

ANALYZING SOIL SEED BANK OF INVASIVE SPECIES IN SOIL IN NATURE PROTECTED AREA

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Abstract

The aim of this research was to determine the number of invasive weed seeds in two protected areas. Soil sampling was carried out in north of Serbia Landscape of Outstanding Features Nature Park "Palić" and Nature Reserve "Ludaško jezero". The depth at which samples were taken in each location was 0-10 cm. Weed seed bank from these two areas contained seeds of: *Lolium multiflorum*, *Amaranthus retroflexus*, *Celtis occidentalis*, *Galinsoga parviflora*, *Vicia articulata*, *Setaria italica*, *Datura stramonium*, *Asclepias syriaca*, *Matricaria discoidea*, *Portulacae oleraceae*, *Veronica persica*, *Iva xanthifolia* and *Echinochloa crus-galli*. *Amaranthus retroflexus*, *Celtis occidentalis*, *Portulaca oleracea* and *Setaria italica* were determined in very large numbers at each protected location. The sampling of soil was done at two locations, with a probe of the same volume. Identifying the seeds and determining their quantity was carried out with microscopes and determiners.

Introduction

Successful weed management in agroecosystems centers on manipulating the weed seed bank in soil, the source of annual weed infestations [1]. In the increasingly disturbed environment created by modern land use, soil seed banks are of growing importance in the management and restoration of vegetation [2]. The main source of annual weeds is the soil seed population [3]. The seed bank is the resting place of weed seeds and is an important component of the life cycle of weeds. Seed banks are the sole source of future weed populations of the weed species both annuals and perennials that reproduce only by seeds. For this reason, understanding fate of seeds in the seed bank can be an important component of overall weed control [4]. A seed bank is a reserve of mature viable seeds located in fruits (or cones) on the plant (aerial seed bank), on the soil surface or buried in soil, duff or litter. The formation of a non-aerial (soil) seed bank begins at seed dispersal and ends with germination or death of the seed. Traditionally, two broad types of soil seed banks have been designated: transient and persistent. Seeds of species with transient seed banks live for <1 year and those with persistent seed banks for more than 1 year. More recent classification schemes subdivide the transient and persistent seed-bank categories into 2 – 3 subtypes each, delineating them by 1 year to decades [5]. What has to be taken into account in the study of weed seed banks in soil is that they are only a part of a complex and dynamic system consisting of soil [6], plants, animals and microorganisms [7]. Seed banks have been described as the 'memory' of a population, because they may contain genotypes that have been eradicated from the growing plant portion of the population [8]. Seed bank enhances the survival of a species by buffering against harsh environmental conditions or highly effective control methods and allowing them to germinate over a period of many years. This ability slows the genetic shift of a weed population exposed to intense selection pressures by ensuring that all the seedlings that germinate in any one year are not all from similar genetic backgrounds [9]. Understanding the nature of seedbanks is a necessary prerequisite for studying plant population dynamics, or for setting up programs of weed control [10]. Invasion by non-native exotic species in alien environments poses a major threat to native plant communities and alters fundamental

structures and functions of ecosystems. It poses one of the most serious threats to biodiversity, causing major changes in vegetation at a global level [11]. Early detection of invasive plants when their spatial extent is small reduces the cost of control and increases the possibility of successful eradication [12].

Experimental

The aim was to determine number of seeds from invasive weeds in two protected areas. Soil sampling was carried out in locations of two protected areas in north of Serbia Landscape of Outstanding Features Nature Park ‘‘Palić’’ and Nature Reserve ‘‘Ludaško jezero’’. The depth at which samples were taken in each location was 0-10 cm. The sampling of soil was done at two locations, with a probe of the same volume. In the laboratory conditions, soil samples were sieved through sieves of various diameters. After that weed seeds separated in the sample from plant and other material and the identification of seeds was carried out. Identifying the seeds and determining their quantity was carried out with microscopes and determiners.

Results and discussion

The seeds of invasive weeds at the location of Nature Park ‘‘Palić’’ were identified: *Lolium multiflorum*, *Amaranthus retroflexus*, *Celtis occidentalis*, *Galinsoga parviflora*, *Vicia articulata*, *Setaria italica*, *Datura stramonium*, *Asclepias syriaca*, *Matricaria discoidea*, *Portulacae oleraceae*, *Veronica persica*. The average number of weeds at the location Nature Park ‘‘Palić’’ in the soil profil 0-10 cm is in the range of 159,51 to 5503,07 seeds per m² respectively. The weed seed bank contains several dominant species in all samples. *Amaranthus retroflexus* and *Celtis occidentalis* were one of the most numerous at the locality. *Celtis occidentalis* is the weed species with the highest number of selected seed from the samples (5503,07 seeds per m²), followed by *Amaranthus retroflexus* (2950,92 seeds per m²), *Datura stramonium* (2871,17 seeds per m²), *Setaria italica* (1515,34 seeds per m²), *Asclepias syriaca* (1196,32 seeds per m²), *Lolium multiflorum* (1116,56 seeds per m²), *Matricaria discoidea* (1036,81 seeds per m²), *Portulacae oleraceae* (877,30 seeds per m²) and *Galinsoga parviflora*, *Veronica persica*, *Vicia articulata* had same number of determinate weed seeds, (159,51 seeds per m²) (Table 1).

Weed seeds	SUM	No m ²
<i>Amaranthus retroflexus</i>	37	2950,92
<i>Asclepias syriaca</i>	15	1196,32
<i>Celtis occidentalis</i>	69	5503,07
<i>Datura stramonium</i>	36	2871,17
<i>Galinsoga parviflora</i>	2	159,51
<i>Lolium multiflorum</i>	14	1116,56
<i>Matricaria discoidea</i>	13	1036,81
<i>Portulacae oleraceae</i>	11	877,30
<i>Setaria italica</i>	19	1515,34
<i>Veronica persica</i>	2	159,51
<i>Vicia articulata</i>	2	159,51

Table 1: Determined invasive weed seeds at Nature Park ‘‘Palić’’

SUM- the total number of invasive weed seeds in 25 soil samples at 0-10 depth

NO m² - the total number of invasive weed seeds in all soil samples expressed per m²

The seeds of invasive weeds at the location of Nature Reserve ‘‘Ludaško jezero’’ were identified: *Amaranthus retroflexus*, *Portulaca oleracea*, *Setaria italica*, *Datura stramonium*,

Echinochloa crus-galli, *Iva xanthifolia*, *Celtis occidentalis*, *Ambrosia artemisiifolia* and *Lolium multiflorum*. The average number of weeds at the location Special at Nature Reserve „Ludasko jezero“ in the soil profil 0-10 cm is in the range of 79,75 to 43226,99 seeds per m² respectively. The weed seed bank contain several dominant species in all samples. *Amaranthus retroflexus* and *Portulaca oleracea* were one of the most numerous at the locality. *Amaranthus retroflexus* is the weed species with the highest number of selected seed from the samples (43226,99 seeds per m²), followed by *Portulaca oleracea* (38521,47 seeds per m²), *Datura stramonium* (3190,18 seeds per m²), *Setaria italica* (1674,85 seeds per m²), *Celtis occidentalis* (478,53 seeds per m²), *Echinochloa crus-galli* (398,77 seeds per m²), *Lolium multiflorum* (319,02 seeds per m²), *Ambrosia artemisiifolia* (159,51 seeds per m²) and *Iva xanthifolia* (79,75 seeds per m²) (Table 2).

Weed seeds	SUM	NO m ²
<i>Amaranthus retroflexus</i>	542	43226,99
<i>Ambrosia artemisiifolia</i>	2	159,51
<i>Celtis occidentalis</i>	6	478,53
<i>Datura stramonium</i>	40	3190,18
<i>Echinochloa crus-galli</i>	5	398,77
<i>Iva xanthifolia</i>	1	79,75
<i>Lolium multiflorum</i>	4	319,02
<i>Portulaca oleracea</i>	483	38521,47
<i>Setaria italica</i>	21	1674,85

Table 2: Determined invasive weed seeds at Special at Nature Reserve „Ludaško jezero“

SUM- the total number of invasive weed seeds in 25 soil samples at 0-10 depth

NO m² - the total number of invasive weed seeds in all soil samples expressed per m²

Conclusion

Analyzing deposited seed (seed bank) of invasive species in soil in nature protected area were conducted in the representative locations of four protected areas in the north of Serbia Landscape of Outstanding Features Nature Park „Palic“ and Special Nature Reserve „Ludasko jezero“. At the two protected location were determined 17 different seeds of invasive weed species. *Amaranthus retroflexus* and *Portulaca oleracea* were determined in every location. *Amaranthus retroflexus*, *Celtis occidentalis*, *Portulaca oleracea* and *Setaria italica* were determined in very large numbers at each protected location, while a smaller number of seeds remain determined invasive weed species. *Ambrosia artemisiifolia* was determined in large numbers at Special Nature Reserve „Ludaško jezero“.

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