

PLANT COMMUNITIES AND ASSOCIATIONS OF ROOT CROPS OF THE KAŁUSZYŃSKA UPLAND

Teresa Skrajna, Janina Skrzyczyńska

Department of Agricultural Ecology, University of Podlasie in Siedlce, B. Prusa 14, 08-110 Siedlce, Poland
e-mail: ekolorol@ap.siedlce.pl

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S u m m a r y

A phytosociological classification and the characteristics of weed communities developing in root crops of the Kałuszyńska Upland are given in this paper. The presence of three associations: *Digitarietum ischaemi*, *Echinochloo-Setarietum* and *Lamio-Veronicetum politae*, as well as of two communities: *Setaria pumila-Setaria viridis* and *Panico-Setarion* alliance, has been found. The differentiation in trophic and soil moisture conditions of habitats results in the floristic diversity of communities, divided into lower phytosociological units. Two variants have been distinguished within the association *Digitarietum ischaemi*, whereas *Echinochloo-Setarietum* has been divided into 2 subassociations and 6 variants.

Key words: root crops, weed communities, Kałuszyńska Upland

INTRODUCTION

Plant communities accompanying root crops are characterised by a specific botanical composition which is formed primarily from the time of the completion of culturing until the harvest of the crop plant (Kapeluszny, 1979; Wnuk, 1989). The composition and structure of these phytocenoses depend on many natural, agricultural practice and economic factors (Domńska and Wójcik, 1974; Rola et al. 1989). Species-poor communities, devoid of characteristic species and difficult to classify, develop more and more frequently (Sotkowski, 1981; Wnuk, 1989; Węgrzynek, 2005).

The current state and dynamics of root crop agrocenoses have been the subject of numerous floristic and phytosociological studies (Warcholińska, 1988; Korniak, 1992; Skrzyczyńska, 1994; Kuźniewski, 1996; Wójcik, 2000; Siciński, 2003; Węgrzynek, 2005).

This publication is a continuation of the characteristics of segetal vegetation of the Kałuszyńska

Upland presented in earlier publications (Skrzyczyńska and Skrajna, 2004; Skrajna and Skrzyczyńska, 2005; 2006). The characteristics of the study area, the distribution of investigation areas in the field and methodological assumptions are presented in the paper of Skrzyczyńska and Skrajna (2004).

The purpose of the study was to demonstrate the floristic diversity of plant communities developing in roots crops of the Kałuszyńska Upland.

MATERIALS AND METHODS

This paper is devoted to phytocenoses accompanying root crops. Root crop communities are described based on 157 phytosociological relevés made using the Braun-Blanquet method (Pałowski, 1972) at the end of August and in September in the years 1995-2000. The classification system and nomenclature of distinguished root crop communities follow Matuszkiewicz (2001), and species nomenclature follows Mirek et al. (2002).

RESULTS

Systematics of distinguished root crop communities and associations

Class: *Stellarietea mediae* R. Tx., Lohm. et Prsg, 1950
Order: *Polygono-Chenopodietalia* (R. Tx. et Lohm. 1950) J. Tx. 1961

Alliance: *Panico-Setarion* Siss. 1946

Association: *Digitarietum ischaemi* R. Tx. et Prsg. (1942) 1950

typical variant

variant with *Bidens tripartita*

Community *Setaria pumila-Setaria viridis*

Species-poor community with *Panico-Setarion*

Association: *Echinochloo-Setarietum* Krusem. et Vlieg. (1939) 1940

Subassociation *Echinochloo-Setarietum sperguletosum*
 variant with *Digitaria ischaemum*
 typical variant
 variant with *Juncus bufonius*
 Subassociation *Echinochloo-Setarietum typicum*
 typical variant
 variant with *Juncus bufonius*
 variant with *Fumaria officinalis*
 Alliance: *Polygono-Chenopodion* Siss. 1946
 Association: *Lamio-Veronicetum politae* Kornaś
 1950

Characteristics of distinguished associations and communities

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

In potato crops on sandy soils belonging to the very weak and weak rye complex and the weak cereal-fodder complex, *Digitarietum ischaemi* patches developed.

This association is described by 43 phytocenoses, out of which 28 represent the typical variant and 15 are characterised by the variant with *Bidens tripartita* (Tab. 1, col. 2, 3). Patches of the typical variant with *Digitarietum ischaemi* often occurred in the Kałuszyńska Upland area, whereas phytocenoses of the variant with *Bidens tripartita* rarely grew on potato plantations. In all the investigated patches, the dominant species was *Digitaria ischaemum*. Permanent components of this association, with large cover, comprised weeds specific to poor and acid habitats, such as: *Rumex acetosella*, *Spergula arvensis*, *Scleranthus annuus*, *Anthemis arvensis* and *Raphanus raphanistrum*. The structure of patches of the moist variant was distinguished by the presence of hygrophilous species, with *Bidens tripartita*, *Juncus bufonius* and *Polygonum hydropiper* occurring most abundantly among them.

Digitarietum ischaemi was floristically poor. In all the patches, a total of 75 species occurred (55 in the typical variant and 57 in the variant with *Bidens tripartita*). The average number of species in a relevé ranged between 14 in the typical variant patches and 19 in phytocenoses of the variant with *Bidens tripartita*.

The community *Setaria pumila* – *Setaria viridis*

This community developed on sandy soils classified as the weak rye and good rye complex (Tab. 1, col. 4). Patches of the community in question are rarely met in the Upland. They are described based on 13 phytosociological relevés in which there was a total of 59 weed species, and the number of species in a relevé ranged between 19 and 28 (on the average, it was 23). Phytocenoses of the community concerned were characterised by a large share of differential species *Setaria viridis* and *Setaria pumila*. In addition to foxtails, aci-

dophilous species *Spergula arvensis*, *Raphanus raphanistrum*, *Rumex acetosella* and *Anthemis arvensis* were noted in great numbers and with large cover. Locally, patches developed which were dominated by the mass occurrence of permanent species, such as *Elymus repens*, *Cirsium arvense* and *Equisetum arvense*, indicating neglect in agricultural practice. Furthermore, *Chenopodium album*, *Stellaria media*, *Fallopia convolvulus*, *Polygonum aviculare*, *Viola arvensis*, *Centaurea cyanus* and *Galeopsis tetrahit* were found frequently and with large cover.

A species-poor community from the alliance *Panico-Setarion* Siss. 1946

On sandy soils belonging to the weak, good rye complex as well as on sandy enclaves of the very good rye complex and the weak cereal-fodder complex, species-poor patches of this community developed, devoid of characteristic species of known root crop associations (Tab. 1 col. 5). This community is described based on 23 phytosociological relevés. It was made up of 60 species; the number of species in a relevé ranged from 14 up to 29 (on the average, 20).

The characteristic feature of the community was the numerous occurrences of acidophilous species, characteristic and distinguishing for the alliance *Panico – Setarion*, such as: *Rumex acetosella*, *Spergula arvensis* and *Raphanus raphanistrum*, as well as the absence of species characteristic for associations of this alliance. Out of species characteristic for the order *Polygono-Chenopodietalia*, only *Chenopodium album* and *Stellaria media* occurred more frequently and in greater numbers. Common weeds characteristic for the class *Stallarietea mediae*, such as: *Anthemis arvensis*, *Fallopia convolvulus*, *Polygonum aviculare* and *Viola arvensis*, comprised a large group, and from companion species, *Elymus repens* and *Equisetum arvense* occurred in great numbers.

Patches of the community in question were also found in excessively moist habitats, locally with a large share of *Equisetum sylvaticum*, *Polygonum hydropiper* and *Gnaphalium uliginosum*.

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

Echinochloo-Setarietum was a commonly occurring association of root crops in the Kałuszyńska Upland. Patches of this association developed in different trophic and soil moisture conditions. These soils were most frequently formed from sands of different origin (rarely from clays) belonging to all soil complexes occurring in the Kałuszyńska Upland, except for the weak rye complex. The wide amplitude of occupied habitats was reflected in the species composition and

Table 1
Digitarietum ischaemi R. Tx. et Prsg. (1942) 1950, community *Setaria pumila*-*Setaria viridis*, impoverished community from alliance *Panico-Setarion* Siss. 1946.

Class		<i>Stellarietea mediae</i>							
Alliance		<i>Panico – Setarion</i>							
Association, community		<i>Digitarietum ischaemi</i>				<i>Setaria pumila</i> – <i>Setaria viridis</i>		Impoverished community from <i>Panico-Setarion</i>	
Variant	typical		with <i>Bidens tripartita</i>						
	1	2	3	4	5				
		S	D	S	D	S	D	S	D
I. Ch. <i>Digitarietum ischaemi</i>									
<i>Digitaria ischaemum</i>		V	1857	V	1167				
II. Ch.D. <i>Panico-Setarion</i>									
<i>Rumex acetosella</i>		V	659	V	167	IV	69	IV	219
<i>Spergula arvensis</i>		V	412	V	420	IV	454	V	348
<i>Scleranthus annuus</i>		IV	184	II	27	II	61	III	69
<i>Raphanus raphanistrum</i>		III	57	III	73	V	408	V	189
<i>Setaria viridis</i>		II	71	II	67	V	854		*
<i>Setaria pumila</i>			*		*	V	788		
III. Ch. D. <i>Polygono-Chenopodietalia</i>									
<i>Chenopodium album</i>		III	141	III	167	IV	354	V	260
<i>Stellaria media</i>		II	50	II	40	IV	242	IV	400
<i>Matricaria maritima subsp. inodora</i>						III	108	II	61
<i>Sonchus arvensis</i>					*	II	38	III	43
<i>Polygonum tomentosum</i>			*			II	61	II	39
<i>Capsella bursa-pastoris</i>			*		*			II	26
<i>Coryza canadensis</i>		II	25		*		*		*
IV. D. var. with hygrophilous species									
<i>Juncus bufonius</i>				V	523		*	II	22
<i>Bidens tripartita</i>			*	V	1000	II	59		
<i>Polygonum hydropiper</i>				IV	173	II	92	III	74
<i>Mentha arvensis</i>				II	53	II	23	II	39

cd. table 1

<i>Gnaphalium uliginosum</i>		II	67	II	31	III	56	
<i>Plantago intermedia</i>		II	27		*			
<i>Equisetum sylvaticum</i>		II	27		*	II	119	
<i>Spergularia rubra</i>			*			II	35	
<i>Gypsophila muralis</i>				II	31	II	35	
V. Ch. Stellarietea mediae								
<i>Anthemis arvensis</i>	IV	159	III	127	V	242	V	259
<i>Fallopia convolvulus</i>	V	125	III	87	IV	138	V	211
<i>Polygonum aviculare</i>	III	57	II	27	IV	138	V	135
<i>Viola arvensis</i>	II	87	IV	100	IV	265	V	139
<i>Centaurea cyanus</i>	II	32		*	IV	138	III	198
<i>Galeopsis tetrahit</i>	II	39	III	733	IV	296	IV	96
<i>Arnoseris minima</i>	II	36	II	33		*		*
<i>Teesdalea nudicaulis</i>	II	50						
<i>Vicia hirsuta</i>			II	27		*		*
<i>Myosotis arvensis</i>					II	38	III	48
<i>Arabidopsis thaliana</i>		*				*		
<i>Vicia tetrasperma</i>						*	II	26
VI. Companion species								
<i>Elymus repens</i>	IV	75	V	167	V	911	V	556
<i>Convolvulus arvensis</i>	IV	89	II	40	III	54	II	56
<i>Achillea millefolium</i>	IV	71	II	33	III	54	III	48
<i>Erodium cicutarium</i>	II	32	III	53		*	II	22
<i>Equisetum arvense</i>	II	24	III	197	V	1135	V	554
<i>Polygonum lapathifolium subsp. lapathifolium</i>	II	50	II	40	II	69	III	230
<i>Cirsium arvense</i>		*	II	40	V	769	IV	272
<i>Polygonum persicaria</i>		*	II	33	III	130	III	170
<i>Veronica arvensis</i>		*		*	II	23	II	157
<i>Plantago maior</i>				*	III	27		
<i>Cerastium holosteoides</i>				*		*	II	35
<i>Poa annua</i>		*		*	II	23	II	48
<i>Trifolium repens</i>		*			III	38		
<i>Galeopsis ladanum</i>		*		*	II	196		
<i>Erophila verna</i>	II	50						

Sporadic species: III – *Rumex crispus* 3,4; *Geranium pusillum* 4,5; *Oxalis fontana* 3; *Veronica persica* 5; *Sonchus oleraceus* 5; *Lamium purpureum* 5; IV – *Ranunculus repens* 3,4,5; *Sagina procumbens* 3,5; *Hypericum humifusum* 3,4,5; *Illecebrum verticillatum* 3; *Juncus capitatus* 3; *Peplis portula* 3; V – *Vicia villosa* 2,4; *Vicia angustifolia* 3,5; *Papaver argemone* 2; *Chamomilla recutita* 4; *Apera spica-venti* 2; *Vicia sativa* 4; VI – *Taraxacum officinale* 2,3,4,5; *Artemisia vulgaris* 2,4,5; *Cerastium arvense* 2,3,4; *Knautia arvensis* 2,3,4,5; *Trifolium arvense* 2,3; *Veronica serpyllifolia* 3; *Leontodon autumnalis* 5; *Stellaria graminea* 2,4; *Arenaria serpyllifolia* 5; *Chenopodium rubrum* 2,3,5; *Ornithopus sativus* 2; *Lupinus luteus* 2; *Myosotis stricta* 2; *Medicago lupulina* 5; *Plantago media* 4,5; *Chamomilla suaveolens* 5; *Poa pratensis* 5; *Hypochoeris glabra* 4; *Galeopsis pubescens* 5; *Rorippa palustris* 5; *Artemisia absinthium* 2; *Anthoxanthum aristatum* 2,3; *Pimpinella saxifraga* 2; *Veronica dillenii* 2; *Holcus mollis* 2; *Hieracium pilosella* 2; *Cerastium semidecandrum* 2; *Alopecurus pratensis* 5; *Crepis tectorum* 5;

Explanatory notes: numbers after species inform about numbers of columns in the table:

S – phytosociological constancy, D – cover factor

* – species constancy with little cover.

Table 2
Echinochloo-Setarietum Krus. et Vlieg. (1939) 1940, *Lamio-Veronicetum politeae* Kornaś 1950.

Class		<i>Stellarietea mediae</i>													
Alliance		<i>Panico – Setarion</i>												<i>Polygono- Chenopodion</i>	
Association, community		<i>Echinochloo-Setarietum</i>												<i>Lamio-Veronicetum politeae</i>	
Subassociation		<i>sperguletosum</i>						typicum							
Variant		with <i>Digitaria ischaemum</i>		typical		with <i>Juncus bufonius</i>		typical		with <i>Juncus bufonius</i>		with <i>Fumaria officinalis</i>			
Soil unit		9,6	6,5,4	9,6,5,	5,4,2	9,8,4,2,	8,4,2,	4,2,							
		A,Bw	A,Bw	A,Bw,D,M	A,Bw,D,	A.Bw,D,Dz	A,Bw,D,Dz	A,Bw,Dz							
		ps:pl	ps:pl	ps:pl /zp/gs	pgl.gl/gs	ps:pl/gl	pgl:gl/gs	pgl.gs							
		pgl:gl/gs	pgl:ps.gl/gs	pgl/pl/gl/gs	pgm:gs	pgl:gl/gs	pgm:gl/gs	pgm.gl/gs							
		pgm:gs	pgm:gs	pgm:gs	gl.gs/gc	pgm.gs/gs	pgmp.gs	gl.gc							
						pgmp.gs	gl.i/gs/gc	gs							
						gl:gs									
Number of phytosociological releves		21	10	36	19	33	20	19							
Number of species in a releve		15-20 (17)	15-24 (20)	18-30 (22)	16-26 (20)	19-35 (25)	23-33 (26)	21-34 (27)							
Ground cover by weeds in %		53	40	68	56	70	62	51							
Number of species		55	48	87	72	98	87	102							
1		2	3	4	5	6	7	8							
		S	D	S	D	S	D	S	D	S	D	S	D	S	D
I. Ch. D. <i>Echinochloo-Setarietum</i>															
<i>Panico-Setarion</i>															
<i>Digitaria ischaemum</i>		V	1012												
<i>Rumex acetosella</i>		IV	171	IV	325	V	278			*		*		*	
<i>Spergula arvensis</i>		V	691	V	750	V	1299	*		*		*		*	
<i>Scleranthus annuus</i>		II	52	III	140	III	67							*	
<i>Raphanus raphanistrum</i>		V	514	III	100	V	319	III	58	III	176	*		*	
<i>Setaria viridis</i>		III	119	II	70	II	36	II	74	*				*	
<i>Setaria pumila</i>		III	109	II	70	II	44	III	100	II	33	II	30	*	
<i>Echinochloa crus-galli</i>		V	545	V		V	1396	V	1539	V	1030	V	937	II	337
II. D. var. with <i>Fumaria officinalis</i>															
<i>Fumaria officinalis</i>												V	1125	*	
III. Ch. <i>Polygono-Chenopodion</i>															
<i>Galinsoga parviflora</i>		II	202	II	30	III	194	V	740	V	921	IV	572	II	197
<i>Galinsoga ciliata</i>		*		*		II	96	III	121	III	685	II	120	*	

cd. table 2

<i>Matricaria maritima</i>														
<i>subsp. inodora</i>				III	53	IV	110	IV	208	IV	187	IV	84	
<i>Euphorbia helioscopia</i>						II	21	II	33	IV	272	V	326	
<i>Veronica persica</i>						II	21	*		II	30	IV	242	
<i>Veronica agrestis</i>						II	32	*		*		IV	114	
<i>Sonchus oleraceus</i>						*		*		III	80	III	53	
<i>Erysimum cheiranthoides</i>				*		*		*		II	60	III	124	
<i>Chenopodium polyspermum</i>							*			III	173	IV	305	
<i>Solanum nigrum</i>							*			II	132	II	21	
<i>Lamium purpureum</i>				*		*		*		II	177	IV	224	
<i>Lamium amplexicaule</i>							*	*		II	100	V	279	
<i>Veronica polita</i>												V	676	
<i>Veronica opaca</i>												III	147	
<i>Sonchus asper</i>								*		*		II	42	
<i>Chaenorhynchus minus</i>										*		II	32	
IV. Ch. D. Polygono-Chenopodietalia														
<i>Chenopodium album</i>	V	414	V	375	V	507	V	674	V	895	V	560	V	847
<i>Stellaria media</i>	II	27	II	30	IV	289	IV	379	V	494	V	755	IV	626
<i>Capsella bursa-pastoris</i>	*		*		II	30	III	42	III	112	IV	65	III	47
<i>Sonchus arvensis</i>	*		*		II	39	IV	105	III	141	III	80	III	145
<i>Descurainia sophia</i>				*		*		*		*			II	21
V. D. var. with hygrophilous species														
<i>Juncus bufonius</i>	II	89	*		V	776			V	742	III	85	II	58
<i>Bidens tripartita</i>	II	81			III	101			III	227	*		*	
<i>Polygonum hydropiper</i>	II	67			IV	187			II	108	*		*	
<i>Mentha arvensis</i>	II	24			II	47			II	139	*		*	
<i>Gnaphalium uliginosum</i>	*				V	455			III	57	*		*	
<i>Plantago intermedia</i>					*				II	36	*		*	
<i>Equisetum sylvaticum</i>	*				*				*		*		*	
<i>Rorippa sylvestris</i>					II	33			III	42	*		*	
<i>Spergularia rubra</i>					II	30			*		*		*	
<i>Gypsophila muralis</i>					II	36			*		*		*	
<i>Stachys palustris</i>					*				II	238	II	235	*	
<i>Potentilla anserina</i>					*				II	33	II	25	*	
VI. Ch. Stellarietea mediae														
<i>Anthemis arvensis</i>	IV	96	IV	80	V	287	IV	105	III	67	II	40	III	68
<i>Fallopia convolvulus</i>	IV	129	III	140	IV	105	IV	126	III	120	III	105	IV	105
<i>Polygonum aviculare</i>	IV	119	II	30	III	86	II	53	II	24	*		II	47
<i>Viola arvensis</i>	IV	90	V	140	IV	117	IV	147	III	85	IV	125	IV	110
<i>Centaurea cyanus</i>	IV	71	IV	70	II	61	II	32	II	36	II	35	II	26
<i>Galeopsis tetrahit</i>	III	90	*		III	129	II	21	II	164	*		*	

cd. table 2

<i>Vicia hirsuta</i>	*		*		*	III	47	III	57	II	35	II	32	
<i>Myosotis arvensis</i>	*		II	40	*	II	42	II	45	III	45	II	32	
<i>Arabidopsis thaliana</i>			II	70	*	*		II	80			*		
<i>Vicia tetrasperma</i>			*		*	*		II	21	*		*		
<i>Vicia angustifolia</i>			*		*	*		II	21	*		*		
<i>Anagallis arvensis</i>						*		*		III	115	III	153	
<i>Thlaspi arvense</i>						*		*		II	58	III	58	
<i>Sinapis arvensis</i>						*		*		II	45	*		
VII. Companion species														
<i>Elymus repens</i>	IV	179	IV	70	IV	130	III	163	IV	198	IV	212	IV	132
<i>Convolvulus arvensis</i>	II	38	II	40	II	42	III	171	II	24	*		*	
<i>Achillea millefolium</i>	III	52	II	40	III	58	*		II	30	*		*	
<i>Erodium cicutarium</i>	III	62	III	50	II	104	III	79	II	51	*		*	
<i>Equisetum arvense</i>	IV	719	V	335	IV	296	III	184	III	227	III	115	III	84
<i>Polygonum subsp. lapathifolium</i>	IV	176	III	130	III	118	III	116	IV	112	III	115	III	121
<i>Cirsium arvense</i>	III	48	II	30	III	135	IV	126	IV	412	III	157	II	74
<i>Polygonum persicaria</i>	III	169	IV	109	*		III	160	IV	296	III	84	III	63
<i>Veronica arvensis</i>	*		II	40	II	71	II		III	103	IV	70	III	182
<i>Plantago maior</i>	*		*		II	22	*		II	27	*		*	
<i>Cerastium holosteoides</i>			*		II	22			*		II	25	*	
<i>Taraxacum officinale</i>	*		*		II	33	*		*		II	25	II	26.3
<i>Galium aparine</i>							III	47	*		II	35	III	232
<i>Galeopsis bifida</i>	*		*		*		II	47	*		*		II	21
<i>Artemisia vulgaris</i>	*		*		*		II	21	*				*	
<i>Poa annua</i>	*		*		*		*		II	48	II	30	II	21
<i>Neslia paniculata</i>									*		*		III	63
<i>Melandrium album</i>			*				*		*		*		II	32
<i>Galium spurium</i>											*		II	26
<i>Galeopsis speciosa</i>									*		*		II	21

Sporadic species: IV – *Polygonum lapathifolium subsp. pallidum* 2,4,5,6,7,8; *Rumex crispus* 4,6,7,8; *Conyza canadensis* 4,5,6; *Geranium pusillum* 2,3,6; *Oxalis fontana* 5; *Atriplex patula* 7,8; V – *Ranunculus repens* 2,4,6,7,8; *Sagina procumbens* 4,5,6,8; *Illecebrum verticillatum* 4,6,8; *Juncus capitatus* 4,7; *Polygonum amphibium* 6,7,8; *Peplis portula* 4; *Myosurus minimus* 4,7; *Phragmites australis* 6; VI – *Arnoseris minima* 2,3,4; *Vicia villosa* 4,6,8; *Chamomilla recutita* 2,4,6,8; *Sisymbrium officinale* 4,5,6,7,8; *Apera spica-venti* 2, 4; *Vicia sativa* 4,6; *Melandrium noctiflorum* 7,8; *Geranium dissectum* 5,6,8; *Papaver argemone* 4; *Consolida regalis* 6,8; *Digitaria sanguinalis* 3,7; *Lycopsis arvensis* 7,8; *Teesdalea nudicaulis* 2; *Lactuca serriola* 4; *Papaver rhoas* 8; VII – *Cerastium arvense* 2,3,5,7,8; *Galeopsis ladanum* 3,4,6,7; *Knautia arvensis* 2,4,6; *Trifolium arvense* 3,4,6; *Veronica serpyllifolia* 4,6,7,8; *Leontodon autumnalis* 2,4,6,8; *Senecio vulgaris* 5,6,7,8; *Stellaria graminea* 2,6; *Daucus carota* 4,5,6,8; *Plantago lanceolata* 2,3,5,6; *Arenaria serpyllifolia* 4,6, 8; *Ornithopus sativus* 2,4; *Lupinus luteus* 2,4; *Myosotis stricta* 3,5; *Medicago lupulina* 7,8; *Plantago media* 4; *Chamomilla suaveolens* 5; *Trifolium pratense* 5,7; *Poa pratensis* 4; *Hypochoeris glabra* 8; *Galeopsis pubescens* 8; *Amaranthus retroflexus* 8; *Rorippa palustris* 4; *Malva neglecta* 4,5; *Armoracia rusticana* 5,6; *Artemisia absinthium* 6; *Urtica urens* 2; *Avena fatua* 5; *Veronica triphyllos* 4; *Echium vulgare* 5; *Cichorium intybus* 5; *Arabis corymbiflora* 4; *Ranunculus sardous* 4; *Epilobium roseum* 6; *Lysimachia nummularia* 6; *Lathyrus pratensis* 7; *Lamium album* 8; *Anchusa officinalis* 8; *Tussillago farfara* 8; *Artemisia campestris* 8.

Explanatory notes: numbers after species inform about numbers of columns in the table: S – phytosociological constancy, D – cover factor

* – species constancy with little cover.

the structure of phytocenoses of the association. Out of the species characteristic for this association, *Echinochloa crus-galli* was noted in great numbers, *Raphanus raphanistrum* occurred frequently, but less numerously. In addition, species characteristic for the alliance *Panico-Setarion* and common field weeds from higher syntaxonomic units made up a large group. The floristic diversity of phytocenoses of this association finds its reflection in subassociations and variants.

On sandy soils most frequently classified as the weak rye, good rye and weak cereal-fodder complexes, patches of *Echinochloa-Setarietum sperguletosum* developed (Tab. 2, col. 2, 3, 4). Acidophilous species occurring in great numbers, such as: *Spergula arvensis*, *Rumex acetosella*, *Anthemis arvensis*, as well as frequently noted *Scleranthus annuus*, *Setaria pumila* and *Setaria viridis* were the species which distinguished this subassociation. In addition, *Chenopodium album*, *Fallopia convolvulus* and *Viola arvensis* occurred frequently and with large cover. Locally, patches dominated by *Equisetum arvense* developed.

The subassociation in question is described by 67 phytocenoses, out of which 21 represent the variant with *Digitaria ischaemum*, 10 the typical variant, and 36 patches are characterised by the variant with *Juncus bufonius*.

Echinochloa-Setarietum typicum phytocenoses were found on soils more cohesive than the previously mentioned subassociation, since they were formed from light and strong loamy sands and clays, most frequently classified as the very good rye, good wheat and strong cereal-fodder complexes (Tab. 2, col. 5, 6, 7). They developed in potato and sugar beet crops. Out of species characteristic for this association, *Echinochloa crus-galli* occurred in great numbers, whereas the acidophilous species *Raphanus raphanistrum* and other species characteristic for *Panico-Setarion* were noted with small cover. Soil fertility and water availability in these habitats affected the floristic composition of the communities. The occurrence of species with higher trophic requirements was found in them, among others: *Galinsoga parviflora*, *Matricaria maritima* subsp. *inodora*, *Stellaria media*, *Polygonum lapathifolium* subsp. *lapathifolium*, *Chenopodium album*, *Sonchus arvensis*, *Anagallis arvensis* and *Thlaspi arvense*. Locally, in the vicinity of buildings, patches with a very large share of *Galinsoga parviflora* and *Galinsoga ciliata* occurred.

The subassociation in question is demonstrated by 72 plant patches, out of which 19 represent the typical variant, 33 the variant with *Juncus bufonius*, and 20 the variant with *Fumaria officinalis*.

Lamio – Veronicetum politae Kornaś 1950

Lamio – Veronicetum politae phytocenoses developed in potato and sugar beet crops, primarily on

strong loamy sands and light clays belonging to the good wheat and very good rye complexes (Tab. 2, col. 8). The extent of the occurrence of this association was restricted to the most fertile soils which occur in small areas within the Upland. It is described by 19 plant patches from the Upland area.

Veronica polita and *Veronica opaca* are its characteristic species which show exclusive attachment to this association. Other characteristic species, *Lamium amplexicaule* and *Veronica agrestis*, though they occur frequently and may have large cover, do not belong to the most faithful of its components, as they are also found in other communities, but their optimal occurrence in the study area is in the association in question.

It is the floristically richest association of root crops within the study area. In its patches, as many as 102 species were found, on the average, 27 in one relevé.

The association in question is characterised by specific physiognomy that is determined by species occurring frequently and in great numbers which have high trophic requirements: *Chenopodium polyspermum*, *Euphorbia helioscopia*, *Matricaria maritima* subsp. *inodora*, *Stellaria media*, *Chenopodium album*, *Anagallis arvensis* and others. In its patches, a numerous groups of hygrophilous species was noted, with low constancy and cover.

DISCUSSION

The floristic richness of agrocenoses developing in root crops of the Kałuszyńska Upland was determined by trophic and moisture conditions of habitats as well as by diverse agricultural practices. Communities of species with a narrow range of tolerance are characterised by great sensitivity. *Digitarietum ischaemi*, which is marked by low persistence, can be included in such associations. The intensification of chemical protection and increased fertilisation (Domńska and Wójcik, 1974) as well as changes in land use methods (fallowing or afforestation) result in the impoverishment of the floristic composition and the limitation in the occurrence of this association (Węgrzynek, 2005).

In the study area, on the poorest soils, in trophic terms, and on dry soils, potato crops were often colonised by the floristically poorest patches of *Digitarietum ischaemi*, but on small areas. Slightly richer phytocenoses with a share of hygrophilous species developed on light loamy sands. This Subatlantic association has better development conditions in western and northern Poland (Kornaś, 1950), as reported by Borowiec and Kutyna (1989). It is also often found in certain regions of the central (Siciński

et al. 1978; Warcholińska, 1987,1998) and eastern (Skrzyczyńska, 1994; Skrajna and Skrzyżyńska, 2004) parts of the country. In many regions, *Digitarium ischaemi* phytocenoses occur rarely and they significantly reduce their extent of occurrence. It applies, *inter alia*, to Poland's southern regions (Kuźniewski, 1974; Szotkowski, 1989; Wnuk, 1989; Anioł-Kwiatkowska, 1990; Kozak, 2002; Węgrzynek, 2005).

Setaria pumila – *Setaria viridis* communities are met in similarly poor habitats (rarely in the study area). Rzymowska (1999) reported from the Podlaski Przełom Bugu mesoregion phytocenoses with a floristic composition similar to that presented in this paper.

Patches devoid of characteristic species, classified as species-poor communities from the alliance *Panico-Setarion*, were also rarely found in root crops of the study area. Such impoverished communities have been described by Szotkowski (1981) and Kuźniewski (1974) in Lower Silesia, by Wnuk (1989) in the Częstochowa Upland (*Wyżyna Częstochowska*), by Wnuk et al. (1989) in the Rzeszów area, and by Węgrzynek (2005) in the Silesian Upland (*Wyżyna Śląska*).

Likewise across the country (Wnuk, 1976, 1989; Kapeluszný, 1979; Wójcik, 1980; Kutyna, 1988; Anioł-Kwiatkowska, 1990; Skrzyżyńska, 1994; Warcholińska, 1998; Kozak, 2002; Siciński 2003; Węgrzynek, 2005), *Echinochloa-Setarietum* was the association commonly occurring in the Kałuszyńska Upland. This is a result of broad-scale ecological requirements of species characteristic for this association and nowadays of the wide occurrence of *Echinochloa crus-galli* biotypes resistant to the effect of herbicides (Rola et al. 1989; Jędruszczak and Antoszek, 2002).

The floristically richest patches of *Lamio-Veronicetum politae* were found very rarely in the study area. The reason for this is the small acreage of proper habitats. This association reaches the optimum of its development on alkaline pH soils, on loess, rendzina and black-earth soils. Judging from literature data, a conclusion can be drawn that this association occurs widely across the country. From other regions, it has been reported by: Kornaś (1972), Kapeluszný (1979), Wójcik (1980), Szotkowski (1981), Kutyna (1988), Wnuk (1989), Anioł-Kwiatkowska (1990), Hołdyński (1991), Trąba and Ziemińska (1994), Warcholińska (1994), Kozak (2002), Siciński (2003).

CONCLUSIONS

1. In root crops of the Kałuszyńska Upland, *Echinochloa-Setarietum* patches were noted most frequent-

ly, differentiated into subassociations and variants.

2. On poor sandy soils, *Digitarium ischaemi* phytocenoses occurred often, *Setaria pumila* – *Setaria viridis* communities – less frequently.
3. The floristically rich patches of *Lamio-Veronicetum politae* grew in the most fertile habitats.

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Zbiorowiska i zespoły roślinne upraw okopowych Wysoczyzny Kałuszyńskiej

Streszczenie

W pracy zawarto klasyfikację fitosocjologiczną i charakterystykę zbiorowisk wykształcających się w uprawach okopowych Wysoczyzny Kałuszyńskiej. Stwierdzono występowanie trzech zespołów: *Digitarietum ischaemi*, *Echinochloo-Setarietum* i *Lamio-Veronicetum politae* oraz dwóch zbiorowisk: *Setaria pumila* – *Setaria viridis* i zbiorowiska kaślubowego ze związku *Panico-Setarion*. Różnicowanie troficzne i wilgotnościowe siedlisk obrazują zbiorowiska różnicowane florystycznie, które zakwalifikowano do niższych jednostek syntaksonomicznych. W obrębie *Digitarietum ischaemi* wyróżniono dwa warianty, *Echinochloo-Setarietum* zróżnicowano na dwa podzespoły i sześć wariantów.