eriophorum latifolium									II+															
	Drepanocladus aduncus									II1-2															

Tabel 1, (Continued)

	Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Number of relevés	1	1	5	4	3	3	5	7	16	7	7	5	1	2	2	2	3	1	1	1	1	1	6	4
	Locality	G	G	G	I	G	G	S	G	G	GJS	R	J	J	S	S	G	R	G	G	S	R	J	G	F
SC	Carex nigra				1 +					II+-2															
	Differential species 10																								
	Mentha rotundifolia										III+-4								4					V 1-4	4 3-4
LP	Alopecurus geniculatus										II+-2														
	Differential species 11																								
Ph	Mentha aquatica						1				I+	V+-2					1 +			+					
Ph	Althaea officinalis										I+	V+-1	I2		2 2-3										
Bi	Polygonum lapathifolium										I+	V+-2	I+												
Mo	Lythrum salicaria						3			I+	I+	V+-1						2 +	+			1			
Ph	Lycopus europaeus									III+-1	II+	V+							1						
Ch	Xanthium strumarium											V+	III+-1												
Arm	Lotus tenuis											IV+													
Ph	Phragmites australis						1					IV+													
Mó	Scutellaria galericulata									I+		IV+													
GS	Veronica anagallis -aquatica											III+-1													
IN	Pulicaria vulgaris											III+													1
Ph	Poa palustris											III+-2													
Bi	Chenopodium glaucum											III+-1													
Mo	Epilobium hirsutum									I+-2	I+	III+-1		+											
Ch	Echinochloa crus-galli										I+	III+											+		
Mo	Stachys palustris											III+	I+												
Mo	Senecio aquaticus										I+	III+-1					1 +								
Mc	Carex vulpina						1				I+	III+													
Ph	Scirpus lacustris											II+													
	Rumex dentatus											II+													
Mc	Lycopus exaltatus											II+													
Mc	Carex melanostachya											II+													
	Differential species 12																								
Pl	Lolium perenne				2 +-1		3	III+-2		I+	II+		V1-2								+			I	
	Pulicaria dysenterica								II		II+	III+	V1-3	+			2 1		1					I	3
Ch	Cichorium intybus									I+	I+		IV+-1									+			
LP	Rorippa sylvestris										I+		IV+												
Ch	Daucus carota					1			I	I+			III+-1				1 +								
Ch	Galeopsis speciosa												III+-1												
Bi	Polygonum mite										I+		III+				2 2								
Ch	Pastinaca sativa												II+				1 +								
Pl	Cynodon dactylon												II1-2												
	Differential species 13																								
Bi	Bidens tripartita									I+	I+	V+-1	V+-1	+		1 +	1 2								
Av	Galega officinalis											III+	IV+-2												
LP	Mentha pulegium										I+	III+	III+	1									2	I	1
Ch	Matricaria perforata	+										II+	II+												
Av	Artemisia vulgaris											II+	III+											I	
LP	Inula britannica											III+	III+												
	Differential species 14																								
Ep	Carex divulsa													+											
Ep	Centaurium erythraea													+											
	Differential species 15																								
	Nepeta nepetella														2 +-1										
Av	Dipsacus fullonum														1 1										
	Differential species 16																								
PB	Sanguisorba minor															1 +									
	Leontodon taraxacoides															1 +									
Ag	Convolvulus arvensis															1 1									
Ch	Setaria sp.															1									
	Differential species 17																								
	Oenanthe banatica																	1							
	Differential species 18																								
Ch	Chenopodium album																		+					I	2
Ch	Diplotaxis tenuifolia																		+					I	2
MA	Vicia sepium																		+					I	2
Av	Calystegia sepium								I										+					I	3
	Differential species 19																								
MA	Arrhenatherum elatius																			+					
Mo	Carex acutiformis																			2					
Av	Cruciata laevipes																			+					
Mo	Phalaris arundinacea																			2					
	Differential species 20																								
Ch	Rumex pulcher																					+			

Tabel 1, (Continued)

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Number of relevés	1	1	5	4	3	3	5	7	18	7	7	5	1	2	2	2	3	1	1	1	1	1	6	4
Locality	G	G	G	I	G	G	S	G	G	GJS	R	J	J	S	S	G	R	G	G	S	R	J	G	F
Plantaginetea																								
Plantago major			II+		3	2	IV+-2	I	IV+-2	III+-1	II+	V+-1	+	1 +	2 +-2	1 1	2 +					+	I	
Potentilla anserina					1	1		IV	V+-2	II1-2	V+-1	II+-1						+					II	3
Poa annua							III+		I+	II1						2 1-2		+					II	
Polygonum aviculare								I		II+-2	II+	II+-2			1 +								I	
Ranunculus sardous							II+					II+	1											
Lolio-Potentillion																								
Agrostis stolonifera	1	+	IV+-2	3 +-1		2	V+-2	III	V+-3	V2-4	V+-2	III+-1	1	2 1-2	1 2	1 2						2	I	1
Juncus inflexus			I+		2	3	V1-3	IV	V1-5	III1-2	V3-4	III+-3	4	1 1			3 3-4	+	2	4	5		IV	1
Potentilla reptans			II+		2		IV+-2	V	V+-3	V+-4	V+		1		2 4-5			+	1	2	+	2	V	3
Rumex crispus					1	1	III+-1	III	III+	II1-3	V+			1 +				+		1			I	2
Carex hirta				4 +-2	2	2	IV+-2	IV	V+-3	II+-1				1 +	1-2								II	
Trifolium fragiferum									I+-1	I+		II+-2												
Juncus compressus									I+				+											
Molinio-Arrhenatheretea																								
Prunella vulgaris			I1	3 +	3	2	IV+-1	III	V+-2	III+-2	II+	III+-1	1	2 +		1 1	2 +				+		II	
Ranunculus acris				2 +	3	3	II1	III	IV+-1				+				1 +							
Plantago lanceolata					3	2		II	II+						1 1	2 1-2			+					
Dactylis glomerata	+	1	IV+-1		1			IV	I+	I+								+	+				III	2
Festuca pratensis			IV+-1		3	3			V+-3								2 +							
Centaurea jacea	1								I+	I+		I1				2 +-1								
Poa pratensis			I1		3	2			I1								2 +						II	
Festuca rubra			I+	2 +-1	3	1			I+															
Leontodon hispidus			I+						I+			I+												
Lathyrus pratensis								I	II+-1															
Arrhenatheretalia																								
Trifolium repens	+				3	2	III+	IV	II+-2	IV+-3	III+	III+-1	1	2 +			1 +					2	I	1
Achillea millefolium	2	+	IV+-1		2				III+			III+-1						+			+		III	
Medicago lupulina	+	+			1			I	II+						1 1			+					I	
Bellis perennis					3	2		II	II+				+										II	1
Galium mollugo	1	+			1				I+							2 +-1								
Leucanthemum vulgare			I		1	1		I	I															
Phleum pratense			Ir		2	2			II+															
Stellaria graminea	+	1	Ir						I+															
Cynosurus cristatus					2			II	I+												+			
Odontites rubra (Baumg.)Op.							I+		II+					1 1										
Lotus corniculatus					1					I+											+		I	2
Pimpinella major	1															1 1								
Heracleum sphondilium			IIr-+						I+															
Anthriscus sylvestris									I+							1 1								
Molinietalia																								
Cirsium palustre	+	1		4					II	I														
Deschampsia caespitosa			I+	2 2-3	2	1		II	II+-1								3 +							
Cirsium oleraceum								I	II+	I+									+					
Carex flacca	+		I+				III+		II+-1					1 +										
Equisetum palustre			I+	3 1		2		I	III+-3															
Myosotis scorpioides				2 +		1			IV+-2	I1						2 +-1	3 +-1							
Juncus effusus				3 +-1	1	2			II+-2	I1							1						II	
Angelica sylvestris			I+						I+-2	I+									+					
Carex distans					1				II+-1								3 +							
Lychnis flos-cuculi						1			II+								3 +							
Pilipendula ulmaria	+	1															2 +							
Lysimachia vulgaris									II+		III+													
Crepis paludosa			I+														3 +							
Molinia caerulea							II+-1		I1															
Juncus conglomeratus									I+-2												+			
Geum rivale				1 1													2 +							
Artemisietea																								
Verbena officinalis							I+	II		III+	III+	II+	1	2 1									III	2
Urtica dioica		+	Vr-1	2 1				IV	I+	II+-1						1 +		+					IV	1
Rumex obtusifolius		+	III+	3 1-2	2					II+-1									+				II	1
Galium aparine	r	1					I+		I+	I+				2 +										
Eupatorium cannabinum		+	II+-2	1 +					I+-1					2 +					+					
Cirsium vulgare			I+					II	I+	I+													I	
Glechoma hederacea									II+							1 1			2					
Rubus caesius	4	1																+					I	1

Table 1, (Continued)

	Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Number of relevés	1	1	5	4	3	3	5	7	18	7	7	5	1	2	2	2	3	1	1	1	1	1	6	4
	Locality	G	G	G	I	G	G	S	G	G	GJS	R	J	J	S	S	G	R	G	G	S	R	J	G	F
	Remaining species																								
Ph	Galium palustre	+	1		4				III	II+-2	I1	IV+						2 +							
	Ranunculus repens		1	V1-2		3	3		V	V1-3	V+-2	V+	IV+-1				2 +-3	3 +		2	2	2		III	2
Ag	Elymus repens			IV+-2		1		II+-1	I	I1	II+				2 +-1						2			I	2
	Taraxacum officinale group			II+-1		2	3		II	III+	II+													II	1
SC	Juncus articulatus				4 +-1	2	3	III+-1	I	IV+-2	III				1 +										
GS	Veronica beccabunga				2 +					III+-2	I+						1 +	2 +							
	Lysimachia nummularia						2		II	III+-2	II+-1	III+-1						3 +-1				+			
	Festuca arundinacea				3 +-1			IV+-2	III						1 2										1
Fa	Lysimachia nemorum	1	+	I1						I1															
	Trifolium hybridum					1	2				I1-3							1 +				+			
	Agrostis capillaris					2	2		I																
	Calamagrostis varia	+	+	I+																					
Fa	Stachys sylvatica	+	+	I1																					
GS	Epilobium parviflorum							II1-3		IV+-1		III+													
Bi	Polygonum hydropiper									Ir	I+			+										I	
	Rumex conglomeratus									I1			III+-1												
FB	Euphorbia cyparissias	1	+	I+																					
	Potentilla erecta	2	+		1 +					I+															
GS	Glyceria fluitans						1			I+	II+-3														
MC	Cardamine amara			I+	2 +-1													2 +							
Ev	Galeopsis tetrahit								II	I+	I+														
Ho	Scirpus holoschoenus										I+				2 1-2							+			2
	Torilis japonica																1								
	Torilis sp.							II+							2 +-1										
Na	Hypericum maculatum			I		1																			
TG	Geranium sylvaticum		+	I1																					
	Odontites verna								II		II+													II	1
Na	Carex ovalis									I+								3 +-1							
Fa	Stellaria nemorum			II1-2							I1														
SC	Carex echinata									I+-1								2 +							
TG	Agrimonia eupatoria			I						II					1										
Ch	Picris hieracioides																							II	1
	Bromus mollis L.																							II	

strong affinity to the *Molinietalia* which is confirmed by the data given in *table 2*. From the *Molinietalia* species *Equisetum palustre, Myosotis scorpioides, Juncus effusus* and *Geum rivale* have their highest frequency in the *Calthion*, tall meadows, often rich in tall forbs (KNAPP 1979). *Epilobium palustre* being differential for this conglomerate also occurs in the *Calthion* although it is typical of the *Caricion curto-nigrae*. CREDARO & PIROLA (1975) stress the unclear syntaxonomic position of this vegetation. They recorded it at water-saturated soils along brooks. It is inundated in spring and during periods with heavy rainfall. It has also been found in *Alnus incana-* and *Alnus viridis* woods. The influence of grazing is not mentioned by them.

The high coverage of *Deschampsia caespitosa* (2–3) probably indicates that grazing, if occurring at all, is only irregular, resulting in a selective advantage for this unpalatable grass species (KLAPP 1971). Under these conditions (selective low grazing pressure) more food is offered by the vegetation than needed, with the consequence that unpalatable species like *Deschampsia caespitosa, Festuca arundinacea* and *Urtica dioica*, are neglected by cattle (KLAPP 1965, DIRVEN & NEUTEBOOM 1975). When the stocking rate is high and herbage availability is low, the turf is kept uniformly short with no coarse vegetation (DUFFEY et al. 1974).

The systematic group value of the *Plantaginetea* including the *Lolio-Potentillion* as represented by *Lolium perenne, Agrostis stolonifera* and *Carex hirta*, is low.

3.1.3. Conglomerates of a) Mentha longifolia and Carex acuta and b) of Mentha longifolia and Alopecurus pratensis (columns 5 and 6)

These conglomerates have been described as respectively *Junco-Menthetum* variant of *Festuca rubra* (a) and variant of *Carex acuta* (b), by PFROGNER (1973). The first is the dry variant and is differentiated by *Molinio-Arrhenatheretea* and *Arrhenatheretalia* species; the latter, the moist variant, is differentiated by *Molinietalia* species.

Although *Mentha longifolia* has been recorded in only one of the relevés, both variants have been assigned to the *Junco-Menthetum* mainly because of the presence of *Juncus inflexus*. *Juncus inflexus* however occurs with high presence class in other communities, belonging to the *Lolio-Potentillion anserinae* (SÝKORA 1982 b and c). Like in the conglomerates discussed before, the group value of the *Molinio-Arrhenatheretea* is considerably higher than that of the *Plantaginetea*. The group values of the *Molinietalia* and *Arrhenatheretalia* confirm the differences between the variants as stated above *(table 2)*.

3.1.4. Conglomerate of a) Mentha longifolia and Deschampsia media (column 7) and b) Mentha longifolia and Scirpus holoschoenus (column 14)

These conglomerates have been described from Spain as *Junco-Menthetum longifoliae guadaricum* subassociation *typicum* (a) and subassociation of *Verbena-Althaea officinalis* (b) by RIVAS GODAY & CARBONELL (1961). The conglomerate

of *Mentha longifolia* and *Deschampsia media* is differentiated by *Trifolium pratense* and *Holcus lanatus (Molinio-Arrhenatheretea), Deschampsia media, Lotus uliginosus* and *Carum verticillatum (Molinietalia)* and by *Leontodon autumnalis (Arrhenatheretalia). Trifolium pratense* is susceptible to waterlogging and grazing by which it is negatively influenced; its presence therefore is a negative indication for the *Lolio-Potentillion.* Other differential species are *Ranunculus bulbosus, Briza media* and *Plantago media,* all occurring optimally in the *Mesobromion* but also in moderately dry *Arrhenatherion* communities. This group indicated in *table 1* by FB/Ar has a systematic group value of 22. The systematic group values of the *Molinio-Arrhenatheretea* and the *Plantaginetea* are almost equal, especially when the FB/Ar species are added. The total of the group value of *Molinio-Arrhenatheretea* and FB/Ar is 124. According to Rivas Goday & Carbonell *Mentha longifolia* is building facies with a nitrophilic tendency within the moist *Holoschoenetalia* and the *Molinietalia* of montane areas. Because of the anthropozoogenic and the nitrophilic character of the habitat they assign this community to the *Plantaginetea.* The authors describe the habitat of the conglomerate with *Scirpus holoschoenus (Junco-Menthetum* subassociation of *Verbena-Althaea officinalis)* as more nitrophilous and more ruderal which is indicated too by the presence of *Dipsacus fullonum, Verbena officinalis, Galium aparine, Eupatorium cannabinum* and *Nepeta nepetella,* all occurring preferentially in nitrophilous tall forb communities (*Artemisietea*). Although *Verbena officinalis* is considered a character species of the *Agropyro-Rumicion crispi* by Oberdorfer (1979), I assign this species to the *Artemisietea* because it is absent from wet soils and generally occurs in tall forb communities of the *Arction,* e.g. in the *Tanaceto-Artemisietum.* In contrast to the *Lolio-Potentillion* the *Arction* is intolerant of inundation. Within the conglomerate with *Scirpus holoschoenus* the *Molinio-Arrhenatheretea* and the *Artemisietea* have the highest group values. It is likely that the sites are hardly, if at all, grazed.

3.1.5. Conglomerate of Mentha longifolia and Senecio cordatus (column 8)

The relevés composing the conglomerate of *Mentha longifolia* and *Senecio cordatus* have been made in Germany by OBERDORFER (1957), between 120 and 900 m. Like the conglomerate of *Mentha longifolia* and *Rumex alpinus,* it has some affinity to the *Rumicetum alpini.* The differential species are *Senecio cordatus,* a character species of that association and *Cirsium arvense (Artemisietea).* The *Plantaginetea* have a systematic group value which is only slightly higher than that of the *Arrhenatheretea.* According to Oberdorfer the community forms a transiton to the *Artemisietalia* and the *Molinietalia.* It is a rather frequent community in wet depressions in meadows, along rivers, ditches or along roads under the influence of treading and grazing.

3.1.6. Conglomerate of Mentha longifolia and Hypericum tetrapterum (column 9)

In this conglomerate, based on relevés made in Czechoslovakia on altitudes of

350–800 m by BLAŽKOVÁ (1971), *Molinio-Arrhenatheretea* species are preponderant. *Plantaginetea* species are less important. *Table 1* shows that this column is differentiated very well, mainly by *Molinio-Arrhenatheretea* species. The *Molinietalia* are presented by *Hypericum tetrapterum* (*Filipendulion*, a tall forb community), *Mentha arvensis, Caltha palustris, Scirpus sylvaticus, Equisetum palustre* and *Myosotis scorpioides* (*Calthion*, meadows, often rich in tall forbs). *Glyceria plicata, Lycopus europaeus, Epilobium parviflorum, Veronica beccabunga* and *Carex paniculata* are representatives of reed communities from inundated sites. BLAŽKOVÁ noticed the considerable proportion of *Molinio-Arrhenatheretea* species in the *Junco-Menthetum* and she ascribed this to the close contact between these units. The *Junco-Menthetum* often is surrounded by *Molinio-Arrhenatheretea* (especially *Cynosurion*) communities. It forms very narrow zones, some metres to even only some decimetres wide zones between the pastures (meadows) and the source or brook and is only inundated for short periods. The community is absent in river valleys with prolonged inundations. Apart from the hydrology the saturation of the soil sorption complex with the cations Ca^{++} and Mg^{++} seems important.

The vegetation often consists of a mosaic of bunches of *Juncus inflexus* on which the *Arrhenatheretea* species grow and of depressions with *Phragmitetea*, particularly *Magnocaricion* species. Penetration of species from other communities is possible because of the open character of the vegetation; the soft, slimy soil surface is easily poached by cattle. According to BLAŽKOVÁ (1971), *Mentha longifolia* has a broader amplitude than *Juncus inflexus* and also penetrates into the fringes on the brook banks. On sites excluded from grazing the *Junco-Menthetum* occurs without any essential difference in floristic composition.

3.1.7. Conglomerate of Mentha longifolia and Mentha rotundifolia (column 10) and Junco-Menthetum rotundifoliae (columns 18, 23 and 24)

The communities presented under this section have been recorded by LOHMEYER (1953), OBERDORFER (1954 and 1957), TÜXEN & OBERDORFER (1958), LÜPNITZ (1967) and MARKOVIČ (1973) from Germany, Jugoslavia and Spain. A common feature is the presence of *Mentha rotundifolia*, a species of verges, roadside ditches, and walls bordering vineyards. It is more drought resistant and seems more thermophilous than the other species of the genus *Mentha* occurring in Europe. The species has a Westmediterranean-Atlantic distribution. The conglomerate of *Mentha longifolia* and *Mentha rotundifolia* (column 10) is a mixture of both species, in the other columns (18, 23, 24) the first species is lacking. The systematic group value of the *Plantaginetea* is considerably higher in the conglomerate, higher in column 24, almost equal in column 23 and lower in 18, than that of the *Molinio-Arrhenatheretea*. The *Mentha rotundifolia*-communities are differentiated against the conglomerate of *Mentha longifolia* by *Chenopodium album* and *Diplotaxis tenuifolia* (*Chenopodietea*), *Vicia sepium* (*Arrhenatheretalia*) and *Calystegia sepium* (*Convolvuletalia*). The *Artemisietea* and *Chenopodietea* element is pronounced. In column 24 in which *Mentha rotundifolia*

has its highest cover value (3–4), the systematic group value of the nitrophilic tall forb communities (*Artemisietea*) is equal to that of the *Plantaginetea*. This is in accordance with the statement of Runge (1980), that in recent times *Mentha rotundifolia* is spreading on ruderal sites.

The relevés made by OBERDORFER (1954) and LOHMEYER (1953) have been recorded on moderately grazed sites. According to MARKOVIČ (1973) the *Mentha longifolia* stands often are influenced by poaching and grazing. TÜXEN & OBERDORFER (1958) state that the community is sensitive to poaching and that when exposed to grazing it is easily disturbed during periods with high water levels. The lower distribution limit of *Mentha longifolia* is determined by the mean high water line in summer. *Mentha rotundifolia* occurs on relatively drier sites. the *Lolio-Potentillion* on the contrary has been observed to tolerate an even rather prolonged inundation during summer (SÝKORA, in prep.).

3.1.8. Conglomerate of Mentha longifolia and Mentha aquatica (column 11)

This conglomerate based on relevés made by POP (1968) from Rumania is differentiated by a large number of species viz. *Mentha aquatica, Althaea officinalis, Lycopus europaeus, Phragmites australis, Scutellaria galericulata, Veronica anagallis-aquatica, Poa palustris, Carex vulpina, Scirpus lacustris, Lycopus exaltatus* and *Carex melanostachya (Phragmitetea*, reed vegetation in more or less stagnant water), *Lythrum salicaria, Epilobium hirsutum, Stachys palustris* and *Lysimachia vulgaris* (*Filipendulion*, tall forb communities). Other differentials are *Polygonum lapathifolium, Chenopodium glaucum, Echinochloa crus-galli, Lotus tenuis* and *Pulicaria vulgaris*. The *Chenopodietea* species *Xanthium strumarium* and *Matricaria perforata* and the *Artemisietea* species *Galega officinalis* and *Artemisia vulgaris* are common differentials for this community and the conglomerate of *Mentha longifolia* and *Pulicaria dysenterica* (column 12, section 3.1.9). The preponderance of *Phragmitetea* species is clearly shown in *table 2*. According to Pop phytocoenoses of *Mentha longifolia* and *Juncus inflexus* form extensive and monotonous two layered stands from 100–200 m^2 to 500–1000 m^2 with a total height of 1 m.

3.1.9. Conglomerate of Mentha longifolia and Pulicaria dysenterica (column 12)

This conglomerate is based on relevés made by MARKOVIČ (1973) from the bank of a brook, from a road side ditch and from a pasture on the bank of the river Save (Jugoslavia). Although the *Plantaginetea* are preponderant there is a strong element of the *Chenopodietea* i.e. nitrophilous weed communities of rootcrop fields and waste places, with a preponderance of annuals. Apart from the species in common with the conglomerate with *Mentha aquatica*, the conglomerate with *Pulicaria dysenterica* is characterized by *Cichorium intybus, Daucus carota, Galeopsis speciosa, Pastinaca sativa (Chenopodietea), Lolium perenne, Cynodon dactylon (Plantaginetea), Polygonum mite (Bidentetea)* and *Pulicaria dysenterica*. According to OBERDORFER (1979) *Daucus carota* and *Pastinaca sativa* occur

Table 2. Systematic phytosociological group values within the conglomerates of *Mentha longifolia*. Species groups of minor importance have been omitted.

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Molinio-Arrhenatheretea	6	3	30	39	93	56	67	37	41	9	3	9	15	63	8	33	25	17	17		13		27	16
Arrhenatheretalia	29	23	58	14	35	18	17	21	17	12	6	19	15	19	7	21	7	11			20	17	17	11
Molinietalia	9	10	14	59	6	28	34	6	34	6	38	1	5	7		21	102	6	22		13		5	
Molinio-Arrhenatheretea total	44	36	102	111	127	101	102	61	90	25	45	29	35	108	15	75	130	33	39		47	17	44	26
Plantaginetea	3	3	15	6	15	17	37	12	14	23	17	56	10	2	35	18	6	11		17		17	13	18
Lolio-Potentillion	3	3	14	38	15	22	102	74	37	52	74	56	25	14	41	4	14	17	11	50	13	50	44	26
Plantaginetea total	6	6	28	42	34	39	134	80	55	75	89	112	35	16	76	21	20	28	11	67	13	67	54	40
Phragmitetea	3	3		25		3		9	6	4	85	1		9		4	6	6	6					
Magnocaricion					11	1			2	2	20								11					
Glycerio-Sparganion				6		1	4		14	4	12					4	6							
Phragmitetea total	3	3		28	11	5	4	9	20	10	132	1		9		8	12	6	17					
Artemisietea	6	23	48	19	5		5	38	4	16	14	28	5	28				17	22				38	40
Fagetalia	20	16	14							1														
Trifolio-Geranietea	6	7	2						2					2										
Chenopodietea	3				1			1	1	2	22	50			8	8		11			13	17	7	17
Agropyretea			13		1		4	4	10	8				9	8				6	17			7	16

Table 3. Systematic phytosociological group values within the *Caricetum vulpinae*. Species groups of minor importance have been omitted.

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Phragmitetea	250	175	148	241	245	102	187	250	109	156	105	143	137	61	89	120	94	79	88	72	65	55
Molinio-Arrhenatheretea	125	99	19	20	18	28	22	9	31	156	42	47	63	41	49	45	102	83	122	82	120	125
Scheuchzerio-Caricetea		28			9		15	2	3	31	2	9	1	9	6	16	0.9	41	61	15	45	46
Plantaginetea	42	31	38	81	10	23	46	7	32	94	22	42	102	21	50	24	17	9	15	18	10	18

preferentially in the *Dauco-Melilotion* and other *Onopordion* communities. In the western part of Europa these species are characteristic of the *Arrhenatheretum.*

Although *Pulicaria dysenterica* is considered to be a character species of the *Lolio-Potentillion anserinae* (previously named *Agropyro-Rumicion crispi* Nordh. 1940 em. Tx. 1950), it has only a negligible presence in the *Lolio-Potentillion* of the northern part of the Atlantic domain. Moreover, according to my own observations the species always occurs optimally in adjacent vegetation where grazing is prevented e.g. just beneath a fence, in tall reed vegetation out of reach of cattle, within patches of coarse vegetation (e.g. *Calamagrostis epigejos, Juncus effusus* or *Juncus maritimus*), or in ungrazed *Arrhenatheretea* stands ruderalized by irregular burning. The conglomerate of *Mentha longifolia* and *Pulicaria dysenterica* is influenced by cattle (MARKOVIČ 1973).

3.1.10. The remaining relevés (columns 13, 15–17, 19–22)

References: MARKOVIČ 1973, TÜXEN & OBERDORFER 1958, LANG 1973, HODISAN 1966, TODOR et al. 1971, OBERDORFER 1954.

In three of the remaining columns the *Plantaginetea* are preponderant (column 15 and 20) or are of equal importance compared to the *Molinio-Arrhenatheretea* (column 13). Column 15 was called the initial phase of the *Juncus inflexus-Mentha longifolia* association by TÜXEN & OBERDORFER (1958). In the other remaining relevés (except column 22) the *Molinio-Arrhenatheretea* have considerably higher systematic group values than the *Plantaginetea.* In column 22 which is dominated by the *Plantaginetea, Mentha longifolia* has a low cover value. As this relevé is recorded from a heavily poached and grazed site, this is quite understandable (OBERDORFER 1954). The relevé from column 19 is further characterized by *Artemisietea* and *Phragmitetea* species giving it the character of a tall forb-tall sedge community. This relevé was made by LANG (1973) on the bank of a brook in the vicinity of a farm. The site was grazed by geese.

3.2. Concluding remarks concerning the mixtum compositum with Mentha longifolia and Mentha rotundifolia.

Mentha longifolia occurs more often in conglomerates in which *Molinio-Arrhenatheretea* species are preponderant than in conglomerates dominated by *Plantaginetea* species (*table 4*). In the conglomerate of *Mentha longifolia* and *Mentha aquatica* the *Phragmitetea* constitute the main element. Since there is no objective criterion to assign the conglomerates to one of these classes and since the floristic composition of the various conglomerates differs considerably, I consider the association *Junco-Menthetum longifoliae* as non-existing. To quote BRAUN-BLANQUET (1928): (translation by me) "The potential number of species combinations is unlimited. Typification of every combination realised in nature would lead to a chaotic shivering of the vegetation units." The conglomerates are mosaics of mainly *Molinio-Arrhenatheretea* and *Plantaginetea* fragments with, in several cases, *Artemisietea, Phragmitetea* or *Chenopodietea* added. According to Blažková (personal communication 1982) these mosaics are com-

Table 4. Summary of the importance of *Molinio-Arrhenatheretea, Plantaginetea* and *Phragmitetea* species in I) the conglomerates with *Mentha longifolia* and II) in the *Junco-Menthetum rotundifoliae.*

I	*Molinio-Arrhenatheretea* species distinctly preponderant in 11 clusters (26 relevés)
	Molinio-Arrhenatheretea species preponderant in 1 cluster (18 relevés)
	Total: 12 clusters (44 relevés).
	Plantaginetea species distinctly preponderant in 5 clusters (16 relevés)
	Plantaginetea species slightly preponderant in 2 clusters (12 relevés)
	Total: 7 clusters (28 relevés)
	Plantaginetea and *Molinio-Arrhenatheretea* species of equal importance in one relevé
	Phragmitetea species distinctly preponderant in 1 cluster (7 relevés)
II	*Plantaginetea* species of equal importance as the *Artemisietea* species but preponderant over the *Molinio-Arrhenatheretea* species in 1 cluster (4 relevés).
	Plantaginetea species of equal importance as the *Molinio-Arrhenatheretea* species in 2 clusters (7 relevés)

posed of mixtures of wet, frequently inundated microsites alternating with moist, relatively drier ones, caused partially by the influence of grazing and partially by the tussocks formed by species like *Juncus inflexus, Festuca pratensis* and *Deschampsia caespitosa.* Under extensive grazing conditions the *Plantaginetea* are of minor importance only. Intensification of grazing favours the *Plantaginetea* element but at the same time the coverage of *Mentha longifolia* decreases. Most of the conglomerates especially those with a preponderance of *Molinio-Arrhenatheretea* species have a tall forb structure, thus reflecting the low grazing pressure. Patches of ungrazed tall herbs e.g. *Mentha longifolia, Festuca pratensis* and *Deschampsia caespitosa* alternate with patches poached by cattle. Usually the *Mentha* species remain ungrazed. This is what Runge (1980) pointed at when he remarked that the *Junco-Menthetum* is avoided by cattle. Also, Blažková (personal communication 1982) reported the *Junco-Menthetum* from several ungrazed sites and stated that the development of this community is not strictly bound to the grazing factor. That the *Lolio-Potentillion* is restricted to grazed, regularly inundated pastures, is in accordance with the phytosociological conclusion by which *Mentha longifolia* can not be considered a representative of this alliance. The tall forb habitus of *Mentha longifolia* and the tall forb structure of the *Junco-Menthetum* have also been remarked by HEGI (1975) and TÜXEN (1956). According to Hegi *Mentha longifolia* is especially growing abundantly in montane and subalpine tall forb communities. The *Juncus inflexus-Mentha* longifolia association has been described by TÜXEN (1956) as a tall forb community rich in hemicryptophyta reptantia. It may be concluded that the epharmony of this species is comparable to that of the *Filipendulion* species. According to NEUHÄUSL & NEUHÄUSLOVA-NOVOTNA (1975) the *Filipendulion* communities are rather heterotoneous. Poaching causes the infiltration of nitrophilous *Agropyro-Rumicion* Nordh. 1940 em. Tx. 1950 species (see SÝKORA 1980).

The floristic composition of the *Junco-Menthetum rotundifoliae* is very similar to that of the conglomerate of *Mentha longifolia* and *Mentha rotundifolia.* As

such it is floristically heterogenous and not sufficiently characterized by a species combination of its own. Furthermore insufficient relevés of this community are available. This leads me to the conclusion that the establishment of this community as an association at present must be rejected.

4. CARICETUM VULPINAE Tüxen 1947

(For enumeration of papers dealing with this association we refer to the appendix.)

The *Caricetum vulpinae* is characterized by the character species *Carex vulpina* and by the presence of a considerable number of *Magnocaricion* species and other species of the *Phragmitetea* (see *table 5*). This justifies its assignment to the above mentioned syntaxa. Due to the absence of grazing the systematic group value of the *Plantaginetea* is considerably lower (*table 3*). As their hydrologic requirements are similar the *Caricetum vulpinae* is replaced by the *Lolio-Potentillion* under the influence of grazing (GÉHU 1961). In this respect it is significant that even a *carex vulpina* variant of the *Rumici-Alopecuretum geniculati* has been described (FREITAG 1957, GÉHU 1961, MEISEL 1977).

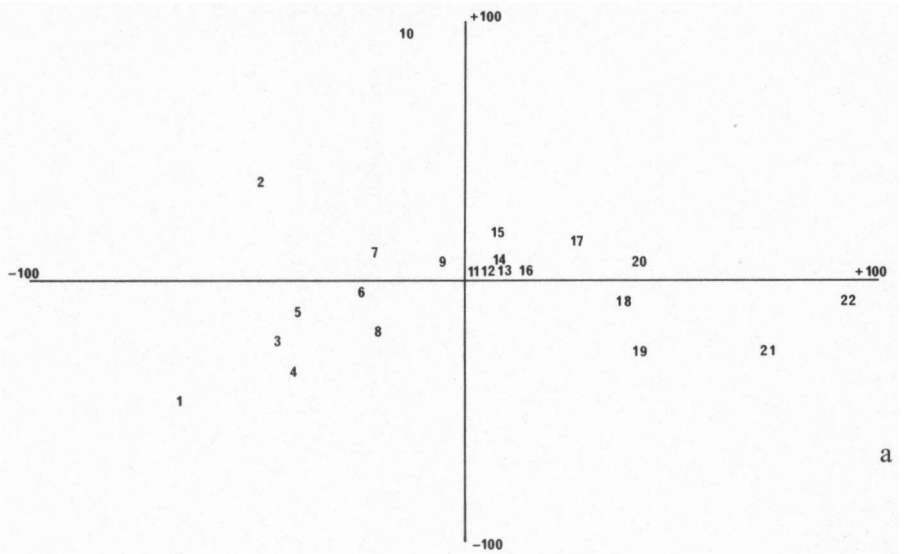
After the construction of the synoptic table a division into subassociations appeared to be impossible. The subassociations described in the literature have only a local significance. Tabulation according to the sequence along the first axis of a principal components analysis shows the gradual increase along this axis of the *Molinio-Arrhenatheretea*, especially the *Molinietalia* as well as that of the *Scheuchzerio-Caricetea* (*table 5* and *fig. 3*). This change in floristic composition reflects a decrease in the amplitude of fluctuations in the water table. The occurrence of the *Molinietalia* indicates a situation in which both the inundation and the desiccation are less severe (BALATOVA-TULÁČKOVÁ 1968). The hydrology of the *Caricetum vulpinae* stands at the left side of the ordination diagram corresponds with that of the *Ranunculo-Alopecuretum geniculati*, while that of stands at the right side is more characteristic of the *Triglochino-Agrostietum stoloniferae* (SÝKORA 1982a, b and c).

As *Carex vulpina* is a poikilohygrophyte (BOUCHAT 1981) the *Caricetum vulpinae* is able to colonize sites where hydrophase, limose ecophase and terrestrial ecophase (HÉJNY 1960) are alternating e.g. on river banks, along ponds, in former river beds and in depressions without discharge, mainly on mineral gley soils rich in silt. Mineralization is enhanced by the fluctuating water table. The association has a northern continental distribution with its highest occurrence in the eastern part of central Europa (WESTHOFF & DEN HELD 1969, OBERDORFER 1977).

Table 5. Synoptic table of the *Caricetum vulpinae*. For explanation of the symbols used see *table 1*. Additional symbols: P = Poland, N = The Netherlands, F = France.

Column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Number of relevés	1	3	5	2	?	5	4	9	33	1	21	6	10	28	9	5	8	9	3	10	12	10
Locality	F	S	F	G	R	R	F	G	G	N	G	G	G	GPCzR	G	G	CzNF	GPCz	G	CzF	Cz	G
Caricetum vulpinae																						
Carex vulpina	2	3 2	V2	2 3	V4	V2-5	4 3	III1	V	4	V2	V2	V	V4	V1-2	V1-2	V3	V2	3 1-2	V3	V2	V1
Magnocaricion																						
Galium palustre	+		III+	2	II	III+	4 2	IV1	V		V1	III1	IV	III1	IV	IV	IV1	V2	5	V1	V1	III+
Phalaris arundinacea	1	2 2	V2	2		I+	3 2	V3	IV	1	V2	V1	V	I+	V	V	V1	V1	1	II+	III+	II1
Carex vesicaria		2 +						I1	II		III1			III1	I	I	II+	II2	1	III+	IV1	III+
Carex disticha	1		IV1	2			2 +		III		III1		II		I	I	II1	III1		I+		
Carex acuta		1 +				I+	1	IV1	IV	+	III1		IV	II+	III	III	IV+	IV2		V2	III1	V2
Carex acutiformis	2	1 +	II+		III		1 +		I		I+			I2			Ir			III1		
Oenanthe fistulosa			III1				3 2									III	II+	I+	2			
Rorippa prostrata	+											II+						I+				
Carex melanostachya					V	II+					I			I+								
Senecio paludosus		2 +																				
Phragmitetea																						
Eleocharis palustris		3 +	II1			IV+-1	4 2	II1	III	2	II1	III1	II	III1	III	II	I1	II1		IV2	III+	III+
Iris pseudacorus				2		I+		IV+	II		II+	V+	IV	I+	IV	V	IV+	I+	2		II+	IV+
Glyceria maxima	1		III2	2		II+		V2				III+	II	I+		I	IV2	II1	1	II+	II2	III+
Poa palustris					V	III+		III1	I		III1	III2	IV	III	IV	III	II3	III1	1	I1	IV2	I+
Mentha aquatica			II2		IV	I+	3 +		II	2	II+	I+		III+	I		I+	I1		I+		
Alisma plantago-aquatica					III	III+		II+	I		II+	I+		I1	I		II+				I+	II+
Rorippa amphibia						III+		V+			II+	IV1				II			1			
Oenanthe aquatica						I+		I			I						II1					I+
Equisetum fluviatile								III+	I					I+								II+
Phragmites australis									I					I+								II1
Sium latifolium						I+		V+				V1		I+	II	II		II+	1			
Butomus umbellatus						III+								Ir			Ir					
Lycopus europaeus					III	I+			I		I+			I+	I							
Glyceria plicata						I+								I+						III1		
Glyceria fluitans							4 2				II+		I	II1		IV		I+	1		II+	
Scrophularia auriculata		1 +																				
Alisma lanceolatum		1 1																				
Molinio-Arrhenatheretea																						
Poa trivialis		2 +	I+			II+			I	+	I1	V2	IV	I+	IV	III	V2	II1	1	II+	III1	
Cardamine pratensis			II+			I+			II	+	II+	III+	I	I+	II	III	IV+	IV1	2	III1	V+	V2
Alopecurus pratensis						II+		I+	I		III1	II2	V	II+	III	II	V1	III1		III+	V1	IV+
Trifolium repens						III+						III+		II+	I	I		III1		III1	I1	I2
Leontodon autumnalis											I	II+	I		II	I		II+	1			II+
Rumex acetosa															II	I	IIr			I1	I+	I+
Poa pratensis	1													I+	I					I1	III1	I+
Holcus lanatus																	I+	I+		I+	II+	II+
Taraxacum officinale group			I+														II+				I+	II+
Prunella vulgaris														I+						I+	I+	II+
Ranunculus acris														II+							III+	I+
Anthoxanthum odoratum																				I1	II+	II+
Climacium dendroides														I2				II+	1	II+	IV2	
Plantago lanceolata														I+								II+
Vicia sepium	+		I+																			
Lathyrus pratensis														I+							III+	I+
Myosotis nemorosa																					V+	
Leontodon hispidus																						II+
Euphrasia rostkoviana																						II+
Molinietalia																						
Myosotis scorpioides					II				II	2	II+	I1	I	II+	I	I	IV+	III1	2	IV+		IV+
Lychnis flos-cuculi				1			1 +		II		I+	I+	IV	III+		III	III+	III+	3	IV1	IV+	V2
Lythrum salicaria			I1		II	I+		I+	II		II+			II+	II		II2	I+	2	I+	I+	IV+
Lysimachia vulgaris			I+			I+			I		I+	I1		I+	IV		II+	III+	2	I1	II+	
Deschampsia caespitosa									II		II1		III	II+	I		I+	II1	3	IV1	V1	IV+
Caltha palustris									I	+	II1	I+		I1	I	II	IV+	I+		V2		V1
Stellaria palustris								II+			II+	II+		Ir		IV	II+	III1	1	I1	II+	
Equisetum palustre				2	I				I		I+			I+			II+	I+		III1	I+	V1
Senecio aquaticus	1						3 +		I				I				I+	I1		I+	III+	
Juncus effusus											II+			II+		I	II1	II1		V1	V1	IV+
Gratiola officinalis						II+								I+		I	II+	I+	1			II1
Filipendula ulmaria			I+														I1	II2		II+	II+	II+
Mentha arvensis															II	I	II+	II1			II+	IV+

Achillea ptarmica			I+						+						I		II1				II1
Stachys palustris			I2										I+							I+	I+
Lathyrus palustris			I							I+					I			3			I+
Sanguisorba officinalis								I								IIr			I+	IV+	
Lotus uliginosus																	II+	1	I+		V2
Galium uliginosum													I+						I+		II1
Succisa pratensis																				I+	II+
Cirsium palustre																				I+	II+
Carex flacca		2 +																			I+
Carex distans					II+																
Carex hartmanii																				II2	
Cirsium oleraceum																					II+
Viola persicifolia																					II+
Carum verticillatum		3 2																			
Scheuchzerio-Caricetea																					
Ranunculus flammula						2 +		I		I+	II1	I	II1	I	III	I1	IV2	3	IV2	V1	V1
Veronica scutellata				II		1 +	I+			I+	I1		I+	II	I		V1	2	II+	II+	IV+
Agrostis canina											II1		I1	I	III		III2	3 3		III2	IV2
Carex nigra								I					I+	I				1	I1	V1	II+
Juncus articulatus		2 1							2				I+						I+		II+
Carex panicea													I+					1	I1	IV1	III1
Epilobium palustre													I+								IV+
Calliergon cordifolium																			II2		
Plantaginetea																					
Agrostis stolonifera		1 +		II	V+-1	1 +		IV		III1	V2	V	III1	V	II	II1	I1		V2	II2	
Rumex crispus			III+	2	I+	1 +		II	+	III+		III	I+	III	I	IVr	III		II+	II+	
Alopecurus geniculatus			III1		I+	4 1	II+			I+	V2	V		IV	V	I+	III1		II2	I+	
Trifolium hybridum					II+							V	I+	I	I		I+		I+	III1	V1
Potentilla anserina				2		1 +	I+	II	2	III1	I1		II1	II	I	I+	I2	2		I1	III+
Carex hirta			II+		I	IV+-1	1 +			I+			II+	I					I2	I+	
Potentilla reptans	1		I+			II+		II		I+			I+	I							
Rorippa sylvestris									+		I+		I+	III	II	II1					II+
Plantago major			II+								II+			I	I						
Juncus inflexus						1 +							II+								
Trifolium fragiferum					II+								I+								
Inula britannica														II							
Eleocharis uniglumis		2 2																			
Remaining species																					
Ranunculus repens			V1		III+	4 2	II+	V	+	V2	V2	V	IV+	V	IV	V2	V2	3	V2	V2	V2
Lysimachia nummularia				1	IV	IV+	III+	III		III+	IV1	I	III+	IV	II	IV+	IV2	2	V2	IV1	V1
Polygonum amphibium			III+			3 +	III+	II		II+	IV1		I+	III	IV	II+	II+		II+	II+	IV+
Symphytum officinale				2	II	II+		I		I+			I+		I	II+			I+		II+
Ranunculus auricomus										I		I	I+			Ir			II+	III+	
Elymus repens	2		II1										Ir	III	I						
Drepanocladus aduncus				1				I					I1				I3		II2	III2	
Carex ovalis													I+				I+		I+	I+	
Glechoma hederacea										I+			I+	II							
Cirsium arvense			II+	1					+							I+		1			
Odontites verna																				I1	II+
Carex pallescens																			II	I	
Festuca arundinacea													II+								
Rumex sanguineus						1 +															
Mentha sp.																			II1		
Calliergonella cuspidata								II		I+			I2		I				IV2	III2	
Scutellaria hastifolia																					II+
Cirsium vulgare																					II+
Myosotus laxa ssp. caespitosa						4 +															
Calystegia sepium	2			1																	
Sisymbrella aspera		2 +																			



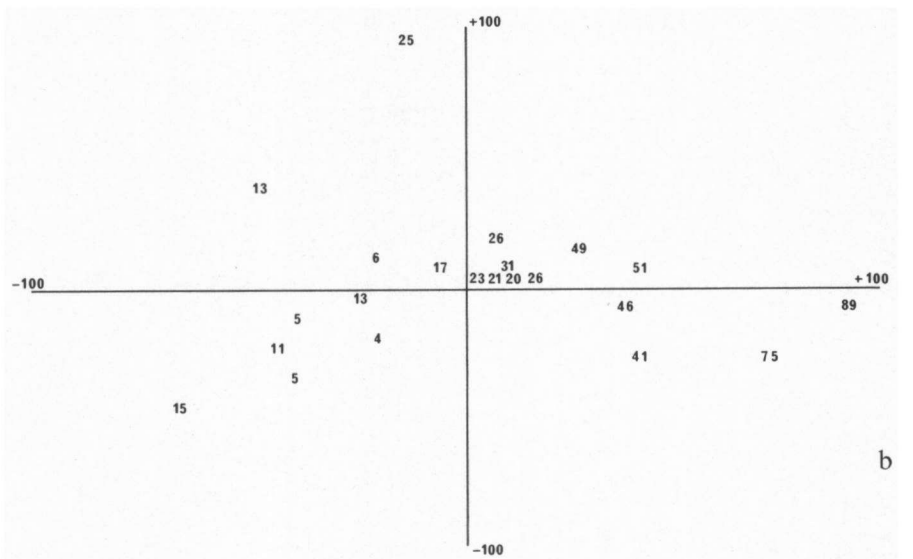
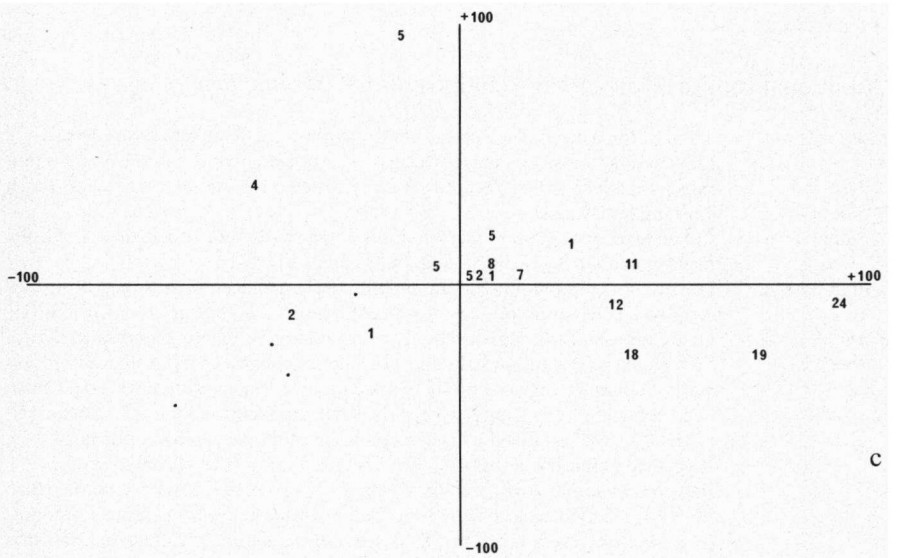


Fig. 3. Principal components analysis of the *Caricetum vulpinae*. Indicated are : (a) the column numbers (corresponding with the numbers in *table 5*); (b) the sum of the presence class values of the *Molinio-Arrhenatheretea*; (c) the sum of the presence class values of the *Scheuchzerio-Caricetea*, and (d) the sum of the presence class values of both the *Molinio-Arrhenatheretea* and the *Scheuchzerio-Caricetea*.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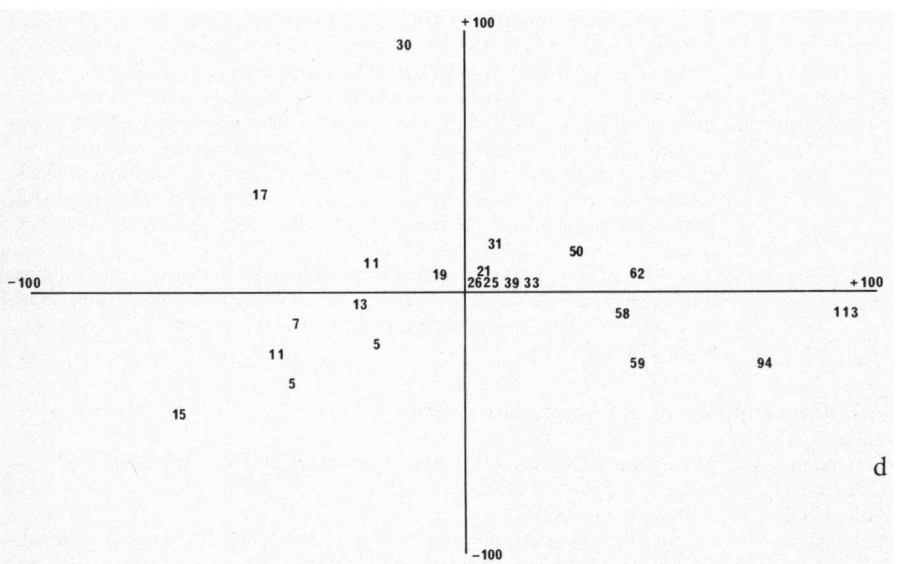
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APPENDIX

Additional species of the mixtum compositum of *Mentha longifolia*

Table 1.

Column nr. 3: Tozzia alpina (+), Thelypteris limbosperma (+), Rhinanthus aristatus (+), Phleum hirsutum (+), Petasites albus (+), Myosotis sylvatica (+), Mycelis muralis (+), Silene dioica (1), Equisetum sylvaticum (1), Aconitum napellus (r, 2);

Column nr. 5: Trifolium dubium (1);

Column nr. 6: Carex panicea (1), Scorzonera humilis (1), Symphytum officinale (1), Alisma plantago-aquatica (1), Polygonum amphibium (1);

Column nr. 8: Polygonum amphibium (I), Lamium album (I), Tanacetum vulgare (I) Carduus crispus (I), Geranium pratense (I), Senecio jacobaea (I), Senecio erucifolius (I);

Column nr. 9: Carex panicea (I), Carex otrubae (I), Vicia cracca (I), Valeriana dioica (I), Trifolium medium (I), Trifolium dubium (I), Sagina procumbens (I), Philonotis fontana (I), Galium verum (I), Epilobium roseum (I), Eleocharis mamillata (I), Cratoneuron filicinum (I), Ajuga reptans (I), Trisetum flavescens (+), Triglochin palustris (+), Stellaria media (1), Scrophularia umbrosa (1), Salix purpurea (+), Rhytidiadelphus triquetrus (+), Ranunculus flammula (1), Primula elatior (+), Polygonum amphibium (+), Platyhypnidium riparioides (2), Pedicularis palustris (+), Dactylorhiza majalis (+), Linum catharticum (+), Juncus bufonius (+), Hygrohypnum luridum (1), Geranium palustre (1), Euphorbia palustris (+), Eleocharis quinqueflora (+), Cirsium canum (1), Carex tomentosa (+), Carex remota (+), Cardamine pratensis (+), Campylium stellatum (1), Anagallis arvensis (+), Aegopodium podagraria (+);

Column nr. 10: Setaria pumila (+), Sambucus ebulus (+), Salix purpurea (+), Salix amplexicaulis (+), Populus nigra (1), Petasites hybridus (+), Oenanthe crocata (+), Melilotus altissima (2), Gratiola officinalis (+), Festuca gigantea (1), Eleocharis palustris (+) Cyperus sp. (+), Crepis capillaris (+), Centaurium erythraea (+), Barbarea sp. (+), Alliaria petiolata (+), Aegopodium podagraria (+);

Column nr. 12: Atriplex patula (+), Myosoton aquaticum (+), Malva sylvestris (+);

With presence class I or II in column nr. 23: Galium mollugo, Bromus sterilis, Capsella bursa-pastoris, Geranium molle, Sagina procumbens, Veronica arvensis, Veronica serpyllifolia, Rumex acetosa, Carex ovalis, Stellaria graminea, Agrostis capillaris, Linaria vulgaris, Hypericum tetrapterum, Epilobium roseum, Holcus lanatus, Festuca rubra, Symphytum officinale, Lysimachia nummularia, Glechoma hederacea;

With presence 1 or 2 in column nr. 24: Cynodon dactylon, Festuca pratensis, Carex vulpina, Raphanus raphanistrum, Ranunculus acris, Trifolium pratense, Pastinaca sativa, Lythrum salicaria, Hypochoeris radicata, Crepis capillaris, Picris echioides, Sonchus asper.

Additional species of the *Caricetum vulpinae*

Table 5.

Column nr. 2: Rumex conglomeratus (1), Mentha longifolia (1), Groenlandia densa (1);

Column nr. 4: Stachys palustris (I), Urtica dioica (I);

Column nr. 5: Althaea officinalis (I);

Column nr. 6: Lycopus europaeus (I), Juncus gerardi (I), Lotus tenuis (I), Myosurus minimus (I), Acorus calamus (I), Sagittaria sagittifolia (I);

Column nr. 8: Carex riparia (I), Rumex hydrolapathum (I), Eriophorum angustifolium (I), Rorippa lippizensis (I);

Column nr. 9: Carex elata (I), Peucedanum palustre (I), Scutellaria galericulata (I), Carex rostrata (I), Juncus filiformis (I), Silaum silaus (I);

Column nr. 12: Acorus calamus (+);

Column nr. 13: Ajuga reptans (I);

Column nr. 14: Eriophorum angustifolium (+), Trifolium pratense (1), Trifolium medium (+), Trifolium campestre (+), Thalictrum lucidum (+), Teucrium scorodonia (+), Stellaria graminea (+), Scirpus sylvaticus (1), Rumex hydrolapathum (+), Rumex aquaticus (+), Rhinanthus rumelicus (+), Potentilla erecta (+), Polygonum persicaria (+), Polygonum bistorta (1), Pedicularis palustris (1), Nardus stricta (+), Lythrum virgatum (+), Lotus corniculatus (I), Juncus gerardi (+), Juncus conglomeratus (+), Juncus compressus (I), Glechoma hederacea (+), Cirsium rivulare (+), Cichorium intybus (+), Carex rostrata (+), Carex riparia (+), Carex otrubae (I), Carex lepidocarpa (+), Carex flava (I), Carex elata (I), Calliergon giganteum (+), Calamagrostis epigejos (+), Bromus commutatus (+), Althaea officinalis (+), Achillea millefolium (+);

Column nr. 15: Scutellaria galericulata (I), Brachythecium rutabulum (I), Juncus filiformis (I);

Column nr. 16: Juncus filiformis (I), Phleum pratense (I);

Column nr. 17: Scirpus sylvaticus (+), Rumex hydrolapathum (+), Rumex aquaticus (r), Carex paniculata (+);

Column nr. 18: Selinum carvifolia (+), Rhytidiadelphus squarrosus (+);

Column nr. 19: Scutellaria galericulata (I), Equisetum arvense (1);

Column nr. 20: Scirpus sylvaticus (I), Rhinanthus minor (I), Mnium sp. (+), Geum rivale (+), Festuca rubra (+), Cerastium fontanum (+);

Column nr. 21: Serratula tinctoria (+), Scirpus sylvaticus (+), Rhinanthus minor (+), Ranunculus sceleratus (r), Polygonum hydropiper (1), Polygonum commutatum (+), Luzula multiflora (+), Festuca rubra (+) Festuca pratensis (I), Cynosurus cristatus (+), Carex curta (+), Carex brizoides (+), Bromus racemosus (+), Brachythecium rivulare (I), Ajuga reptans (+), Agrostis capillaris (+);

Column nr. 22: Allium angulosum (I), Centaurium erythraea (+), Eriophorum angustifolium (+), Linum catharticum (+), Parnassia palustris (I) Selinum carvifolia (+), Senecio jacobaea (+), Viola palustris (+) Valeriana officinalis (+), Trifolium campestre (I), Thalictrum angustifolium (I), Scutellaria galericulata (I), Scirpus sylvaticus (+), Potentilla erecta (I), Myosoton aquaticum (+), Cerastium fontanum (I), Cerastium arvense (+), Centaurea jacea (+), Carex elongata (+), Carex curta (+), Bellis perennis (+).

Author quotation for the *Caricetum vulpinae*

BALATOVA- TULAČKOVA 1965 (column nr. 20), ibid. 1968 (c. 17), ibid. 1976 (c. 14 & 17); BLAŽKOVA 1973 (c. 18 & 21); BOURNERIAS et al. 1976 (c. 1,3 & 7), VAN DONSELAAR & VAN LEEUWEN 1957 (c. 17); FALINSKI 1966 (c. 14); GÉHU 1961 (c. 17, 18 & 20); GRIGORE 1971 (c. 6); GRIGORE & COSTE 1976 (c. 14); KOVAR, 1981 (c. 17); MEISEL 1977 (c. 4, 15, 16 & 19), MITITELU & BARABAS 1975 (c. 5); OBERDORFER 1957 (c. 13), ibid. 1977 (c. 9); PASSARGE 1964 (c. 8 & 11); RATIU 1971 (c. 14); RIVAS GODAY & CARBONELL 1961 (c. 2); SPANIKOVA 1971 (c. 14 & 20); VAN DER STEEG (pers. comm.) (c. 10); TÜXEN 1954 (c. 12); WALTHER 1977 (c. 12, 14, 18); WILZEK 1935 (c. 22).

ACKNOWLEDGEMENT

I wish to thank the following persons: Professor Dr. V. Westhoff and Professor Dr. M. J. A. Werger for critically examining the text and Drs. O. van Tongeren for his assistance in using the computer programmes.

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