

PRELIMINARY DATA CONCERNING ALIEN PLANT SPECIES IN AGRICULTURAL CROPS FROM DÂMBOVIȚA COUNTY (ROMANIA)

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Abstract

At the worldwide, the alien plant species represent a real threat to biodiversity and not only it. These species have a negative impact on agriculture, natural habitats, touristic activities, transport industry and human health. Agriculture is one of the most affected economic sector by the alien species, causing the productivity decrease and high economic costs for their prevention, eradication and control.

*This paper presents a briefly review regarding the alien plant species from croplands in Dâmbovița county. The investigation in this territory revealed the presence of 23 allogenic and potentially allogenic plant species that vegetate in different types of agroecosystems, most of them have been recorded in the maize crops. Due to their invasive character, *Ambrosia artemisiifolia*, *Sorghum halepense* and *Xanthium orientale* subsp. *italicum*, with high population densities in some areas, are required specific measures for their control.*

Keywords: allogenic, control, croplands, hotspots, Dâmbovița

1. INTRODUCTION

Invasive alien species (IAS) intentionally or unintentionally introduced by humans in certain regions can become acclimatized, spreading over large areas, having a major impact on natural and anthropogenic ecosystems from an ecological, economic and social point of view (Eschen et al., 2021).

The development of transport infrastructure, the intensification of trade, the abandonment of arable land, the cultivation of blacklisted species in private gardens are the main factors that have favored the infiltration of IAS into agricultural crops and their dissemination over large areas.

The IAS have a negative impact on agricultural productivity and food security (Cook et al., 2011; Kariyawasam et al., 2021) due to their ability to inhibit the germination of crop seeds and their growth (Shrestha and Thapa, 2018), to reduce the soil fertility (Nagabhushan et al., 2022), to disturb the water flow in irrigation channels (European Commission, 2020), or to perturb the livestock production and reduced land value (Gouldthorpe, 2006). Also, the IAS are important vectors of pathogens (Najberek et al., 2022).

The costs for their control or eradication from agricultural crops are high. For example, Pimentel et al. (2005) mentioned that there are 25.000 nonindigenous plant species and the cost for their control reach up to 3000 million dollars only for crop weeds in the USA. Annually, Africa spends approximately 36.34 billion dollars with control of IAS from crops (Eschen et al., 2021). Haubrock et al. (2021) made an ex-haustive study concerning the economic costs of IAS in Italy. According to his study, the amounts for the *Ambrosia artemisiifolia* control were more than 340 million dollars between 1990 and 2020, especially in the northern part of the country.

The continental temperate climate, diversity of landforms and the position of the Dâmbovița county in the southern-central part of Romania had permitted the development of the agriculture as an important economic sector.

According to statistical data provided by the Dâmbovița Agricultural Direction, approximately 61% of the county's territory is agricultural land, of which 70% is arable land, and the rest is cultivated with vines (0.1%) and fruit trees (3.9%). Maize (37.1%) is mainly cultivated on arable land, followed by wheat (18.35%), sunflower (5.7%) and potatoes (5.43%). Vegetable crops have a significant share in the county's agriculture, approximately 5.5% (<https://dadrdambovita.ro/vegetal/>).

Over time, the assortment of agricultural crops diversified in the studied area, as new varieties were introduced, the seed material being imported from abroad or purchased from producers in other areas of the country, which also led to the infiltration and expansion of some IAS in the agricultural crops and not only.

The issue of IAS also involves the permanent dissemination of information related to these species within local communities. On the website of the Dâmbovița Agricultural Direction is a page dedicated only for *Ambrosia artemisiifolia*, where the community can get information about its morphological, biological and ecological features, characteristics habitats, control methods and specific legislation.

The objective of this paper was to evaluate the specific diversity of allogenic flora from the agricultural crops of Dâmbovița county, highlighting the *hotspots* characterized by high population densities where specific measures are required to reduce their impact both on agroecosystems and natural habitats.

2. MATERIALS AND METHODS

The inventory of allogenic and potentially allogenic plant species in Dâmbovița county was carried out during 2020-2022, under the research contract POIM/178/4/1/120008 - Adequate management of invasive species in Romania, in accordance with EU Regulation 1143 /2014 on the prevention and management of the introduction and spread of invasive alien species. The specialized literature was also consulted in which allogenic and potentially allogenic plant species identified over time in Dâmbovița county are mentioned (Flora R.P.R.-R.S.R., 1952-1976; Mirițescu, 1998; Hodișan and Morar, 2008; Sîrbu and Oprea, 2011; Dumitru and Săvescu, 2011; Sîrbu et al., 2013; Hoza et al., 2015).

Field studies were carried out by establishing transects and observation points for which geographical coordinates were noted. Within each observation point, assessments regarding the size of the population were made. Observations were made in agricultural crops (wheat, maize, sunflower, alfalfa, oats, cabbage, potatoes, beetroot, celery, pepper, eggplant, leek, dill, parsley, beans) from 117 localities.

3. RESULTS AND DISCUSSIONS

The research in agricultural crops in Dâmbovița county resulted in the identification of 23 species of allogenic and potentially allogenic plants belonging to 10 families, as follows: **Amaranthaceae** (*Amaranthus emarginatus* Uline & W. L. Bray, *Amaranthus hybridus* L., *Amaranthus powellii* S. Watson, *Amaranthus retroflexus* L.), **Asteraceae** (*Ambrosia artemisiifolia* L., *Erigeron annuus* (L.) Desf subsp. *annuus*, *Erigeron canadensis* L., *Galinsoga parviflora* Cav., *Helianthus tuberosus* L., *Xanthium orientale* L. subsp. *italicum* (Moretti) Greuter, *Xanthium strumarium* L.), **Brassicaceae** (*Brassica juncea* (L.) Czern., *Brassica rapa* L., *Sinapis alba* L.), **Cannabaceae** (*Cannabis sativa* L.), **Convolvulaceae** (*Cuscuta campestris* Yunck.), **Malvaceae** (*Abutilon theophrasti* Medik.), **Plantaginaceae** (*Veronica persica* Poir.), **Poaceae** (*Eriochloa villosa* (Thunb.) Kunth, *Panicum milliaceum* L., *Sorghum halepense* (L.) Pers.), **Portulacaceae** (*Portulaca oleracea* L.), **Solanaceae** (*Datura stramonium* L.).

Most species belong to Asteraceae family (7 sp.), followed by Amaranthaceae (4 sp.), Poaceae (3 sp.), Brassicaceae (3 sp.), the rest containing only one species.

According to their origin, most species come from America (52.17%), predominating those from North America, to which are added taxa that arrived in this area from Asia (21.73%), the Mediterranean region (8.69%) or the tropical one (4.34 %), and for two species the origin is uncertain (8.69%) (fig. 1).

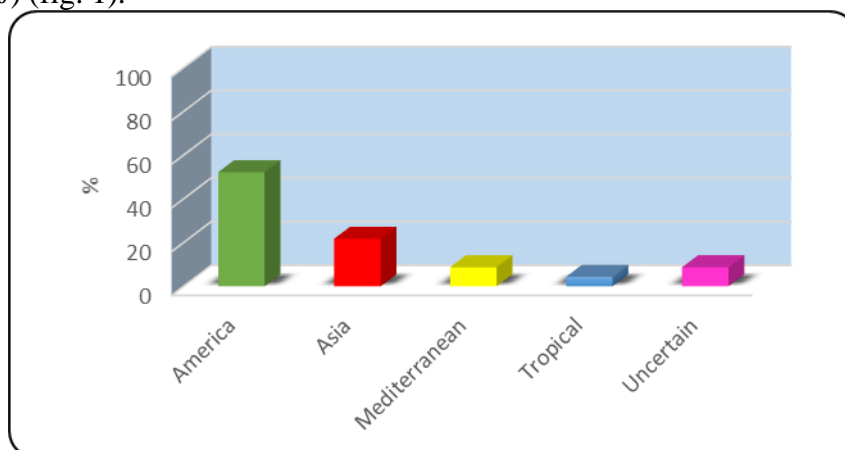


Figure 1. The origin of allogenic and potentially allogenic plants from agricultural crops

There is a preponderance of annually dicotyledonous terophytes in the investigated agricultural crops from Dâmbovița county (91.3%) (fig. 2).

Analyzing the species from the point of view of the introduction period in Romania, the highest percentage is registered by neophytes (73.91%), while archaeophytes (*Cannabis sativa*, *Panicum milliaceum*, *Sinapis alba*, *Portulaca oleracea*) and cryptogenic taxa (*Brassica rapa*, *Abutilon theophrasti*) have much lower percentages 17.39% and 8.6% respectively (fig. 3).

There are 16 invasive and potentially invasive species that were identified in the main crops from Dâmbovița county, most of them being accidentally introduced: *Xanthium orientale* subsp. *italicum*, *X. strumarium*, *Ambrosia artemisiifolia*, *Erigeron annuus* subsp. *annuus*, *E. canadensis*, *Sorghum halepense*, *Amaranthus retroflexus*, *A. powellii*, *Helianthus tuberosus*, *Veronica persica*, *Abutilon theophrasti*, *Datura stramonium*, *Cuscuta campestris*, *Galinsoga parviflora*, *Eriochloa villosa*, *Panicum milliaceum* (Ministerul Mediului, Apelor și Pădurilor & Universitatea din București, 2020).

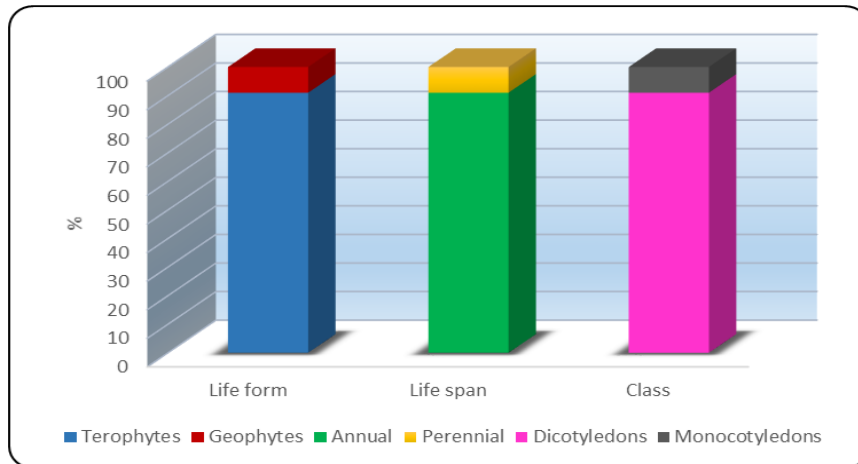


Figure 2. Bioforms spectrum of allogenic and potentially allogenic plants from agricultural crops

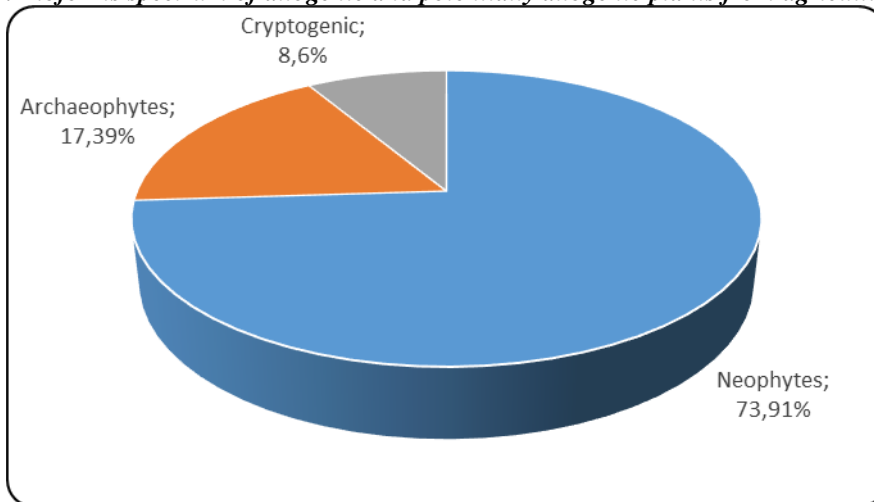


Figure 3. The allogenic and potentially allogenic species distribution according to residence time

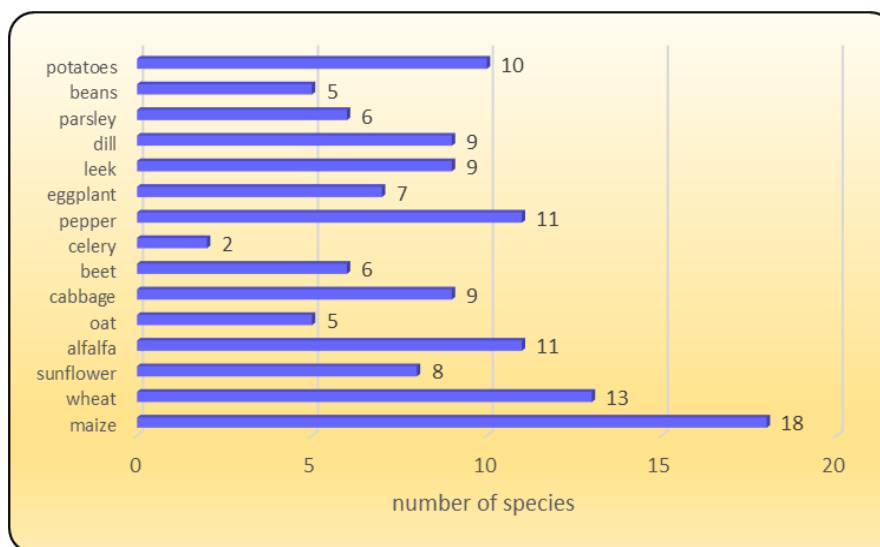


Figure 4. Species distribution according to the crop type

Taking into account the distribution of alien species according to the crop type, the most numerous species are present in the maize crop (18 sp.), followed by the wheat crop (13 sp.), alfalfa (11 sp.), pepper (11 sp.), potatoes (10 sp.), less than 10 species are growing in the rest of the crops (fig. 4, table 1).

Table 1. Allogenic and potentially allogenic species in agricultural crops from Dâmbovița county recorded between 2020-2022

Species	Crops
<i>Abutilon theophrasti</i>	maize, wheat, cabbage, beans, potatoes
<i>Amaranthus hybridus</i>	maize, pepper, eggplant
<i>Amaranthus powellii</i>	maize, wheat, sunflower, alfalfa, pepper, leek, dill, parsley
<i>Amaranthus retroflexus</i>	maize, wheat, alfalfa, oat, cabbage, pepper, leek, dill, parsley, potatoes
<i>Ambrosia artemisiifolia</i>	maize, wheat, sunflower, alfalfa, oat, cabbage, beet, pepper, eggplant, leek, dill, parsley, beans, potatoes
<i>Cannabis sativa</i>	maize
<i>Cuscuta campestris</i>	maize, wheat, alfalfa
<i>Datura stramonium</i>	maize, cabbage, pepper, leek, dill, potatoes
<i>Erigeron annuus</i> subsp. <i>annuus</i>	maize, wheat, sunflower, alfalfa, oat, beet, pepper, eggplant, leek, dill, beans
<i>Erigeron canadensis</i>	maize, wheat, sunflower, alfalfa, cabbage, beet, pepper, leek, dill, potatoes
<i>Eriochloa villosa</i>	wheat
<i>Galinsoga parviflora</i>	maize, wheat, alfalfa, cabbage, pepper, eggplant, leek, dill, parsley, potatoes
<i>Helianthus tuberosus</i>	maize, wheat, sunflower, alfalfa
<i>Panicum milliaceum</i>	maize
<i>Portulaca oleracea</i>	maize, cabbage, beet, celery, pepper, eggplant, leek, dill, parsley, beans, potatoes
<i>Sorghum halepense</i>	maize, wheat, sunflower, alfalfa, oat, cabbage, beet, pepper, eggplant, potatoes
<i>Veronica persica</i>	maize, wheat, sunflower
<i>Xanthium orientale</i> subsp. <i>italicum</i>	maize, wheat, sunflower, alfalfa, oat, cabbage, beet, pepper, eggplant, leek, dill, parsley, beans, potatoes

Ambrosia artemisiifolia, *Erigeron annuus* subsp. *annuus*, *E. canadensis*, *Sorghum halepense*, *Xanthium orientale* subsp. *italicum* are species commonly found in maize, wheat and sunflower crops in Dâmbovița County. *Amaranthus retroflexus* is added to these, often found in maize crop.



Figure 5. *Ambrosia artemisiifolia*: wheat crop in Petrești village (left); sunflower crop in Puțu cu Salcie village (right)



Figure 6. Xanthium orientale subsp. italicum in wheat crop in Săcuieni village (left); Sorghum halepense on uncultivated land between Mărcești and Rățoaia (right)



Figure 7. Cuscuta campestris in sunflower crop in Izvoru village (left); Abutilon theophrasti in abandoned maize crop in Zăvoiu village (right)



Figure 8. Helianthus tuberosus in abandoned wheat crop in Crângurile village

Nowadays, in Dâmbovița county, maize is currently cultivated on the largest area (37%), which also causes the expansion of the area of some IAS, such as *Sorghum halepense*. This aspect was also observed in Hungary by Novak et al. (2009).

Regarding the chorology of allogenic and potentially allogenic species in agricultural crops inventoried from 117 localities of Dâmbovița county, three species are frequent: *Ambrosia artemisiifolia* (69 localities), *Xanthium orientale* subsp. *italicum* (66 localities), *Sorghum halepense* (56 localities). These are the most widespread IAS in the agricultural crops of other areas from Romania like in Oltenia (Răduțoiu and Băloniu, 2021).

After wheat harvesting there is an explosive increase of *Ambrosia artemisiifolia*, *Xanthium orientale* subsp. *italicum* and *Sorghum halepense* populations, on these lands, with over 500 individuals/50 sq. m. Moreover, the highest population densities of these species (100-500 individuals/50 sq. m and over 500 individuals/50 sq. m) were recorded in the southern part of the county where the mild climate offers favorable conditions for their development (fig. 9).

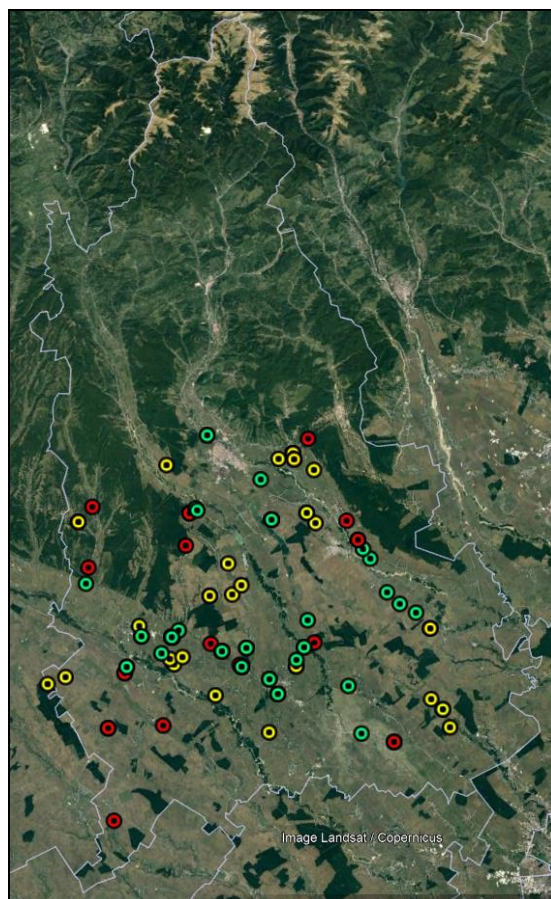


Figure 9. Populations distribution with high densities for *Ambrosia artemisiifolia* (yellow), *Xanthium orientale* subsp. *italicum* (red) and *Sorghum halepense* (green) in Dâmbovița county

There is a similar situation with *Xanthium orientale* subsp. *italicum* in Mureș county, that records large populations of 100-500 individuals and >500 individuals on cultivated or abandoned lands (Oroian et al., 2022).

Ambrosia artemisiifolia has been reported as forming populations with high densities in agricultural crops especially in the western part of the country (Ianovici, 2009). In the studied area, due to herbicides use, when the crop plants are in vegetation, the IAS (*Ambrosia artemisiifolia*, *Sorghum halepense*, *Xanthium orientale* subsp. *italicum*) have representative populations, mainly at the edge of the agricultural crops, forming alignments along the roads.

Uncultivated arable lands are a refuge and, at the same time, a source for spreading of IAS, as we observed in case of *Sorghum halepense*, *Ambrosia artemisiifolia*, *Erigeron annuus* subsp. *annuus* and *Abutilon theophrasti*.

4. CONCLUSIONS

There are 23 allogenic and potentially allogenic plant species that vegetate on the agricultural crops from Dâmbovița county, most of them belonging to Asteraceae family. *Ambrosia artemisiifolia*, *Sorghum halepense* and *Xanthium orientale* subsp. *italicum* are the main IAS recorded frequently on croplands. Most of the IAS have been registered on the maize lands.

Most of the arable lands are cultivated in Dâmbovița county, and the application of weed control methods, especially chemical ones, allowed to kept IAS under control.

However, emphasis should be placed on community accountability concerning lands maintenance that are not cultivated, on which IAS can settle and thrive, representing points of infestation for other areas.

An important role in the success of measures for prevention and control of IAS is played by awareness actions on IAS danger among agricultural producers, traders, and local community through competent institutions.

Effective control measures can be adopted to prevent the expansion of IAS areas by identifying the so-called *hotspots* characterized by large populations.

An adequate management of IAS requires the adoption of prevention and control measures in the early stages of invasion, with the participation of all factors involved in agricultural, touristic, commercial and transport activities (McNeely et al., 2001).

5. ACKNOWLEDGEMENTS

This study was supported by the project POIM/178/4/1/120008 - Adequate management of invasive species in Romania, in accordance with EU Regulation 1143/2014 on the prevention and management of the introduction and spread of invasive alien species.

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