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Vegetation of the Class Stellarietea mediae in the Lijevče Polje Area

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Research Article

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ABSTRACT

This paper shows the results of many years researches (2013-2014) of the weed vegetation of the Lijevče polje area which includes four associations: Panico-Galinsogetum parviflorae Tüxen at Becker 1942, Panico-Portulacetum oleraceae Lozanovski 1962, Cynodono-Sorghetum halepense (Laban 1974) Kojić 1979 and Erigerono-Setarietum glaucae Šumatić 1997. Floristic- phytosociology researches were performed by the principles and methods of the Switzerland-French phytosociological school on 61 localities. By projecting the plant communities on the mail components (Principal Component Analysis) and comparting them to the ecological indices (variables), it shows that Panico-Galinsogetum parviflorae depends on humidity the (F) and the chemical reaction (R), while Panico-Portulacetum oleraceae shows the dependence on the nutrients (N). Association Cynodono-Sorghetum halepense shows the dependence on the temperature (T) and the light (L). Association Erigerono-Setarietum glaucae is separated because it develops on the stubble.

INTRODUCTION

Weed flora and vegetation mostly depends of ecological conditions of the particular area, the kind of the crop and applied agrotechnical measurements [1-3]. There are several data about weed vegetation of the particular parts of the Balkan Peninsula [4-10].

The weed vegetation has not been thoroughly researched in the area of Bosnia and Herzegovina and Republika Srpska. The weed vegetation in north east of Bosnia has been researched by Šumatić [11,12]. In a study of weed vegetation of the Pannonian basin in the Republic of Srpska in row crop, Šumatić noted association *Panico-Galinsogetum parviglore* Tüxen et Becker 1942, which has distinguished *Panico-Galinsogetum ambrosiosum artemisifoliae* facies, and associations *Galeopsi-Calistegietum sepii* Stepić 1984 and *Erigerono-Setarietum glaucae* (new ass.) in small grains, which is the first serious study of weed vegetation in this area [13].

Weeds in orchards have also been neglected until the research done Kojić and Mitrić, Kovačević has been doing research of the vegetation of weeds and vineyards in Bosnia and Herzegovina and found eight associations [14-16]. The weed vegetation, that is, plant communities of weed in the phytocoenological sense, is a special phenomenon in the nature with the row of specificities. In the agro-ecosystems, there are extremely complex relations, caused by the strong influence of anthropogenic factor with the addition of natural circumstances [17].

The weed communities in plough lands are anthropogenic creations, which grew and develop under strong influence of ecologic factors (biotic and abiotic). Following the complexity of agrotechnical measures and the total influence of the weed communities in plough lands, we can distinguish two groups: the weed communities in plough lands of dense set and the weed communities in plough lands of spring sown plants [18].

Studying of the weed vegetation in the area of Lijevce Polje is neglected. The last serious research of the vegetation of weed in Lijevce has been done by Kovačević where two associations are noted. In the grains society we have *Trifolium arvense-Scleranthus annuus* with 62 weed species in grains, and as far as root crops are concerned, there are 64 species under association of *Oxaleto-Chenopodietum polyspermi medioeuropeaneum*. The aim of the paper is to analyze the weed vegetation in the Lijevče polje area from the floristic, ecological and phyto-geographical aspects.

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MATERIALS AND METHODS

Floristic-phytosociology researches were performed by the principles and methods of the Switzerland-French phytosociologic school [19]. The research includes 61 regions from the area of four municipalities (Gradiška, Laktaši, Srbac and Kozarska Dubica) in Bosnia and Herzegovina where 49 relevés were taken **(Figure 1)**. Vegetation research in the field included taking of relevés on test area of 100 m^2: Space in row and between rows in orchard and vineyard, in grain crops and stubble from the whole area, root crops, and space between the rows. Relevés in orchards and vineyards on the territory of Lijevče polje were taken in neglected orchards and vineyards and in vineyards which are extensively processed and relevés in thick set crops and stubble were taken from parcels where herbicides were used, as well as from parcels where the application of herbicides was reduced. Also, relevés in root crops were taken in the same manner.

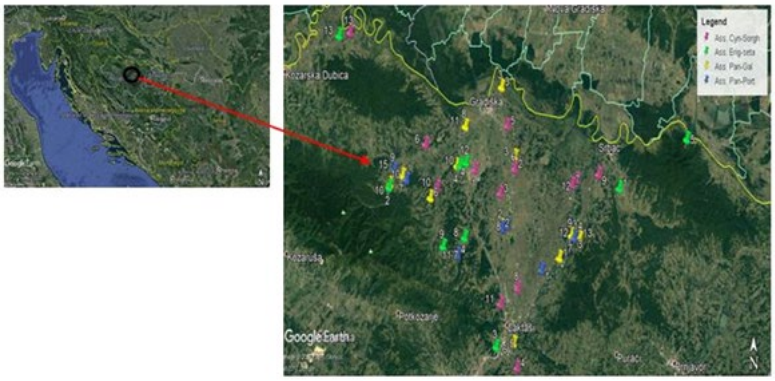

Figure 1. Study area in the Lijevče polje. Ass. Cyn-Sorgh-*Cynodono–Sorghetum halepense* (Laban 1974) Kojić, 1979; Ass. Erig-Seta-*Erigerono–Setarietum glauce* Šumatić 1997; Ass. Pan-Gal-*Panico–Galinsogetum parviglore* Tüxen et Becker 1942; Ass. Pan-Port-*Panico–Portulaceum oleraceae* Lozanovski 1962.

Determination of the plant species was performed according to Josipović, Domac, Beck, Čanak and Javorka and Csapody [20-24]. Taxonomy and the nomenclature were given according to Josipović [20]. Ecological optimum (ecological values) for each weed species was determined according to Kojić et al. who presents the adjusted ecological indices of the others autors, with amendments for the types characteristic for the researched region [25,26]. There are ecological indices for the soil humidity (F), chemical reaction of the soil (R), content of nitrogen in the soil (N), light (L) and temperature (T). The life forms of the plants are classified according to Raunkiaer in modification Ujvarosi. Affiliation of the species to floristic elements is determined according to Oberdorfer [27,28]. Sintaxonomic review of the vegetation is given according to Kojić [29]. Since Braun-Blanquet combined scale of number and cover consists of not only the numeral, but descriptive grades as well, it was undertaken the modification of the estimated values according to the scale Westhoff and van der what is complitely numerical which enabled the statistical processing of the data. Statistical processing of the data was dane by using the program BioDiversity pro and SPSS 21.0 [30-32]. Phytosociologic differentation of the associations included the numerical classification which was completed by corrresponence analysis [33].

Study Area

Lijevče polje is flatland in the lower flow of the Vrbas river, between the Sava river up north, and the mountains Prosara (on west), Motajica (on east) and Kozara (on south west). The land is fertile, and climate is moderate continental. Agriculture is the most represented branch of economy. The total surface area of Lijevče polje is 42.416 ha. Lijevče polje covers areas of municipalities of Gradiška (most part), Srbac and Laktaši (smaller part). Northern and northeastern part of the area spans accumulative flatland of rivers Sava and Vrbas with its affluents, while the south and south east is made of mountainous area of Potkozarje. Lijevče Polje covers area with two towns, Gradiška and Laktaši, as well as larger place, Nova Topola.

Wider area of Lijevče polje covers municipalities: Gradiška, Laktaši and Srbac, while the municipality of Kozarska Dubica represents its natural continuation. This area has a strong potential of growth in the agriculture sector and the subsectors of production of meat, milk, fruit and vegetables, production of berries and spices and herbs. Considering that the region has a long tradition in agriculture and that there is a lot of qualified and motivated work force, it is very possible to produce under competitive prices. The location is approximately near the city of Banja Luka and all the research and education institutions that are located there, including the University of Banja Luka and Agricultural insititute. That can enable close interaction of research, development and application.

In the last couple of years, a lot is done on the increase of the scope of agricultural production. However, in the most branches, the level that was set before the Bosnian war, especially in the production of meat, has not been met afterwards. The production of meat in Bosnia and Herzegovina was the highest in Yugoslavia before the war. The agricultural resources of Lijevče Polje and Potkozarje are still not exploited enough. It is estimated that in 2.010,95% of agricultural surface area (50.600 ha) has been cultivated. Lijevče polje has 66.330 ha covered with forest and the average bruto of wooden mass is 248.690 m^3.

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Lijevče polje represents terrific production base for foreign market of fruit, vegetables, berries, spices and herbs. The basic natural riches and resources of Lijevče polje are fertile ground, forest and water.

RESULTS AND DISCUSSION

In order to have a better control of weeds in the agroecosystem, it is nesessary to have knowledge about their floristic composition as well as the characteristics and dynamics of their communities in comparison with ecological conditions which rule on the particular area [34]. Based on the two years long floristic-phytosociologic researches can be concluded that the weed vegetation in the Lijevče polje area consists of four communities [35,36]. In accordance with syntaxonomic review of verification by Kojić et al, the weed communities are classified the following units of vegetation:

Class *Stellarietea mediae* Tx., Lohm.et Prsg.1950

Order *Chenopodietalia albi* Tx., Lohm.et Prsg. 1950

Alliance *Polygono-Chenopodion* Koch 1926 em. Sissing 1946

Ass. *Panico-Galinsogetum parviglore* Tüxen et Becker 1942

Ass. *Panico-Portulaceum oleraceae* Lozanovski 1962

Ass. *Cynodono-Sorghetum halepense* (Laban 1974) Kojić, 1979

Order *Centaurealia cyani* Tx., Lohm.et Prsg. 1950

Alliance *Galeopsion speciosae-pubescentis* Kojić 1972

Ass. *Erigerono-Setarietum glauce* Šumatić 1997

Weed flora covered with four plant communities consists of 91 species showed in the **Table 1**.

Table 1. Synoptic table of the plant communities in the Lijevče polje area.

Associations*			Pan-Gal	Pan-Port	Cyn-Sorgh	Erig-Seta
Number of species			71	52	34	67
Life forms**	Floristic elements***	DP–A****				
Characteristic species of the associations						
T	cosm	*Panicum crus-galli* L.	V^{+-4}	V^{+-3}	II^{+-3}	II^{+-1}
T	cosm	*Setaria glauca* (L.) P. B.	III^{+-3}	III$^{1-3}$	II^{+-3}	V^{+-4}
G	adv	*Sorghum halepense* (L.) Pers.	II^{+-2}	II^{+-4}	V^{+-5}	II^{+-5}
G	cosm	*Cynodon dactylon* (L.) Pers.	I$^{2-3}$	I$^{2-3}$	V^{+-4}	I^{4}
T	adv	*Galinsoga parviflora* Cav.	IV^{+-2}	III^{+-3}	-	II^{+-2}
T	sdv	*Portulaca oleracea* L.	I^{+-2}	III^{+-3}	-	I^{+}
Th	adv	*Erigeron canadensis* L.	I^{+}	-	-	III^{+}
Companions						
T	adv	*Ambrosia artemisifolia* L.	V^{+-3}	V^{+-2}	IV^{+-3}	IV$^{1-5}$
G	cosm	*Convolvulus arvensis* L.	V^{+-4}	II^{+-4}	II$^{1-4}$	IV^{+-4}
T	adv	*Amarantus retroflexus* L.	II^{+-2}	III^{+-2}	II^{+-1}	II^{+}
Th	euroas	*Daucus carota* L.	II^{+-2}	I^{+-2}	II^{+}	III^{+-2}
T	euroas	*Polygonum lapathifolium* L.	II^{+-2}	I^{+-2}	II^{+}	III^{+-1}
T	boreal	*Chenopodium album* L.	II^{+-1}	I^{+}	II^{+-1}	III^{+}
H	cosm	*Plantago mayor* L.	I^{+-4}	II^{+-4}	I^{+}	II^{+}
H	euroas	*Roripa sylvestris* L.	II^{+-1}	I^{+}	II^{+}	I^{+}
H	cosm	*Calystegia sepium* (L.) R.BR.	II$^{1-3}$	I^{2}	I^{2}	I^{1}
H	boreal	*Ranunculus repens*	I^{+-1}	I^{1}	I^{+}	II^{+-2}
G	cosm	*Agropyrum repens* (L.) Beauv.	I^{1}	I^{1}	I^{1}	II^{+-1}
T	cosm	*Anagalis arvensis* L.	I^{+}	I^{+}	I^{1}	II^{+}
Th	cosm	*Sonchus oleraceus* L.	I^{+}	I^{+}	I^{+}	II^{+}
H	cosm	*Taraxacum officinale* Web.	I^{+-2}	I$^{1-2}$	I^{1}	I^{1}
G	boreal	*Mentha arvensis* L.	I^{+-1}	I^{1}	I^{+}	I^{+}
H	cosm	*Potentilla reptans* L.	I^{+-1}	I^{+}	I^{+}	I^{1}
Th	boreal	*Lamium purpureum* L.	I^{+}	I^{+}	I^{+}	I^{+}

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T	med	*Digitaria sanguinalis* (L) Scop.	II^{+-2}	I^{+-2}	-	II^{+-2}
Th	adv	*Stenactis annua* (L.) Ness.	II^{+-2}	I^{+-2}	-	II^{+}
H	mod.cont	*Rumex obtusifolius* L.	-	I^{+}	II^{+-2}	I$^{1-3}$
T	cosm	*Polygonum aviculare* Agg. L.	I^{1}	I^{1}		II^{+-1}
Th	cosm	*Verbena officinalis* L.	I^{+}	-	I^{+}	II^{+}
Th	cosm	*Trifolium repens* L.	I^{2}	-	I^{1}	I^{+}
H	euroas	*Epilobium palustre* L.	I^{+}	I^{1}	-	I^{+-2}
T	cosm	*Solanum nigrum* L.	I^{+-1}	I^{+-1}	-	I^{+-1}
H	euroas	*Lythrum salicaria* L.	I^{+-1}	I^{+-1}	I^{+}	
G	smed	*Mentha longifolia* (L.) Huds	I^{+}	-	I^{+-1}	I^{+-1}
Th	boreal	*Stellaria media* (L.) Vill.	I^{+}	-	I^{1}	I^{+}
H	subatl	*Holcus lanatus* L.	I^{+}	I^{+}	-	I^{+}
H	euroas	*Plantago lanceolata* L.	I^{+}	I^{+}	-	I^{+}
Th	smed	*Lactuca serriola* L.	I^{+}	I^{+}	-	I^{+}
H	euroas	*Humulus lupulus* L.	I^{+}	I^{+}	-	I^{+}
H	euroas	*Scrophularia scopoli* Hoppe	I^{+}	I^{+}	-	I^{+}
Th	euroas	*Veronica hederifolia* L.	I^{+}	I^{+}	-	I^{+}
Th	euroas	*Sonchus asper* (L) Hill.	I^{+}	I^{+}	-	I^{+}
Th	cosm	*Capsella–bursa pastoris* (L) Medic.	I^{+}	I^{+}	-	I^{+}
H	subatl	*Bellis perennis* L.	I^{+}	-	I^{+}	I^{+}
T	med	*Ranunculus arvensis* L.	I^{+}	-	I^{+}	I^{+}
H	boreal	*Achillea mellefolium* L.	I^{+-2}	II$^{1-2}$	-	-
T	adv	*Abutilon theophrasti* Medic.	-	-	II^{+-1}	I^{+}
H	boreal	*Cirsium arvense* (L) Scop.	-	-	II^{+}	I^{+-1}
H	adv	*Oxalis stricta* L.	I^{+}	-	-	II^{+}
Th	euroas	*Viola arvensis* Murr.	I^{+}	-	-	II^{+}
H	boreal	*Prunela vulgaris* L.	I^{+}	-	-	II^{+}
Th	boreal	*Myosotis arvensis* (L.) Hill.	I^{+}	-	-	II^{+}
H	euroas	*Symphytum officinale* L.	I^{3}	-	-	I^{2}
H	euroas	*Trifolium pratense* L.	-	I^{2}	-	I^{+}
Th	cosm	*Poa annua* L.	I^{1}	I^{1}	-	-
nP	euroas	*Rubus caesius* L.	I^{1}	-	-	I^{+}
Th	euroas	*Papaver rhoeas* L.	I^{+}	I^{+}	-	-
H	med	*Erodium cicutarium* (L.) LHerit	I^{+}	I^{+}	-	-
T	med	*Raphanus raphanistrum* L.	I^{+}	I^{+}	-	-
H	cosm	*Rumex acetosella* L.	I^{+}	I^{+}	-	-
T	smed	*Crepis setosa* Mall.	I^{+}	-	-	I^{+}
H	euroas	*Sonchus arvensis* L.	I^{+}	-	-	I^{+}
Th	euroas	*Silene alba (Mill.)* E. Krause	I^{+}	-	-	I^{+}
Th	med	*Verbascum blattaria* L.	I^{+}	-	-	I^{+}
Th	subatl	*Crepis capillaris* (L) Wallr.	I^{+}	-	-	I^{+}
H	cosm	*Cychorium intybus* L.	-	I^{+}	-	I^{+}
T	cosm	*Setaria viridis* (L.) P. B.	I^{1}		-	-
Th	euroas	*Medicago lupulina* L.	-	I^{1}	-	-
H	euroas	*Epilobium hirsutum* L	-	I^{1}	-	-
H	smed	*Cirsium eriophorum* (L.) Scop.	-	-	-	I^{1}
H	boreal	*Stachys palustris* L.	I^{+-1}	-	-	
H	euroas	*Artemisia vulgaris* L.	I^{+}	-	-	-
H	euroas	*Lysimachia vulgaris* L.	I^{+}	-	-	-
T	smed	*Veronica polita* Fr.	I^{+}	-	-	-
T	cosm	*Datura stramonium* L.	I^{+}	-	-	-
G	euroas	*Origanum vulgare* L.	I^{+}	-	-	-
H	euroas	*Picris hieracioides* L.	I^{+}	-	-	-
H	euroas	*Stachys officinalis* (L.) Trev.	I^{+}	-	-	-
Th	euroas	*Trifolium arvense* L.	I^{+}	-	-	-
H	euroas	*Rumex crispus* L.	-	-	-	-
T	euroas	*Bidens tripartitus* L.	-	-	-	-
H	boreal	*Vicia cracca* L.	-	-	-	-
T	euroas	*Sinapis arvensis* L.	-	-	I^{+}	-
T	Smed	*Torilis arvensis* (Huds.) Link.	-	-	I^{+}	-

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Th	subocean	*Matricaria inodora* L.	-	-	-	I^+
H	Smed	*Galium mollugo* L.	-	-	-	I^+
H	Subatl	*Festuca arundinacea* Schreb.	-	-	-	I^+
G	Med	*Stachys annua* L.	-	-	-	I^+
T	Med	*Xanthium strumarium* L.	-	-	-	I^+
G	Boreal	*Equisetum arvense* L.	-	-	-	I^+
H	Med	*Leucanthemum vulgare* Lam.	-	-	-	I^+

Pan-Gal-*Panico-Galinsogetum parviflorae*; Pan-Port-*Panico-Portulacetum oleraceae*; Cyn-Sorgh-*Cynodono-Sorghetum halepense*; Erig-Seta-*Erigerono-Setarietum glaucae*

** Life forms: T-Therophytes, H-Hemikrypotphytes, G-Geophytes, Th-Therophytes-chamaephytic, nP-nano Phanerophytes

***Floristic elements: adv-adventive, bor-Boreal, euroas-Euroasian, smed-submediterranean, subatl-subatlantic, cont-continental, med-Mediterranean, cosm-Cosmopolitan, mod.cont-moderately continental. ****DP-degree of presence (I-V), A (+,1,2,3,4,5)-abundance of the species

The biological spectrum of the plant communities is presented by 6 life forms, among which H (hemicryptophytes) **(Table 2)** dominates in all associations. In the range of 9 groups of floral elements, the largest number of species is cosmopolitan distribution **(Table 3)**.

Table 2. Biological spectrum of the plant communities in the Lijevče polje area.

Life form*	Associations							
	Pan-Gal		Pan-Port		Cyn-Sorgh		Erig-Seta	
	№	%	№	%	№	%	№	%
T	18	25,35	14	26,92	11	32,35	16	23,88
Th	21	29,58	12	23,08	6	17,65	18	26,87
G	7	9,86	5	9,62	6	17,65	8	11,94
H	24	33,80	21	40,38	11	32,35	24	35,82
Np	1	1,41	-	-	-	-	1	1,49

Pan-Gal-Panico-Galinsogetum parviflorae; Pan-Port-Panico-Portulacetum oleraceae; Cyn-Sorgh-Cynodono-Sorghetum halepense; Erig-Seta-Erigerono-Setarietum glaucae

** Life forms: T-Therophytes, H-Hemikrypotphytes, G-Geophytes, Th-Therophytes-chamaephytic, nP-nano Phanerophytes

***Floristic elements: adv-adventive, bor-Boreal, euroas-Euroasian, smed-submediterranean, subatl-subatlantic, cont-continental, med-Mediterranean, cosm-Cosmopolitan, mod.cont-moderately continental. ****DP-degree of presence (I-V), A (+,1,2,3,4,5)-abundance of the species

Table 3. Chorological spectrum of the plant communities of the Lijevče polje area.

Floristic elements*	Associations							
	Pan-Gal		Pan-Port		Cyn-Sorgh		Erig-Seta	
	№	%	№	%	№	%	№	%
cosm	22	30,99	19	36,54	14	41,18	18	26,87
euroas	22	30,99	15	28,85	6	17,65	15	22,39
med	5	7,04	3	5,77	1	2,94	5	7,46
boreal	7	9,86	6	11,54	5	14,71	8	11,94
adv	8	11,27	6	11,54	4	11,76	9	13,43
smed	4	5,63	1	1,92	3	8,82	6	8,96
subatl	3	4,23	1	1,92	-	-	4	5,97
mod.cont	-	-	1	1,92	1	2,94	1	1,49
subocean	-	-	-	-	-	-	1	1,49

Pan-Gal-*Panico-Galinsogetum parviflorae*; Pan-Port-*Panico-Portulacetum oleraceae*; Cyn-Sorgh-*Cynodono-Sorghetum halepense*; Erig-Seta-*Erigerono-Setarietum glaucae*

** Life forms: T-Therophytes, H-Hemikrypotphytes, G-Geophytes, Th-Therophytes-chamaephytic, nP-nano Phanerophytes

***Floristic elements: adv-adventive, bor-Boreal, euroas-Euroasian, smed-submediterranean, subatl-subatlantic, cont-continental, med-Mediterranean, cosm-Cosmopolitan, mod.cont-moderately continental. ****DP-degree of presence (I-V), A (+,1,2,3,4,5)-abundance of the species

Ass. *Panico–Galinsogetum* parvflore Tüxen et Becker 1942

Ass. *Panico–Galinsogetum parvflore* Tüxen et Becker 1942 is widespread in row crops and growing crops. In the area which is covered by research association *Panico-Galinsogetum parvflore* Tüxen et Becker 1942 includes important place in weed vegetation in the Lijevče polje area. It is represented in orchards, vineyards, small grains and row crops. Stands of association *Panico-Galinsogetum parvflore* Tüxen et Becker 1942 *Panico-Galinsogetum parvflore* Tüxen et Becker 1942 build 71 plant species **(Table 1)**. General cover of plant cover is 60% to 100%. Number of species ranges 5-28.

Biological spectrum of the association **(Table 2)** shows that the most common hemicryptophytes which are represented by 24 species or 33,80%. In this group is significant species *Calystegia sepium* (L.) R.BR. The second group is therophytes-hemicryp-

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tophytes which consists of 21 species or 29,58%. The most important species in this group are dominant species *Galinsoga parviflora* Cav. and *Panicum crus-galli* L, then *Ambrosia artemisifolia* L. and *Setaria glauca* (L.) P. B. Although geophytes was presented with 7 species or 9,86% and they have degree of presence I and II they are very significant because they represent big problem in fighting. In the spectrum of areal types (tab.3) there were established seven groups of floristc elements of which are equally represented cosmopolitan and euroasian. They represent by 22 species and total 61,98%. Numerical classification analyzed stands of association *Panico- Galinsogetum parviglore* Tüxen et Becker 1942 which was conducted UPGMA method do not stand out sub associations and the results of ordination which was performed by correspondence analysis. **Figure 2a** shows similarity of stands. Based on numerical classification and ordination stands 3 and 15 were allocated from other stands.

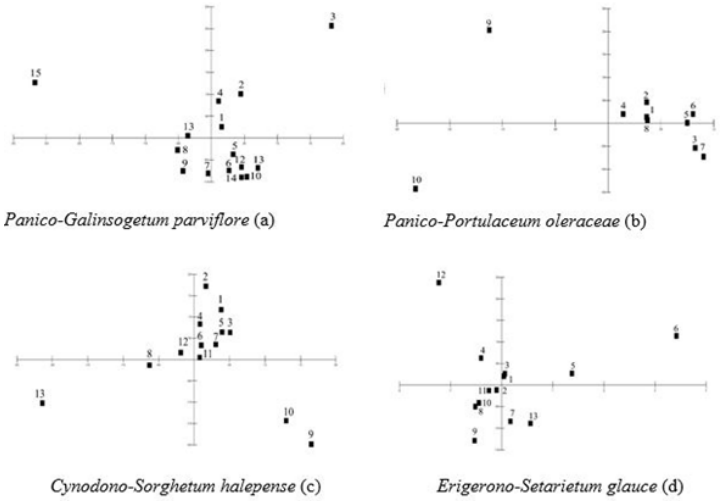

Figure 2. The correspondence analysis of stands of four plant communities.

Ass. *Panico-Potrulacetum* oleraceae *Lozanovski* 1962

Ass. Panico-Potrulacetum oleraceae Lozanovski 1962 is firstly described in Macedonija. Kovačević et al. was described this association in vineyards of Bosnia and Herzegovina. Stands of this association appear how in various row crops also and growing crops. In weed vegetation of the Lijevče polje area this association is row crops such as corn and watermelon and in orchards which are extensively processed. In the floristic composition of association *Panico-Potrulacetum oleraceae* Lozanovski 1962 included 52 species **(Table 1)**. Total vegetation cover ranges 60% to 100% and number of species ranges 5-24.

Characteristic species in this association are *Portulaca oleraceae* L. and *Panicum crus-galli* L. Although the species *Portulaca oleraceae* L is edificator, due to the application of herbicides in the row crops the cover has a lower value and deegre of presence than species *Panicum crus galli* L Companions are presented with 50 species. With the highest degree of presence and the highest cover value in this association is invasive species *Ambrosia artemisifolia* L.

Analysis of the biological spectrum this association can be concluded that association has hemicryptophytic-terophytic character **(Table 2)**. Hemicryptophytes represents 21 weed species or 40,38% of total. The most important among them is species *Calystegia sepium* (L.) R. BR. In areal spectrum of the association there are eight groups of floristc elements (tab. 3), where cosmopolitan elements are dominant. Cosmopolitan group of floral elements belongs to 19 weed species or 36,54% of total. This group belongs dominant species *Panicum crus galli* L. and next to it are significant species *Convolvulus arvensis* L, *Galinsoga parviflora* Cav. and *Cynodon dactylon* (L.) Pers. Numerical classification analysed stands of association *Panico–Portulaceum oleraceae* Lozanovski 1962 that was conducted with UPGMA method, do not stand out stand of sub association and results of ordination which was conducted with correspondent analysis shows certain floristic similarity of stands. Correspondent analysis shows a certain similarity of the floristic composition of stands of association *Panico–Portulaceum oleraceae* Lozanovski 1962 where are groups of the stands in a coordination diagram of the remote stands 9 and 10 **(Figure 2b)**. Separation of stands is conditioned because they were recorded in the orchard, then others were recorded in row crops and small grains.

Ass. *Cynodono-Sorghetum* halepense (Laban 1974) Kojić, 1979

ss. Cynodono-Sorghetum halepense (Laban 1974) Kojić, 1979 most details was described in Kosovo. Stands of association usually occur in row of orchards, row crops such as corn. In vineyards of Bosnia and Herzegovina this association was described Kovačević et al. On the Lijevče polje area association *Cynodono-Sorghetum halepense* Kojić, is typical developed in corn crop, soy crop, beans crop and in row of orchards. General coverage of plant cover is 50% to 100%. Number of species after recording is 2-19. The main characteristic of this association is high level of application of herbicides which results smaller number of available species, totally 34 **(Table 1).**

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Characteristic species in this association are *Cynodon dactylon* (L.) Pers. and *Sorghum halepense* (L.) Pers. Both species have degree of presence V and high cover values. Furthermore both of species are geophytes and which means that have high potential of vegetative propagation and they represent a big problem in weed control. Companions are presented with 32 species one of which is the most important species *Convolvulus arvensis* L. with degree of presence V and something less covering value then characteristic species of the association.

Biological spectrum of the association shows that therophytes and hemicryptophytes are dominated (both of life forms are presented with 11 species **(Table 2).** Although the present geophytes a lower percentage, they represent the main feature of this association and big problem in weed control. Cosmopolitan group of the areal types belongs 14 species **(Table 3)** of which the highest covering value has dominant species this association *Cynodon dactylon* (L.) Pers. and species *Convolvulus arvensis* L. Numerical classification analyzed stands of this association can clearly be distinguished as two groups of stands as evidenced by the results of ordination that was performed by correspondental analysis **(Figure 2c)**. Correspondental analyisis as similar botanical extracts first group of stands which are marked with numbers od 1-8 and second group 9-13. Stands 9, 10 and 13 stand out from the rest.

Ass. *Erigerono-Setarietum* glauce Šumatić 1997

Ass. Erigerono-Setarietum glauce Šumatić 1997 is for the first time described as the weed community of the cereal (stublle) in Semberija to Doboj. Also, this association was described on vineyards of Bosnia and Herzegovina.

In weed vegetation in the Lijevče polje area this association is widespread on the stubble, row crops (corn) and in orchards. Association is made of 67 plant species (tab.1). General coverage of plant cover is 50% to 100%, and number of species per stands varies 5-28.

Biological spectrum of the association constitutes 5 life formes of which the most species represented hemicryptophytes **(Table 2)**. Areal spectrum of the association **(Table 3)** of the association shows 9 group of floral elements where cosmopolitan group is dominate. Cosmopolitan group was presented with 18 species or 26,87% in total. This group includes dominant species *Setaria glauca* (L.) P. B. and then very important species such as *Convolvulus arvensis* L. and *Agropyrum repens* (L.) Beauv. Numerical classification of stands this association conducted with UPGMA method not allocated stands of sub association because stands show a certain similarity botanical composition. Results of ordination correspondent analysis conducted confirm the similarity of the floristic composition. Stands 6 and 12 are located from other stands **(Figure 2d)**. Stand 12 was recorded in orchard and is floristic than stands which was recorded in row crops.

Ecological Relations between Communities

For the evolution of the ecological relations, among the described plant communities, according to the ecological indices of the total floristic composition of the each community and the established number and coverness of each species in the community, from the transformed values, the statistical process of the data was undertaken. Starting from the correlation matrix of the average values of the five ecological indices (F, R, N, L, T) for four the communities described **(Table 4),** by applying the method PCA (Principal Component Analyis), the reduction of the beginning group of the changeable (ecological indices) is undertaken onto two main components which explain of the variability of the beginning the changeable **(Table 5)**.

Table 4. Matrix of Pearson's correlation coefficients of ecological indices.

Correlation	F	R	N	L	T
F	1.000	0.906	0.756	-0.956	-0.805
R	0.906	1.000	0.411	-0.890	-0.814
N	0.756	0.411	1.000	-0.710	-0.429
L	-0.956	-0.890	-0.710	1.000	0.619
T	-0.805	-0.814	-0.429	0.619	1.000

Table 5. Correlation of principal components with the initial variables.

Variables	Component	
	PC1	PC2
F	0.252	0.063
R	0.232	-0.479
N	0.184	0.923
L	-0.239	-0.162
T	-0.209	0.543

Biplot diagram **Figure 3** shows the ecological indices and it is given the projection of some plant communities onto the main components (IBM, 2013). The sharp angles between the vectors show the positive correlation while the obtuse angle shows shows the negative correlation of the appropriate changeable. So, the values of the ecological indices F and R as well as N are

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positively correlated, and values of the indices L and T are negatively correlated.

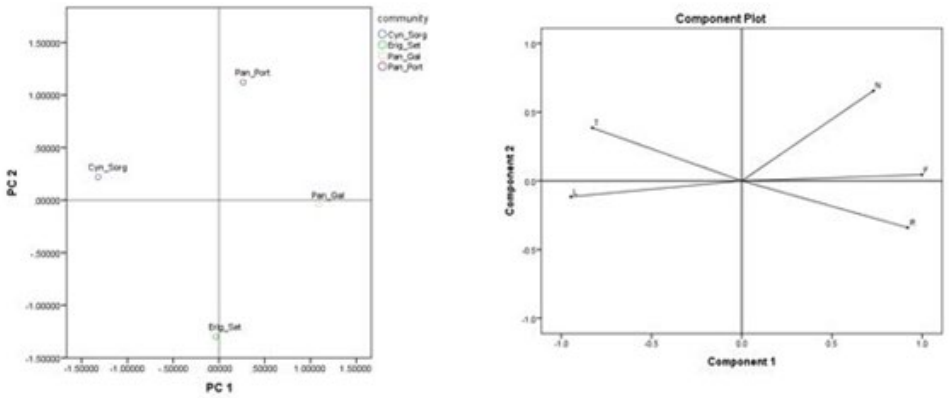

Figure 3. Biplot diagram of plant communities and ecological indices.

Association *Cynodono-Sorghetum halepense* shows the dependence on the temperature (T) and the light (L), while association *Panico-Galinsogetum parviflorae* shows the depence on the humidity (F) and the chemical reaction (R). Association *Panico-Portulacetum oleraceae* shows the dependence on the nutrients (N), while association *Erigerono-Setarietum glaucae* is separated because it develops on the stubble.

CONCLUSION

On the researched area, it was clarified that four weed plant communities that are characterized and clearly defined which is conditioned by reduced applying of the herbicides and generally weaker agronomic practices which reflected on the floristic difference since it is known that the intensive applying of the herbicides and the other agronomic practices leads to the significant changes of the structure and makes the biodiversity of the weed communities much poorer.

Species *Ambrosia artemiisifolia* L. has the highest degree of presence, after it follows species *Convolvulus arvensis* L.

This paper shows comprehensive and fundamental research weed flora in the Lijevče polje area, considering that the latest research was conducted 1956. Detailed analysis of the weed vegetation should serve as a basis for successful planning and implementation of measures of weed control. Special attention should devote for invasive weed species which spread aggressively and except that are problem in agrophytocenoses, represent and health problems.

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