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QUANTITATIVE ANALYSIS OF WEED FLORA OF PODRAVINA REGION (NORTH CROATIA)

JASENKA TOPIĆ

University of Zagreb, Faculty of Science, Department of Botany, Marulićev trg
20, Zagreb, Croatia

The share of single species was expressed for the weed flora in the Podravina region, North Croatia. The analysis was based on standard phytosociological records according to Braun-Blanquet. Different types of crops were included, both row crops (maize, sugar beet, potato, vine, sunflower) and dense cereals such as wheat and barley. An analysis of 552 records was made, to find quantitative relations within the same type of weed vegetation, such as in row crops, with respect to climate change from West to East, as well as the differences between row crops and dense cereals, wheat and barley.

Key words: weed flora, Podravina region, Croatia

Introduction

Although segetal weeds, unwanted and harmful companions of any cultivated plant, are permanently controlled, the exact share of single species in weed vegetation of some larger area or culture is unknown. Since both mechanical and chemical control are rather expensive, the latter also being harmful to other organisms, it is necessary to consider the available quantity indicators.

Obviously, weed vegetation, although composed of many cosmopolites and widely distributed species, varies in its floristic composition from place to place

as well as in the quantitative relationship between species. Thus, the aim of this contribution is to determine the relative share of each single weed species in the Podravina region, North Croatia. These data may be considered a basis for economical weed control and the first step in the calculation of Ia, index of abundance, as a relative share of each single species in the total flora of a region (TOPIĆ 1987, 1993, TOPIĆ and KUSULJA 1986, PANJKOVIĆ 1989).

The investigations were carried out along the Drava river in Croatia, from the westernmost part toward East, up to the Drava mouth in the Danube river.

Area of Investigation

Area of investigation and all the UTM (Universal Transferred Mercator) quadrants where the vegetation records were made, both in row crops (black triangle) as well as in wheat and barley (striped triangle) are presented on Fig. 1. The border between the western and eastern part is indicated by a dashed line.

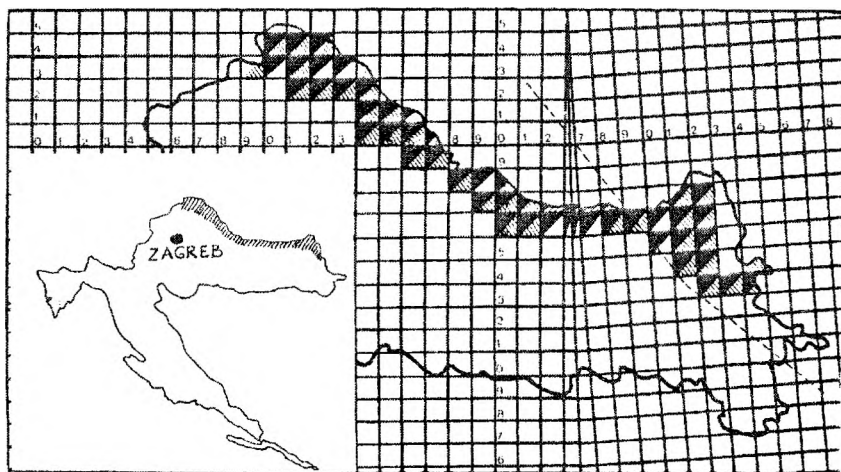


Fig. 1. Area of investigation with the UTM quadrants in which row crop weeds (black triangles) and wheat-barley weeds (striped triangles) were surveyed in the Podravina region (North Croatia)

Although the Podravina region is mainly alluvial lowland, the ecological conditions vary considerably, with respect to the climate, hydrology and anthropogenic influence. The most obvious differences seem to be in the climate conditions, with decreasing humidity and increasing aridity from the western to the eastern part (Table 1). As the meteorological stations in Table 1 are ordered from West to East, the increasing number of semi-arid and arid months (bordered with line) as well as the decrease in annual humidity is visible.

The relief is mainly flat, yet there are some hills near the Drava mouth.

Agricultural soils occupy the main part of Podravina.

Tab. 1. Climate humidity for the period 1948-1960 (KIRIGIN 1971)

Meteorological Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Varaždin	-	ph	h	sh	sh	sh	sh	sa	sa	h	ph	ph	h
Virovitica	-	ph	h	sh	sh	sh	sa	a	sa	sh	ph	ph	h
Osijek	-	ph	h	sh	a	sa	sa	sa	a	sa	h	ph	sh
Ilok	ph	ph	h	sh	sa	sa	sa	a	a	sa	h	ph	sh
Brestovac "Belje"	ph	ph	h	sh	sa	sa	sa	a	a	sa	h	ph	sa

Climate humidity Month rain factor after Gračanin (Monthly precipitation / mean monthly temperature) Lang's (year) rain factor (Yearly precipitation / mean yearly temperature) expanded after Gračanin (GRAČANIN and ILJANIĆ 1977)

perarid (pa)	< 1.6	
arid (a)	1.7 - 3.3	< 40
semiarid (sa)	3.4 - 5.0	40 - 60
semihumid (sh)	5.1 - 6.6	60 - 80
humid (h)	6.7 - 13.3	80 - 160
perhumid (ph)	> 13.3	> 160

Methods

Phytosociological records were made according to the method of BRAUN-BLANQUET (1964). A total of 552 records were made, 242 being in row crops (maize, sunflower, potato, vine, sugar beet) and 310 in wheat and barley.

The analysis of relative abundance (RA) of each species was calculated as follows:

$$RA = F \times C$$

where F is frequency (percent of records where the species was noted), and C is mean cover value, i.e. ratio between sum of cover values in each record and number of records where the species were noted according to values in records of 5, 4, 3, 2, 1 and 0.5 for + (TOPİĆ 1993). The research was performed using software for floristic and vegetational analysis (unpublished). The humidity in Table 1 was given after Lang and Gračanin (GRAČANIN and ILIJANIĆ 1977). The nomenclature of plant species was used according to EHRENDORFER (1973).

Results and Discussion

Vegetation records from previous investigations (TOPİĆ 1978, 1982, 1984, MATE 1990) were used in addition to newly created records. A total of 236 weed taxa were registered within 552 vegetation records in Podravina. Among them 95 taxa are common to both types of crops, row crops and dense cereals (wheat and barley), the Coefficient of Community after Sørensen consequently being 37%.

Tab. 2. Weed flora in row crops and dense crops (wheat, barley) in Podravina

* indicates the position in the other column

ROW CROPS				DENSE CROPS			
No.	RA	Species	*	No.	RA	Species	*
1	129.80	<i>Galinsoga parviflora</i>	48	1	66.45	<i>Convolvulus arvensis</i>	3
2	100.00	<i>Echinochloa crus-galli</i>		2	64.03	<i>Ambrosia artemisiifolia</i>	8
3	96.73	<i>Convolvulus arvensis</i>	1	3	46.61	<i>Papaver rhoeas</i>	
4	96.00	<i>Chenopodium album</i>	8	4	39.84	<i>Galium aparine</i>	73
5	70.54	<i>Setaria glauca</i>	120	5	37.59	<i>Cirsium arvense</i>	12
6	61.28	<i>Stellaria media</i>	16	6	35.16	<i>Apera spica-venti</i>	
7	54.36	<i>Amaranthus retroflexus</i>	34	7	35.16	<i>Agropyron repens</i>	36
8	48.91	<i>Ambrosia artemisiifolia</i>	2	8	34.20	<i>Chenopodium album</i>	4
9	46.01	<i>Digitaria sanguinalis</i>	162	9	29.68	<i>Matricaria arvensis</i>	51
10	45.82	<i>Chenopodium polyspermum</i>	52	10	27.10	<i>Matricaria chamomilla</i>	95
11	41.09	<i>Equisetum arvense</i>	22	11	26.94	<i>Polygonum aviculare</i>	37
12	40.55	<i>Cirsium arvense</i>	5	12	26.29	<i>Consolida regalis</i>	
13	40.18	<i>Polygonum persicaria</i>	38	13	25.20	<i>Fallopia convolvulus</i>	17
14	36.00	<i>Sonchus sp. div.</i>	32	14	25.00	<i>Centaurea cyanus</i>	84
15	33.09	<i>Capsella bursa-pastoris</i>	23	15	24.47	<i>Sorghum halepense</i>	19
16	30.18	<i>Polygonum lapathifolium</i>	25	16	24.19	<i>Stellaria media</i>	6
17	26.54	<i>Fallopia convolvulus</i>	13	17	23.22	<i>Synapsis arvensis</i>	31
18	24.91	<i>Lamium purpureum</i>	36	18	22.10	<i>Lathyrus tuberosus</i>	49
19	24.73	<i>Sorghum halepense</i>	15	19	20.16	<i>Rubus caesius</i>	32
20	24.18	<i>Setaria viridis</i>		20	19.52	<i>Artemisia vulgaris</i>	69
21	23.64	<i>Solanum nigrum</i>	100	21	18.07	<i>Anthemis arvensis</i>	57
22	20.36	<i>Veronica persica</i>	26	22	15.97	<i>Equisetum arvense</i>	11

Tab. 2. -- continued

ROW CROPS				DENSE CROPS			
No.	RA	Species	*	No.	RA	Species	*
23	20.00	<i>Rorippa sylvestris</i>	96	23	15.96	<i>Capsella bursa-pastoris</i>	15
24	19.82	<i>Calystegia sepium</i>	75	24	14.86	<i>Viola arvensis</i>	88
25	17.64	<i>Mentha arvensis</i>	35	25	12.74	<i>Polygonum lapathifolium</i>	16
26	17.09	<i>Stachys palustris</i>	71	26	10.17	<i>Veronica persica</i>	22
27	14.73	<i>Hibiscus trionum</i>	92	27	9.68	<i>Vicia hirsuta</i>	
28	13.82	<i>Chenopodium hybridum</i>	93	28	9.55	<i>Daucus carota</i>	63
29	13.46	<i>Portulaca oleracea</i>		29	8.78	<i>Arctium lappa</i>	
30	13.45	<i>Taraxacum officinale</i>	50	30	8.51	<i>Arabidopsis thaliana</i>	
31	12.36	<i>Sinapis arvensis</i>	17	31	8.07	<i>Lolium temulentum</i>	142
32	12.36	<i>Rubus caesius</i>	19	32	8.05	<i>Sonchus</i> sp. div.	14
33	12.36	<i>Oxalis fontana</i>	51	33	7.90	<i>Stachys annua</i>	
34	12.36	<i>Heliotropium europaeum</i>	34	34	7.90	<i>Amaranthus retroflexus</i>	7
35	11.45	<i>Eragrostis megastachya</i>	35	35	7.42	<i>Mentha arvensis</i>	25
36	11.27	<i>Agropyron repens</i>	7	36	7.42	<i>Lamium purpureum</i>	18
37	8.91	<i>Polygonum aviculare</i>	11	37	6.94	<i>Pastinaca sativa</i>	139
38	8.73	<i>Eragrostis minor</i>	38	38	6.29	<i>Polygonum persicaria</i>	13
39	8.36	<i>Salvia verticillata</i>	150	39	5.81	<i>Ranunculus arvensis</i>	119
40	8.36	<i>Mentha longifolia</i>	40	40	5.79	<i>Mentha longifolia</i>	40
41	8.36	<i>Euphorbia helioscopia</i>	73	41	5.28	<i>Veronica hederifolia</i>	
42	8.00	<i>Cynodon dactylon</i>	42	42	5.00	<i>Vicia cracca</i>	129
43	7.43	<i>Mercurialis annua</i>	43	43	4.52	<i>Vicia lutea</i>	
44	7.28	<i>Brassica</i> sp. div.	70	44	4.52	<i>Trifolium repens</i>	58
45	7.26	<i>Plantago major</i> (incl. <i>intermedia</i>)	79	45	4.46	<i>Erigeron canadensis</i>	55
46	7.09	<i>Amaranthus albus</i>	46	46	4.20	<i>Ranunculus repens</i>	90
47	6.91	<i>Polygonum lapathifolium</i> subsp. <i>incanum</i>	102	47	4.03	<i>Poa trivialis</i>	
48	6.53	<i>Verbena officinalis</i>	48	48	4.03	<i>Galinsoga parviflora</i>	1
49	6.18	<i>Lathyrus tuberosus</i>	18	49	4.04	<i>Agrostis</i> sp. div.	153
50	6.00	<i>Stachys annua</i>	33	50	3.87	<i>Taraxacum officinale</i>	30
51	5.45	<i>Anagallis arvensis</i>	9	51	3.87	<i>Oxalis fontana</i>	33
52	5.27	<i>Potentilla reptans</i>	78	52	3.87	<i>Chenopodium polyspermum</i>	10
53	5.09	<i>Panicum capillare</i>	53	53	3.72	<i>Linaria vulgaris</i>	112
54	4.91	<i>Diplotaxis muralis</i>	161	54	3.71	<i>Agrostemma githago</i>	
55	4.52	<i>Erigeron canadensis</i>	45	55	3.55	<i>Achillea millefolium</i>	64
56	3.27	<i>Bidens tripartita</i>	147	56	3.46	<i>Legousia speculum-veneris</i>	
57	3.15	<i>Anthemis</i> sp.	21	57	3.39	<i>Cerastium</i> sp. div.	101
58	3.09	<i>Trifolium repens</i>	44	58	3.23	<i>Lycopus europaeus</i>	
59	3.00	<i>Medicago lupulina</i>	74	59	3.07	<i>Sambucus ebulus</i>	91
60	2.91	<i>Lamium amplexicaule</i>	124	60	3.06	<i>Glechoma hederacea</i>	78
61	2.73	<i>Chondrilla juncea</i>	61	61	2.66	<i>Lolium perenne</i>	96
62	2.71	<i>Geranium</i> sp. div.	62	62	2.42	<i>Symphytum officinale</i>	79
63	2.55	<i>Daucus carota</i>	28	63	2.26	<i>Vicia tetrasperma</i>	
64	2.55	<i>Achillea millefolium</i>	55	64	2.26	<i>Anagallis coerulea</i>	152
65	2.36	<i>Reseda lutea</i>	72	65	1.86	<i>Vicia grandiflora</i>	
66	2.36	<i>Fumaria officinalis</i>	127	66	1.86	<i>Lactuca serriola</i>	113
67	2.36	<i>Datura stramonium</i>	67	67	1.84	<i>Draba verna</i>	
68	2.18	<i>Ranunculus sardous</i>	83	68	1.83	<i>Poa pratensis</i>	
69	2.18	<i>Artemisia vulgaris</i>	20	69	1.83	<i>Urtica dioica</i>	105
70	2.00	<i>Kickxia elatine</i>	126	70	1.62	<i>Brassica</i> sp. div.	44
71	2.00	<i>Erodium cicutarium</i>	139	71	1.61	<i>Stachys palustris</i>	26
72	2.00	<i>Erigeron annuus</i>	90	72	1.61	<i>Reseda lutea</i>	65
73	1.87	<i>Galium aparine</i>	4	73	1.61	<i>Euphorbia helioscopia</i>	41

Tab. 2. – continued

ROW CROPS				DENSE CROPS			
No.	RA	Species	*	No.	RA	Species	*
74	1.82	<i>Atriplex patula</i>		74	1.60	<i>Medicago lupulina</i>	59
75	1.64	<i>Rubus</i> sp.		75	1.60	<i>Calystegia sepium</i>	24
76	1.64	<i>Raphanus raphanistrum</i>	108	76	1.52	<i>Polygonum amphibium</i>	
77	1.64	<i>Kochia lanata</i>	125	77	1.52	<i>Aphanes arvensis</i>	
78	1.64	<i>Glechoma hederacea</i>	60	78	1.45	<i>Potentilla reptans</i>	52
79	1.45	<i>Symphytum officinale</i>	62	79	1.45	<i>Plantago major</i>	45
80	1.45	<i>Euphorbia esula</i>		80	1.36	<i>Lythrum salicaria</i>	
81	1.45	<i>Aristolochia clematidis</i>		81	1.33	<i>Thlaspi arvense</i>	
82	1.27	<i>Gypsophila muralis</i>	138	82	1.33	<i>Bromus sterilis</i>	
83	1.27	<i>Cichorium intybus</i>	130	83	1.29	<i>Ranunculus sardous</i>	68
84	1.27	<i>Centaurea cyanus</i>	14	84	1.29	<i>Festuca pratensis</i>	
85	1.27	<i>Amaranthus lividus</i>		85	1.13	<i>Vicia</i> sp.	
86	1.27	<i>Ajuga chamaeepytis</i>		86	1.13	<i>Silene alba</i>	89
87	1.11	<i>Senecio vulgaris</i>		87	1.00	<i>Chaerophyllum aureum</i>	
88	1.09	<i>Viola arvensis</i>	24	88	1.00	<i>Caucalis</i> sp.	
89	1.09	<i>Silene alba</i>	86	89	0.99	<i>Solidago gigantea</i>	102
90	1.09	<i>Ranunculus repens</i>		90	0.97	<i>Erigeron annuus</i>	72
91	0.91	<i>Sambucus ebulus</i>	59	91	0.84	<i>Lythrum virgatum</i>	
92	0.91	<i>Robinia pseudacacia</i>		92	0.84	<i>Hibiscus trionum</i>	27
93	0.91	<i>Poa annua</i>		93	0.84	<i>Chenopodium hybridum</i>	28
94	0.91	<i>Myosotis arvensis</i>		94	0.81	<i>Viola tricolor</i>	
95	0.91	<i>Matricaria chamomilla</i>	10	95	0.81	<i>Rumex acetosella</i>	134
96	0.91	<i>Lolium perenne</i>	61	96	0.81	<i>Rorippa sylvestris</i>	23
97	0.73	<i>Rumex crispus</i>		97	0.81	<i>Dactylis glomerata</i>	
98	0.73	<i>Malva sylvestris</i>		98	0.80	<i>Galium album</i>	
99	0.73	<i>Gnaphalium uliginosum</i>		99	0.75	<i>Holcus lanatus</i>	144
100	0.73	<i>Falcaria vulgaris</i>	100	100	0.74	<i>Solanum nigrum</i>	21
101	0.73	<i>Cerastium</i> sp. div.	57	101	0.64	<i>Bromus</i> sp.	150
102	0.72	<i>Solidago gigantea</i>	89	102	0.53	<i>Polygonum lapathifolium</i> subsp. <i>incanum</i>	47
103	0.55	<i>Xanthium strumarium</i>		103	0.53	<i>Fumaria vaillantii</i>	
104	0.55	<i>Veronica arvensis</i>	106	104	0.50	<i>Potentilla recta</i>	
105	0.55	<i>Urtica dioica</i>	69	105	0.49	<i>Vicia villosa</i>	
106	0.55	<i>Trifolium pratense</i>	117	106	0.49	<i>Veronica arvensis</i>	104
107	0.55	<i>Rumex obtusifolius</i>		107	0.49	<i>Spergula arvensis</i>	115
108	0.55	<i>Pteridium aquilinum</i>		108	0.49	<i>Raphanus raphanistrum</i>	76
109	0.55	<i>Panicum milliaceum</i>		109	0.49	<i>Myosurus minima</i>	
110	0.55	<i>Medicago sativa</i>	143	110	0.49	<i>Melilotus officinalis</i>	
111	0.55	<i>Lolium multiflorum</i>		111	0.49	<i>Lepidium campestre</i>	
112	0.55	<i>Linaria vulgaris</i>	53	112	0.49	<i>Camelina</i> sp.	
113	0.55	<i>Lactuca serriola</i>	66	113	0.38	<i>Euphorbia falcata</i>	147
114	0.55	<i>Galeopsis tetrahit</i>		114	0.33	<i>Valerianella</i> sp. div.	130
115	0.54	<i>Spergula arvensis</i>	107	115	0.33	<i>Hordeum murinum</i>	
116	0.38	<i>Plantago lanceolata</i>		116	0.32	<i>Veronica dillenii</i>	
117	0.36	<i>Sherardia arvensis</i>		117	0.32	<i>Trifolium pratense</i>	106
118	0.36	<i>Scirpus</i> sp.		118	0.32	<i>Torilis arvensis</i>	
119	0.36	<i>Ranunculus arvensis</i>	39	119	0.32	<i>Silene vulgaris</i>	
120	0.36	<i>Pulicaria vulgaris</i>		120	0.32	<i>Setaria glauca</i>	5
121	0.36	<i>Nonnea pulla</i>		121	0.32	<i>Nigella arvensis</i>	
122	0.36	<i>Lycium europaeum</i>	122	122	0.32	<i>Lycium europaeum</i>	122
123	0.36	<i>Euphorbia cyparissias</i>	159	123	0.32	<i>Lepidium graminifolium</i>	
124	0.36	<i>Coronilla varia</i>	136	124	0.32	<i>Lamium amplexicaule</i>	60
125	0.36	<i>Cerintho minor</i>	131	125	0.32	<i>Kochia lanata</i>	77

Tab. 2. – continued

ROW CROPS				DENSE CROPS			
No.	RA	Species	*	No.	RA	Species	*
126	0.36	<i>Carex hirta</i>		126	0.32	<i>Kickxia elatine</i>	70
127	0.34	<i>Herniaria hirsuta</i>		127	0.32	<i>Fumaria officinalis</i>	66
128	0.18	<i>Xanthium spinosum</i>		128	0.32	<i>Euphorbia lucida</i>	
129	0.18	<i>Vicia cracca</i>	42	129	0.32	<i>Erodium cicutarium</i>	71
130	0.18	<i>Valerianella</i> sp. div.	114	130	0.32	<i>Cichorium intybus</i>	83
131	0.18	<i>Stellaria graminea</i>		131	0.32	<i>Cerinthe minor</i>	125
132	0.18	<i>Saponaria officinalis</i>		132	0.32	<i>Centaurea pulchella</i>	
133	0.18	<i>Rumex pulchra</i>		133	0.32	<i>Camelina microcarpa</i>	
134	0.18	<i>Rumex acetosella</i>	95	134	0.32	<i>Ballota nigra</i>	
135	0.18	<i>Pulicaria dysenterica</i>		135	0.29	<i>Papaver hybridum</i>	
136	0.18	<i>Potentilla verna</i>		136	0.27	<i>Vicia pannonica</i>	
137	0.18	<i>Potentilla erecta</i>		137	0.27	<i>Rumex</i> sp.	
138	0.18	<i>Phleum pratense</i>		138	0.27	<i>Gypsophila muralis</i>	82
139	0.18	<i>Pastinaca sativa</i>	37	139	0.27	<i>Buglossoides arvensis</i>	
140	0.18	<i>Myosoton aquatica</i>		140	0.25	<i>Scrophularia nodosa</i>	
141	0.18	<i>Lythrum hyssopifolia</i>		141	0.25	<i>Ranunculus acris</i>	
142	0.18	<i>Lolium temulentum</i>	31	142	0.25	<i>Potentilla anserina</i>	
143	0.18	<i>Lapsana communis</i>		143	0.25	<i>Medicago sativa</i>	110
144	0.18	<i>Holcus lanatus</i>	99	144	0.25	<i>Matricaria discoidea</i>	
145	0.18	<i>Euphorbia</i> sp.		145	0.25	<i>Lotus corniculatus</i>	
146	0.18	<i>Euphorbia peplus</i>		146	0.25	<i>Cannabis sativa</i>	
147	0.18	<i>Euphorbia falcata</i>	113	147	0.25	<i>Bidens tripartita</i>	56
148	0.18	<i>Clinopodium vulgare</i>		148	0.25	<i>Bellis perennis</i>	
149	0.18	<i>Chaenarrhinum minus</i>		149	0.16	<i>Scutellaria hastifolia</i>	
150	0.18	<i>Bromus</i> sp. div.	101	150	0.16	<i>Salvia verticillata</i>	39
151	0.18	<i>Artemisia annua</i>		151	0.16	<i>Salvia pratensis</i>	
152	0.18	<i>Anagallis coerulea</i>	64	152	0.16	<i>Salvia nemorosa</i>	
153	0.18	<i>Agrostis</i> sp. div.	49	153	0.16	<i>Potentilla argentea</i>	
154	0.18	<i>Agrimonia eupatoria</i>		154	0.16	<i>Moenchia mantica</i>	
155	0.18	<i>Abutilon theophrasti</i>		155	0.16	<i>Knautia arvensis</i>	
				156	0.16	<i>Juncus buffonius</i>	
				157	0.16	<i>Heracleum sphondylium</i>	
				158	0.16	<i>Galium verum</i>	
				159	0.16	<i>Euphorbia cyparissias</i>	123
				160	0.16	<i>Eupatorium cannabinum</i>	
				161	0.16	<i>Diploaxis muralis</i>	54
				162	0.16	<i>Digitaria sanguinalis</i>	9
				163	0.16	<i>Coronilla varia</i>	124
				164	0.16	<i>Calepina irregularis</i>	
				165	0.16	<i>Bromus mollis</i>	
				166	0.16	<i>Arenaria serpyllifolia</i>	
				167	0.16	<i>Anchusa officinalis</i>	

Table 2 shows comparatively quantitative arrays of weed flora in row crops and dense cereals. Although the number of weed species was greater in dense cereals than in row crops the mean relative abundance was greater in the latter one. The average RA for row crops is 10.01, while for wheat and barley it is 5.97. These differences, particularly obvious among the most abundant species, are due to dense vegetation in wheat and barley, not to different level of weed control.

Tab. 3. Comparative analysis of the fifteen most abundant weed species in row crops with regard to geographical distribution

TOTAL AREA			WESTERN PART			EASTERN PART		
Species	RA	Species	RA	Species	RA			
<i>Galinsoga parviflora</i>	129.82	<i>Galinsoga parviflora</i>	177.24	<i>Convolvulus arvensis</i>	92.27			
<i>Echinochloa crus-galli</i>	100.00	<i>Echinochloa crus-galli</i>	119.02	<i>Amaranthus retroflexus</i>	91.75			
<i>Chenopodium album</i>	96.00	<i>Chenopodium album</i>	105.22	<i>Chenopodium album</i>	76.80			
<i>Convolvulus arvensis</i>	96.00	<i>Convolvulus arvensis</i>	99.15	<i>Digitaria sanguinalis</i>	68.04			
<i>Setaria glauca</i>	70.54	<i>Setaria glauca</i>	76.40	<i>Sorghum halepense</i>	68.04			
<i>Stellaria media</i>	61.28	<i>Stellaria media</i>	70.78	<i>Echinochloa crus-galli</i>	64.95			
<i>Amaranthus retroflexus</i>	54.36	<i>Ambrosia artemisiifolia</i>	68.25	<i>Solanum nigrum</i>	64.95			
<i>Ambrosia artemisiifolia</i>	48.91	<i>Chenopodium polyspermum</i>	67.41	<i>Setaria glauca</i>	59.79			
<i>Digitaria sanguinalis</i>	46.01	<i>Equisetum arvense</i>	62.07	<i>Setaria viridis</i>	56.70			
<i>Chenopodium polyspermum</i>	45.82	<i>Polygonum persicaria</i>	60.11	<i>Stellaria media</i>	43.81			
<i>Equisetum arvense</i>	41.09	<i>Cirsium arvense</i>	52.24	<i>Galinsoga parviflora</i>	42.78			
<i>Cirsium arvense</i>	40.55	<i>Polygonum lapathifolium</i>	43.53	<i>Fallopia convolvulus</i>	38.14			
<i>Polygonum persicaria</i>	40.18	<i>Capsella bursa-pastoris</i>	42.13	<i>Hibiscus trionum</i>	37.63			
<i>Capsella bursa-pastoris</i>	33.09	<i>Amaranthus retroflexus</i>	35.39	<i>Chenopodium hybridum</i>	37.11			
<i>Polygonum lapathifolium</i>	30.18	<i>Lamium purpureum</i>	33.98	<i>Heliotropium europaeum</i>	35.05			

Comparing the quantitative data for row crop weeds exclusively, one can see differences from the West to the East. Table 3 shows the fifteen most abundant species over the whole investigated territory, in the western part as well as in the eastern part of Podravina. Columns 1 and 2 correspond in all the species except in one, but with greater abundance in the western part. The flora of the eastern part differs both qualitatively and quantitatively. These differences, due to the climate conditions, are also mirrored in the syntaxonomical division of row crop weed vegetation (TOPIĆ 1982) since it has not yet been established for wheat. From the phytogeographical standpoint, the area of eastern Croatia represents a transitional area, where the zones of the *Carpinion betuli illyricum* and *Aceri tatarici* – *Quercion* alliances overlap (HORVAT et al. 1974). This overlapping was established not only at the level of climazonal vegetation, but is also reflected in the other types: grasslands, ruderal and segetal vegetation. The border between two alliances in row crop vegetation was recently established – the western part of continental Croatia belonging to the alliance *Polygono-Chenopodion*, while the eastern part is occupied by the alliance *Eragrostion*. That border coincides with the dashed line in Fig. 1 (TOPIĆ 1982). Such qualitative differences were not established in the weed flora of wheat and barley in eastern Croatia. According to the literature (SLAVNIĆ 1951), vegetation of the *Secalinion orientale* alliance occurs on the nearby territory of Vojvodina (Serbia). It seems that this border, as distinct from that at any other type of vegetation, lies a bit more toward the East, and is probably due to the dense structure of vegetation. One of the characteristic species of the *Secalinion orientale* alliance, *Consolida orientalis*, could be found in eastern Croatia, but out of fields, on the open margins. More detailed investigations are necessary to determine the real border for this type of vegetation. Certainly, new investigations will contribute to a slight increase in weed taxa number, particularly considering the different seasons. In this case the quantitative data would differ even more, because all the data in this paper refer to late spring and summer.

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Corresponding author:

Prof. Jasenka Topić

University of Zagreb, Faculty of Science

Department of Botany, Marulićev trg 20,

HR-10 000 Zagreb, Croatia

e-mail: jtopic@yahoo.com