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WEED COMMUNITIES IN POTATO (*Solanum tuberosum* L.)CROPS OF THE MAZOWIECKI LANDSCAPE PARK

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A b s t r a c t

This paper presents a description of segetal communities in potato crops cultivated in the Masovian Landscape Park. The communities were analysed based on 64 phytosociological relevés made at 45 localities. 4 associations were found in the study area, that is, *Digitarietum ischaemi, Echinochloo-Setarietum, Galinsogo-Setarietum,* and *Lamio-Veronicetum politae*. Phytocenoses representing the associations *Digitarietum ischaemi* and *Echinochloo-Setarietum* were most varied floristically. Lower syntaxonomical units were determined within these associations, that is, subassociations and variants. These phytocenoses were frequently found; they occurred in various habitats characterized by different trophic and moisture conditions. Patches of the association *Lamio-Veronicetum polita* were rare and they occurred only on fertile soils and on small areas.

Key words: root crops, weed communities, biodiversity of weeds, Mazowiecki Landscape Park

IINTRODUCTION

The area under potato has fallen considerably over the last decade from 1250.4 (in 2000) to 388.3 th (in 2010) (GUS, 2011). This has resulted from changes in the cropping structure, increased fallow area, an unfavourable economic situation, and in the case of land in the vicinity of urban areas, the allocation of land for building development. As far as the Masovian Landscape Park is concerned, there is an additional element, that is, the land use structure: 70% of the area is covered by forest, whereas 11.3% is ploughed land. All the aforementioned factors have influenced potato cultivation in the Masovian Landscape Park causing its continuous decline. The areas cropped to potato are small and yields harvested are mainly used to meet the needs of households.

This paper presents the next study on phytocenoses established in crop plants in this area (S k r a j n a et al. 2009; S k r a j n a and Ł u g o w s k a , 2010). The objective of the study was to analyse communities in potato crops against the background of various habitats under conditions of extensive farming in the Masovian Landscape Park area.

RESEARCH METHODS AND AREA

Observations of segetal communities in the Masovian Landscape Park area were conducted in the years 2003–2008. 64 phytosociological relevés were made by the Braun-Blanquet method (P a w ł o w s k i , 1972) in 45 localities (Fig. 1) within the Park and its buffer zone. During the field study, agricultural soil maps at a scale of 1:5000 were used to select sites for examination and to determine soil conditions. The factual material collected was analysed phytosociologically based on the rules suggested by M a t u s z k i e w i c z (2007). Species nomenclature followed M i r e k et al. (2002).

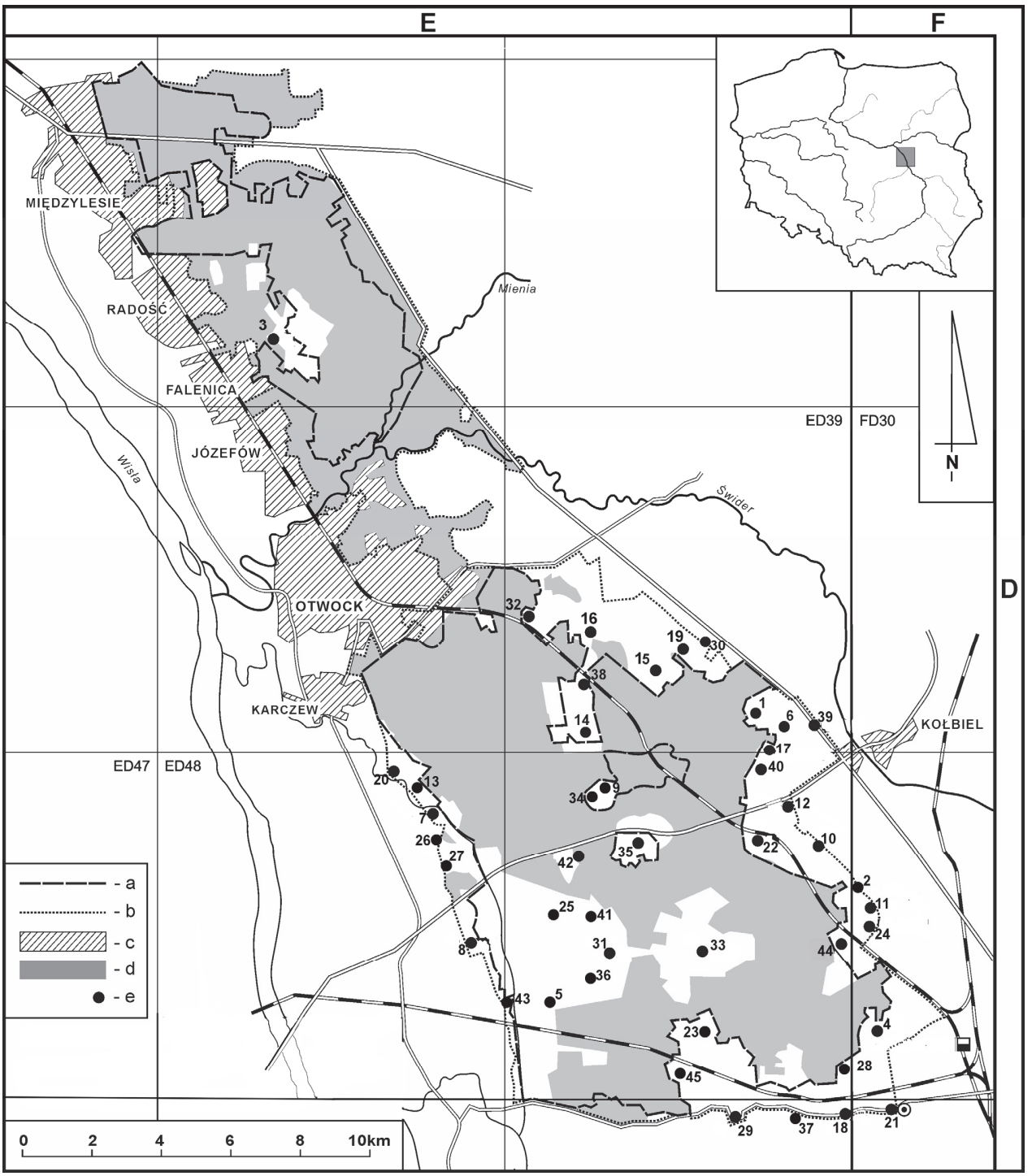

Figure 1. Study area

a – borders of the Landscape Park; b – borders of the buffer zone; c – built-up areas; d – forest complexes; e – localities, study sites.

1 –Anielinek, 2 – Antoninek, 3 – Aleksandrówka, 4 – Augustówka, 5 – Bąki, 6 – Bocian, 7 – Brzezinka, 8 – Całowanie, 9 – Celestynów, 10 – Chrosna, 11 – Chrząszczówka, 12 – Człekówka, 13 – Dąbrowa, 14 – Dąbrówka, 15 – Dyzin, 16 – Glina, 17 – Gózd, 18 – Grabianka, 19 – Jatne, 20 Janów, 21 – Jaźwiny, 22 – Karpiska, 23 – Kąciki, 24 – Kąty, 25 – Kominki, 26 – Kozłówka, 27 – Łukowiec, 28 – Ocznia, 29 – Osieck, 30 – Ostrowik, 31 – Podbiel, 32 – Pogorzel, 33 – Ponurzyca, 34 – Radzyń, 35 – Regut, 36 – Rosłańce, 37 – Rudnik, 38 – Stara Wieś, 39 – Stara Wieś II, 40 – Skorupy, 41 – Szatany, 42 – Tabor, 43 – Warszówka, 44 – Zabieżki, 45 – Zawada.

RESULTS

Ten different types of phytocenoses, represented by subassociations and variants of 4 associations, were recognised in the Masovian Landscape Park.

Systematics of distinguished root crops communities

Class: *Stellarietea mediae* Tx., Lohm. et Prst. 1950

Order: *Polygono-Chenopodietalia* (R.Tx. et Lohm. 1950) J. Tx. 1961

Alliance: *Panico-Setarion* Siss. 1946

1. Association: *Digitarietum ischaemi* R. Tx. et Prsg (1942) 1950
   a. typical variant
   b. variant with a share of ruderal species
   c. variant with a share of wet species
2. Association: *Echinochloo-Setarietum* Krusem. et Vlieg. (1939) 1940
   Subassociation: *Echinochloo-Setarietum sperguletosum*
   Subassociation: *Echinochloo-Setarietum typicum*
   a. typical variant
   b. variant with a share of wet species
   c. variant with *Amaranthus retroflexus*
   d. variant with *Veronica agrestis*

Alliance: *Polygono-Chenopodion* Siss. 1946

1. Association: *Galinsogo-Setarietum* (R. Tx et Beck. 1942) R. Tx. 1950
2. Association: *Lamio-Veronicetum politae* Kornaś 1950

***Digitarietum ischaemi* R.** Tx. Et Prsg (1942) 1950

The association, of Sub-Atlantic character, occurred both in the Park and its buffer zone.

It was described on the basis of 17 phytosociological relevés. Altogether, there were recorded 71 species in all the examined patches of land (Table 1). Due to the great floristic diversity within this association, apart from the typical form, there was found a form characterised by the presence of ruderal and wet species. The appearance of the community was dominated by the typical species *Digitaria ischaemum*, with its percentage exceeding 60% in some patches.

Typical patches of this community developed on dry and poor soils. 42 taxa were found that were the poorest phytocenoses in the potato fields. The nature of the analysed phytocenoses was influenced by the group of acidophilous species representing the association *Panico-Setarion* and which included *Rumex acetosella, Spergula arvensis, Scleranthus annuus, Setaria pumila* and *Raphanus raphanistrum.*

Patches of this variant including ruderal species formed in small areas cropped to potato located adjacent to fallow land. This variant was distinguished because the community was characterised by a considerable share of ruderal species compared with other agrophytocenoses. Frequent components of the flora of this community were as follows: *Artemisia vulgaris, Erigeron acer, Lactuca serriola, Tanacetum vulgare, Malva neglecta, Sisymbrium officinale.*

On light loamy sands, representing different soil types belonging to the cereal-fodder poor soil quality complex, phytocenoses formed that included moisture-loving species. The variant with these species was distinguished based on 5 plant patches. They were slightly richer phytocenoses than the previous ones as 44 weed species were found. The nature of this community was defined, apart from the typical species, by moisture-loving species with shallow roots, the most numerous and most frequent species being *Spergularia rubra, Gnaphalium uliginosum, Juncus bufonius, Sagina procumbens,* and *Plantago intermedia*.

Echinochloo-Setarietum Krusem. et Vlieg. (1939) 1940

The association *Echinochloo-Setarietum* was characterised on the basis of 26 phytosociological relevés which comprised 114 weed species (Table 2). These phytocenoses were most frequently found in the examined fields. The diversity of habitats where the phytocenoses of this association developed influenced the heterogeneity of individual patches. Within the association, 2 subassociations and 3 variants were found. The whole association was influenced by the mass presence of its typical species, *Echinochloa crus-galli*, which reached a very high cover index (D=2567). In turn, *Raphanus raphanistrum* was most frequently found in *Echinochloo-Setarietum* typicum, in the remaining communities being found in parts of the patches only. Moreover, the common species in the association were *Setaria pumila, Matricaria maritima* subsp. *indora, Chenopodium album, Stellaria media, Viola arvensis, Polygonum aviculare,* and *Polygonum lapathifolium* subsp. *lapathifolium.*

Relevés 1 to 5 revealed communities of the most acidophilous character which were included in *Echinochloo-Setarietum sperguletosum*. Patches of this subassociation developed on different types of soils representing the good and poor rye soil quality complex. It was the floristically poorest community in the association *Echinochloo-Setarietum*. Only 39 weed species were found in it. The nature of the association was defined by 3 acidophilous species:

Spergula arvensis, Rumem acetosella, Scleranthus annuus.

Typical patches of the association were found on leached brown soils belonging to the very good and good rye soil quality complex. The community comprised 54 weed species. Apart from the species typical of this association, *Matricaria maritima* subsp. *indora* was a regular component of these phytocenoses, whereas *Chenopopodium album* was the most frequent component of the syntaxa of this association.

The association *Echinochloo-Setarietum*, with a high share of wet species, was found on light and strong loamy sands representing degraded chernozems and alluvial soils. These were the richest phytocenoses in this association, represented by 73 weed species. The following were the most frequent and numerous species: *Plantago intermedia, Gnaphalium uliginosum, Mentha arvensis, Ranunculus repens, Polygonum hydropiper*.

Some patches of the association *Echinochloo-Setarietum* were characterised by a substantial share of *Amaranthus retroflexus*, which made it possible to classify these phytocenoses as a variant including this species. The community developed on various soils and was floristically abundant, as 70 species were found in 5 relevés. Numerous *Amaranthus retroflexus* plants in the communities were accompanied by other species, such as *Stellaria media, Polygonum lapathifolium* subsp. *lapathifolium,* and *Senecio vulgaris*, which is indicative of high soil nitrogen content in these habitats. The analysed phytocenoses comprised a small number of wet species.

Communities representing *Echinochloo-Setarietum* with *Veronica agrestis* established on trophically rich and well-moistened fertile soils. The phytocenoses were characterised by a high share of species of the alliance *Polygono-Chenopodion*, of which *Veronica persica, Lamium purpureum* and *Euphorbia helioscopia* were regular components.

Galinsogo-Setarietum

(R. Tx et Beck. 1942) R. Tx. 1950

Patches of the association *Galinsogo-Setarietum* developed on leached brown soils which were well fertilised and in good tilth. These phytocenoses were most frequent in the Park's buffer zone, mainly in the proximity of buildings. The association was described based on 10 phytosociological relevés which were floristically rich communities. There were found 76 species in all the examined patches, the average number of species per relevé being 25 (Table 3). The regular components of the phytocenoses were species typical of the association, of which *Galinsoga parviflora* had a very high cover index. The analysed patches were characterised by a high share of the alliance *Polygono-Chenopodion* species, the most frequent being *Lamium purpureum, Veronica persica, Euphorbia helioscopia* and *Matricaria maritima* subsp. *inodora*. Moreover, the nature of the phytocenoses was also influenced by species belonging to higher syntaxonomic units which locally reached higher cover, that is, *Chenopodium album, Stellaria media, Setaria pumila, Viola arvensis,* and *Anthemis arvensis*.

Lamio-Veronicetum politae

Kornaś 1950

Patches of the association developed on fertile $CaCO_3$-rich soils of the good wheat soil quality complex. The association is found both in the Park and in its buffer zone. The phytocenoses were floristically rich as 82 weed species were recorded in 10 patches, the average number of species per relevé being 26 (Table 4). Of the typical species, *Lamium amplexicaule* was the most common component of this association, *Veronica agrestis* was less frequent, whereas *Veronica opaca* and *Veronica polita* occurred only in some plant patches. There was found a considerable group of the *Polygono-Chenopodion* alliance species, of which the most numerous species that reached the highest cover were: *Veronica persica, Lamium purpureum, Chenopodium polyspermum, Euphorbia helioscopia* and *Oxalis fontana*. In turn, common species of higher syntaxonomic units in the association included: *Chenopodium album, Stellaria media, Anagallis arvensis, Chaenorchinum minus, Echinochloa crus-galli, Polygonum lapathifolium subsp. pallidum*, and *Aethusa cynapium*.

Table 1

Digitarietum ischaemi R. Tx. et Prsg (1942) 1950

Subassociation	typicum																					
Variant									with ruderal species						with wet species							
Relevé no. in table	1	2	3	4	5	6	7		8	9	10	11	12		13	14	15	16	17			
Relevé no.in field	135	157	139	193	141	154	145		130	197	180	149	159		151	148	156	136	137			
Date: month	8	8	8	9	8	8	8	number of occurrences	8	9	8	8	8	number of occurrences	8	8	8	8	8	number of occurrences	Mean number of species per relevé	
year	.06	.07	.06	.08	.06	.06	.06		.05	.08	.08	.06	.07		.06	.06	.06	.06	.06			
Locality	3	21	9	42	11	18	13		1	44	37	16	22		16	12	19	3	7			
Crop cover in %	60	zn	zn	zn	zn	zn	zn		zn	zn	zn	50	65		zn	zn	zn	zn	zn			
Weed cover in %	40	70	75	75	70	55	75		65	55	65	50	60		60	55	75	55	75			
Soil unit	7Bw pl	7Bw pl	7Bw pl	6Bw ps	7Bw pl	6Bw ps	7Bw pl		9F płz.psp	6M ps	6A pgl:pl	6Bw pgl.gl	5Bw pgl:ps		9Bw pgl:pl	9Bw pgl	9M pgl.pl	9Bw pgl:gl	6F pgl.gl			
Number of species per relevé	16	15	15	17	13	16	15		19	18	22	21	19		22	25	19	23	21		19	
I. Ch.D. *Digitarietum ischaemi*								n						n						n	D	S
Digitaria ischaemum (Schreb.) Mühlenbg.	1	4	4	3	2	3	1	7	2	2	3	2	3	5	2	2	1	2	2	5	V	2529
II. D var. with ruderal species																						
Artemisia vulgaris L.	+							1	+	2	1	+	1	5	+					1	III	24
Solidago canadensis L.									+		1	1	+	4							II	71
Erigeron acris L.			+					1			+	1	1	3			+			1	II	53
Malva neglecta Wallr.									+		1		+	3					+	1	II	47
Lactuca serriola L.		+						1	+	+		+	+	4	+					1	II	35
Tanacetum vulgare L.				+				1	+	+		+	+	4							II	29
Sisymbrium officinale L.			+					1		+	+		+	3							II	24
III. D. var. with of wet																						
Polygonum hydropiper L.									+		+			2	2		2			2	II	218
Plantago intermedia Gilib.										+		+		2		2			2	2	II	218
Spergularia rubra (L.) J. Presl & C. Presl															1	1	2	+	1	5	II	197
Gnaphalium uliginosum L.															1	1	+	1	+	5	II	159
Juncus bufonius L.													+	1	1		2		+	3	II	144
Sagina procumbens L.															+	+		2	+	4	II	121
Phragmites australis (Cav.) Trin. et Steud.										+				1	+	+	+	+		4	II	29
Bidens tripartita L.										+			+	2	+	+				2	II	24

IV. Ch.D. *Panico-Setarion, Polygono-Chenopodietalia*																						
Scleranthus annuus L.		1		+	2	1	2	5		+		+	+	3	+	+		+	+	4	IV	312
Setaria pumila (Poir.) Roem. & Schult.			+	1	+	+	2	5	2	+	+			3	+	+	1	+		4	IV	312
Rumex acetosella L.	1	+	1	2	1	+	+	7		1		+	+	3			+		+	2	IV	141
Spergula arvensis L.	2		+		2	+	+	5			+	1		2		+	+	+		3	III	276
Chenopodium album L.	+		+	+				3			+	+	+	3		+	+	+	+	4	III	59
Raphanus raphanistrum L.				1		+	1	3	2	+				2			+			1	II	179
Setaria viridis (L.) P. Beauv.				+				1	+					1					+	1	II	47
Echinochloa crus-galli (L.) P. B.		+			+			2				+		1	+					1	II	24
Capsella bursa-pastoris (L.) Med.					+	+	+	3											+	1	II	24
V. Ch. *Stellarietea mediae*																						
Viola arvensis Murr.		+	+				+	3	+	+		1		3	+		+		+	3	III	76
Fallopia convolvulus (L.) A. Löve	+	+		+	+	1	+	6								+		+		2	III	65
Conyza canadensis (L.) Cron.		+				+	+	3		1	+		+	3			+			1	III	65
Polygonum aviculare L.					+	+	+	3	+		+			2	+	+	+	+	+	5	III	59
Anthemis arvensis L.	+	+	+	+				4	+		+	+		3							III	41
Centaurea cyanus L.	+	+						2	+					1	+	+		+		3	II	35
Arnoseris minima (L.) Schweigg. & Körte			+					1	+		+	+		3							II	24
Myosotis arvensis (L.) Hill.				+				1							+	+		+		3	II	24
VI. Companions																						
Achillea millefolium L.	+	+				+		3		+	1	1		3			+	+		2	III	65
Convolvulus arvensis L.	+	+	+	+	+	+	+	7							+				+	2	III	53
Erodium cicutarium (L.) L'hér.		+		+		+	+	4		+		+		2	+		+		+	3	III	53
Veronica arvensis L.	+			+	+	+	+	5								+		+		2	III	41
Polygonum lapathifolium L. subsp. *lapathifolia*			1				2	2	+		+			2							II	144
Gnaphalium sylvaticum L.									+		+	1	1	4							II	71
Elymus repens (L.) Gould					+	+		2							+	+		+		3	II	29
Agrostis stolonifera L.												+	+	2			+	+		2	II	24

Sporadic species: **II** – *Datura stramonium* L. 8(r), 10(+), 12(+); *Torylis japonica* (Houtt.) DC. 10(+), 11(+); *Descurainia sophia* (L.) Weeb 11(+), 12(+); **III** – *Stachys palustris* L. 13(+), 14(+), 15(+); *Bidens frondosa* L. 14(+), 16(1); *Polygonym amphibium* L. 17(2); *Potentilla anserina* Borkh. 10(+); **IV** – *Polygonum lapathifolium* L. subsp. *pallidum* 5(+), 17(+); *Geranium pusillum* Burm. f. ex L. 14(+), 16(+); **V** – *Anthoxanthum aristatum* Boiss. 2(+), 4(+), 10 (+); *Stellaria media* (L.) Vill. 4(+),6(+); *Vicia hirsuta* (L.) S.F. Gray 1(+); *Matricaria maritima* subsp. *inodora* (L.) Dostal 4(+); **VI** – *Taraxacum officinale* Wigg. 2(+), 8(+), (17); *Galeopsis ladanum* L. 1(+), 3(+); *Plantago lanceolata* L. 1(+), 17(+); *Holcus mollis* L. 3(+), 17(+); *Poa annua* L. 14(+), 16(+); *Epilobium roseum* Schreb. 14(+), 16(+); *Equisetum arvense* L. 14(+), 16(+); *Gypsophila muralis* L. 14(+), 16(+); *Cerastium holosteoides* Fr. em Hyl. 1(+); *Cirsium arvense* (L.) Scop. 1(+); *Leontodon autumnalis* L. 3(+); *Holcus lanatus* L. 9(+); *Daucus carota* L. 9(+); *Veronica dillenii* Cr. 10(+); *Lotus corniculatus* L. 12(+); *Chamomilla suaveolens* (Pursh) Rydb. 13(+); *Erophila verna* (L.) Chevall. 14(+).

Comments: numbers after species inform about the relevé in the table. S - phytosociological constancy, D - coverage index, zn -withered top leaves

Table 2

Echinochloo-Setarietum Krusem. et Vlieg. (1939) 1940

Subassociation	*sperguletosum*						*typicum*																									
Variant							with wet species												with Amaranthus retroflexus						with Veronica agrestis							
Relevé no. in table	1	2	3	4	5		6	7	8	9	10		11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26			
Relevé no.in field	158	152	192	164	177		191	196	131	142	134		178	133	183	195	170	168	132	194	179	161	172		187	166	171	167	175			
Date: month	8	8	8	8	8		8	9	8	8	9		8	8	8	9	8	8	8	9	8	8	8		8	8	8	8	8			
year	.07	.06	.08	.07	.08		.08	.08	.05	.06	.05		.08	.05	.08	.08	.07	.07	.05	.08	.08	.07	.08		.08	.07	.07	.07	.08			
Locality	22	17	40	29	37		39	44	1	11	2		37	1	37	44	33	31	1	43	37	24	34		38	29	33	29	35			
Cerop cover in %	60	zn	zn	zn	zn		10	10	zn	zn	zn		zn	20	40	zn	zn	zn	zn	70	zn	50	zn		zn	40	zn	zn	zn			
Weed cover in %	65	90	90	80	95	number of occurrences	85	60	95	60	65	number of occurrences	100	60	75	85	85	80	100	60	100	70	60	number of occurrences	80	65	80	70	65	number of occurrences		
Soil unit	6Bw ps:pl	6M pgl.pl	9M pgl.pl	5A pgl:gl	5Bw pgl.gl		5Bw pgl.gl	5Bw pgl.gc	4Bw płz.pl	5Bw pgl.gl	5Bw pgl.gl		9Bw pgl:pl	8Dz płz.ps	8Dz pgmp.ps	9M pgl.pl	8 Dz pgmp.ps	9M pglp	4Bw płz:gl	5Bw pgl.gl	2Bw gl	4Dz pgl:gl	5Bw płz:gl		2Bw pgm.gs	2Bw gl	8Dz gl.gs	2F pli:pl	2Bw pgl:gs		Mean number of species per relevé	
Number of species per relevé	22	19	22	20	22	n	25	24	23	24	21	n	30	24	26	28	30	27	27	27	29	27	26	n	25	27	26	26	31	n	25	
I. Ch. *Echnochloo-Setarietum*																															D	S
Echinochloa crus-galli (L.) P. B.	2	4	3	3	3	5	2	2	3	2	4	5	3	2	2	1	2	3	6	3	2	2	2	1	5	3	2	1	2	2	5	V	2567
Raphanus raphanistrum L.		+		1	1	3	1	+	+	1		4	+			+	+	+	4	+		+			2		+		+		2	III	119
II. Ch. *Echnochloo-Setarietum sperguletosum*																																
Spergula arvensis L.	2	1	2	2	2	5											+		1				+		1						II	296
Rumex acetosella L.	+	1	1		1	4														+		+			2						II	69
Scleranthus annuus L.	+		+	+	1	4			+		+	2																			II	38
III. D var. with *Amaranthus retroflexus*																																
Amaranthus retroflexus L.					+	1													3	2	3	2	2	5		+				1	II	490
IV. D var. with *Veronica agrestis*																																
Veronica agrestis L.													+					+	2		+			1	1	2	2	2	1	5	II	252

V. D. var. with wet species																																				
Plantago intermedia Gilib.				+	+	2			+			1	2		+	2	2	2	5							+		1	+	+	4	III	315
Mentha arvensis L.														2	1		+		3				+		1			+		+	2	II	102
Stachys palustris L.									+		1		+	2			1	3								+			+		2	II	102
Gnaphalium uliginosum L.													+			1	1	+	4					+	1	+	+	1		+	4	II	81
Polygonum hydropiper L.														1		+	+	1	4			+			1	+	+		+		3	II	62
Bidens tripartita L.														+		+	1		3	+	+				2	1	+		+		3	II	62
Ranunculus repens L.														1	+	+	+	+	5	+					1							II	38
Potentilla anserina L.				+		+	2								+			+	2								+	+	+	+	4	II	31
VI. Ch. D. *Panico-Setarion*																																				
Setaria pumila (Poir.) Roem.&Schult.			1	+	1	+	4	+		+	+	+	4		+	+	+	+		4	1	+	1		+	4		+				1	IV	127
Setaria viridis(L.) P. B.	+				+		2	+		1	+	+	4			+				1		+				1							II	46
VII. Ch. D. *Polygono-Chenopodion*																																				
Matricaria maritima subsp. *inodora* (L.) Dostal			+	+			2	+	+	3	+	+	5	2	+	+	2	1	+	6	+		1			2	1	+		1		3	IV	398
Veronica persica Poir.									+		+		2				+		+	2		+	+		+	3	+	1	2	1	2	5	III	204
Lamium purpureum L.											+	1	2	+						1		+		+		2	1	+	1	+	1	5	II	100
Euphorbia helioscopia L.																	+	+	2					+	1	1	+	1	+	1	5	II	77
Sonchus oleraceus L.									+		+	+	3					+		1	+				+	2		+	+	+		3	II	35
VIII. Ch. D. *Polygono-Chenopodietalia*																																				
Chenopodium album L.	+	1	1	+	1	5	2	2	+	2	+	5		1	2			+	3	+	+	+	1		4	1	+	1	1		4	V	458
Stellaria media (L.) Vill.		+					1		+	1	+	4	+	+	+	2	2		5	+	1	1		2	4		+			1	2	IV	329
Polygonum lapathifolium L. subsp. *pallidum*			+		1	2	1		+		+	3	1	+	+	1	+		5			+			1			+	+		2	III	112
Sonchus arvensis L.							1		+	+		3	+		+	1			3		+				1	1					1	II	77
Geranium pusillum Burm. f. ex L.							+			1	+	3	1	+		+	+		4									1		1	II	77
Capsella bursa-pastoris (L.) Med.			+		+		2		+	+	+	3	+	+	+				3					+	1		1				1	II	54
Lapsana communis L.								+		+		2	+		+				2		1	1	+		3					+	1	II	62
IX. Ch. D. *Stellarietea mediae*																																				
Viola arvensis Murr.			+	+	+	+	4	1	+		+	+	4	+			+	+		3	+	+			+	3	+	1			+	3	IV	96
Polygonum aviculare L.	+	+	+		+	4	1	+	+		+	4	+	+	+	+	1	+	6	+	+				2							IV	92

Fallopia convolvulus (L.) A. Löve	1	+		+	1	4	1	+		+	+	4			1				1	+	+	1		+	3		1				1	III	146
Myosotis arvensis (L.) Hill.				+	+	2	1	1			+	3	1	+	+			+	4		+		+		2			1	+		2	III	112
Anthemis arvensis L.	1	+	1	+	+	5		+		+		2		+	+	+		+	4				+		1			+			1	III	81
Conyza canadensis (L.) Cron.			+		+	2	+				+	2			+				1	+		+			2	+					1	II	31
Anagallis arvensis L.													+						1			+	+		2		+	+	1	+	4	II	42
Centaurea cyanus L.			+		+	2	+	+				2	+			+			2	+		+	+		3							II	35
Vicia hirsuta (L.) S.F. Gray									+			1			+				1		+	+		+	3		+	+			2	II	27
Galeopsis tetrahit L.							+	+				2	+						1		+				1	+		+			2	II	23
X. Companions																																	
Polygonum lapathifolia L. subsp. *lapathifolia*	+	1	1	1		4	+	1		+	+	4	+					+	2	1	+	1	1	+	5			+		+	2	IV	173
Equisetum arvense L.	1		+	+		3			1	+		2		+	+			+	3	+			+	+	3	+					1	III	77
Elymus repens (L.) Gould	1		+	+	+	4					+	1		+				+	2	+		1		+	3							II	69
Erysimum cheiranthoides L.								+				1					+		1			+	1	1	3		+	+	+	+	4	II	65
Polygonum persicaria L.			1			1				+		1	+						1			1	1	+	3					+	1	II	73
Senecio vulgaris L.																				+	1	1	+	+	5		+				1	II	54
Artemisia vulgaris L.									+			1	+					1	2	+			1	+	3							II	54
Cirsium arvense (L.) Scop.				+		1		1			+	2				+	+		2							+			+	+	3	II	50
Erodium cicutarium (L.) L'hér.	+	+	+	+		4	+					1								+		+	+		3							II	31
Taraxacum officinale Wigg.							+	+				2	+				+		2			+		+	2				+	+	2	II	31
Convolvulus arvensis L.	+	+				2	+			+		2				+			1	+					1					+	1	II	27
Melandrium album (Mill.) Garcke	+					1	+		+			2										+		+	2		+				1	II	23

Sporadic species: **V** – *Phragmites australis* (Cav.) Trin. et Steud. 13(+), 15(+), 16(1), 22(1), 24(+); *Polygonym amphibium* L. 12(+), 13(1), 15(+), 16(+); *Juncus bufonius* L. 11(+), 15(+), 23(+), 24(+); *Sagina procumbens* L. 12(+), 14(+); *Rorippa sylvestris* (L.) Besser 18(+), 20(+); *Rorippa palustris* (L.) Besser 13(+); *Rorippa austriaca* (Crantz) Besser 16(+); **VI** – *Digitaria ischaemum* (Schreb.) Mühlenbeg. 1(+), 4(+), 5(+), 20(+); **VII** – *Galinsoga parviflora* Cav. 6(+), 12(+), 17(1),23(+), 24(+); *Galinsoga ciliata* (Raf.) Blake 8(+), 12(+), 14(+), 22(+); *Chenopodium polyspermum* L. 15(+), 20(+), 22(+); *Oxalis stricta* L. 18(+), 20(+), 25(+); *Rumex crispus* L. 16(+), 25(+), 26(+); *Lamium amplexicaule* L. 13(+), 18(+); *Sonchus asper* (L.) Hill 18(+), 24(+); **VIII** – *Solanum nigrum* L. 15(+), 23(1), 25(+); *Atriplex patula* L. 14(+), 15(+),20(+); **IX** – *Vicia tetrasperma* (L.) Schreb. 1(+), 7(+), 11(+), 17(+); *Anthoxanthum aristatum* Boiss. 1(+), 3(+), 5(+); *Arnoseris minima* (L.) Schweigg. & Körte2(+), 4(+), 5(+); *Vicia angustifolia* L. 1(+), 19(+), 26(+); *Bromus secalinus* L. 1(+), 6(+); *Anchusa arvensis* (L.) Bieb. 8(+), 26(+); *Chaenorchinum minus* (L.) Lange 12(+), 22(+); *Aethusa cynapium* L. 18(+), 26(+); *Sisymbrium officinale* (L.) Scop. 8(+); *Melandrium noctiflorum* (L.) Fr. 12(+); *Agrostemma githago* L. 24(+); *Descurainia sophia* (L.) Weeb 26(+); **X** – *Lysimachia nummularia* L.14(1), 15(+); *Veronica arvensis* L. 9(+), 11(+), 21(+), 25(+), 26(+); *Galium aparine* L. 2(+), 14(+), 22(+), 26(+); *Plantago major* L. 7(+), 11(+), 15(+), 26(+); *Poa annua* L. 8(+), 11(+), 18(+), 26(+); *Symphytum officinale* L. 14(+), 16(+), 23(+), 26(+); *Daucus carota* 7(+), 9(+), 11(+); *Plantago lanceolata* 1(+), 2(+), 3(+); *Knautia arvensis* 3(+), 7(+), 8(+); *Gypsophila muralis* L. 10(+), 14(+), 22(+); *Avena strigosa* Schreb.11(+), 19(+), 21(+); *Silene vulgaris* (Moench) Garcke 17(+), 26(+); *Lotus corniculatus* L. 22(+); *Agrostis stolonifera* L. 16(+); *Lactuca serriola* L. 20(+); *Galeopsis bifida* Boenn. 19(+), 21(+); *Galeopsis pubescens* Bess.20(+), 24(+); *Medicago lupulina* L. 24(+), 25(+); *Malva neglecta* Wallr. 6(+), 20(+); *Chamomilla suaveolens* (Pursh) Rydb. 7(+); *Sysimbrium loeselii* L. 7(+); *Hypochoeris radicata* L. 8(+); *Trifolium repens* L. 8(+); *Erigeron acris* L. 12(+); *Achillea millefolium* L. 14(+), 16(r); *Galeopsis ladanum* L. 15(+); *Potentilla argentea* L. s.s. 17(+); *Trifolium repens* L. 20(+); *Urtica urens* L. 21(+); *Scrophularia nodosa* L. 21(+); *Potentilla colina* 22(+); *Atriplex nitens* Schkuhr 26(+); *Rhinanthus serotinus* (Schönh.) Oborný 19(r).

Comments: numbers after species inform about the relevé in the table. S – phytosociological constancy, D – coverage index, zn – withered top leaves.

Table 3

Galinsogo-Setarietum (R. Tx et Beck. 1942) R. Tx. 1950

Relevé no. in table	1	2	3	4	5	6	7	8	9	10		
Relevé no.in field	140	144	153	162	189	185	182	197	181	155		
Date: month	8	8	8	8	8	9	8	9	9	8		
year	.06	.06	.06	.07	.08	.08	.08	.08	.08	.06		
Locality	10	12	18	24	39	38	36	44	37	18		
Crop cover in %	zn	zn	zn	zn	zn	zn	zn	zn	zn	40		
Weed cover in %	55	70	80	70	85	65	50	80	95	70		
Soil unit	5 Bw pgl.gl	2 Bw plz.gl	5 Bwpgl.gl	4 Dz pgl.gl	5 Bw pgl.gl	2 Bw pgm.gs	4 D plz.ps	4 Dz gl:gs	2 Bw gl	5 Bw pgl.gl		
Number of species per relevé	25	23	28	27	24	25	28	26	22	25	25	
I. Ch. D. *Galinsogo-Setarietum*											D	S
Galinsoga parviflora Cav.	2	2	3	3	2	3	3	1	2	3	V	2625
Galinsoga ciliata (Raf.) Blake	1	1	1	+	+	+	+	2	1	1	V	465
II. Ch. D. *Polygono-Chenopodion*												
Lamium purpureum L.	+	+	2	+	2	+	1	2		+	V	625
Euphorbia helioscopia L.	+	1		1	1		+		+		III	230
Veronica persica Poir.		2	1		2			+	2		III	535
Chenopodium polyspermum L.	+			+		+		+	2		III	420
Veronica agrestis L.			+			+			+		II	30
Matricaria maritima subsp. *inodora* (L.) Dostal		1	+			+	+		+	1	III	130
Sonchus oleraceus L.			+	+		+	+	+			III	50
III. Ch.D. *Polygono-Chenopodietalia*												
Chenopodium album L.	+	1	+	+	1		+	1	2	+	V	375
Stellaria media (L.) Vill.	2		+	1			2	1	+	1	IV	470
Setaria pumila (Poir.) Roem.&Schult.			1	+	+	1		1	1		III	220
Echinochloa crus-galli (L.) P. B.	+	1		+			+		1		III	130
Polygonum lapathifolium L. subsp. *pallidum*			+	+		+	+		1		III	90
Setaria viridis (L.) P. B.	1		+	+			+			+	III	90
Sonchus arvensis L.		+	+		+			1		+	III	90
Capsella bursa-pastoris (L.) Med.	+			+	1	+	+				III	90
Geranium pusillum Burm. f. ex L.	+			+	+			+		+	III	50
Atriplex patula L.			+	+				+		+	II	40

Mean number of species per relevé

IV. Ch. D. *Stellarietea mediae*												
Viola arvensis Murr.	+	+	+	1	1	+		+	1	+	V	210
Anthemis arvensis L.	+		+	1		1	+		1		III	180
Polygonum aviculare L.	+		+	+	+	1	+				III	100
Vicia hirsuta (L.) S.F. Gray		+				+	+		+	+	III	50
Fallopia convolvulus (L.) A. Löve	+		+			+	+	+			III	50
Myosotis arvensis (L.) Hill.			+			+		+	1		II	80
Conyza canadensis (L.) Cron.	+			+				+			II	30
Vicia angustifolia L.				+							I	10
Centaurea cyanus L.	+				+					+	II	30
Apera spica-venti (L.) P. Beauv.	+				+				+		II	30
Anagallis arvensis L.			+	+					+		II	30
V. Companions												
Erodium cicutarium (L.) L'hér.	+	+			+			+		+	III	50
Achillea millefolium L.				+	+			+	+	+	III	50
Galium aparine L.		+	+		+		+	+			III	50
Veronica arvensis L.	+						+		1		II	70
Erysimum cheiranthoides L.		+			+					1	II	70
Polygonum lapathifolium L. subsp. *lapathifolia*	+	+			+						II	30
Convolvulus arvensis L.	+		+				+				II	30
Galeopsis pubescens Bess.		+		+	+						II	30
Taraxacum officinale Wigg.						+		+		+	II	30
Artemisia vulgaris L.		+			+	+					II	30

Sporadic species: **I** – *Lapsana communis* L. 5(+); **II** – *Sonchus asper* (L.) Hill 1(+), 7(+); *Oxalis stricta* L. 6(+), 8(+); *Rumex crispus* L. 10(+); **III** – *Raphanus raphanistrum* L. 1(+), 6(+); *Solanum nigrum* L. 2(+); **IV** – *Vicia villosa* Roth. 3(+), 7(+); *Descurainia sophia* (L.) Weeb 3(+), 7(+); *Aethusa cynapium* L. 7(+), 10(+); *Lactuca serriola* L. 2(+); *Vicia tetrasperma* (L.) Schreb. 6(+); *Anchusa arvensis* (L.) Bieb. 7(+); *Rumex acetosa* L. 7(+); **V** – *Elymus repens* (L.) Gould 3(1), 4(1); *Cirsium arvense* (L.) Scop. 3(1), 5(+); *Equisetum arvense* L. 1(+), 8(1); *Scrophularia nodosa* L. 2(+), 8(+); *Potentilla anserina* L. 2(+), 7(+); *Polygonum hydropiper* L. 2(+), 9(+); *Epilobium roseum* Schreb. 3(+), 6(+); *Gypsophila muralis* L. 3(+), 10(+); *Amaranthus retroflexus* L. 6(+), 10(+); *Melandrium album* (Mill.) Garcke 7(+), 10(+); *Agrostis stolonifera* 8(+), 10(+); *Polygonum persicaria* L. 9(+), 10(1); *Gnaphalium uliginosum* L. 2(+); *Medicago lupulina* L. 4(+); *Ranunculus repens* L. 4(+); *Prunella vulgaris* L. 5(+); *Veronica serpyllifolia* L. 6(+); *Leontodon autumnalis* L. 6(+); *Plantago major* L. 7(+); *Alopecurus geniculatus* L. 8(+); *Mentha arvensis* L. 8(+); *Ranunculus flammula* L. 10(+); *Rhinanthus serotinus* (Schönh.) Oborný 4(r).

Comments: numbers after species inform about the relevé in the table. S – phytosociological constancy, D – coverage index, zn – withered top leaves

Table 4

Lamio-Veronicetum politae Kornaś 1950

Relevé no. in table	1	2	3	4	5	6	7	8	9	10	Mean number of species per relevé	
Relevé no.in field	165	186	138	129	147	188	169	150	160	163		
Date: month	8	8	8	8	8	8	8	8	8	8		
year	.07	.08	.06	.05	.06	.08	.07	.06	.07	.07		
Locality	29	38	8	1	12	39	33	17	22	24		
Crop cover in %	60	zn	zn	zn	zn	zn	zn	40	zn	60		
Weed cover in %	55	75	60	55	50	55	75	50	55	50		
Soil unit	2Bw gl	2Bw pgm.gs	2Bw plz.gl	2Bw gl	2F pli:pl	2Bw pgl:gs	8Bw plz:pgl	2Bw pgm.gs	4Bw plz:gl	2Bw gl		
Number of species per relevé	31	28	27	26	25	24	24	27	25	26	26	
I. Ch. *Lamio-Veronicetum*											D	S
Lamium amplexicaule L.	2	1	+	1	1	1	1	+	1	1	V	545
Veronica agrestis L.	1	1		1	+		+		+	2	IV	355
Veronica opaca Fr.			1	+				2	+		II	245
Veronica polita Fr.				+		1	+		+		II	80
II. Ch. *Polygono-Chenopodion*												
Veronica persica Poir.	+	+	2	2	2	1	2	+	+	2	V	965
Lamium purpureum L.	1	1	+	+	+	+	+	2	2	+	V	510
Chenopodium polyspermum L.	1	1	+		+	+		+		+	IV	150
Euphorbia helioscopia L.	+	+	+	2	+	+	+	+	1		V	295
Oxalis fontana Bunge			+	+		1	+	+	1	+	IV	150
Sonchus asper (L.) Hill	1	+	+					+	1	+	III	140
Matricaria maritima subsp. inodora (L.) Dostal	+	+		+		+		+		+	III	60
Sonchus oleraceus L.	+		+			1	+			+	III	90
Galinsoga parviflora Cav.	+	+		+	+		+	+			III	60
Galinsoga ciliata (Raf.) Blake		+			+	+			+	+	III	50
Lapsana communis L.			2		1		1				II	275
III. Ch.D. *Polygono-Chenopodietalia*												
Chenopodium album L.	1	+	+	+	+	+	+	+	+	+	V	140
Stellaria media (L.) Vill.	+	+	1	+	+	1	2	+	1	+	V	385
Echinochloa crus-galli (L.) P. B.			+	+	+	+	+	+	+	+	IV	80
Polygonum lapathifolium L. subsp. *pallidum*			+	+	+	+	+	+	+		IV	70
Sonchus arvensis L.	+	3		+	+	+			+	+	III	435
Capsella bursa-pastoris (L.) Med.		+					+	+	+	+	III	50
Solanum nigrum L.	+				1		2	+	+		II	255

IV. Ch. D. *Stellarietea mediae*												
Anagallis arvensis L.	+	+		+	+	2	+	+	1	+	V	295
Chaenorchinum minus (L.) Lange	+	1		+	1	+	+	+	+	+	V	170
Anchusa arvensis (L.) Bieb.		+	+	+		+		+	+	+	IV	70
Aethusa cynapium L.	+	+		+	+					+	III	50
Myosotis arvensis (L.) Hill.			+	+	+			+	+		III	50
Anthemis arvensis L.				+			+	+	+	+	III	50
Fallopia convolvulus (L.) A. Löve			+					+		+	III	30
V. Companions												
Ranunculus repens L.	1	1			+	+		+			III	130
Plantago major L.		+	1		+			1			III	120
Elymus repens (L.) Gould	+	+	+			+			+		III	50
Cirsium arvense (L.) Scop.	+		+					+			II	30

Sporadic species: **II** – *Melandrium noctiflorum* (L.) Fr. 1(+), 2(+); **III** – *Setaria viridis* (L.) P. B. 4(+), 6(+); *Atriplex patula* 1(+); *Geranium pusillum* Burm. f. ex L. 7(+); *Setaria pumila* (Poir.) Roem.&Schult. 1(+); **IV** – *Vicia angustifolia* L. 1(+), 2(+); *Polygonum aviculare* L. 3(+), 7(+); *Euphorbia exigua* L. 1(+); *Galeopsis tetrahit* L. 2(+); *Consolida regalis* Gray 3(+); *Thlaspi arvense* L. 3(+); *Descurainia sophia* (L.) Weeb 5(+); *Papaver rhoeas* L. 5(+); *Viola arvensis* Murr. 7(+); *Sisymbrium officinale* (L.) Scop. 7(+); *Agrostemma githago* L. 8(+); *Lactuca serriola* L. 9(+); *Centaurea cyanus* L. 10 (+); **V** – *Equisetum arvense* L. 1(+); *Polygonum lapathifolium* L. subsp. *lapathifolia* 1(+); *Trifolium medium* L. 1(+); *Polygonym amphibium* L. 1(+); *Symphytum officinale* L. 1(+); *Galium aparine* L. 1(r); *Epilobium roseum* Schreb. 2(+); *Convolvulus arvensis* L. 2(+); *Artemisia vulgaris* L. 2(+); *Stachys palustris* L. 2(+); *Melandrium album* (Mill.) Garcke 3(+); *Bidens tripartita* L. 3(+); *Ranunculus repens* L. 3(+); *Urtica urens* L. 3(r); *Veronica arvensis* L. 4(+); *Tanacetum vulgare* L. 4(+); *Polygonum hydropiper* L. 4(+); *Mentha arvensis* L. 4(+); *Gnaphalium uliginosum* L. 5(+); *Rorippa sylvestris* (L.) Besser 5(+); *Amaranthus retroflexus* L. 6(+); *Gypsophila muralis* L. 6(+); *Rorippa palustris* (L.) Besser 6(+); *Bidens frondosa* L. 7(+); *Phragmites australis* (Cav.) Trin. et Steud. 8(+); *Erysimum cheiranthoides* L. 9(+); *Juncus bufonius* L. 10(+); *Hieracium pilosella* L. 10(+); *Sagina procumbens* L. 10(+); *Medicago lupulina* L. 10(+).

Comments: numbers after species inform about the relevé in the table. S – phytosociological constancy, D – coverage index, zn – withered top leaves.

DISCUSSION

Intensification of modern agriculture leads to impoverishment of agroecosystems. Many weed species disappear irreversibly, while others spread at a high rate and change the composition and structure of communities. Many authors focus on biodiversity preservation in agriculturally utilised areas and suggest various forms of species conservation, thereby conserving shrinking segetal communities (Ratyńska and Boratyński 2000; Dostatny, 2004; Siciński and Sieradzki, 2010). Such a role might also be fulfilled by landscape parks where the traditional farming system is maintained.

Soils of the Masovian Landscape Park have varied trophic and moisture conditions. Small areas under potato adjacent to fields cropped to cereals, meadows or ruderal communities additionally influence the diversity of segetal communities. These factors have contributed considerably to the high diversity within and inside the associations. Although no intermediate or impoverished associations or alliances were found in the area of the Masovian Landscape Park, reports by other authors examining various areas in different parts of Poland, Wnuk (1976), Szotkowski (1981), Szmeja (1989), Anioł-Kwiatkowska (1990), Kozak (2002), Siciński (2003), Węgrzynek (2005), Skrajna and Skrzyczyńska (2008), Rzymowska and Skrzyczyńska (2007), have shown that the floristic distinctiveness of agrophytocenoses is diminishing.

4 associations were found in fields cropped to potato in the study area, that is, *Digitarietum ischaemi, Echinochloo-Setarietum, Galinsogo-Setarietum* and *Lamio-Veronicetum politae*, the first two associations being internally diverse. Due to its Sub-Atlantic character, *Digitarietum ischaemum* reaches the south-eastern boundary of its occurrence in Poland. According to many authors (Anioł-Kwiatkowska, 1990; Kozak, 2002; Węgrzynek, 2005), the association is disappearing from agrophytocenoses as the poorest habitats are excluded from cultivation, the production potential of these habitats increases, and they are allotted for construction or afforestation.

What is interesting is the presence of phytocenoses with ruderal species in parts of the patches, which can result from small cropped areas and the proximity of buildings and fallow land. It is also indicative of partial ruderalisation of these communities. The process of infiltration of ruderal species into segetal communities in Poland has been reported by Kapeluszny (2000), Misiewicz et al. (2000), Kutyna et al. (2010), and Trąba (2010).

Some *Digitarietum ischaemi* patches included a group of wet shallow-rooting species. Wet species are quite rare in this association. Similar phytocenoses with wet species in fields cropped to potato have been reported by Głazek and Kowalik (1983), Szmeja (1994), Skrajna and Skrzyczyńska (2008), Rzymowska and Skrzyczyńska (2007), and Siciński (2003).

Well-developed patches of *Lamio-Veronicetum politae* with a full range of the association's diagnostic species established on fertile nutrient-rich soils. The analysed association found in some areas of Poland is usually mentioned in its impoverished form with a rare occurrence of *Veronica sp*. (Korczyński, 1998; Szmeja, 1989; Kozak, 2002; Węgrzynek, 2006). According to Wnuk (1987) and Anioł-Kwiatkowska (1990), *Veronica polita*, *Veronica opaca* and *Veronica agrestis* are the species that best characterise *Lamio-Veronicetum politae*.

CONCLUSIONS

1. Potato fields in the Masovian Landscape Park cover small areas and are more and more difficult to find.
2. Plant communities established in the investigated crops are diversified and floristically rich, which reflects substantial soil variability and extensive farming.
3. The type of farming in such areas is particularly important in preserving the segetal flora diversity of agricultural landscape.

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Zbiorowiska chwastów upraw ziemniaka (*Solanum tuberosum* L.) Mazowieckiego Parku Krajobrazowego

Streszczenie

Praca przedstawia charakterystykę zbiorowisk segetalnych wykształcających się w uprawach ziemniaka na terenie Mazowieckiego Parku Krajobrazowego. Do opracowania zbiorowisk wykorzystano 64 zdjęcia fitosocjologiczne wykonane w 45 miejscowościach. Na badanym terenie w uprawach ziemniaka stwierdzono występowanie 4 zespołów: *Digitarietum ischaemi, Echinochloo-Setarietum, Galinsogo-Setarietum, Lamio-Veronicetum politae*.

Najbardziej zróżnicowane pod względem florystycznym były fitocenozy zakwalifikowane do zespołów *Digitarietum ischaemi* i *Echinochloo-Setarietum*. W ramach tych asocjacji wyróżniono niższe jednostki syntaksonomiczne w randze podzespołów i wariantów. Fitocenozy te były często spotykane, występowały w szerokim spektrum siedliskowym zarówno pod względem troficznym, jak i wilgotnościowym. Na glebach żyznych rzadko i na niewielkich powierzchniach notowano płaty zespołu *Lamio-Veronicetum politae*. Charakteryzowały się one pełnym składem gatunków diagnostycznych dla tej asocjacji.