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INFLUENCE OF INTENSIVE FARMING ON NUMBER AND VERTICAL DIVISION OF *Galinsoga parviflora* CAV. SEEDS IN ARABLE SOIL LAYER

WPŁYW UPRAWY INTENSYWNEJ NA LICZEBNOŚĆ I ROZDZIAŁ PIONOWY NASION *Galinsoga parviflora* CAV. W ORNEJ WARSTWIE GLEBY

Abstract: The degree of soil pollution with vital seeds of weeds depends on many factors, such as amount and species biodiversity of the habitat of weeds inhabiting in the crop, type of crop, method of cultivation as well as the level of nutrients supply in soil and its physicochemical properties. Various species of weeds differ from each other in possibilities to produce seeds. Differences between actual and potential seed production are significant, which is determined by environmental conditions in which plant vegetation takes place. At the population level weeds have the ability to produce such quantities of seeds, which largely compensate reduction in their appearance. This ability makes it significantly difficult to reduce the degree of their presence in the crop. In order to identify the impact of the above technology of cultivation on the amount and vertical distribution of *Galinsoga parviflora* Cav seeds in arable layer, pot experiments were carried out, in which soil samples taken twice from winter wheat fields were subjected to detailed analysis. The results indicate that the technology of plant cultivation significantly affects the number of seeds of weed species and their distribution in the arable layer of soil.

Keywords: soil weed seed bank, mechanical tillage, weed seed emergence, ecological weeding

In agrocenoses of intensive farming system as a result of disrupted biodiversity there do not function (or function very badly) natural self-regulation mechanisms of plant groups. Increased level of fertilisation and applied farming simplifications namely direct drilling or ploughless sowing increase the number of weed species in the cultivated plant field, and facilitate greater share of dominant species [1].

Weeding infestation of corn field depends, among others, on intensive chemical protection, therefore on number and accuracy of performed herbicide treatment, on a kind of applied herbicidal preparation, active ingredient dose size, time of its application, weather conditions etc. [2].

The most significant element of field weed infestation are segetal weeds that adapt to growth conditions of cultivated plants and ruderal weeds that grow in not cultivated areas. The source of weed infestation is diaspore reserve in soil called by Harper [3] “seed bank”. It is supplemented every year mostly by annual weeds, which account for 95% or more of seeds found in the soil [3].

Smallflower galinsoga (*Galinsoga parviflora* Cav.) is a weed that often appears in vegetable and root crops plantations. It comes from South America, from where it was brought to botanical garden in Prague by a scientific expedition. At present it is the most annoying weed of segetal and ruderal form found in the gardens all over Europe and Asia [4]. It prefers clayey soil and humus soil and soil rich in nitrogen. During its vegetation period in favourable conditions it may produce several generations, because it needs from 4 to 6 weeks to reach full growth [5].

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Methods

The experiments were conducted on soil samples taken in year 2000 from a field located in Opole-Polwies. The soil for laboratory examination was taken at twice: in spring and in autumn. In both cases at depth of 0÷10 and 10÷20 cm.

Plant emergence and growth in vases was observed in few time periods (cycles), of which each lasted for roughly 6 weeks. After each period an analysis of weed concentration was conducted to determine species spectrum, number of emergence and development phase. In order to facilitate emergence after each analysis the soil in vases was mixed. After the fifth analysis fallowing was applied, during which watering factor was limited. The research was conducted with optimal photoperiod and relative moisture [6].

In the taken soil samples pH were determined and the amount of humus and macro and microelements was determined.

Results

The field of which soil samples were taken was located in the western part of Opole town. Plant production technique was involved a conventional way of farming vegetables (cucumber, beans, cabbage, peas) partitioned every second year with Jawa variety winter wheat. Plant production was conducted in intensive farming system, namely, there applied 395 kg NPK/ha and full chemical protection from pest. In vegetable farming mineral fertilisation was optimal, however in winter wheat there applied the following doses: 160 kg N, 110 kg P_2O_5 and 120 kg K_2O/ha. Winter wheat was sowed using ploughless tillage and together with sowed fertiliser it was covered with disc harrow.

The research was conducted on chernozem fen soil, IIIa valuation class of good wheat complex.

Very high amount of magnesium, phosphorus and potassium and high amount of manganese, zinc and average amount of iron was determined as a result of the analysis in the examined soil (Table 1).

Table 1

The results of the analyses of soil samples

Soil layer [cm]	pH (1 N KCl)	Humus [%]	P_2O_5	K_2O	Mg	B	Mn	Cu	Zn	Fe
			[mg/100 g soil]			[mg/kg]				
0÷10	8.5	2.10	67.0	33.5	13.6	4.4	307.0	7.6	20.1	1682
10÷20	8.6	1.80	65.3	25.3	13.6	4.3	291.0	7.5	20.9	1415

During both collection times of soil samples using frame method there were determined species content of weeds present in the field. As a result of the analysis there were determined the presence of 6 weed species, of which the most numerous were: *Chenopodium album* L - 81% and *Galinsoga parviflora* Cav. - 11% (Table 2).

As a result of conducted vase experiments *Galinoga parviflora* emerged in total number of 1480 piece/m^2, of which on soil samples taken in spring it accounted for 43% and on soil samples taken in autumn 57% (Fig. 1).

Table 2

Analysis of the weed field

Plant species	Number of weeds [piece/m^2]
Lamb`s quarters *Chenopodium album* L.	40
Common chickweed *Stellaria media* (L.) Vill.	1
Shepherd`s purse *Capsella bursa pastoris* (L.) Med.	1
Field violet *Viola arvensis* Murray	1
Smallflower galinsoga *Galinsoga parviflora* Cav.	5
Green amaranth *Amaranthus retroflexus* L.	1
Total score	49

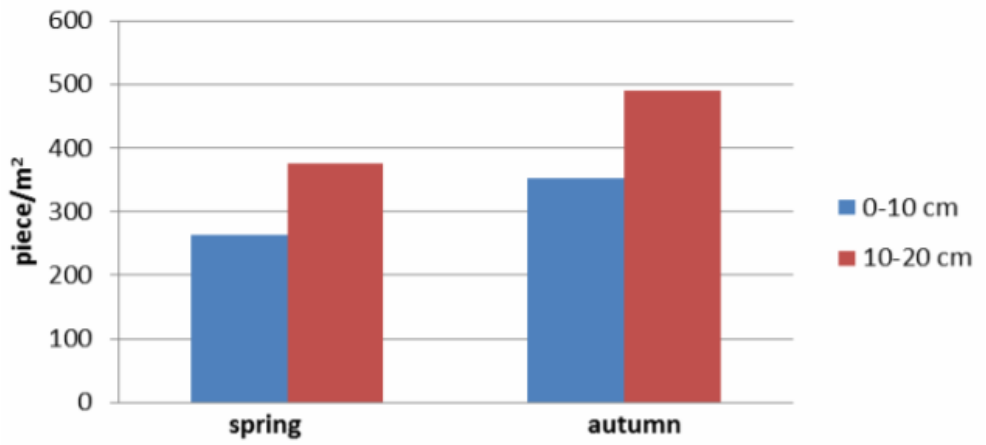

Fig. 1. Emergence concentration of *Galinsoga parviflora* Cav. on soil samples taken in spring and autumn

At both times the most numerous emergence of smallflower galinsoga was noted at soil samples taken at depth 10÷20 cm. In spring they accounted for 59% and on samples taken in autumn they accounted for 58%.

Table 3

Emergence dynamics of *Galinsoga parviflora* Cav. on a spring soil

Soil layer [cm]	Number of cultivation																		
	1-4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	[piece/m^2]																		
0÷10	145	28	0	11	11	6	11	0	17	0	11	11	0	0	11	17	6	0	6
10÷20	216	0	6	28	39	17	6	17	6	17	11	0	0	0	6	0	0	0	6

This species reacted in different ways to soil reversing and mixing applied during the examinations. In spring samples the highest emergence was noted after first 4 cultivations,

after which there emerged 55.1% in a soil layer of 0÷10 cm and 57.6% of plants in a soil layer of 10÷20 cm (Table 3).

The isolation of all vital seeds of smallflower galinsoga from the above-mentioned samples required application of 7 cycles of examination, namely 23 treatments, which total time of emergence account for 1008 days.

In autumn soil the highest emergence was characterised by first 5 cultivations, after which there emerged 58.2% in soil layer of 0÷10 cm and 60.4% plants in a layer of 10÷20 cm (Table 4).

There isolation of all vital seed of *Galinsoga parviflora* from soil samples required performing 6 cycles of examination, namely 22 treatment lasting for total 921 days.

Table 4

Emergence dynamics of *Galinsoga parviflora* Cav. in autumn soil

Soil layer [cm]	Number of cultivation																
	1-5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	[piece/m^2]																	
0÷10	205	0	14	10	5	0	0	14	14	14	14	7	0	0	0	7	0	0
10÷20	29	54	20	20	5	4	7	0	14	14	20	7	7	0	0	15	0	7

Summary

The presented outcome achieved during the conducted research show that vital seeds of *Galinsoga parviflora* Cav. were quite numerous in a soil seed bank. This species could, therefore, create some kind of danger for winter wheat crops. *Galinsoga parviflora* and *Chenopodium album* are taxons, which do not appear, or rarely appear in crops cultivation. Their presence in soil was a result of forecrop cultivation, which were vegetables. Ploughing applied after their harvest displaced smallflover galinoga and lamb`s quarters seeds cumulated in surface layer to deeper layers. Therefore, we noted their increased amount in the layer of 10÷20 cm. The application of intensive farming system facilitated more numerous weed growth. Weeds, however, appeared in limited number of species, what was proven by results achieved in field conditions. In case of extensive and conventional farming system, the way of cultivation influences positively not only number, but also species biodiversity of habitat [6]. With ploughless sowing and monoculture of cultivated plant, weed seeds in the soil, due to limited number of mechanical cultivations, did not have adequate emergence conditions, especially from deeper layers, therefore it was difficult to elaborate an effective programme that limits their amount.

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Abstrakt: Stopień zanieczyszczenia gleby żywotnymi nasionami chwastów zależy od wielu czynników, takich jak: liczebność i bioróżnorodność gatunkowa siedliska chwastów bytujących w uprawie, rodzaj uprawy, sposób gospodarowania oraz poziom zasobności gleby w składniki pokarmowe i jej właściwości fizykochemicznych. Poszczególne gatunki chwastów różnią się między sobą możliwościami wytwarzania nasion. Różnice między faktyczną i potencjalną produkcją nasion są znaczne, o czym decydują warunki środowiska, w jakich odbywa się wegetacja rośliny. Na poziomie populacji chwasty mają zdolność do produkcji takiej ilości nasion, która w znacznym stopniu kompensuje zmniejszenie ich nasilenia. Zdolność ta w znaczny sposób utrudnia stopień ograniczania ich obecności w łanie rośliny uprawnej. W celu rozpoznania wpływu technologii uprawy na liczebność i rozdział pionowy, w warstwie ornej, nasion żółtlicy drobnokwiatowej przeprowadzono doświadczenia wazonowe, w których szczegółowej analizie poddano próbki glebowe pobrane w dwóch terminach z pól z uprawą pszenicy ozimej. Uzyskane wyniki wskazują, że technologia uprawy roślin w dużym stopniu wpływa na ilość nasion gatunków chwastów oraz na ich rozmieszczenie w ornej warstwie gleby.

Słowa kluczowe: glebowy bank nasion chwastów, uprawa mechaniczna gleby, nasilenie wschodów chwastów, ekologiczna walka z chwastami