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INVASIVE AND POTENTIALLY INVASIVE ALOGEN PLANTS IN THE AGRICULTURAL CROPS OF OLTENIA

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Abstract

Following the research carried out in the recent years in Oltenia it was found out that there is an affinity between certain invasive allogenic and potentially invasive plant species and cultivated land. The analysis of the presence of these plant species in agricultural crops highlights their presence in large numbers in weeding crops and less in cereal crops. Data on the existence of these plants in agricultural crops in Oltenia territory are sporadically found in several specialized works. The analysis of the floristic spectrum of invasive and potentially invasive allogenic plants in Oltenia`s agricultural crops highlights the presence of some taxa that are on the list of alarming for the European Union (eg. Ailanthus altissima – in vine crops in Dolj and Mehedinți counties and Asclepias syriaca in corn crops in Gorj county). Among the species with a strong impact on the agricultural crops of Otenia we mention: Sorghum halepense (for corn crops), Ambrosia artemisiifolia (for corn, sunflower and watermelon crops) and Galinsoga parviflora (for watermelon crops).

Key words*: allogenic plants, crops, invasive, Oltenia, Romania.*

INTRODUCTION

Invasive species are one of the biggest threats of biodiversity. In 2002 the United Nations Convention on Biological Diversity (CBD) mentioned the need for a global approach on invasive species.

A set of tools with best prevention and and management practices for these plants is presented by Wittenberg et Cock (2001).

The study of the segetal plant species from the agricultural crops of Oltenia attracted the attention of the numerous botanists who roamed the lands in this part of Romania.

The analysis of the research carried out so far shows the presence of invasive and potentially invasive taxa in agricultural crops (Buia, 1939; Păun, 1966; Păun & Pop, 1970; Păun et al., 1975, 1979; Păun & Popescu 1983; Chirilă et al., 1998; Ianovici & Sârbu, 2007; Anastasiu & Negrean, 2005, 2007; Rădutoiu et al., 2010). The species mentioned in the work papers are part of the floristic inventory of each researched region. In the paper prepared by Niculescu & Cismaru (2013) is presented an inventory of invasive species without mentioning the invasive energy and its effect.

Data on the study of segetal weed species are known from different regions of the country (Bujorean et al., 1956; Anghel et al., 1972; Ciocârlan & Chirilă, 1982; Chirilă, 2001, Chirilă et al., 2002; Ciocârlan et al., 2004), but information on invasive and potentially invasive plants in the segetal weed species group is sporadic (Costache & Răduțoiu, 2005, 2006; Răduțoiu & Costache, 2006, 2008; Răduțoiu, 2011; Niculescu & Cismaru, 2013; Răduțoiu et al., 2010; Răduțoiu & Stan, 2013; Răduțoiu & Ștefănescu, 2016; Răduțoiu & Popescu, 2020 - under print).

In addition to invasive and potentially invasive species, various pathogens are part of the category of biotic stress factors for Oltenia agricultural crops (Paraschivu et al., 2014, 2015, 2017, 2019), which have recently grown due to climate change. That is why we consider paying more attention to both factors of biotic stress that cumulatively cause significant damage for crops.

At European level there is a list of invasive species of interest to the EU. Among them are taxa that have an area also in Oltenia (*Asclepias syriaca*, *Elodea nuttallii* and *Impatiens glandulifera*). Globally, there is a database of invasive species.

MATERIALS AND METHODS

Oltenia is one of the most interesting regions of Romania in terms of natural conditions. To the south is placed Oltenia Plain, part of the Romanian Plain which continues to the north with the Getic Piedmont represented by Motru, Jiu and Olteț hills and by the beautiful hilly depressions of Desnățui and Teslui rivers to the south. At the upper part of the Getic Piedmont is the sub-Carpathian depression area that continues with the Meridionali Carpathians (Parâng and Căpățânii Mountains).

The agricultural crops in Oltenia are present from the level of plain region to the sub-Carpathian hills. The substratum of these areas is represented by quaternary loess, alluvium of gravel and sands (at the plain level), sedimentary deposits with very different character (at the level of the piedmont and sub-Carpathians hills).

Soils in areas favorable to agricultural crops in Oltenia are represented by many types and varieties (Popescu, 1975). These varied conditions led to the installation of a varied spontaneous flora.

Data included in this paper were obtained following numerous trips made in different agricultural areas of Oltenia, in Olt, Vâlcea, Mehedinți, Gorj and Dolj counties (127 localities).

There were studied the invasive and potentially invasive allogenic weeds from the following crop groups: straw cereals (wheat, barley, rye), weeding crops (corn, potato, beans, peas), vines, vegetable gardens and tree orchards.

The study was carried out on the itinerary, by geographical regions: Oltenia Plain, Getic Piedmont and the sub-Carpathian depression to cover a wider range of anthropogenic habitats. The itineraries for floristic studies targeted the areas where agricultural crops were well represented. In order to assess the impact of this category of plants on certain areas, stationary studies were also conducted to analyse the populations of identified invasive and potentially invasive species. The diagnosis of the species has been made according to Ciocârlan (2009).

A classification of the most invasive species in the research territory is also made according to the number of localities in which the population typology was found.

RESULTS AND DISCUSSIONS

Following the analysis of the allogenic invasive and potentially invasive species in Oltenia`s agricultural crops regarding the number of localities in which there were identified and their population typology by geographical regions we can say which are the most aggressive of them. The table analysis highlights the large spread in the plain and Getic Piedmont level (Table 1).

Table 1. Invasive and potentially invasive plant species in agricultural crops from Oltenia

Scientific name	Population typology			Crop	Way of introduction	Loc. nr.	Loc. nr. (percent from total)
	Plain	Getic Piedmont	Sub-Carpathian s hills				
Ambrosia artemisiifolia L. (Figure 3)	5	5	3	Pb, V, Gr, Oz, Sec.,Leg., Sunflower	accidentally	127	100%
Sorghum halepense (L.) Pers. (Figure 4)	5	5	3	Pb, V, Gr, Oz, Leg., Sunflower	accidentally	116	100%
Xanthium italicum Moretti	5	5	4	Pb, C, V, Leg.	accidentally	112	97.32%
Conyza canadensis (L.) Cronq.	5	5	4	Leg., Trees	accidentally	97	86.59%
Amaranthus powellii S.Watson	5	5	4	V	accidentally	84	92.85%
Erigeron annuus (L.) Pers. subsp. *strigosus* (Muhl. ex Willd.) Wagenitz (Figure 5)	5	4	5	Gr, Oz, V, Sec.	accidentally	72	90.27%
Amaranthus retroflexus L.	4	4	2	V, Trees	accidentally	71	87.32%
Bassia scoparia (L.) A. J. Scott	4	2	1	Leg.	accidentally	28	50%
Galinsoga parviflora Cav. (Figure 6)	4	5	2	Pb, Leg., Lub.	accidentally	124	91.93%
Cuscuta campestris Yunck. (Figure 7)	4	3	2	Pb	accidentally	66	81.81%
Xanthium spinosum L.	3	2	1	Sunflower	accidentally	42	83.33%
Ailanthus altissima (Mill.) Swingle (Figure 8)	3	3	1	V	accidentally	25	100%
Abutilon theophrasti Medik.	3	3	1	Pb, Leg.	accidentally	102	87.25%
Amaranthus hybridus L.	3	2	1	V	accidentally	24	75%

Scientific name	Population typology			Crop	Way of introduction	Loc. nr.	Loc. nr. (percent from total)
	Plain	Getic Piedmont	Sub-Carpathian s hills				
Veronica persica Poir.	3	3	2	Gr, Oz, Pb, C, Leg., Sec.	accidentally	98	92.85%
Datura stramonium L.	2	2	1	Leg.	accidentally	45	80%
Amaranthus albus L.	2	1	-	Pb, V	accidentally	23	91.30%
Acer negundo L.	1	1	-	V, Trees	accidentally	68	79.41%
Bidens frondosa L.	1	-	-	Lub.	accidentally	76	71.05%
Galinsoga quadriradiata Ruiz et Pav.	2	2	3	Leg., Lub.	accidentally	54	77.77%
Oxalis corniculata L.	2	2	2	Leg.	accidentally	52	86.53%
Oxalis dillenii Jacq.	3	2	1	V, Pb, Sec.	accidentally	85	95.29%
Phytolacca americana L.	2	2	1	Lub., Leg., V	accidentally	75	85.33%
Asclepias syriaca L. (Figure 9)	2	1	4	Pb.	accidentally	4	75%
Lycium barbarum L.	2	2	-	Lub., V	ornamental	34	82.35%

Loc. nr. – number of localities where the species was identified.
Population typology: 1 - solitary individuals; 2 - rare populations, on areas < 10 m^2; 3 - rare populations, on areas > 10 m^2; 4 - dense populations, on areas < 10 m^2; 5 - dense populations, on areas > 10 m^2.
Used shortcuts: V - vine; Pb corn; Leg. – Vegetables (tomatoes, paper, cabbage, onions, cucumbers); Lub. – watermelon; C – Potato; Gr – Wheat; Oz – Barley, Sec. – Rye.

At the level of sub-Carpathians hills some species are represented by solitary individuals or by rare populations, rarely by dense populations on large areas.

If it is made a residence time analysed, we can observe that all the species are neophytes.

The taxonomic analysis highlights the leading place occupied by the Asteraceae family. It is followed by Amaranthaceae, Solanaceae and Oxalidaceae (Table 2). The best represented genera are: Amaranthus (4 species), Xanthium, Galinsoga and Oxalis (with 2 species each).

Table 2. Taxonomic analysis

Family	Nr. genera	Nr. species
Asteraceae	6	8
Amaranthaceae	1	4
Solanaceae	2	2
Oxalidaceae	1	2
Poaceae	1	1
Chenopodiaceae	1	1
Cuscutaceae	1	1
Simaroubaceae	1	1
Malvaceae	1	1
Scrophulariaceae	1	1
Aceraceae	1	1
Phytollacaceae	1	1
Asclepiadaceae	1	1

Cytotaxonomic analysis of invasive and potentially invasive allogenic plant from Oltenia`s agricultural crops highlight the large number of tetraploid species followed by diploid and polyploid ones (Table 3).

Table 3. The analysis of cytotaxonomic

Ploidy degree	Nr. species
Tetraploid	15
Diploid	6
Polyploid	4

The analysis of bioforms highlights the predominance of annual species (Table 4). Although the geophytes have only one representative, it has a good representation in the crops placed at plain and Getic Piedmont level where it causes significant damages.

Table 4. The analysis of life forms

Bioform	Nr. species
Therophyta	18
Phaneropyta	3
Hemicryptophyta	3
Geophyta	1

Of the total invasive and potentially invasive allogenic species in Oltenia`s agricultural crops, 72% originate from America, 20% from Asia and 8% from the Mediterranean (Figure 1).

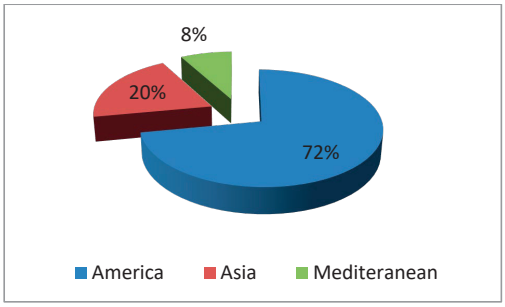

Figure 1. Geoelements spectrum

A good part of these plants (around 70%) are less demanding species compared to the water factor (Figure 2). This explains their development and expansions in this part of Romania, considering the characteristic climatic conditions in the Olteni area,

especially those in the southern part where the water regime is defective.
The large area occupied by agricultural lands in Oltenia are present in the plain region (over 50% of the agricultural area).

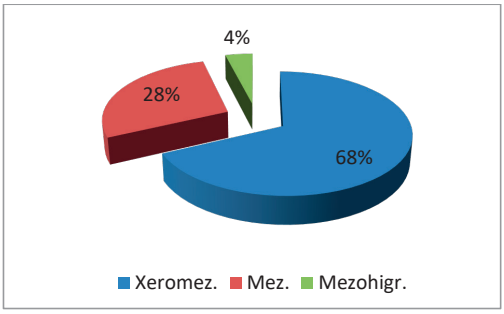

Figure 2. The humidity index spectrum

In some areas a mutual contamination between these species could be observed (ex. *Ambrosia artemisiifolia* installed in a wheat crop was strongly parasitized by *Cuscuta campestris*, aspect mentioned also by Sârbu et al. (2015).

Figure 3. *Ambrosia artemisiifolia* in watermelon culture at the edge of Ghindeni locality

Figure 4. *Sorghum halepense* in cereal culture at the edge of Castranova locality

Figure 5. *Erigeron annuus* in vine culture at the edge of Scăești locality

Figure 6. *Galinsoga parviflora* in watermelon culture in Rojiște locality

Figure 7. *Cuscuta campestris on Ambrosia artemisiifolia* after wheat culture at the edge of Scăești locality

Figure 8. *Ailanthus altissima* in vine culture at the edge of Șimnicul de Sus locality

Figure 9. *Asclepias syriaca* in corn culture at the edge of Tg. Cărbunești locality

CONCLUSIONS

An analysis of the number of individuals of certain invasive allogenic species weed species in a certain crop and the degree of weeding of these crops highlights the predominance of the species belonging to *Poaceae* family (both for straw and hoe crops) and the predominance of the species belonging to *Amaranthaceae* and *Asteraceae* family (for hoe and vegetable crops).

Annual weeds are common in vegetable, hoe and straw crops; the perennials are better represented in autumn crops, vines and tree orchards.

The most harmful and widespread segetal weeds belonging to allogenic species or potentially invasive are: *Sorghum halepense*, *Xanthium italicum*, *Ambrosia artemisiifolia*. In addition, there are species that have a limited spread imposed by ecological conditions (eg. *Abutilon theophrasti* – invasive in corn crops in the Danube meadow and almost absent in the sub-Carpathians piedmonts and hills).

The presence of these plants in agricultural crops brings multiple disadvantages manifested by high yield losses and high costs for control.

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