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Cropfield-weed communities of northern Poland on the eastern and western sides of the Vistula

KRYSTYNA SZMEJA

Department of Biology and Pharmaceutical Botany, Medical University of Gdańsk, Al. Hallera 107, 80-416 Gdańsk, Poland

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Summary

The research was carried out in the following 9 mesoregions of northern Poland, located on either side of the Vistula: Cassubian Coast, Cassubian Lakeland, Elbląg Plateaux, Górowo Plateaux, Ermelandic Plain, Iława Lakeland, Vistula Delta, Starogard Lakeland and Lower Vistula Valley. A total of 11 cropfield-weed communities have been distinguished and described. Those found in cereal crops included: *Teesdaleo-Arnoseridetum*, *Papaveretum argemones*, a transition community between *Vicietum tetraspermae* and *Aphano-Matricarietum*, *Aphano-Matricarietum*, *Lathyro-Melandrietum* and *Spergulo-Chrysanthemetum segeti*. In root crops the occurrence was found of: *Digitarietum ischaemii*, *Echinochloo-Setarietum*, *Lamio-Veronicetum politae*, *Galinsogo-Setarietum*, *Fumarietum officinalis* and *Spergulo-Chrysanthemetum segeti*. Due to the presence in the patches of most communities, especially root crop communities, of many common species, they show a number of similarities, floristic and structural.

Key words: weed communities, phytosociology, northern Poland.

INTRODUCTION

Weed communities are a sensitive indicator of habitats and cultivating practices applied, e.g. herbicide treatment, reclamation (W ó j c i k, K m o s e k, 1988). Many anthropogenic actions eliminate some weed species, especially stenotopic ones,

that is with a narrow ecological scale. The weed elimination process appeared to have been fairly common, especially during the last two and a half decades (K o r n a ś, 1970, 1971; M i r e k, 1976; S z m e j a, 1986). Many weed communities thus partially changed their original structure.

Because of the political-system changes in Poland, in the last decade of the 20th century changes in the structure of agriculture were started. In many regions, large-area state-owned farms were gradually replaced by small privately-held farms. This process will have a significant effect on the distribution and structure of cropfield weed communities mainly in north-western Poland. Tracing these changes must be preceded by exact recording of the segetal vegetation on spatial micro- and macroscales. In many regions of this part of Poland cropfield vegetation has become the subject of appropriate detailed studies (H e r b i c h, 1982; S z m e j a, 1986, 1987, 1989, 1994; H o ł d y ń s k i, 1991), but so for there have been few synthetical studies (M a t u s z k i e w i c z, 1982; W ó j c i k, 1973). Contemporary trends of changes in the segetal vegetation of this area are still rather little understood.

The aim of the present study is to provide a synthesis of the information concerning the type of segetal vegetation in the selected part of northern Poland, situated on either side of the Vistula. The synthesis concerns the kind of cropfield weed communities found in the following nine regions: Cassubian Coast, Cassubian Lakeland, Elbląg Plateaux, Górowo Plateaux, Ermelandic Plain, Iława Lakeland, Vistula Delta, Starogard Lakeland and Lower Vistula Valley. The total surface area is 14682 km^2, including the eastern part of the Pomeranian Lakeland and a small fragment of the Eastern – Pomeranian Lakeland (K o n d r a c k i, 1980).

MATERIAL AND METHODS

In the study 540 phytosociological records have been used. The records were made in the years 1973-1999, by the Braun-Blanquet method (P a w ł o w s k i, 1972), during the period of optimum growth of cereal- (June, July) and root- (September, October) crop weeds. Only species of the 2nd, at least, degree of constancy were taken into account in the analysis of weed communities. The material to be studied was divided into two groups: weeds derived from regions west of the Vistula (Cassubian Lakeland, Cassubian Coast, Starogard Lakeland, Lower Vistula Valley and Vistula Delta), and from regions east of the Vistula (Elbląg Plateaux, Górowo Plateux, Ermelandic Plain, Iława Lakeland and the eastern part of the Vistula Delta) (Fig. 1).

In the table communities are arranged according to increasing soil fertility, from dry and sandy habitats poor in nutrients, to moist clayey ones, rich and characterized by a considerable biological activity.

Plant names have been adopted according to M i r e k et al., (1995).

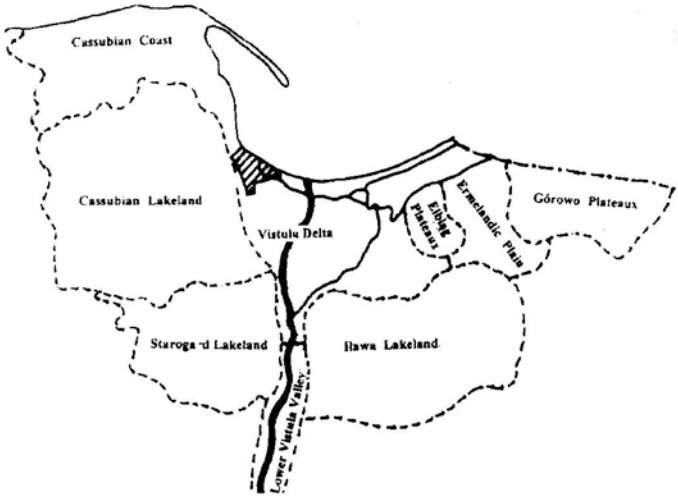

Fig. 1. Distribution of the physico-geographical units under study

RESULTS AND CONCLUSIONS

In nine regional units, east and west of the Vistula, 11 cropfield weed communities have been found. They included: *Teesdaleo-Arnoseridetum*, *Papaveretum argemones*, a transition community between *Vicietum tetraspermae* and *Aphano-Matricarietum*, *Aphano-Matricarietum*, *Spergulo-Chrysanthemetum segeti*, *Lathyro-Melandrietum*, *Digitarietum ischaemii*, *Echinochloo-Setarietum*, *Galinsogo-Setarietum*, *Lamio-Veronicetum politae* and *Fumarietum officinale*.

The above communities are made up of a large number of common species (Table 1), characterized by a wide scale of ecological requirements, including phytocoenotic ones. This species group includes *Viola arvensis*, *Chenopodium album*, *Agropyron repens*, *Fallopia convolvulus* and *Myosotis arvensis*. Other weeds, e.g. *Cirsium arvense*, *Equisetum arvense*, *Matricaria maritima* subsp. *inodora*, *Polygonum aviculare*, *Capsella bursa-pastoris*, *Stellaria media*, *Polygonum lapathifolium* subsp. *pallidum*, *Centaurea cyanus*, *Vicia hirsuta*, *Thlaspi arvense* and *Sinapis arvensis* are only occurring in some of the communities found east and west of the Vistula.

The communities distinguished differ among other things by the type of habitats they occupy. On poor, sandy and dry soils *Teesdaleo-Arnoseridetum* occurs which in root-crop fields is replaced by *Digitarietum ischaemii*. In *Teesdaleo-Arnoseridetum* the main species are first of all *Teesdalea nudicaulis*, *Arnoseris minima*, *Agrostis giganthea* and *Anthoxanthum aristatum*. West of the Vistula the latter species is an expansive weed that colonizes mainly rye fields on light soils. A similar distribution is found for *Digitarietum ischaemii* which also occupies light soils, but is very rarely represented. *Digitaria ischaemum* and *Setaria viridis* give a specific physiognomy to patches of this community; in the study area the former is far less frequent than the latter.

Another group of communities includes *Papaveretum argemones* and *Echinochloo-Setarietum*. Both communities are found on soils that are warm, well aerated and at the same time richer in nutrients than soils from which *Teesdaleo-Arnoseridetum* and *Digitarietum ischaemii* have been recorded. *Papaveretum argemones* patches form on both sides of the Vistula, except that west of the river *Papaver rhoeas*, *Vicia villosa*, *Lithospermum arvense* and *Trifolium arvense* are more frequent. In addition, *Papaver argemone* is more frequent west (constancy class V) than east (constancy class II) of the Vistula, while *Papaver dubium* – reversely (class III versus IV). West of the Vistula, in patches of this community more frequent are acidophilous species, e.g. *Rumex acetosa*, *Spergula arvensis*, *Scleranthus annuus* and *Raphanus raphanistrum*. A common feature of this community on both sides of the Vistula is a fairly frequent (constancy class II) occurrence of *Aphanes arvensis* – the characteristic species of *Aphano-Matricarietum*.

In the same habitats in which *Papaveretum argemones* occurs in grain crops *Echinochloo-Setarietum* develops in root crops. Typically formed patches of this association are only found in areas west of the Vistula. Constantly present in them is *Echinochloa crus-galli* accompanied by *Setaria viridis*, *Amaranthus retroflexus* and *Geranium pusillum*. In areas east of the Vistula this association nearly always includes *Galinsoga ciliata* and *G. parviflora*. Due to this floristic composition it becomes similar to *Galinsogo-Setarietum*.

A further group of communities is *Aphano-Matricarietum* and a transition community between *Aphano-Matricarietum* and *Vicietum tetraspermae*. A common feature of these two units of segetal vegetation is the constant presence in them of *Aphanes arvensis*. East of the Vistula *Chamomilla recutita* is usually absent from *Aphano-Matricarietum*, because it occurs there mainly in ruderal habitats. Also, in patches of this association west of the Vistula the following species are less frequent: *Ranunculus repens*, *Juncus bufonius*, *Gnaphalium uliginosum*, *Polygonum lapathifolium* subsp. *pallidum* and *Plantago intermedia*. They are more frequently recorded for areas east of the Vistula, where they are indicators of a good moisture of the soil and arable layer. *Aphano-Matricarietum* patches on either side of the Vistula are linked by a sizeable group of common species, e.g. *Veronica arvensis*, *Polygonum persicaria*, *Apera spica-venti*, *Poa annua*, *Achillea millefolium*, *Raphanus raphanistrum* and *Vicia angustifolia* which were not encountered in patches of the transition community between *Vicietum tetraspermae* and *Aphano-Matricarietum*.

Spergulo-Chrysanthemetum segeti occupies habitats similar to those occupied by *Aphano-Matricarietum*. A specific characteristic of *Spergulo-Chrysanthemetum segeti* is the constant presence of *Polygonum lapathifolium* subsp. *lapathifolium* and *Chrysanthemum segetum*; the latter has infested many cropfields and is difficult to control. West of the Vistula *Spergulo-Chrysanthemetum segeti* rarely includes species of the alliance *Eu-Polygono-Chenopodion*, e.g. *Lamium amplexicaule*, *L. purpureum*, and *Sonchus asper*, and absent from it are plants with high tropic requirements, e.g. *Erysimum cheiranthoides*, *Sinapis arvensis*, *Thlaspi arvense*, *Sonchus arvensis*, *Vicia hirsuta* and *Centaurea cyanus*. Present, however, are plants like *Artemisia vulgaris*, *Erodium cicutarium*, *Rumex acetosella*, *Anchusa officinalis* and *Galeopsis tetrahit* which are much rarer than in regions east of the Vistula.

Lathyro-Melandrietum – a further cropfield weed community – in the study area its occurrence is restricted to the Lower Vistula Valley where it develops on very rich black soils. In addition to the characteristic species, i.e. *Lathyrus tuberosus* and *Melandrium noctiflorum*, there occurred many calciphilous plants of the alliance *Caucalidion daucoidis*, e.g. *Adonis aestivalis*, *Euphorbia exigua*, *Ranunculus arvensis* and *Fumaria vaillantii*. In patches of this association the characteristic species of *Aphano-Matricarietum*, *Vicietum tetraspermae* and *Papaveretum argemone* do not occur, and the *Aperion spicae-venti* alliance is poorly represented. Because of such a species composition, *Lathyro-Melandrietum* cannot be classified among the rich-soil forms of one of the above-listed plant communities.

In the area under study the richest soils are occupied by *Galinsogo-Setarietum*, *Lamio-Veronicetum politae* and *Fumarietum officinale*. *Galinsogo-Setarietum* patches form on intensively fertilized soils, especially on manured soils, and in fields near farmsteads. Frequent components of this association are *Galinsoga parviflora* and *Galinsoga ciliata*, usually accompanied by *Solanum nigrum* and *Veronica polita*. In patches of this association found east of the Vistula *Echinochloa crus-galli* occurs constantly.

Lamio-Veronicetum politae is characterized by a constant presence of *Veronica agrestis* and *Veronica polita*. East of the Vistula patches of this association are floristically richer, among other things because of the more frequent occurrence of species of the *Eu-Polygono-Chenopodion* alliance, especially *Lamium purpureum*, *Sonchus asper* and *Veronica persica*, and also on account of the presence of more fertile soils.

Fumarietum officinale is often formed near *Lamio-Veronicetum politae* patches. In segetal plant syntaxonomy these two communities are fairly close and are for this reason sometimes erroneously identified. The main characteristic species of *Fumarietum officinalis* is *Fumaria officinalis* whose constancy is very high (Table 1). Typically formed patches of this association were found west of the Vistula where they were accompanied by other species of the *Eu-Polygono-Chenopodion* alliance, e.g. *Lamium amplexicaule*, *L. purpureum* and *Sonchus asper*. East of the Vistula *Fumarietum officinale* occurs in a floristically poorer form, because a number of species of the *Eu-Polygono-Chenopodion* alliance are missing, while *Fumaria officinalis* is less frequent than, e.g. in the Cassubian Lakeland.

The following conclusions were drawn from the study:

1. In nine regional units, located in northern Poland on either side of the Vistula, 11 cropfield weed communities have been found. In grain fields the following have been recorded: *Teesdaleo-Arnoseridetum*, *Papaveretum argemones*, a transition community between *Vicietum tetraspermae* and *Aphano-Matricarietum*, *Lathyro-Melandrietum* and *Spergulo-Chrysanthemetum segeti*. In root-crop fields: *Digitarietum ischaemii*, *Echinochloo-Setarietum*, *Lamio-Veronicetum politae*, *Galinsogo-Setarietum*, *Fumarietum officinalis* and *Spergulo-Chrysanthemetum segeti*.

2. *Lamio-Veronicetum politae*, *Galinsogo-Setarietum*, *Fumarietum officinalis* and *Spergulo-Chrysanthemetum segeti* have a number of species in common, especially species of the alliance *Eu-Polygono-Chenopodion*. Because of their presence, patches of these association are floristically similar.
3. *Digitarietum ischaemii* is an association commonly occurring west of the Vistula. Its patches are often found there, its characteristic species being abundant. East of the Vistula, where rich and moist habitats are more frequent, phytocoenoses of this association are less abundant.
4. *Aphano-Matricarietum* is well developed in terrains east of the Vistula, but in areas west of this river in northern Poland, its patches are floristically poorer and often similar to *Papaveretum argemones*.
5. *Spergulo-Chrysanthemetum segeti* occurs in grain- and root-crop fields.
6. *Lathyro-Melandrietum* was only found in regions west of the Vistula, on very fertile soils in the Lower Vistula Valley. This association is distinguishable by the presence of many species of the *Caucalidion daucoidis* alliance. These species have not been found in any other cropfield weed community.

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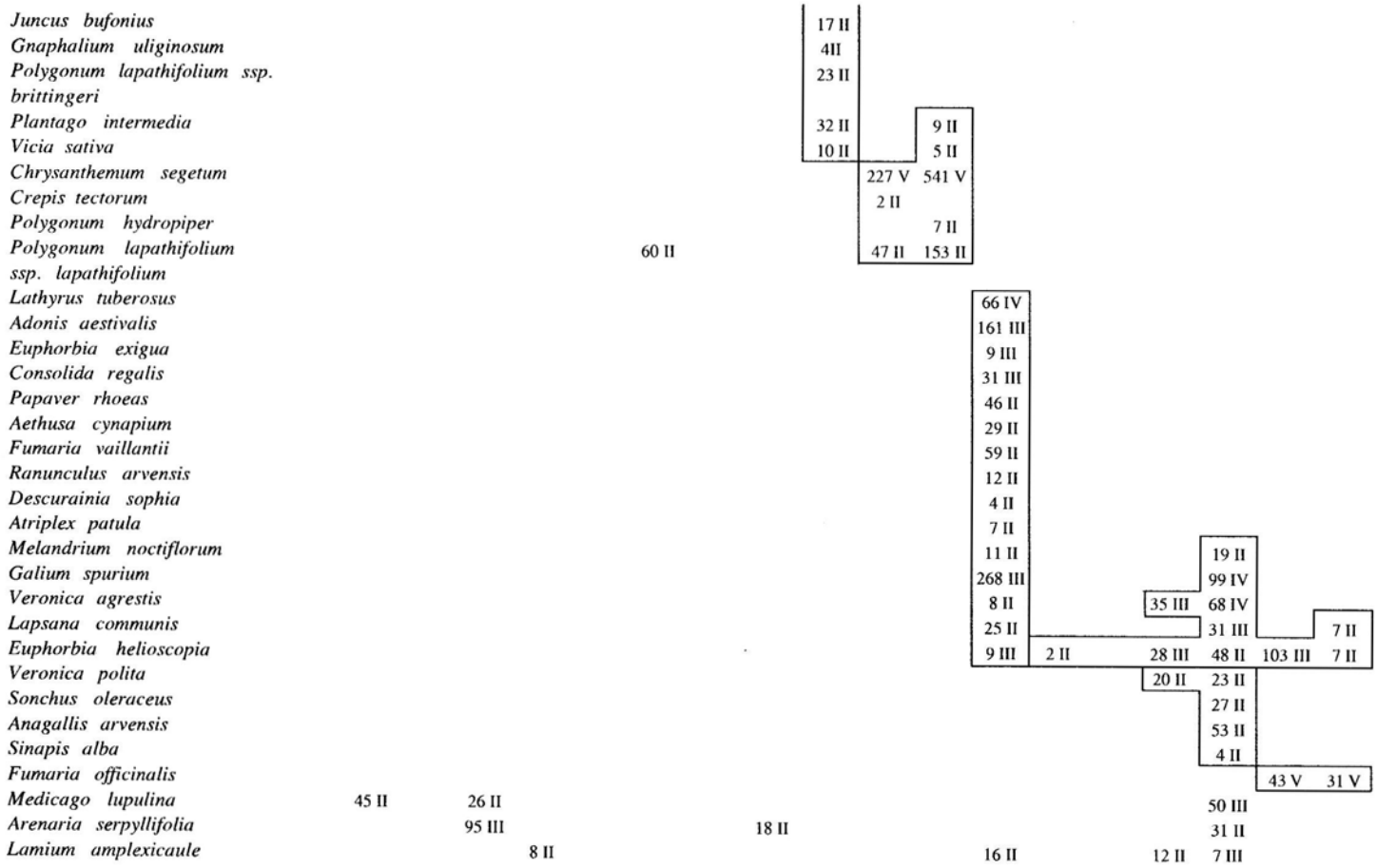
Zbiorowiska chwastów upraw polnych Polski północnej po wschodniej i zachodniej stronie Wisły

Streszczenie

Badania roślinności segetalnej prowadzono w dziewięciu mezoregionach Polski północnej, położonych po obu stronach Wisły. Są to: Pobrzeże Kaszubskie, Pojezierze Kaszubskie, Wzniesienia Elbląskie, Wzniesienia Górowskie, Równina Warmińska, Pojezierze Iławskie, Żuławy Wiślane, Pojezierze Starogardzkie i Dolina Dolnej Wisły. W pracy wyróżniono i opisano 11 zbiorowisk chwastów upraw polnych. W uprawach zbożowych są to: *Teesdaleo-Arnoseridetum*, *Papaveretum argemones*, zbiorowisko przejściowe między *Vicietum tetraspermae* i *Aphano-Matricarietum*, *Lathyro-Melandrietum* i *Spergulo-Chrysanthemetum segeti*. W uprawach okopowych stwierdzono występowanie: *Digitarietum ischaemii*, *Echinochloo-Setarietum*, *Lamio-Veronicetum politae*, *Galinsogo-Setarietum*, *Fumarietum officinalis* i *Spergulo-Chrysanthemetum segeti*. Występowanie w płatach większości zbiorowisk, zwłaszcza okopowych, wielu gatunków wspólnych sprawia, że wykazują one szereg podobieństw zarówno florystycznych jak i strukturalnych.

Table 1. Floristic comparision of weed communities of field cultivations of the eastern and western sides of the Vistula

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Arnoseris minima	195 V																	
Teesdalea nudicaulis	115 V																	
Anthoxanthum aristatum	368 II																	
Agrostis giganthea	13 II																	
Setaria viridis		133 V			42 III												42 II	
Digitaria ischaemum		47 V																
Myosotis stricta			30 II															
Trifolium arvense			9 II															
Arabidopsis thaliana			71 III															
Papaver rhoeas			14 II															
Vicia villosa			18 II															
Lithospermum arvense			57 II															
Papaver argemone			55 V	30 II														
Papaver dubium			16 III	30 IV														
Veronica hederifolia			114 III	268 V														
Raphanus raphanistrum			26 II	16 II														
Geranium pusillum					14 II													
Amaranthus retroflexus					6 II													
Echinochloa crus-galli					100 V	30 IV								49 III				
Stachys palustris						12 II								51 III			4 II	24 II
Galinsoga ciliata						151 II							19 II	258 IV		92 II		
G. parviflora						31 II							81 IV	457 V				
Solanum nigrum						8 II							16 III	40 II				
Vicia tetrasperma							43 V											
Anagallis arvensis							2 II											
Galeopsis bifida							2 II											
Melandrium album							1 II											
Chamomilla recutita							55 II		404 V									
Aphanes arvensis			22 II	35 II			20 II	70 V	97 III									
Ranunculus repens							2 II											


Juncus bufonius
Gnaphalium uliginosum
Polygonum lapathifolium ssp. brittingeri
Plantago intermedia
Vicia sativa
Chrysanthemum segetum
Crepis tectorum
Polygonum hydropiper
Polygonum lapathifolium ssp. lapathifolium
Lathyrus tuberosus
Adonis aestivalis
Euphorbia exigua
Consolida regalis
Papaver rhoeas
Aethusa cynapium
Fumaria vaillantii
Ranunculus arvensis
Descurainia sophia
Atriplex patula
Melandrium noctiflorum
Galium spurium
Veronica agrestis
Lapsana communis
Euphorbia helioscopia
Veronica polita
Sonchus oleraceus
Anagallis arvensis
Sinapis alba
Fumaria officinalis
Medicago lupulina
Arenaria serpyllifolia
Lamium amplexicaule
17 II
4II
23 II
32 II
10 II
9 II
5 II
227 V
541 V
2 II
7 II
60 II
47 II
153 II
66 IV
161 III
9 III
31 III
46 II
29 II
59 II
12 II
4 II
7 II
11 II
268 III
8 II
25 II
9 III
19 II
99 IV
35 III
68 IV
31 III
7 II
2 II
28 III
48 II
103 III
7 II
20 II
23 II
27 II
53 II
4 II
43 V
31 V
45 II
26 II
50 III
95 III
18 II
31 II
8 II
16 II
12 II
7 III

Trifolium repens				15 II		5 II		4 II	12 III		42 III								
Lamium purpureum				77 III	3 II							40 III				37 III	6 II		
Galeopsis speciosa									88 III		12 II						12 II		
Sonchus asper						38 II					44 III			7 II		28 II		8 II	
Erodium cicutarium		2 II	16 II		8 II					6II					20 II		50 II		
Rumex acetosella	109 IV	23 II	27 II					19 II		54 II	5 II								
Erysimum cheiranthoides						27 II					9 II		34 II	20 III	10 II		25 II	38 II	
Carduus crispus		11 II	30 II									8 II	30 II			27 II	12 II	7 II	
Veronica arvensis			14 II					22 III	47 II	6 II	54 II	8 II				31 II		12 II	
Polygonum persicaria	12 II							38 II	31 III	51 V	32 III			25 II				7 II	
Apera spica- venti	98 III		392 IV	49 II				218 V	185 III	122 IV							3 II		
Poa annua					4 II	24 III		151 II	13 III		26 II			29 II	26 III	8 II			
Achillea millefolium	13 II		4 II	4 II				14 II	9 II	20 III	3 II							31 II	
Raphanus raphanistrum	24 III							21 II	22 II	97 IV	9 II				8 III	3 II	25 II		
Anthemis arvensis	48 II		93 II		9 II			83 III		7 II			43 II	89 III			51 II		
Vicia angustifolia	20 III		16 III	10 II				22 III	8 III	12 II						4 II		3 II	
Polygonum amphibium	13 II					9 II	11 II	21 II	9 II					30 II		84 II		30 II	
Scleranthus annuus	310 IV		46 II				29 III	186 III	87 II	30 III	27 III			13 II					
Veronica persica				32 II		46 II	1 II						7 III	8 II	46 II	93 IV	35 II	13 II	
Avena fatua				84 III	36 II	7 II	41 III				13 II			12 II	31 III	84 III		39 III	
Artemisia vulgaris			6 II		4 II			5 II	21 II	2 II			35 II	4 II		11 III	13 II	3 II	
Anchusa arvensis				8 II	3 II	18 II	7 II		3 II	3 II				8 II	23 II	22 II	33 II	13 II	
Galeopsis tetrahit	62 III	2 II		74 III			29 III	17 III	112 V	69 IV				30 II		8 II	29 II	32 IV	
Spergula arvensis	79 IV	57 II	14 II		4 II		23 II		23 II	66 V	125 IV				8 II		27 II	20 II	
Taraxacum officinale			8 II	14 II	10 III	9 II		4 II	3 II		5 II	3 III		19 III	7 III	36 IV	5 II		
Mentha arvensis	73 II			25 II		10 II	42 IV	23 II	24 II	41 II	95 II		100 II	72 II			46 II	61 II	
Sinapis arvensis				49 III	27 II	6 III	24 III				8 II	83 IV	30 IV	4 II	38 III	20 II	149 IV	109 IV	
Thlaspi arvense			43 II	48 III	12 III		2 II		37 II		22 II	40 III	19 II		32 IV	49 III	30 III	11 II	
Sonchus arvensis				38 III	10 III	59 III	17 III	21 II	63 III		8 III		97 IV	128 V	53 III	54 IV	114 III	96 V	
Vicia hirsuta			80 III	72 III	25 II	18 II	12 III	80 III	59 IV		39 IV			8 II	9 III	53 III	5 II	4 II	
Centaurea cyanus	46 V		145 IV	68 III	8 II		12 III	120 IV	225 IV		57 IV		32 II	69 III		18 II	74 III	15 III	
Polygonum lapathifolium ssp.pallidum	45 II	92 II		18 II	13 II	73 III	3 III	15 III	128 III	76 IV	84 III		159 III		23 III	6 II	11 III	36 III	
Stellaria media			24 II	190 V	63 III	143 IV	67 IV	200 V	263 V		296 V	27 IV	74 V	173 IV	206 V	257 V	181 IV	205 IV	
Capsella bursa-pastoris			27 II	49 III	74 III	53 IV	2 II	15 II	13 III	17 III	17 III		24 III	36 III	52 III	41 II	23 II	22 II	

Polygonum aviculare			30 II	37 III	20 III	55 III	2 IV	53 IV	36 IV	33 II	17 III	68 III	32 II	8 II	28III	38 III	11 III	14 III
Matricaria maritima ssp. inodora		2 II	55 II	177 IV	110 IV	105 IV	47 V	105 IV	240V	7 II	211 V		16 III	95 IV	69 IV	130 V	145 IV	35 IV
Equisetum arvense	113 III	36 V	11 III	27 IV	146 IV	57 III	59 IV	86 III	24 IV	22 IV	146 IV		93 V	123 IV	178 IV	145 III	101 IV	133 IV
Cirsium arvense	90 IV		65 II	35 IV	67 III	44 IV	25 IV	82 IV	49 IV	17 III	17 III	22 III	86 V	14 III	131 IV	72 IV	72 IV	156 V
Myosotis arvensis	8 II	11 II	71 IV	33 III	9 III	16 III	17 IV	62 IV	92 V	20 III	59 IV	9 III	19 II	22 IV	49 V	42 III	9 II	26 III
Fallopia convolvulus	90IV	22 V	158 V	94 IV	76 IV	44 IV	60 IV	145 IV	83 V	48 IV	76 IV	42 IV	81 IV	60 IV	92 V	114 V	138 V	93 IV
Agropyron repens	62 III	222 V	171 IV	304 V	77 V	404 V	72 III	147 IV	304 V	54 IV	197 IV	226 V	258 IV	56 IV	357 IV	379 V	273 V	229 V
Chenopodium album	43 III	35 IV	62 IV	250 III	233 V	555 V	47 IV	87 III	116 V	27 IV	123 IV	127 IV	258 V	257 V	264 V	457 V	370 V	249 V
Viola arvensis	103 IV	16 III	97 V	26 IV	421 V	56 III	20 III	12 IV	82 V	46 V	30 IV	17 II	53 IV	20II	33 IV	83 IV	86 III	20 II

Explanations:

1 -*Teesdaleo-Arnoseridetum* (PZ),
2 - *Digitarietum ischaemi* (PZ),
3 - *Papaveretum argemones* (PZ),
4 - *Papaveretum argemones* (PW),
5 - *Echinochloo-Setarietum* (PZ),
6 - *Echinochloo-Setarietum* (PW),
7 - a transition community between *Vicietum tetraspermae* and *Aphano-Matricarietum* (PZ),
8 - *Aphano-Matricarietum* (PZ),
9 - *Aphano-Matricarietum* (PW),
10 - *Spergulo-Chrysanthemetum segeti* (PZ),
11 - *Spergulo-Chrysanthemetum segeti* (PW),
12 - *Lathyro-Melandrietum* (PZ),
13 - *Galinsogo-Setarietum* (PZ),
14 - *Galinsogo-Setarietum* (PW),
15 - *Lamio-Veronicetum politae* (PZ),
16 - *Lamio-Veronicetum politae* (PW),
17 - *Fumarietum officinale* (PZ),
18 - *Fumarietum officinale* (PW).

PZ – regions of the west of Vistula

PW – regions of the east of Vistula