

## DOMINANT WEED SPECIES OF POTATO CROP IN MOUNTAIN-CONTINENTAL PART OF MONTENEGRO

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### ABSTRACT

In this paper we throw light on dominant weed species of potato crop cultivated in mountainous continental part of Montenegro. Although potato is one of the main food plants for local population, with long tradition of cultivation, data about its weed flora are insufficient and incomplete. In 1998 through the project of investigations of different ways of weed control of potato crop in mountainous continental part of Montenegro we started systematic investigations of its weed flora. The data revealed that 19 weed species were registered. While dominant group of consists of *Convolvulus arvensis* (L.), *Anthemis arvensis* (L.), *Erigeron arvensis* (L.), *Helianthus scaberrimus* (L.) & *Gnaphalium uliginosum* (L.) ssp. *uliginosum* (L.) ssp. *uliginosum* (L.). The epiphytic species *Urtica dioica* (L.) but with significant participation of prostrate *Urtica dioica* (L.). *Convolvulus arvensis* is the most prevalent weed in the field.

**Key words.** Potato weeds Montenegro; *Convolvulus arvensis* L., *Anthemis arvensis* L.

### INTRODUCTION

Weed floras from weeds are huge and diverse and they reflect themselves in the way of their increase of quantity and very often through decrease of quality of plant product (Kocić and Šinžar, 1988). Plasticity of genotype, high adaptability to different environmental conditions and wide ecological prevalence has made weeds a serious competitors to planted crop. Although they are consumers of water, heat and light they cause difficulties or even unable land cultivation and implementation of agricultural techniques. Further they are hot spots and hosts of pests and different diseases, unable to successfully fight the weed problem, i.e. to choose appropriate herbicides. It is important to understand biology and ecology of dominant weed species (Kocić and Šinžar, 1988; Šinžar *et al.*, 1992; Mišović *et al.*, 1992). Since in the mountainous continental part of Montenegro, potato is one of the main crops, we are here presenting data on its weed flora as following and new separate complex.

### MATERIALS AND METHODS

Investigations on impact of different ways of potato crops weed control were conducted in period 1998-2000 in Vruja area (Pljevlja district, altitude ca. 900 m, continental soil type). The field experiment was carried in randomized complete block design with 4 repetitions, with elementary plots not treated with herbicides, surface of 20 m<sup>2</sup>. The soil type of crop of potato in 1998 was natural grassland while in 1999 and 2000 made

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and 1000 kg m<sup>-2</sup> of mineral seedling. Basic land cultivation with fertilizing in all 3 years was done in spring at the depth of 30 cm. Preceding preparation with rolling disc, harrow and roller was done once before sowing. NPK fertilizer (6:10:6 kg ha<sup>-1</sup>) in 1996 and 1997, and 6:12:6 kg ha<sup>-1</sup> in 1998 was used with KAN (25%) just before sowing in 2000 kg ha<sup>-1</sup>.

Development of weeds was followed by qualitative and quantitative methods. Small parts of the growing vegetation season, the first one 10 days before sowing, flowering the second one in the phase of full flowering and the third one at the end of the growing season of potato. Determination of weed species was done in accordance with the following authors: Deyl (1964), Domac (1973), Šarić (1991), and nomenclature given by the authors: Čađanović and Čađanović (1964-1980), Tutin *et al.* (1991), and Čađanović and Čađanović (1992).

**Agro-Ecological Conditions**

Soils are placed in the mountainous continental region of Montenegro, at all investigated localities. The climate belongs to moderate continental type, with the average temperature of 10.3°C and the average annual precipitation of 827.8 mm. Average temperature during growing season is 12-14°C and 53% of the total annual precipitation is concentrated there. Such conditions are extremely good for the planted crop but also for the weeds. During the period of three years long investigations thermal conditions have not differed significantly compared to the long term averages. Precipitation analysis for the growing season of potato indicates that the amount of precipitation in 1996 and 1997 was higher as compared to the average during the recent years, which was good for the growth and development of potato but weeds as well. During growing season in 1998 precipitation was below the long term average so the potato yield as well as weed biomass was lower.

The land belongs to aluvial d'luvia type, by the texture classification it belongs to fine-textured. It has a good permeability but weak retention capacity. The humidity content increases with depth, from 3.5 in the surface layer to 1.7% in the layer up to 10 cm. The pH is of acid reaction (pH 5.7-6.5). The land is insufficiently fed with elements. The soil is prosperous in the first place (Table 1). It is of medium productive features with low productivity values.

**Table-1. Chemical features of the soil of investigated locality**

Depth (cm)	pH		CaCO <sub>3</sub> (%)	Humus (%)	dissolved (mg 100 g <sup>-1</sup> )	
	H <sub>2</sub> O	KCl			P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
0-20	5.70	4.80	0.43	3.54	8.52	27.71
20-40	6.50	5.30	0.43	2.92	2.40	8.51
40-60	6.40	5.50	0.43	1.70	0.97	5.04

**RESULTS AND DISCUSSION**

Taxonomic qualitative analysis of potato agrophytocoenosis in mountainous continental part of Montenegro (Vruja- Plevljar district), showed presence of 57 weed species belonging to 46 genera and 23 families (Table 2). Comparing this number with the weed species registered during investigations of potato agrophytocoenosis in mountainous area of Kaune (Mišović *et al.* 1992), we notice the great floristic richness in the studied area. Among the information that phytogeographic analysis resulted with presence of 33 floral elements (Stevović and Jovović, 2004, in press) we conclude that potato agrophytocoenosis at Vruja locality, in mountainous continental part of Montenegro

is rich as well as diverse. Higher number of grassland species is explained with the fact that in the first year of investigation, potato crop was preceded by natural grasslands (on which herbicides had never been applied before) and also with possibility of introduction from surrounding grassland ecosystems. Dominant group of weed species gotten as the sum of 3 years long systematic investigations in field, with condition that the abundance of each species was equal or more than 3 plants  $m^{-2}$  consists of: *Convolvulus arvensis* (21.6%), *Anthemis arvensis* (9.9%), *Sinapis arvensis* (6.5%), *Bildordickya convolvulus* (6.0%) *Galeopsis tetrahit* (5.6%), *Chenopodium album* (5.3%) and *Fumaria officinalis* (5.1%). Its participation in agrophytocenosis is nearly 60%. A large number of species are present with low abundance and coverage. According to the Šinžar et al., 1994, these two peculiarities are typical for potato crop in mountainous regions. Opposite to this, lowland's potato agrophytocenosis is characterized with floristic poorness and quantity richness.

In the whole series of investigations of different ways of weed control of potato crop in mountainous part of Montenegro, *Convolvulus arvensis* L. was shown as "always present" in years of investigations as well as in estimations. Phonological observation it belongs to spring-winter group of weeds. It reached maximal abundance in second estimation (3 years average- 16.5 plants  $m^{-2}$  or 32.5%, while minimal abundance was marked in the first (9.1 plants  $m^{-2}$  or 18.9%). During the years of investigation, composition of weeds in agrophytocenosis was changed so its participation increased from 13.6% in 1998, to 37.1% in 2000. *Convolvulus* is perennial, with strong, deep and on several levels horizontally branched roots with the ability of vegetative reproduction (alongwith seeds). Because of this peculiarity, mechanical way of treatment should not be put on the first plan, because cutting the underground parts of the plant contributes to its spreading. Chemical way of treatment expressed stronger effect on biomass than on number of individuals. Between tested products Sencor, Sencor + Fusilade super were the most efficient ones (Stešević and Jovović, 2003; Jovović and Stešević 2003).

*Anthemis arvensis* L. as the second dominant weed species of potato crop of investigated area was present with 6.6%. It reached maximal abundance in 3<sup>rd</sup> estimation (8.9 plants  $m^{-2}$  or 13.4%) and minimal in the first one (2.2 plants  $m^{-2}$  or 4.6%). By years of investigation in 1998, it was the most abundant species with 21.5 plants  $m^{-2}$  or 25.3%, while in the 2000, abundance decreased to 1.2% (Table-2). As the rest of the species from group of dominant weeds *Anthemis* belongs to annuals. In general biological spectrum of potato agrophytocenosis in continental part of Montenegro terophytes participate with 54.9% while perennials with 45.1%. The spectrum is in correlation with the rule that increase of altitude and change of agro ecological conditions induces increases of hemi cryptophytic and geophytic forms in general weed infestation (Šinžar et al. 1994; Jovović et al., 2000).

Observing the dominant group of potato crop weeds in general, efficiency of mechanical way of control was shown as irrelevant. Application of herbicides Sencor + Fusilade super expressed high efficiency especially at *Anthemis* and *Galeopsis*. *Anthemis* left the agrophytocenosis after the first year of treatment while *Galeopsis* did it after the second year. Mentioned herbicide tank mixture also affected other weed species through decrease of number of individuals as well as its biomass (Stešević and Jovović, 2003). *Sinapis arvensis* L., the third dominant weed species was present with 6.5% density. It reached its highest abundance in the first estimation and the first year of investigation, while minimal values are noted in the third estimation and in the third year (Tables-2&3). Other species from group of dominant one are *Bildordickya convolvulus* L., *Galeopsis tetrahit*, *Chenopodium album*, and *Fumaria officinalis*, express some

peculiarities in changes in abundance and biomass during the years of investigations and estimations (Table-4). Opposite to all other weed species, abundance of *Chenopodium album* was increasing during the years of investigations, and reached its maximal value in 2000 (Table-4).

Among all mentioned peculiarities of potato crop weeds on investigated locality (abundance and biological-ecological characters), we conclude that with regular choice, in time and consequent weed prevention, extraordinary results in weed control can be achieved

**Table-2. Floristic composition of potato agrophytocenosis in mountain continental part of Montenegro (Vrulja)**

Fam: AMARANTHACEAE	Fam: AMARANTHACEAE
<i>Amaranthus retroflexus</i> L.	<i>Amaranthus retroflexus</i> L.
Fam: APIACEAE	Fam: APIACEAE
<i>Daucus carota</i> L.	<i>Daucus carota</i> L.
Fam: ASTERACEAE	Fam: ASTERACEAE
<i>Achillea millefolium</i> L.	<i>Achillea millefolium</i> L.
<i>Anthemis arvensis</i> L.	<i>Anthemis arvensis</i> L.
<i>Centaurea cyanus</i> L.	<i>Centaurea cyanus</i> L.
<i>C. scabiosa</i> L.	<i>C. scabiosa</i> L.
<i>Cirsium arvense</i> (L.) Scop.	<i>Cirsium arvense</i> (L.) Scop.
<i>Galinsoga parviflora</i> Cav.	<i>Galinsoga parviflora</i> Cav.
<i>Matricaria chamomilla</i> L.	<i>Matricaria chamomilla</i> L.
<i>Sonchus arvensis</i> L.	<i>Sonchus arvensis</i> L.
Fam: BORAGINACEAE	Fam: BORAGINACEAE
<i>Anchusa officinalis</i> L.	<i>Anchusa officinalis</i> L.
FAM: BRASSICACEAE	FAM: BRASSICACEAE
<i>Capsella bursa-pastoris</i> (L.) Med.	<i>Capsella bursa-pastoris</i> (L.) Med.
<i>Sinapis arvensis</i> L.	<i>Sinapis arvensis</i> L.
Fam: LAMIACEAE	Fam: LAMIACEAE
<i>Lamium amplexicaule</i> L.	<i>Lamium amplexicaule</i> L.
<i>Galeopsis tetrahit</i> L.	<i>Galeopsis tetrahit</i> L.
<i>Mentha longifolia</i> (L.) Huds.	<i>Mentha longifolia</i> (L.) Huds.
<i>Salvia verticillata</i> L.	<i>Salvia verticillata</i> L.
<i>Stachys annua</i> L.	<i>Stachys annua</i> L.
Fam: CARYOPHYLLACEAE	Fam: CARYOPHYLLACEAE
<i>Scleranthus annuus</i> L.	<i>Scleranthus annuus</i> L.
<i>Stellaria media</i> (L.) Vill.	<i>Stellaria media</i> (L.) Vill.
Fam: CHENOPODIACEAE	Fam: CHENOPODIACEAE
<i>Atriplex patula</i> L.	<i>Atriplex patula</i> L.
<i>Chenopodium album</i> L.	<i>Chenopodium album</i> L.
Fam: CONVULVULACEAE	Fam: CONVULVULACEAE
<i>Convolvulus arvensis</i> L.	<i>Convolvulus arvensis</i> L.
Fam: EQUISETACEAE	Fam: EQUISETACEAE
<i>Equisetum arvense</i> L.	<i>Equisetum arvense</i> L.
Fam: EUPHORBIACEAE	Fam: EUPHORBIACEAE
<i>Euphorbia cyparissias</i> L.	<i>Euphorbia cyparissias</i> L.
<i>E. helioscopia</i> L.	<i>E. helioscopia</i> L.

**Table-3. Floristic composition of dominant group of weeds of potato agrophytocenosis in mountain-continental part of Montenegro (by years of investigations)**

Weed species and life form		Year of investigation						1998-2000 %
		1998		1999		2000		
		Density m <sup>-2</sup>	%	Density m <sup>-2</sup>	%	Density m <sup>-2</sup>	%	
<i>Convolvulus arvensis</i>	G	11.1	13.6	7.7	14.2	13.5	37.1	21.6
<i>Anthemis arvensis</i>	T	21.5	25.3	1.5	2.2	0.5	1.2	9.9
<i>Sonchus arvensis</i>	T	2.4	2.8	6.4	11.6	2.8	5.2	6.5
<i>Bilderdykia convolvulus</i>	S	6.7	7.9	3.0	5.4	1.8	4.9	6.0
<i>Galeopsis tetrahit</i>	T	3.7	4.4	2.9	5.3	2	5.5	5.6
<i>Chenopodium album</i>	T	1.1	1.2	1.3	2.0	7.5	14.0	5.3
<i>Fumaria officinalis</i>	T	0.9	1.0	2.8	5.2	3.2	8.6	5.1

**Table-4. Floristic composition of dominant group of weeds of potato agrophytocenosis in mountain-continental part of Montenegro (by each estimation for 3 years long period)**

Weed species and life form		1998-2000					
		1 <sup>st</sup> estimation		2 <sup>nd</sup> estimation		3 <sup>rd</sup> estimation	
		Density m <sup>-2</sup>	%	Density m <sup>-2</sup>	%	Density m <sup>-2</sup>	%
<i>Convolvulus arvensis</i>	G	9.1	18.9	16.5	23.7	14.4	21.6
<i>Anthemis arvensis</i>	T	2.2	4.6	7.2	10.4	8.9	13.4
<i>Sonchus arvensis</i>	T	5.1	10.6	3.8	5.5	3.2	4.7
<i>Bilderdykia convolvulus</i>	ST	4.3	8.9	5.0	7.2	1.7	2.6
<i>Galeopsis tetrahit</i>	T	4.8	9.9	3.6	5.3	1.9	2.8
<i>Chenopodium album</i>	T	1.9	3.9	5.8	8.4	3.2	4.7
<i>Fumaria officinalis</i>	T	3.6	7.2	4.4	6.3	1.3	2.0

### Conclusions

During the 3 years long investigation of potato weed snooze in mountain continental part of Montenegro we registered 51 weed species, while dominant group of dominant ones consists of *Convolvulus arvensis* (21.6%), *Anthemis arvensis* (9.9%), *Sinapis arvensis* (6.5%), *Bilderdykia convolvulus* (6.0%), *Galeopsis tetrahit* (5.6%), *Chenopodium album* (5.3%) and *Fumaria officinalis* (5.1%). The agrophytocenosis had terophytic character (54.9%), but with significant participation of perennial forms (45.1%).

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