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LOLIO-POTENTILLION COMMUNITIES IN IRELAND

K. V. SÝKORA

Botanisch Laboratorium, Afdeling Geobotanie, Toernooiveld, 6525 ED Nijmegen

Very splendid is the bounty of the cattle pond
the Iris is gold because of it.

unknown Irish author, 9th–10th century

SUMMARY

The results of a study of Irish *Lolio-Potentillion* communities are presented in this paper. The syntaxonomical and synecological position of the following communities are described:

1. Basal community of *Agrostis stolonifera-[Lolio-Potentillion anserinae]*
   a) *Lolium perenne-Juncus inflexus* type
   b) *Juncus articulatus-Galium palustre* type
2. *Nasturtio-Alopecuretum geniculati*
   a) *stellarietosum alsinis* subass.nov.
   b) *ranunculetosum scelerati* subass.nov.
3. *Triglochino-Agrostietum stoloniferae*
   a) subassociation *ranunculetosum repentis*
   b) subassociation *juncetosum gerardii*
   c) subassociation *inops*
4. *Agrostio-Trifolietum fragiferi*
   a) subassociation *inops*
   b) subassociation *festucetosum rubrae*

The relations of the communities to the two main environmental factors determining the internal differentiation within the *Lolio-Potentillion* are discussed on the basis of ordination diagrams.

1. INTRODUCTION

This paper is the third in a series presenting the syntaxonomy and synecology of the *Lolio-Potentillion* Tüxen 1947 in a part of Western Europe (SÝKORA 1980, 1982). It reports the results of a study of Irish *Lolio-Potentillion* communities. the field work was carried out in July 1979, mainly along the Irish coast. The locations of the visited sites are indicated in *fig. 1.*

For floristic and ecological reasons this alliance has been separated from the Agropyro-Rumicion Nordhagen 1940 em. Tüxen 1950 (SÝKORA, 1980). The *Lolio-Potentillion* is characterized by the character-species *Agrostis stolonifera, Rumex crispus, Alopecurus geniculatus* and the constant companion *Poa trivialis.* Apart from these the character-species of the *Plantaginetea* Tüxen & Preising 1950, *Potentilla anserina, Plantago major, Lolium perenne* and *Poa annua* are present with often high presence degrees in most or in some of its communities.

Almost all species occurring in this alliance are reptant hemicryptophytes

Fig. 1. Map of Ireland on which the sampling localities are indicated by a square.

and rhizome-geophytes, frequenting soils with a rather high to high phosphorus and nitrogen status (KRUYNE et al. 1967, ELLENBERG 1978), and are tolerant of winter and spring inundation. The *Lolio-Potentillion* is restricted to pastures. For a detailed description of its synecology and syntaxonomy I refer to SÝKORA 1982.

The occurrence of the *Lolio-Potentillion* in Ireland is less extensive than in The Netherlands. This is due to the undulating landscape which is easily

Table 1: Synoptic table of the *Lolio-Potentillion* communities studied in Ireland. In the first column of every cluster the presence class is given. (+ = present only in one relevé; I = 1–20%, II = 21–40%; III = 41–60%; IV = 61–80%; V = 81–100%).
In the second column the characteristic coverage is given according to the Braun-Blanquet scale as refined by Barkman et al. (1964).
Communities: cluster 1: Basal community of *Agrostis stolonifera-[Lolio-Potentillion anserinae] Juncus inflexus-Rumex obtusifolius* type.
cluster 2: *Nasturtio-Alopecuretum geniculati stellarietosum alsinis* subass. nov.
cluster 3: Basal community of *Agrostis stolonifera-[Lolio-Potentillion anserinae], Juncus effusus-Holcus lanatus* type.
cluster 4: *Triglochino-Agrostietum* subass. *ranunculetosum repentis.*
cluster 5: idem, subass. *inops*
cluster 6: idem, subass. *juncetosum gerardii*
cluster 7: *Agrostio-Trifolietum fragiferi* subass. *inops*
cluster 8: idem, subass. *festucetosum rubrae*

Species indicated with an asterisk occur twice in the table.

cluster number	1		2		3		4		5		6		7		8	
number of relevés	27		15		22		20		7		9		18		6	
Plantaginetea + Lolio-Plantaginetum																
Potentilla anserina	IV	2m	I	1	III	1	IV	2m	III	1	V	2a	V	3	V	2b
Plantago major	III	1	I	+	+	+	III	+			II	+	IV	1	+	+
* Lolium perenne	IV	1	I	+	I	1	I	+			II	+	+	+		
Poa annua	II	1			II	1	+	1	+	+						
Polygonum aviculare	I	+			I	+										
Lolio-Potentillion character-species and constant companion																
Agrostis stolonifera	V	3	V	2b	V	3	V	2b	V	3	V	3	V	2b	V	2a
Rumex crispus	V	1	IV	1	III	+	IV	+	V	+	IV	+	III	+		
Alopecurus geniculatus	V	2a	V	2b	V	2a	V	2a	V	2m	II	2m	+	+		
c.c. Poa trivialis	V	2b	V	2a	V	2a	V	2a	II	1						
Basal community of Agrostis stolonifera-[Lolio-Potentillion], Lolium perenne-Juncus inflexus type																
* Lolium perenne	IV	1	I	+	I	1	I	+			II	+	+	+		
Juncus inflexus	III	2a	I	2m	I	2b	I	1								
* Elymus repens	III	1	+	+	+	2m					+	1	I	2m		
Nasturtio-Alopecuretum geniculati																
Apium nodiflorum	I	+	V	2m	+	+	III	2m	III	+	III	+				
Nasturtium microphyllum	I	1	IV	1	+	2a	II	+								
Epilobium parviflorum			II	+	I	+	III	+								
Glyceria declinata	+	+	I	1			II	1								
Ranunculus sceleratus			I	+							+	+				
Veronica catenata			+	+												
Constant companion Ranunculo- + Nasturtio-Alopecuretum, differential species Triglochino-Agrostietum ranunculetosum																
Ranunculus repens	V	2b	V	2a	V	2b	V	2b	III	+	II	1				
Triglochino-Agrostietum stoloniferae																
Juncus articulatus	II	+	I	1	III	+	V	1	V	1	III	1	II	1		
Galium palustre	II	+	II	+	IV	+	II	1	IV	1	III	+				
Myosotis laxa ssp. caespitosa	I	1	II	+	I	+	II	+	III	2m						
Ranunculus flammula	+	+	+	+	II	+	III	1	V	1	III	1	I	+		
Carex nigra					I	1	III	1	III	2m	III	2b	+	1		
Hydrocotyle vulgaris					+	+	I	1	III	1	V	2m	I	2m		
Triglochin palustris					+	+	IV	1			III	1	I	1		
Further differentiation																
Holcus lanatus	III	1	III	+	V	1	III	+								
Senecio aquaticus	I	+	II	+	II	1	IV	1	II	+	+	+				
* Myosotis scorpioides			+	+			III	+								
Glyceria fluitans	I	1	III	2m	III	1	III	2m	V	1						
Oenanthe lachenalii	+	+									IV	+	I	+		
Eleocharis uniglumis			+	+	+	1	I	1	+	2a	IV	2m				
Carex otrubae	I	1	I	+	I	+	+	1			III	+	I	+	+	+
Samolus valerandi							I	+			III	1				
Juncus maritimus											II	2a				
Agrostio-Trifolietum fragiferi character- and differential species																
Juncus gerardi							+	2m			IV	1	V	2b	IV	2m
Glaux maritima											II	1	V	1	V	1
Trifolium fragiferum											II	2b	I	1	V	2b

cluster number	1	2	3	4	5	6	7	8
Triglochin maritima						+ +	I +	+ +
Carex distans						+ +	II 2m	V 1
Agrostio-Trifolietum fragiferi festucetosum rubrae + Ononido-Caricetum distantis								
Lotus corniculatus						II +	II 1	V 1
Plantago maritima							II 2m	IV +
Festuca rubra				+ +		+ 2a	I 1	V 2b
Plantago coronopus							III 1	I +
Ranunculo-Alopecuretum geniculati								
• Elymus repens	III 1	+ +	+ 2m			+ 1	I 2m	
• Myosotis scorpioides		+ +		III +				
Carex hirta	II 1		I 1	I 1	+ +	+ 1		
Potentilla reptans	+ +	+ +		+ +		+ +		
Polygonum amphibium	I 1		I 1	+ +				
Equisetum palustre		+ 1	+ +	I +				
Alopecurus pratensis	+ +		+ 2b					
Phalaris arundinacea	I +							
Taraxacum officinale group	I +							
Companion species								
Trifolium repens	IV 2m	III 1	IV 1	V 2m	III +	III 1	II 1	V 2a
Juncus bufonius	II 1	I 1	II 1	IV 1	III 1		II 1	
Juncus effusus	III +	I 1	V 2a	II 1	V 2a	+ +		
Iris pseudacorus	II 2m	II +	II 1	+ +	+ +	+ +		
Eleocharis palustris	I 1	I 1	+ 1	II 1	III 1		I 1	
Leontodon autumnalis	I +		+ +	II 1		IV 1	IV 2m	III +
Calliergonella cuspidata	I 1	+ +	I 1	III 2a	+ +	II +	+ 2b	
Bellis perennis	+ +	+ +	I +	I 1		II 1	I +	
Cardamine pratensis	I 1		I +	I 1	II +	II +		
Cynosurus cristatus	I +	+ +	I 1	II +				
Sagina procumbens	+ +		I +	II 1	+ +	II 1		
Rumex obtusifolius	III 1	II +	+ +	+ +				
Stellaria alsine	I +	III +	II +	II +				
Mentha aquatica		II +	I +	III +		II +		
Cerastium fontanum	I +	+ +	II +	II +				
Cirsium arvense	II +	I +	+ +				+ +	
Carex ovalis	+ 1		I +	+ +	II 1			
Equisetum fluviatile		I +	II 1	I 1				
Ranunculus acris	I +		II +			+ +		
Lythrum salicaria			+ +	+ +		II +	I +	
Leontodon taraxacoides						III 1	II 1	
Juncus acutiflorus			I +		II 1			
Caltha palustris			+ +	II +				
Veronica beccabunga		II +		II +				

Also with presence class I or +: Anagallis tenella (cl. nr. 6), Angelica sylvestris (3, 2), Anthoxanthum odoratum (3), Armeria maritima (7), Aster tripolium (7), Atriplex hastata (7), Brachythecium rutabulum (1, 4), Bromus hordaceus ssp. hordaceus (1), Bryum sp. (1, 7, 6, 4) Calystegia sepium (3), Campylium polygamum (5), Cardamine flexuosa (1, 2), Carex arenaria (1, 7, 6), Carex disticha (1), Carex flacca (4), Cerastium glomeratum (2), Cirsium palustre (1, 3, 2, 4), Cochlearia officinalis (7), Convolvulus arvensis (3), Dactylis glomerata (3), Dactylorhiza incarnata (6), Drepanocladus aduncus (7, 6, 5, 2, 4), Epilobium hirsutum (3), Epilobium obscurum (1, 3), Festuca arundinacea (7, 6, 4, 8), Festuca pratensis (1, 2), Filipendula ulmaria (1, 3, 2, 4), Geranium dissectum (1), Glyceria maxima (1), Glyceria plicata (4), Hypericum tetrapterum (4), Lotus uliginosus (1, 3, 7, 6, 5, 2), Matricaria perforata (1), Matricaria maritima (7), Mentha arvensis (1, 2), Odontites verna ssp. serotina (3), Oenanthe crocata (3), Dactylorhiza maculata (3), Phleum pratense (1, 2), Phragmites australis (3, 2), Plantago lanceolata (1, 4), Poa pratensis (7, 6), Polygonum hydropiper (1, 3, 2, 4), Potentilla palustris (5), Prunella vulgaris (1, 3, 4), Pulicaria dysenterica (3), Rhynchostegiella curviseta (7, 6), Rumex acetosa (3), Rumex conglomeratus (1, 3), Salix repens (7), Scirpus lacustris ssp. lacustris (5), Scirpus maritimus (1, 6, 2), Senecio erucifolius (1), Spergularia marina (7), Stachys palustris (1), Stellaria graminea (1, 3), Stellaria media (1, 2), Symphytum officinale (3), Trifolium dubium (1, 3), Trifolium pratense (1, 3), Urtica dioica (1, 3, 2), Veronica scutellata (5, 4), Veronica anagallis-aquatica (2).

drained naturally or artificially, the absence of long rivers with wide river forelands, the steepness of its coasts and the low nutrient status of a part of Ireland, which is covered by peat bogs (About 15% of the total surface) and moorland (PRAEGER 1934, WEBB 1952, WHITTOW 1974).

2. METHODS

Hundred and twenty four relevés (*table 1*) were made on the basis of the principles of the French-Swiss school of phytosociology (WESTHOFF & VAN DER MAAREL 1973). Sample plot size, site selection and habitat description are conform SÝKORA 1982. The raw table was structured by means of the Tabord program (VAN DER MAAREL et al. 1978, VAN DER MAAREL 1979). The similarity ratio (WISHART 1969) was used to measure similarities between relevés and clusters. In the definite table the threshold value was 0.40 and the fusion level 0.77. One relevé was relocated by hand from cluster 2 tot cluster 1, one from cluster 1 to 2 and another from the rest-group to cluster 6. In this paper only the synoptic table is presented.

Both the relevés and the cluster centroids were used in a principal components analysis according to the Ordina program (ROSKAM 1971). Plant nomenclature follows the Flora Europaea (TUTIN et al. 1964–1980) for phanerogams and LANDWEHR (1966) for bryophytes.

3. STATUS OF THE ALLIANCE IN RELATION TO THE CONTINENT

The *Ranunculo-Alopecuretum geniculati* Tüxen 1937 has not been observed in Ireland during the present study. As can be seen in *table 1* the character-species *Potentilla reptans, Carex hirta, Rorippa sylvestris* and *Mentha pulegium* and the differential species *Phalaris arundinacea, Polygonum amphibium, Taraxacum officinale* (group), *Elymus repens, Lysimachia nummularia, Myosotis scorpioides, Rorippa amphibia, Alopecurus pratensis, Equisetum palustre, Glechoma hederacea* and *Glyceria maxima,* are either absent or present with a low presence degree. *Juncus compressus* and *Inula britannica* are absent from Ireland and *Mentha pulegium* is very rare (WEBB 1967). Because of the special topographic conditions in Ireland and the absence of wide rive forelands, the *Ranunculo-Alopecuretum,* being restricted to sites with a highly dynamic water table, with inundation water that can be several meters deep and a water table that in summer drops sufficiently deep to allow desiccation of the top soil, is very rare or possibly even absent. Besides desiccation is less frequent by the constancy of atmospheric moist the even distribution of the rainfall throughout the year and from year to year (WEBB 1952). Because of these climatic characteristics the effluence of the rivers is more or less equally distributed over the year. These conditions are unfavourable for the *Ranunculo-Alopecuretum,* especially for the subassociation *rorippetosum sylvestris,* which is confined to sites with a low ground water table during the summer. *Rorippa sylvestris,* a species highly indicative for these circumstances, is rare in Ireland.

4. THE PLANT COMMUNITIES (*table 1*)

4.1. Basal community of *Agrostis stolonifera-[Lolio-Potentillion anserinae], Juncus inflexus-Rumex obtusifolius* type (cluster 1)

Fig. 2. Basal community of Agrostis stolonifera- [Lolio-Potentillion anserinae] occurring on the bank of a brook (grazed patch on the right side of the picture.)

From all the communities described in this paper the basal community of *Agrostis stolonifera-[Lolio-Potentillion anserinae], Juncus inflexus-Rumex obtusifolius* type (cluster 1) has the strongest affinity to the *Ranunculo-Alopecuretum*. It is differentiated from the other Irish communities by *Lolium perenne, Juncus inflexus* and *Elymus repens*. As it clearly belongs to the *Lolio-Potentillion* but cannot be assigned to one of its associations, because character-species and sufficient differential species are lacking, it is here described as a basal community according to the deductive method of KOPECKÝ & HEJNÝ (1974, 1978). Two other types of this basal community have been described for The Netherlands (viz. the *Trifolium fragiferum-Ranunculus sardous* type and the *Scirpus maritimus-Juncus bufonius* type) (SÝKORA, 1982). The *Juncus inflexus-Rumex obtusifolius* type is different from the other types by the presence of *Juncus inflexus, Elymus repens* and *Rumex obtusifolius* with presence class III. It has been found mainly on heavy clay and a few times on sandy clay. The soil was often very hard by desiccation and spots of rust indicating the temporarily waterlogged conditions were clearly visible. The basal community occurred on lower parts of pastures, in drainage furrows, along ditches and brooks with running water and on the bottom of a totally drained lake. Like in The Netherlands the basal community of *Agrostis stolonifera* was found on severely poached sites. The clay soils in Ireland are often partly waterlogged, even when on a fairly steep slope, resulting in encroachment by rushes (WEBB,

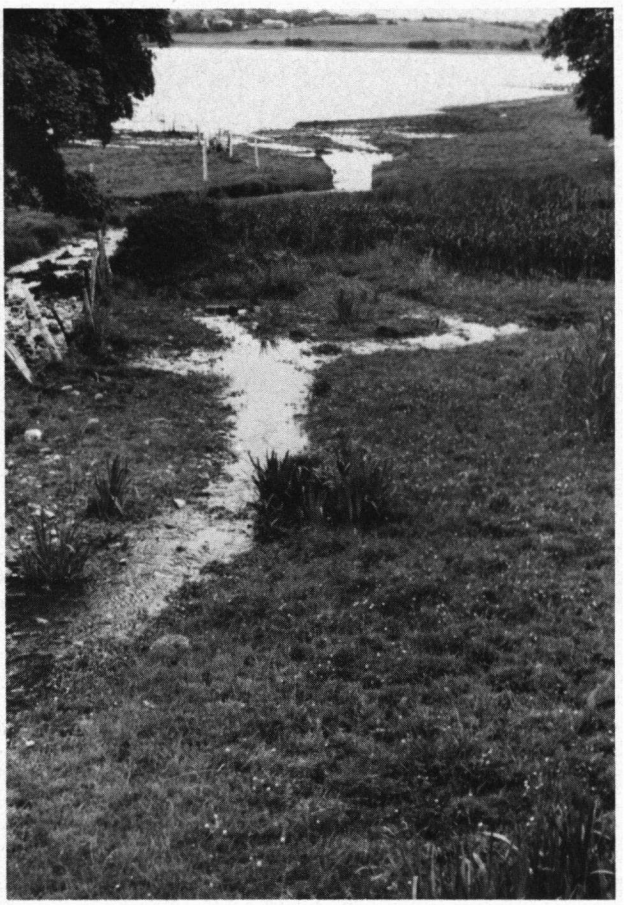

Fig. 3. The Triglochino-Agrostietum stoloniferae ranunculetosum repentis along a rivulet. As banks are absent, water continually seeping sideways is keeping the soil moist throughout the year. Iris encoachment is a common feature in Irish pastures.

1952, O'SULLIVAN 1968). *Juncus inflexus,* as a calcicole species, is indicating the alkalinity of the soil.

Elymus repens, being a differential species of the *Ranunculo-Alopecuretum geniculati rorippetosum sylvestris,* is indicative of a low water table and a dry top soil during the summer season. *Rumex obtusifolius,* a character-species of the *Artemisietea vulgaris* Lohm., Prsg. & Tüxen 1950, has its highest presence on alkaline (pH water > 7.00), nutrient rich soils, with a high nitrogen and phosphorus status (p-citric acid > 80) (CAVERS & HARPER 1964, KRUYNE et al. 1967, WESTHOFF & DEN HELD 1969, OBERDORFER 1970). I do not agree with the statement of HÜLBUSCH (1969) that *Rumex obtusifolius* has to be considered a character-species of the *Lolio-Potentillion* (called *Agropyro-Rumicion* by him). The distinction of the association *Poo triviali-Rumicetum obtusifolii* Hül-

Fig. 4. The Agrostio-Trifolietum fragiferi subassociation inops as found on the shore of a salt lake. It is extensively grazed by sheep.

busch 1969 is insufficiently founded. For the synecology of the *Juncus effusus-Holcus lanatus* type (cluster 3) differentiated by *Juncus effusus* (presence class V) and *Holcus lanatus* (presence class V) see section 4.4.

4.2. *Nasturtio-Alopecuretum geniculati* Sýkora 1982.
Subassociation nov. *ranunculetosum scelerati* and subassociation nov. *stellarietosum alsinis* (cluster 2).

Within the *Lolio-Potentillion* the *Nasturtio-Alopecuretum* is the association with some floristic relation to the swamp alliance *Glycerio-Sparganion,* mainly consisting of helophytes (OBERDORFER 1977). In the Netherlands where the association has been described (SÝKORA 1982), it is characterized by the character-species of the order and alliance as well as by a number of differential species. In Ireland the association presents itself in a somewhat impoverished form. Because of the presence of *Nasturtium microphyllum,* character-species of the *Nasturtietum officinalis* Seib. 1962, cluster 2 should be assigned however, to the *Nasturtio-Alopecuretum.*

It appears moreover, that the Irish form of the association contains *Apium nodiflorum* as a second differential species (presence class V) against the other Irish communities. *Apium nodiflorum,* likewise a swamp helophyte, is a character-species of the *Helosciadetum nodiflori* Br.Bl. 1931. *Apium nodiflorum,* being rather rare in The Netherlands (ARNOLDS et al. 1975, VAN DER MAAREL 1971), is frequent in Ireland. As a species with mainly a mediterranean-subatlantic

distribution it reaches its northern limit in The Netherlands (TUTIN et al. 1968). This may be responsible for its absence in the Dutch relevés.

From the continental form of the *Nasturtio-Alopecuretum* the Irish community is differentiated not only by the constant presence of *Apium nodiflorum* but furthermore by the presence of *Holcus lanatus* (presence class III) and *Stellaria alsine* (presence class III) and the absence or lower presence of *Potentilla anserina, Plantago major, Eleocharis uniglumis, Ranunculus sceleratus, Veronica catenata* and *Ranunculus sardous*. In the previous publication (SÝKORA 1982) the Dutch form of the *Nasturtio-Alopecuretum* has not been subdivided. For the difference mentioned above, it is now possible to distinguish two subassociations. The Dutch material is described here as the subassociation *ranunculetosum scelerati* subass.nov., the Irish community as the subassociation *stellarietosum alsinis* subass.nov.

The subassociation *ranunculetosum* occurs on nutrient-rich, basic soils. *Ranunculus sceleratus* is a character-species of the *Ranunculo-Rumicetum maritimi* Siss. (1946) 1966, a community of very nutrient-rich soils (WESTHOF & DEN HELD 1969, VAN DER TOORN 1980). *Ranunculus sardous* has its highest relative average frequency in pastures on alkaline (pH water > 7) soils (KRUYNE et al. 1967). It is absent on strongly acid and moderately acid soils and very infrequent on weakly acid soils (pH water respectively < 5.05, 5.05–5.50 and 5.55–6.00).

The subassociation *stellarietosum alsinis* is restricted to less nutrient-rich, moderately acid soils. It has some affinity to the *Montio-Apietum nodiflori* (MAAS 1959) SEGAL & WESTHOFF 1969, which occurs along clear, nutrient- and calcium-poor rivulets. According to ELLENBERG (1978) *Stellaria alsine* is indicative for sites where the soil is between acid and moderately acid and between nitrogen-poor and moderately nitrogen-poor. The *Nasturtio-Alopecuretum stellarietosum alsinis* has been found on very soft, reduced clay along ditches, pools and in drainage furrows.

4.3. *Triglochino-Agrostietum stoloniferae* Konczak 1968 (cluster 4–6) and basal community of *Agrostis stolonifera-[Lolio-Potentillion anserinae], Juncus effusus-Holcus lanatus* type (cluster 3).

The *Triglochino-Agrostietum* is restricted to pastures occurring on moderately acid soils with a low nutrient status. Consequently it is highly susceptible to fertilization. It is characterized by *Triglochin palustris* (character-species) and *Juncus articulatus, Galium palustre, Ranunculus flammula, Hydrocotyle vulgaris, Carex nigra, Myosotis laxa* ssp. *caespitosa* (differential species against the other Irish associations).

The subassociation *ranunculetosum repentis* (*table 1*, cluster 4), characterized by the presence of *Ranunculus repens* and (in the Dutch relevés) also by *Lolium perenne*, is confined to marshy soils uninfluenced by salt. In Ireland it has been found on soft, moist clay mixed with organic material, in depressions in pastures, along rivers and rivulets, on a lake shore and in a ditch without standing water.

The high presence degree of *Senecio aquaticus, Holcus lanatus* and *Myosotis scorpioides* indicates that this community is grazed extensively only. While *Senecio aquaticus* has its highest relative average frequency on pure hayfields, *Holcus lanatus* and *Myosotis scorpioides* are found most frequently on hay pastures (KRUYNE et al. 1967). On the continent *Senecio aquaticus* is a character-species of the *Senecioni-Brometum racemosi* R.Tx. & Preising 1951, a community from moist, sometimes also slightly grazed hayfields on calcium-poor soils (WESTHOFF & DEN HELD 1969). In Ireland it is a character-species of the *Senecioni-Juncetum acutiflori* Braun-Blaquet & Tüxen 1952, a community occurring on soils with a high water retention capacity and a low to moderate base status.

On pastures with slightly brackish soils the subassociation *juncetosum gerardii* (cluster 6) has been recorded. Differential species of this subassociation are *Juncus gerardi* and *Glaux maritima* (see SÝKORA 1982). It is differentiated against the other *Lolio-Potentillion* communities found in Ireland by *Eleocharis uniglumis, Oenanthe lachenalii, Carex otrubae, Samolus valerandi* and, with presence class II, *Juncus maritimus. Oenanthe lachenalii* and *Juncus maritimus* are character-species of the *Juncetum maritimi* Bilik 1956, a community found on brackish, extensively grazed higher salt marshes. The subassociation *juncetosum gerardii* was recorded in Ireland on sandy soils mostly covered with a 3 to 10 cm top soil very rich in organic material. It occurs on the shore of salt lakes connected to the sea by a narrow inlet and on the banks of a river and a brook near the sea coast.

Both the *Triglochino-Agrostietum* subassociation *inops* (cluster 5) and the basal community of *Agrostis stolonifera-[Lolio-Potentillion], Juncus effusus-Holcus lanatus* type (cluster 3) have been found on small, grazed, open patches in pastures dominated by *Juncus effusus*. While in the subassociation *inops* all differential species of the *Triglochino-Agrostietum* are present with a high presence class, these species are restricted to *Juncus articulatus* and *Galium palustre* in the basal community. The ground between the ungrazed and untrampled rush clumps is subject to heavy grazing and trampling resulting in openings in the field-layer. As *Juncus effusus* seedlings are extremely susceptible to competition from other plants, establishment of the species depends on these patches of bare soil (AGNEW 1961). Poaching has its most severe effects under winter grazing conditions. While in the subassociation *inops* trampling intensity is still sufficiently low to permit the presence of the differential species, they are excluded from the basal community by the severe poaching. Both communities have been found on clay, the basal community under drier conditions. Under still drier conditions the *Centaureo-Cynosuretum* Braun-Blanquet & Tüxen 1952 subassociation of *Juncus effusus* (O'SULLIVAN 1968) will develop.

4.4. *Agrostio-Trifolietum fragiferi* Sýkora 1982 (cluster 7 and 8)

The *Agrostio-Trifolietum fragiferi* subassociation *inops* (SÝKORA 1982) as found in Ireland (cluster 7) is differing from the Dutch subassociation *inops* by the absence of *Eleocharis uniglumis* (presence class IV in the Dutch table) and the higher presence of *Plantago major, Rumex crispus, Plantago coronopus* and

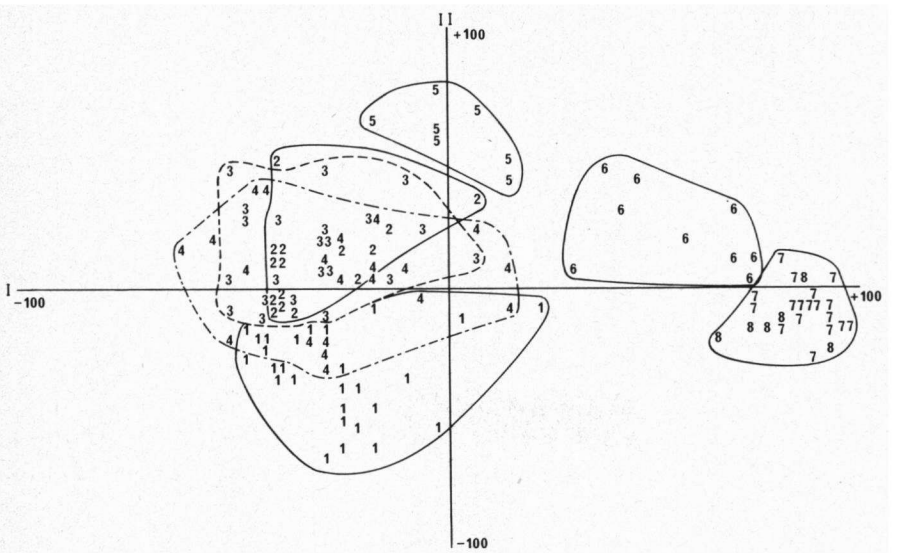

Fig. 5a. P.C.A. ordination of all relevés along the first and second dimension.

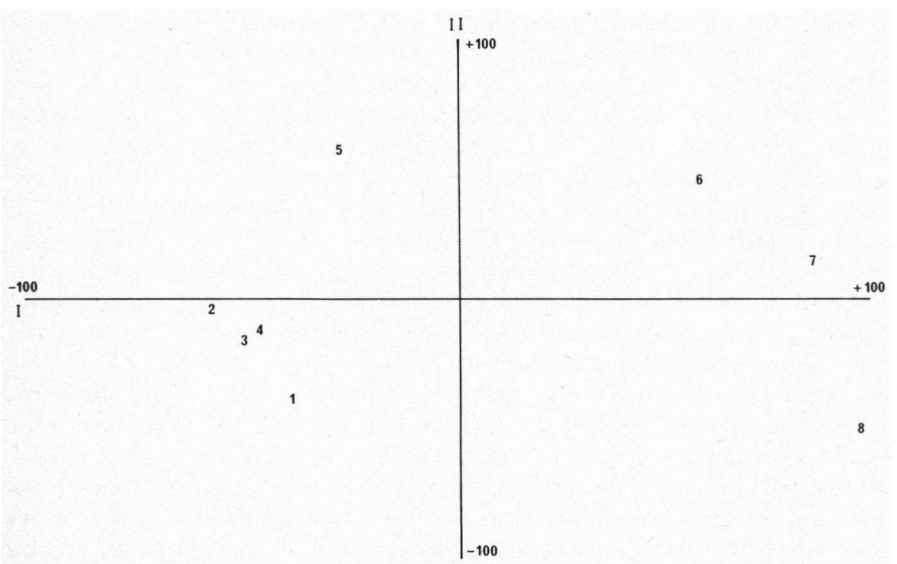

Fig. 5b. Ordination of the centroids of the clusters presented in *table 1*.

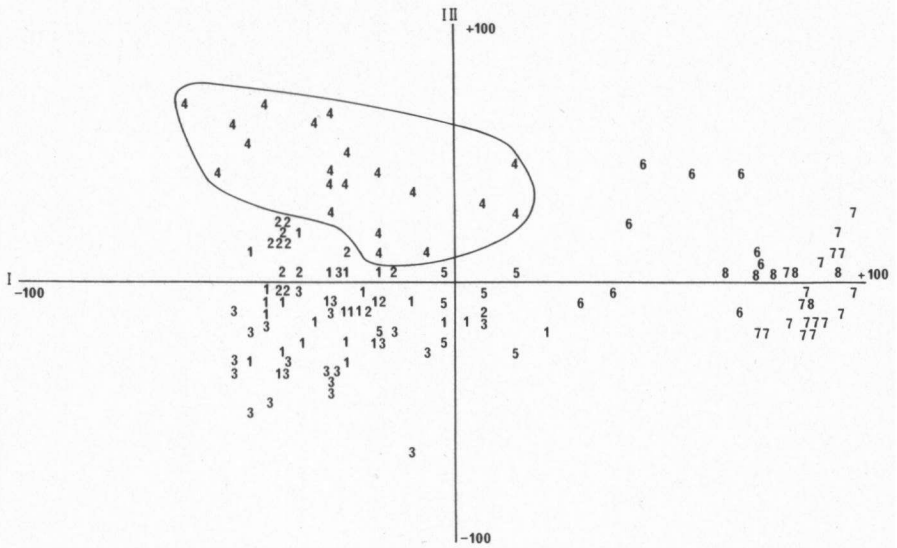

Fig. 5c. Ordination of the relevés composing the clusters in *table 1* along the first and third dimension. The numbers correspond to the cluster numbers used in *table 1*.

Leontodon autumnalis. Like in The Netherlands this community is characterized by the very low grazing pressure. It is found under drier conditions than the Dutch community. It occurs on the shores of salt lakes in connection with the sea by a narrow inlet. The vegetation is considerably influenced by salt spray and often, during periods with sufficient wind velocity, foam of the sea is blown into the vegetation. Inundation with sea water occurs during extreme high tide. The subassociation *inops* has been found on gravelly sand and on pure sand, in a few cases covered by a layer of silt.

Cluster 8 can be assigned to the *Agrostio-Trifolietum fragiferi festucetosum rubrae*, characterized by *Trifolium fragiferum* (character-species) and *Juncus gerardi, Glaux maritima, Plantago maritima, Festuca rubra* and *Carex distans* (differential species). Unlike the Dutch material *Centaurium pulchellum, Holcus lanatus, Poa pratensis, Cerastium fontanum* and *Odontites verna* ssp. *serotina* are absent. *Lotus corniculatus* however has a higher presence class in Ireland (V) than in The Netherlands (presence class I) where it is a differential species for the *Ononido-Caricetum distantis* Runge 1966. The latter community has only been recorded from the Wadden islands and along the coast of the Baltic sea. It forms a zone above the *Agrostio-Trifolietum fragiferi festucetosum rubrae*, on small dunes occurring in extensively grazed upper salt marshes on the Wadden islands and along the coasts of the Baltic sea. This might be an indication that the *festucetosum rubrae* from *table 1* is confined to drier soils when compared to the *festucetosum rubrae* of the Dutch material. The data from KRUYNE et al. (1967) showing that *Lotus corniculatus* has by far the highest relative average frequency on dry soils are in accordance with this suggestion.

The Irish variant, to be named variant with *Lotus corniculatus*, was found on small dunes on an old race course now turned into a salt marsh by a dike burst. The soil consisted of sand with a top soil of about 10 cm silt mixed with some organic material.

5. Principal Components Analysis

Figures 5a and *c* are the result of the ordination of the separate relevés. In *fig. 5b* an ordination of the cluster centroids is represented. The percentage extracted variance values of the first two axes are respectively 24 and 8 for *fig. 5a* and 51 and 15 for *fig. 5b*. The percentage extracted variance for the third axis (*fig. 5c*) is 7. The *figures 5a* and *b* show a similar arrangement of the clusters. Dimension I corresponds with a gradient in salt influence, the *Triglochino-Agrostietum juncetosum gerardii* (cluster 6) being intermediate between the *Agrostio-Trifolietum fragiferi inops* and *festucetosum rubrae* (cluster 7 and 8) from brackish soils and the *festucetosum rubrae* (cluster 7 and 8) from brackish soils and the *Triglochino-Agrostietum inops* and *ranunculetosum repentis* (cluster 5 and 4), the basal community of *Agrostis stolonifera-[Lolio-Potentillion], Juncus effusus-Holcus lanatus* type (cluster 3) the *Nasturtio-Alopecuretum* (cluster 2) and the basal community of *Agrostis stolonifera-[Lolio-Potentillion], Juncus inflexus-Rumex obtusifolius* type (cluster 1), all from fresh soils.

Dimension II arranges the communities according to the moisture content of the soil during the summer season. On fresh soils the *Nasturtio-Alopecuretum geniculati* (cluster 2), the basal community of *Agrostis stolonifera-[Lolio-Potentillion], Juncus effusus-Holcus lanatus* type (cluster 3) and the *Triglochino-Agrostietum ranunculetosum repentis* (cluster 4) are placed intermediate between the relatively dry basal community of *Agrostis stolonifera-[Lolio-Potentillion], Juncus inflexus-Rumex obtusifolius* type (cluster 1) and the wet *Triglochino-Agrostietum* subassociation *inops* (cluster 5). In a brackish environment the sequence from relatively dry to wet is represented by *Agrostio-Trifolietum fragiferi festucetosum rubrae* (cluster 8), followed by the subassociation *inops* (cluster 7) and ended by the *Triglochino-Agrostietum juncetosum gerardii* (cluster 6). The two subassociations of the *Agrostio-Trifolietum* (clusters 7 and 8) have only been separated clearly in *fig. 5b*, the ordination diagram of the cluster centroids. In *fig. 5a* the two overlapping clusters 3 and 2 are clearly separated from clusters 1 and 5. Cluster 4 having a broad overlap with clusters 1, 2 and 3 along the second dimension, is clearly separated from these communities along the third dimension. Although the second dimension can be interpreted ecologically without difficulty, interpretation of the third dimension (*fig. 5c*) is less easy. Possibly the separation of cluster 4 from the clusters 1, 2 and 3 reflects its lower nutrient status. It is certainly less disturbed by poaching and grazing pressure is lower in comparison to these communities. From the ordination diagrams can be concluded that the main factors for the internal differentiation of the Irish *Lolio-Potentillion* are the water content of the soil during the summer season and the influence of salt. The same conclusion was reached in The Netherlands (Sýkora 1982).

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REFERENCES

AGNEW, A. D. Q. (1961): The ecology of Juncus effusus L. in North Wales. *J. Ecol.* **49** (1): 83–102.

ARNOLDS, E. J. M. & R. VAN DER MEIJDEN (1976): *Standaardlijst van de Nederlandse Flora.* Rijksherbarium, Leiden, 26 pp.

BARKMAN, J. J., H. DOING & S. SEGAL (1964): Kritische Bemerkungen und Vorschläge zur quantitativen Vegetationsanalyse. *Acta Bot. Neerl.* **13**: 394–419.

BRAUN-BLANQUET, J. & R. TÜXEN (1952); Irische Pflanzengesellschaften. In: Die Pflanzenwelt Irlands (W. LUDI ed.), p. 224–415, *Veröff. Geobot. Inst. Rübel, Zürich,* H **25**, H. Huber, Bern, Stuttgart.

CAVERS, P. B. & J. L. HARPER (1964): Rumex obtusifolius L. and R. crispus L. *J. Ecol.* **52** (3): 737–766.

ELLENBERG, E. (1978): *Vegetation Mitteleuropas mit den Alpen.* Ulmer, Stuttgart, 981 pp.

HÜLBUSCH, K. H. (1969): Rumex obtusifolius in einer neuen Flutrasen-Gesellschaft an Flussufern Nordwest- und Westdeutschlands. *Mitt. Florist.-Soziol. Arbeitsgem.* **14**: 169–178.

KOPECKÝ, K. & S. HEJNÝ (1974): A new approach to the classification of antropogenic plant communities. *Vegetatio* **29**: 17–20.

— & — (1978): Die Anwendung einer deduktiven Methode syntaxonomischer Klassifikation bei der Bearbeitung der strassenbegleitenden Pflanzengesellschaften Nordostböhmens. *Vegetatio* **36** (1): 43–51

KRUYNE, A. A., D. M. DE VRIES & H. MOOI (1967): *Bijdrage tot de oecologie van de Nederlandse graslandplanten.* Pudoc, Wageningen, 65 pp.

LANDWEHR, J. (1966): *Atlas van de Nederlandse Bladmossen.* K.N.N.V., 548 pp.

MAAREL, E. VAN DER (1971): Florastatistieken als bijdrage tot de evaluatie van natuurgebieden. *Gorteria* **5** (7/10): 176–188.

— (1979): Multivariate methods in phytosociology with reference to the Netherlands. In: *The study of vegetation.* (M. J. A. WERGER ed.) Junk, the Hague, 316 pp.

MAAREL, E. VAN DER, J. G. M. JANSSEN & J. M. W. LOUPPEN (1978): Tabord, a program for structuring phytosociological tables. *Vegetatio* **38** (3): 143–156.

OBERDORFER, E. (1970): *Pflanzensoziologische Exkursionsflora für Süddeutschland.* Stuttgart, 987 pp.

— (1977): *Süddeutsche Pfanzengesellschaften. I,* Fischer Verlag, Stuttgart, 304 pp.

O'SULLIVAN, A. M. (1968): The lowland grasslands (Molinio-Arrhenatheretalia) of County Limerick. *Irish Veg. Stud.* **2**, Dublin, 57 pp.

PRAEGER, R. LL. (1974): *The botanist in Ireland.* Publ. Ltd., Yorkshire, 587 pp.

ROSKAM, E. (1971): Program: Ordina: multidimensional ordination of observation vectors. Programmed in Fortran-IV G/H for IBM-360/= S. *Program-Bulletin* **16**: 1–7.

SÝKORA, K. V. (1980): A revision of the nomenclatural aspects of the Agropyro-Rumicion crispi Nordh. 1940. *Proc. K. Ned. Akad. Wet. Ser. C Biol. Med. Sci.* **83** (4): 355–361.

— (1982): Syntaxonomy and synecology of the Lolio-Potentillion Tüxen 1947 in The Netherlands. *Acta Bot. Neerl.* **31**: 65–95.

TOORN, J. VAN DER (1980): On the ecology of Cotula coronopifolia L. and Ranunculus sceleratus L. *Acta Bot. Neerl.* **29** (5/6): 385–396.

TUTIN, T. G., V. H. HEYWOOD, N. A. BURGES, D. M. MOORE, D. H. VALENTINE, S. M. WALTER & D. A. WEBB (eds.) (1964–1980): *Flora Europaea I-V.* Cambridge University Press, London, 464, 455, 370, 505, 452 pp.

WEBB, D. A. (1952): The flora and vegetation of Ireland. In: *Die Pflanzenwelt Irlands* (W. LUDI ed.), Veröff. Geobot. Inst. Rübel, Zürich, H25, H. Huber, Bern & Stuttgart, 46–78.
— (1967): *An Irish Flora.* Dundalk Press, Dundalk, 259 pp.
WESTHOFF, V. & A. J. DEN HELD (1969): *Plantengemeenschappen in Nederland.* Thieme, Zutphen, 324 pp.
— & E. VAN DER MAAREL (1973): The Braun-Blanquet Approach. In: *Handbook of Vegetation Science* V (R. WHITTAKER ed.), 747 pp., Junk, the Hague.
WHITTOW, J. B. (1974): *Geology and scenery in Ireland.* Penguin Books, Harmondsworth, 301 pp.
WISHART, D. (1969): *Clustan 1 A.* Computing Lab. St. andrews, 7 pp.