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STUDY CONCERNING ALIEN FLORA FROM DÂMBOVIȚA COUNTY (ROMANIA)

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Abstract
A comprehensive analysis of alien flora from Dâmbovița county (Romania) was performed both on data from literature and personal observations in the field. The assessment of alien flora was focused on taxonomy, species origin, way of introduction, invasiveness status, introduction period, lifespan, bioforms, characteristic habitats and population size. There were identified 187 alien species of which 70 taxa are invasive and potentially invasive. A number of 138 species have been introduced intentionally in the area of Dâmbovița county, most of them being neophytes. There were identified some hotspots where 11 alien taxa have a high density, as follows: Ambrosia artemisiifolia, Sorghum halepense, Amaranthus retroflexus, Erigeron canadensis, Xanthium orientale subsp. *italicum, Reynoutria x bohemica, Solidago canadensis, Reynoutria japonica, Erigeron annuus* subsp. *annuus, Robinia pseudoacacia, Eriochloa villosa. The largest populations of alien species were recorded in natural and anthropogenic habitats such as: railway embankments, roadsides, vacant lands, abandoned arable lands, wastelands, croplands, riparian habitats and degraded grasslands. The information regarding the habitats, size of populations and spreading of alien species are useful in order to take specific measures for their control.*

Keywords: alien flora, Dâmbovița county, Romania

1. INTRODUCTION

The invasive plant species have a major impact on biodiversity: decreasing species diversity and population sizes by hybridization, transmission of diseases, species competition, changing habitat, ecosystem functioning and ecosystem services (Pyšek and Richardson, 2010; Heshmati et al., 2019; Bradley et al., 2019; Middleton, 2019; Langmaier and Lapin, 2020). For example, invasive species may change the light, air and water characteristics in native plant habitats (Middleton (2019). Also, invasive plant species have a significant impact on the human health (Anastasiu and Negrean, 2007; Pyšek and Richardson, 2010; Middleton, 2019; Rai and Singh, 2020).

Anthropogenic disturbances are the prime factors responsible for biotic invasions (Rai and Singh, 2020). Dispersal opportunities, ecological suitability and naturalization in the new habitat facilitate the spread of the alien species in the new region (Rejmanek et al., 2005).

The management of alien plant species involves high costs to the economy. According to Diagne et al. (2021), the global costs of plant invasions are much higher than the US$ 8.9 billion for the period 1970-2017. The research made by Eschen et al. (2021) in Africa revealed that its important

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to develop and implement a management against targeted invasive plant species, safe for the environment and people and adapted to the local circumstances.
According to Anastasiu et al. (2016), the number of alien plant species reported by some authors in Romania is different due to incomplete data from the literature and differences in taxonomical composition of the alien flora. The same authors confirmed that in Romania are 490 neophytes, belonging to 93 families, the most comprehensive being Asteraceae.
The most aggressive species that have a major impact on natural habitats are: *Ailanthus altissima, Azolla filiculoides, Paspalum distichum, Reynoutria japonica* and *Amorpha fruticosa* (Anastasiu and Negrean, 2009).
The research activities carried out so far in Romania emphasize that the most aggressive invasive plant species are *Ambrosia artemisiifolia, Ailanthus altissima* and *Amorpha fruticosa* (Pioarcă-Ciocănea et al., 2020).
The main factors that favored the spreading of alien species in Romania were: development of the commercial activity, development of the transport infrastructure (railway and road infrastructure), cultivation as decorative plants of the alien species, degradation of natural habitats, gaps in the national legislation related to alien species (Hodișan and Morar, 2008; Anastasiu et al., 2009; Anastasiu and Negrean, 2009; Ianovici, 2009; Onete et al., 2015; Grigorescu et al., 2020; Sîrbu et al., 2021).
Invasive alien species are a major threat that requires international cooperation and a multidisciplinary approach at different levels: academic, administrative and local communities (Anastasiu et al., 2016).
In the present, in Romania, it is ongoing an important project whose the main objective is to create scientific and administrative tools for an adequate management of alien species in Romania according to UE Regulation 1143/2014. One of the specific objective of this project is the inventory and mapping of the invasive alien plants (https://invazive.ccmesi.ro/wp-content/uploads/2020/01/Ghid-inventariere_final24112019.pdf).
Updating the distribution of the invasive alien species is required at the level of each Member State of the European Union in order to report to the European Commission of their situation, as referred to in the Article 24(1) of the EU Regulation 1143/2014 (Burduşel et al., 2020).
The aim of this study is to complete the data that refers to the habitats, size of populations and spreading of alien plant species not only at the local, but also at the national level, in order to take specific measures for their control.

2. MATERIALS AND METHODS

Dâmbovița county is situated in the central-southern part of Romania having a surface of approximately 4054 sq. km. The landforms are varied being represented by mountains, hills, plains and meadows. The highest altitude is recorded on the Bucegi Mountains (Omu Peak – 2505 m) and the lowest is in the southern part of Crevedia commune (105 m).
The climate is continental-temperate with average annual temperatures that fluctuates between -2^0C (Omu Peak) and $+10^0$C (Titu). The annual average precipitation ranges from 500-600 mm in southern plains to 1400 mm in mountain area. The geomorphological, pedological and climatic features of the Dâmbovița county are suitable for establishment and spreading of alien species.
The inventory of alien plant species from Dâmbovița county was based both on the data from the literature that refer to this area (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; Dumitru and

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Săvescu, 2014) and our field studies carried out over three years (2019-2021). Most of these studies were carried out, from June to September, as part of 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.*
There were realized itineraries in the field for covering as much as possible a large surface in the county according to the methodology provided in the project (https://invazive.ccmesi.ro/wp-content/uploads/2020/02/POIM_120008_Subactv.-1.1.3._Protocoale.pdf).
The data were collected from different natural and anthropogenic habitats, respectively: roadsides, railway embankments, cemeteries, vacant lands, watercourses, meadows, cultivated land, abandoned arable land, land on which road rehabilitation works have been carried out, backyards, public parks.
Along each itinerary, depending on the terrain configuration, points of observation of 50 m width on the both side of the road were established. The geographical coordinates were reported and processed with Google Earth software, free Pro version, using the coordinate system in LatLong angular format.
The size of the population of each species were noted, using a scale from 1 to 5: 1 (1-20 individuals), 2 (11-50 individuals), 3 (51-100 individuals), 4 (101-500 individuals), 5 (over 501 individuals).
The observations in the field and data from the literature have been integrated in a database of the Access program. The alien cormoflora from Dâmbovița county was analyzed focusing on: taxonomy, species origin, way of introduction, invasiveness status, introduction period, lifespan, bioforms, characteristic habitats, population size.
The taxonomic, biological and ecological analysis was realized according to Sîrbu et al. (2013), Sîrbu and Oprea (2011), but also on the basis of on-line databases Flora Europaea (https://ww2.bgbm.org/EuroPlusMed/query.asp) and The plant list (http://www.theplantlist.org/).
The species origin, way of introduction, invasiveness status and introduction period were taken both from the paper by Sîrbu and Oprea (2011) and from the inventory protocol of invasive and potentially invasive plant species, document available on-line on the site of the project POIM/178/4/1/120008 (https://invazive.ccmesi.ro/wp-content/uploads/2020/02/POIM_120008 Sub actv.-1.1.3._Protocoale.pdf).

3. RESULTS AND DISCUSSIONS

The data regarding alien flora from Dâmbovița county revealed the presence of 187 species (see Supplementary Material 1), belonging to 61 families, 143 genus and 5 hybrids, that represent 27.86% of all allogenic plant species from Romania recorded by Sîrbu et al. (2011). The Asteraceae family has the highest number of species (29 sp.–15.5%), followed by Fabaceae (16 sp.–8.55%), Rosaceae (15 sp.–8.02%), Amaranthaceae (9 sp.–4.81%), Solanaceae (7 sp.–3.74%), Brassicaceae (7 sp.–3.74%) and Poaceae (5 sp.–2.67%). There are 54 families that have less than 5 species (52.97%) (fig. 1).
A number of 70 alien species are invasive and potentially invasive (Ministerul Mediului, Apelor şi Pădurilor & Universitatea din Bucureşti, 2020). Among them, *Impatiens glandulifera* and *Elodea nuttallii* are listed in Regulation no.1263/2017 as species of EU concern, to which is added *Ailanthus altissima* in Regulation no. 1262/2019.
The field observations in 154 localities in Dâmbovița county revealed that the most frequent invasive and potentially invasive species are: *Robinia pseudoacacia* (139 locations), *Xanthium*

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orientale subsp. *italicum* (129 locations), *Erigeron canadensis* (124 locations), *Erigeron annuus* subsp. *annuus* (123 locations), *Prunus cerasifera* (123 locations), *Ambrosia artemisiifolia* (109 locations), *Morus alba* (99 locations), *Sorghum halepense* (92 locations), *Amaranthus retroflexus* (91 locations).

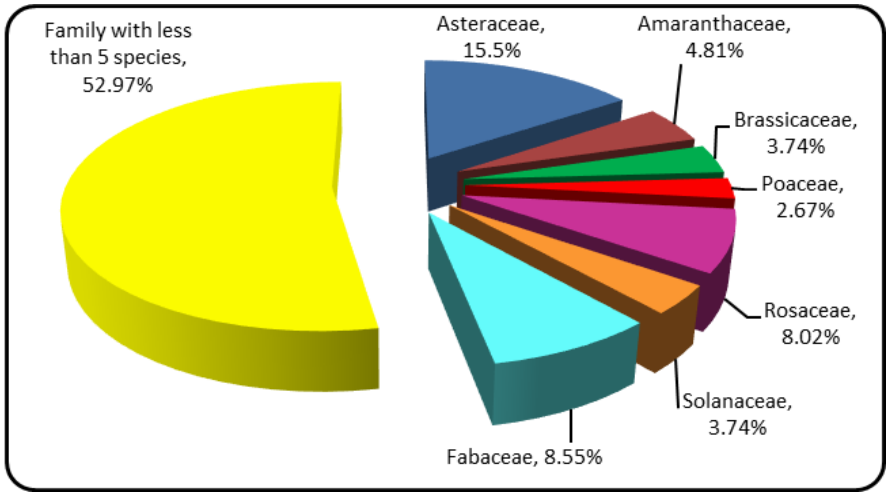

Figure 1. Percentage of alien species recorded in different families

For 19 species have been identified populations with more than 100 individuals/100 sq.m in the natural and anthropogenic habitats (railway embankments, vacant lands, abandoned arable lands, wastelands, agricultural lands, riparian habitats, degraded grasslands) from Dâmbovița county: *Ambrosia artemisiifolia*, *Sorghum halepense*, *Xanthium orientale* subsp. *italicum*, *Erigeron canadensis*, *Erigeron annuus* subsp. *annuus*, *Reynoutria japonica*, *Reynoutria* x *bohemica*, *Veronica persica*, *Impatiens glandulifera*, *Amaranthus retroflexus*, *A. hybridus*, *A. powellii*, *Solidago canadensis*, *Chamaesyce maculata*, *Galinsoga parviflora*, *G. quadriradiata*, *Eriochloa villosa*, *Panicum capillare*, *Helianthus tuberosus*.

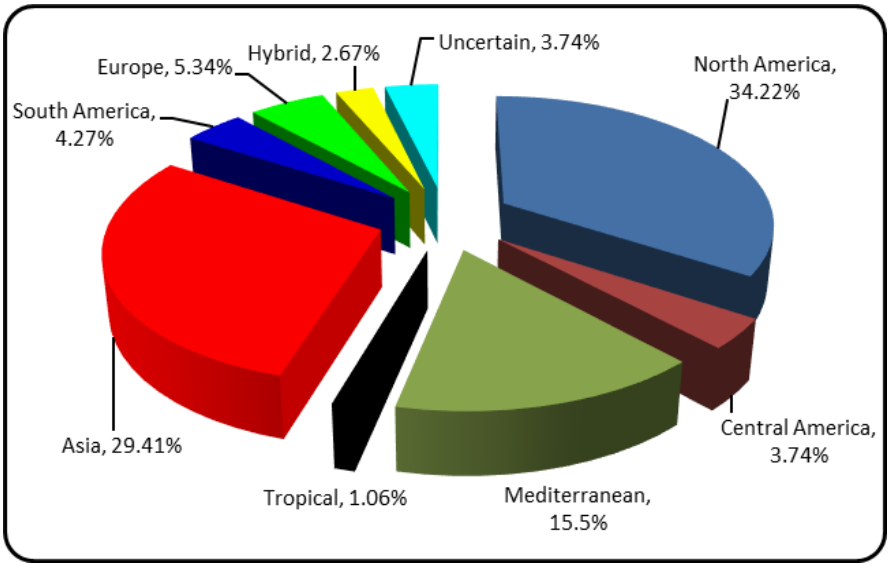

Figure 2. Distribution of alien species according to their geographical origin

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Taking into consideration the species origin, we noticed that the majority of alien species are native to North America (34.22%), Asia (29.41%) and Mediterranean region (15.5%), similarly to the situation at the national level (Anastasiu and Negrean, 2007; Anastasiu and Negrean, 2009; Anastasiu et al., 2016). We can mention also species that came in our country in different periods of time from South America (4.27%), Central America (3.74%) and Tropical region (1.06%). Other taxa are hybrids (2.67%) and for 3.74% of species the origin is uncertain (fig. 2).
The majority of species are angiosperms (95.72%) and dicotyledons (88.77%). As we found out, regarding the life span, perennial taxa are dominant (57.75%), followed by annual (39.57%) and biannual species (2.67%).
Among the life forms, the terophytes and phanerophytes have the highest percentages (40.86%), respectively (38.17%), being accompanying by hemicryptophytes (10.21%), geophytes (3.22%), epiphytes (3.22%), helohidatophytes (2.15%), hemiterophytes (1.07%) and camephytes (1.07%) (fig. 3).
Phanerophytes are represented by shrubs or trees, cultivated either as ornamental or as edible plants. Some of them vegetate at the edge of the forest (*Maclura pomifera, Robinia pseudoacacia, Gleditsia triacanthos, Prunus cerasifera*), on the roadsides (*Gleditsia triacanthos, Ailanthus altissima, Acer negundo, Morus alba, Koelreuteria paniculata, Populus* x *canadensis, Prunus cerasifera*), near the railway embankments (*Acer negundo, Amorpha fruticosa, Robinia pseudoacacia, Morus alba, Gleditsia triacanthos, Prunus cerasifera*) or in riparian habitats (*Ailanthus altissima, Acer negundo, Robinia pseudoacacia, Prunus cerasifera, Morus alba*).
The most cultivated phanerophytes in green spaces from Dâmbovița county are: *Ailanthus altissima, Acer negundo, Fraxinus pennsylvanica, Lonicera japonica, Spiraea* x *vanhouttei, S. japonica, Quercus rubra, Populus* x *canadensis, Morus alba, Prunus cerasifera, Elaeagnus angustifolia, Salix babylonica, Hibiscus syriacus, Chaenomeles japonica, Platycladus orientalis, Buxus sempervirens, Mahonia aquifolium, Symphoricarpos albus*.

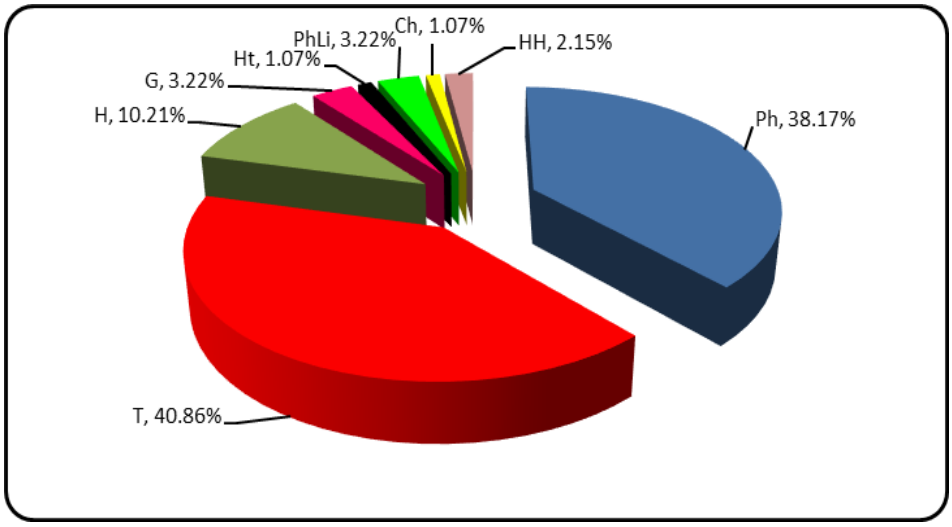

Figure 3. Bioforms spectrum of the alien flora

As regards the residence time, the neophytes are predominant (87.16%). The archaeophytes represent only 10,16% from the all alien species, while cryptogenic taxa registered smallest

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percentages (2,13%) (fig. 4). Most of the archaeophytes are cultivated as ornamental or edible taxa such as: *Prunus laurocerasus, P. persica, P. domestica, Pisum sativum, Panicum milliaceum, Juglans regia, Cydonia oblonga, Castanea sativa, Atriplex hortensis, Aquilegia vulgaris, Antirrhinum majus*.

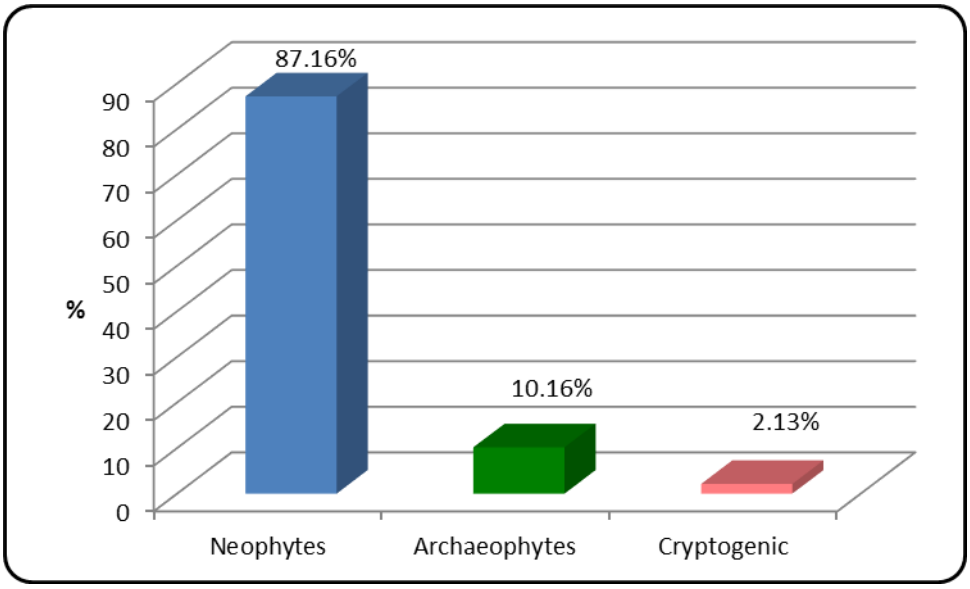

Figure 4. The taxa distribution according to residence time

A high number of alien species (138 sp.) were intentionally introduce in the area of Dâmbovița county as ornamental taxa in green spaces or due to their economic importance for human or animal nutrition. The intensification of commercial transactions was the main factor that favored the accidentally spreading of a number of 48 alien species in this territory. Most of them are weeds in agricultural crops like: *Agrostemma githago, Abutilon theophrasti, Amaranthus retroflexus, A. powellii, A. hybridus, Ambrosia artemisiifolia, Cuscuta campestris, Datura stramonium, Erigeron annuus* subsp. *annuus, E. canadensis, Eriochloa villosa, Sorghum halepense, Xanthium orientale* subsp. *italicum*.

The field observations revealed that there are some *hotspots* where 11 invasive and potentially invasive taxa have populations with a large number of individuals, as follows: *Ambrosia artemisiifolia, Sorghum halepense, Amaranthus retroflexus, Erigeron canadensis, Xanthium orientale* subsp. *italicum, Solidago canadensis, Erigeron annuus* subsp. *annuus, Eriochloa villosa, Reynoutria* x *bohemica, Reynoutria japonica, Robinia pseudoacacia*. The distribution of *hotspots* for alien taxa is represented in figure 5.

Most of the *hotspots* are situated along the roadsides, railway embankments, watercourses or on the degraded meadows, croplands with maize, wheat, sunflower, abandoned arable lands.

There are four alien species for which we have identified more than 9 *hotspots* in Dâmbovița county, such as: *Ambrosia artemisiifolia* (14 *hotspots*), *Erigeron annuus* subsp. *annuus* (10 *hotspots*), *Xanthium orientale* subsp. *italicum* (10 *hotspots*) and *Sorghum halepense* (9 *hotspots*).

Monitoring and application of effective control methods are required to prevent the spreading of these taxa from *hotspots* affecting not only the native flora, but also the fauna.

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Identification of invasion *hotspots* is a pre-requisite for control and management of invasion of alien species (Adhikari et al., 2015).

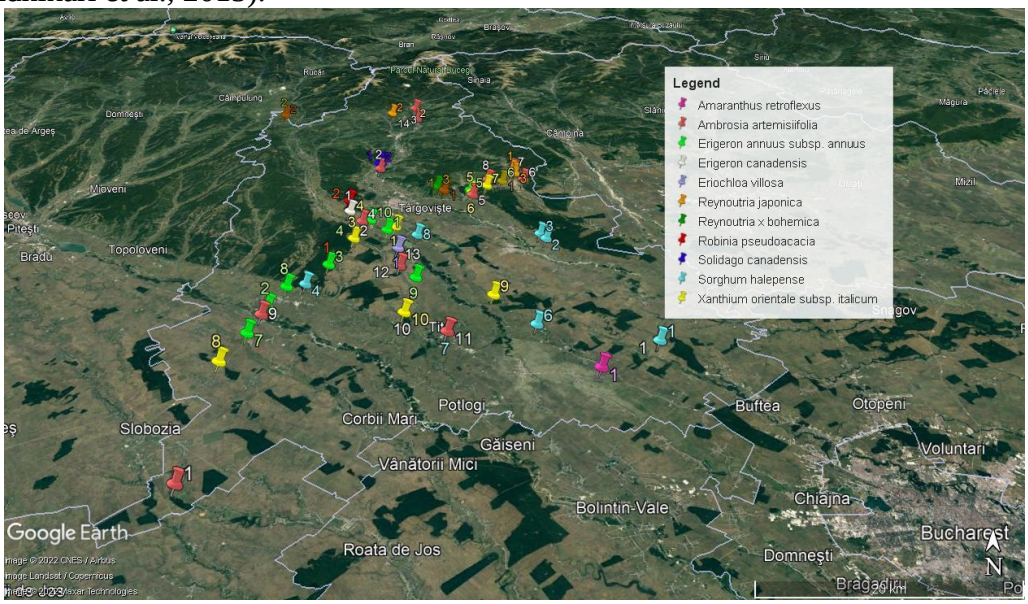

Figure 5. The distribution of hotspots for 11 alien species in Dâmbovița County

Reynoutria japonica and ***Reynoutria* x *bohemica*** were found, mainly, in riparian habitats in the hilly and mountaineous area of Dâmbovița county, covering the banks of watercourses for hundreds of meters in Moreni, Răzvad, Văleni, Runcu, Pucioasa.

In the town of Moreni, the specimens of *Reynoutria japonica* from the banks of Cricovul Dulce were periodically cut at certain points (fig. 6). However, the regeneration capacity is very high and the financial and human resources are insufficient to be able to control this invasive species.

Unfortunately, in the mountainous area, *Reynoutria japonica* borders the banks of the Ialomicioara brook in Runcu commune, thus affecting the habitats with *Alnus glutinosa* and *Fraxinus excelsior* (fig. 6). In these habitats, along with *Reynoutria japonica*, we also report *Xanthium orientale* subsp. *italicum*, *Erigeron canadensis*, *Erigeron annuus* subsp. *annuus*, *Robinia pseudoacacia*, *Impatiens glandulifera* and *Rudbeckia triloba*.

In other parts of Romania, *Reynoutria japonica* was identified in similar habitats like riparian forests and shrubs developed close to the Mureș river (Grigorescu et al., 2020), floodplains, riverbanks from Rodna Mountain National Park, Maramureș Mountains Natural Park (Dumitrașcu et al., 2012; Kucsicsa et al., 2016 cited by Grigorescu et al., 2020).

When *Reynoutria japonica* is established and developed in the riparian area, it might disperse from there laterally invading more areas (agricultural fields, grasslands) like in Arieș Valley (Onete et al., 2015).

Reynoutria japonica has a high extension capacity by developing density of individual stems up to 50/sq.m, that limiting the development of native species (Dumitrașcu et al., 2012).

Reynoutria x *bohemica* grows luxuriantly in the habitats edified by *Salix alba*, *Populus nigra* and *Fraxinus excelsior* on the banks of the Slănic brook (Răzvad commune) and Văleni (fig. 7).

Both *Reynoutria japonica* and *Reynoutria* x *bohemica* are cultivated in the gardens of the locals, but they also are spreaded in cemeteries, vacant lands, roadsides, railway embankments.

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Figure 6. Riparian habitats with Reynoutria japonica (left – Moreni, right – Runcu)

Figure 7. Riparian habitats with Reynoutria x bohemica (left – Răzvad, right – Văleni)

Amorpha fruticosa forms galleries along the irrigation canals of the Odobești, Picior de Munte streams or appears spreaded along the roadsides with *Robinia pseudoacacia, Acer negundo, Prunus cerasifera, Fraxinus pennsylvanica, Gleditsia triacanthos, Morus alba, Koelreuteria paniculata* (fig. 8). It can be found along the railway at Dârza or near the phytocoenoses with *Typha latifolia, Schoenoplectus lacustris* at Morteni, Crevedia.

Figure 8. Amorpha fruticosa along the irrigation canal in Odobești (left); Ailanthus altissima along the Baranga brook – Iazu village (right)

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Ailanthus altissima appears sporadically, cultivated in people's gardens or on the roadside in most localities from Dâmbovița county. We point out the presence of many juveniles of tree of heaven on the roadside, on the canal banks of the watercourses, vacant lands (Doicești thermal power station, Glodeni, between Vulcana Băi and Vulcana Pandele, Iazu, Butimanu, Cătanele), or fruiting specimens (Samurcași, Lucianca) (fig. 8). *Ailanthus altissima* has integrated quite well in the natural habitats with *Alnus glutinosa, Salix alba* and *Populus nigra* from Făgetu. The coenotic affinity for natural habitats was also highlighted by Elorza et al. (2004), who noted the efficiently colonization of riparian forests from Central Spain with *Ailanthus altissima*.

The tree of heaven is frequently cultivated as an ornamental plant in urban areas, as we found in Găești (green spaces, near to railway station) and Târgoviște (along the Calea Domnească Street), which can became centers for spreading the species in neighboring localities. Seeds can be dispersed especially by the wind. However, Kowarik and von der Lippe (2011) demonstrate the importance of road traffic as secondary dispersal mechanism for *Ailanthus altissima*.

Even if it is a species of interest for landscaping, we recommend replacing it with other species that do not have such a high invasive potential.

Robinia pseudoacacia and ***Prunus cerasifera*** are the most frequently observed invasive woody species in the investigated areas, both cultivated in the local's gardens and disseminated along the roadside, railways, riparian and forest habitats. There were identified plantations of black locust on areas of over 2 ha inserted among the forest ecosystems in the hilly area in Picior de Munte, but also alignments along the roadside between Geangoești and Dragomirești or between Vulcana Băi and Vulcana Pandele.

Fraxinus pennsylvanica is cultivated in green spaces, but also on the roadsides where it can form populations between 10-50 individuals as we observed in Ionești, Slobozia Moară, Băleni Români. The green ash is represented by juveniles and fruiting adults in the degraded meadows with *Agrostis capillaris* in the vicinity of the road between Olteni and Viișoara. It forms alignments on the roadside whose length varies between 100 m (Lucianca) and over 1 km (between Butimanu and Lucianca; between Lucieni and Olteni). Among them, *Fraxinus pennsylvanica* is associated with *Acer negundo, Prunus cerasifera, Robinia pseudoacacia, Morus alba, Gleditsia triacanthos, Koelreuteria paniculata*.

Gleditsia triacanthos is cultivated as an ornamental species by the locals, being observed in natural habitats (communities with *Salix alba, Populus nigra* and *Populus alba* from Fierbinți; phytocoenoses with *Alnus glutinosa* and *Salix alba* from Gura Vulcanei; at the edge of oak forests at Moreni, Șuța Seacă). It appears sporadically on the roadside and near the railways in many localities such as Crevedia, Șelaru, Petrești, Broșteni, Săcuieni, Răcari, Bâldana, Tărtășești, Ionești, Șotânga, Vulcana Pandele etc. Sometimes it forms alignments of different lengths from 100-200 m (in Ungureni, Mătăsaru, Voinești) up to 1 km in Doicești, where it is also associated with *Acer negundo* and *Robinia pseudoacacia*.

Helianthus tuberosus is cultivated as an ornamental plant in the local's gardens, from where it has spread on the roadsides, agricultural crops and vacant lands. There are populations of Jerusalem artichoke with over 100 individuals/100 sq. m in the natural habitats edified by *Salix alba* and *Populus nigra* along the watercourses in Bărbulețu.

Ambrosia artemisiifolia forms large populations in the riparian habitats edified by *Populus alba, Populus nigra* and *Fraxinus excelsior* on the Cricovul Dulce riverbanks (Moreni).

The favorable areas for ragweed development (populations with more than 500 individuals/100 sq.m) were the railway embankments (Doicești, Buciumeni, Pietroșița), the vacant lands (Gura

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Ocniței, Moreni), the roadsides (Șelaru, Moreni, Siliștea), agricultural lands, especially those from which triticale were harvested (Sălcuța, Petrești, Gura Ocniței, Olteni, Viișoara) (fig. 9). The ragweed most often borders agricultural lands cultivated with corn, oats, alfalfa, sunflower, peas, cabbage, red pepper and beetroot.

Ambrosia artemisiifolia is spreaded on large surfaces of similar habitats from other parts of Romania (Pele et al., 2006; Anastasiu and Negrean, 2007; Ianovici, 2009; Sîrbu, 2008; Sîrbu and Oprea, 2011). In Romania, there were described typical phytocoenoses with *Ambrosia artemisiifolia* (*Ambrosietum artemisiifoliae* Vițălariu 1973) from the vicinity of the railway embankments and ruderal places around of the railway stations (Sârbu, 2008).

Generally, in Dâmbovița county, *Ambrosia artemisiifolia* is associated with *Xanthium orientale* subsp. *italicum, Sorghum halepense, Amaranthus retroflexus* and *Erigeron canadensis*.

Figure 9. Ambrosia artemisiifolia (left – along the railway embankment – Doicești; right – at the edge of cropland – Gura Ocniței)

Xanthium orientale* subsp. *italicum is a very widespread allogenic species in Dâmbovița county, especially on arable lands cultivated with triticale (Șuța Seacă, Olteni, Viișoara, Săcuieni, Gura Ocniței, Moreni, Crângași), but also along watercourses, in areas where household wastes are deposited (Lucieni, Malu cu Flori) (fig. 10).

Figure 10. Xanthium orientale subsp. italicum on the cropland in Săcuieni (left); Solidago canadensis near the railway in Doicești (right)

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It is a common species along the roadsides together with *Ambrosia artemisiifolia, Erigeron canadensis, Erigeron annuus* subsp. *annuus, Amaranthus retroflexus*.

Solidago canadensis is frequently cultivated in the local's gardens as a decorative plant, being also observed in cemeteries, vacant lands, railway embankments. One of the *hotspot* areas due to the invasiveness of this species is nearby the Doicești thermal power station, extending along the railway to Pucioasa (fig. 10).

Dissemination with *Solidago canadensis* occurs in the communities with *Salix alba, Populus alba* and *Populus nigra* in the Nisipuri and in the riverside coppice with *Alnus glutinosa* and *Fraxinus excelsior* from Fieni. The presence of *Solidago canadensis* in these natural habitats is due to the works of road infrastructure, nearby being a wasteland invaded by *Ambrosia artemisiifolia, Erigeron canadensis, Erigeron annuus* subsp. *annuus, Amaranthus retroflexus, Xanthium orientale* subsp. *italicum*.

If goldenrod specimens are not eliminated, the structure of natural habitats will change over time by reducing the specific diversity. For example, the research of De Groot et al. (2007) in Central Slovenia, in semi-natural habitats, revealed that on invaded plots with goldenrod, the diversity of native plants dramatically decreases, by almost 60 %.

Erigeron annuus subsp. ***annuus*** have a high density in degraded meadows (Picior de Munte), orchards (Gura Ocniței), roadsides (Găești, Punte de Greci, Cătunu, Lucieni), vacant lands (Ionești, Moreni, Șuța Seacă). It is one of the most spreaded invasive alien species not only in Dâmbovița county, but also in Romania, the most affected being grasslands where *Erigeron annuus* subsp. *annuus* forms monodominant stands and substitute the native vegetation (Sîrbu et al., 2016).

In other countries, for example in Croatia, the daisy fleabane has a wide distribution in different habitats (roadsides, grasslands, wastelands, railway embankments, vegetable gardens, agricultural lands, forests) due to its morphological plasticity and a pronounced competitiveness and ruderality (Levačić and Jelaska, 2022).

Eriochloa villosa was identified near the road DC64A in the abandoned arable field of the Raciu commune (Dâmbovița county) on a surface of 11285 sq. m together with *Ambrosia artemisiifolia, Xanthium orientale* subsp. *italicum, Erigeron annuus* subsp. *annuus, Erigeron canadensis* (fig. 11). Maybe the seeds of *Eriochloa villosa* have reached in this area along with the seed material of the maize, wheat or sunflower (Neblea, 2022). More detailed monitoring of adjacent areas to that in which this species was observed is needed.

Figure 11. Eriochloa villosa (left) and Sorghum halepense (right) on an abandoned arable lands

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Sorghum halepense forms large populations, mainly on uncultivated arable lands such as those between Mărcești and Rățoaia, Urziceana, Lucieni, Conțești, Produlești, Sălcuța, Perșinari (fig. 11). It frequently appears in the southern part of the county, on the roadside or on the edge of agricultural crops (corn, sunflower, triticale, oats, cabbage, red peppers).
The largest populations of amaranth species (*Amaranthus retroflexus, A. hybridus, A. powellii*) vegetate on vacant lands (Dârza), near the crop fields with corn, oats, red peppers, beetroots, cabbage, alfalfa (Băleni Sârbi, between Mărcești and Rățoaia, Slobozia Moară, Samurcași) and along the railway embankments (Găești).

4. CONCLUSIONS

The alien flora from Dâmbovița county is very diversified, including more than 180 species and 60 families of cormophytes, Asteraceae family being the most representative.
A number of 70 alien species are invasive and potentially invasive, three of them being mentioned in EU legislation regarding invasive species.
The roadsides, railway embankments, vacant lands, crop lands, public parks are the main anthropogenic habitats for the spreading of alien species.
The most commonly cultivated alien species in public parks, green spaces or local gardens as ornamental plants are: *Ipomoea purpurea, Lonicera japonica, Acer negundo, Ailanthus altissima, Quercus rubra, Reynoutria japonica, Rudbeckia triloba, Calendula officinalis, Callistephus chinensis, Coreopsis tinctoria, Cosmos bipinnatus, Tagetes patula, Helianthus tuberosus, Zinnia elegans, Solidago canadensis, Rhus typhina, Campsis radicans, Bassia scoparia, Platycladus orientalis, Elaeagnus angustifolia, Hemerocallis fulva, Tulipa gesneriana, Oenothera biennis, Parthenocissus inserta, Parthenocissus quinquefolia, Viola* x *wittrockiana, Spiraea* x *vanhouttei, Spiraea japonica, Kerria japonica, Chaenomeles japonica, Antirrhinum majus*.
Reynoutria japonica and *Reynoutria* x *bohemica* are the most harmful alien species in the mountain area.
Ambrosia artemisiifolia, Sorghum halepense, Erigeron annuus subsp. *annuus, Erigeron canadensis, Xanthium orientale* subsp. *italicum, Eriochloa villosa* have the largest populations in the hilly and plain area.
The riparian habitats and meadows are the most natural habitats affected by invasive species such as: *Ailanthus altissima, Solidago canadensis, Reynoutria japonica, Reynoutria* x *bohemica, Impatiens glandulifera, Robinia pseudoacacia, Ambrosia artemisiifolia, Acer negundo, Helianthus tuberosus, Amorpha fruticosa, Galinsoga quadriradiata, Symphyotrichum lanceolatum, Parthenocissus inserta, Erigeron annuus* subsp. *annuus*.
The most harmful alien species on crop lands are: *Ambrosia artemisiifolia, Erigeron canadensis, Xanthium orientale* subsp. *italicum, Amaranthus retroflexus, A. hybridus, A. powellii, Cuscuta campestris, Sorghum halepense, Veronica persica, Eriochloa villosa*.
For an efficient management of invasive species in Dâmbovița county, it is necessary to apply, first of all, appropriate control measures in *hotspots* areas, where invasive species are represented by very large populations.

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SUPPLEMENTARY MATERIAL 1.
List of the alien plant species from Dâmbovița county (Romania)

Amaranthaceae: *Amaranthus albus* L., *Amaranthus blitoides* S. Watson, *Amaranthus blitum* L., *Amaranthus crispus* (Lesp. & Thévenau) J. M. Coult. & Watson, *Amaranthus emarginatus* Uline & W. L. Bray, *Amaranthus hybridus* L., *Amaranthus hypochondriacus* L., *Amaranthus powellii* S. Watson, *Amaranthus retroflexus* L.
Anacardiaceae: *Rhus typhina* L.
Apiaceae: *Anethum graveolens* L., *Levisticum officinale* W. D. J. Koch, *Petroselinum crispum* (Mill.) Fuss
Aquifoliaceae: *Ilex aquifolium* L.
Asteraceae: *Ambrosia artemisiifolia* L., *Artemisia annua* L., *Bidens frondosus* L., *Calendula officinalis* L., *Callistephus chinensis* (L.) Nees, *Coreopsis tinctoria* Nutt., *Cosmos bipinnatus* Cav., *Cyanus segetum* Hill, *Erigeron annuus* (L.) Desf subsp. *annuus*, *Erigeron canadensis* L., *Erechtites hieraciifolius* (L.) DC., *Galinsoga parviflora* Cav., *Galinsoga quadriradiata* Ruiz & Pav., *Helianthus annuus* L., *Helianthus tuberosus* L., *Helminthotheca echioides* (L.) Holub, *Lactuca sativa* L., *Matricaria discoidea* DC., *Rudbeckia laciniata* L., *Rudbeckia triloba* L., *Sigesbeckia orientalis* L., *Solidago canadensis* L., *Solidago gigantea* Aiton, *Symphyotrichum lanceolatum* (Willd.) G. L. Nesom, *Tagetes patula* L., *Xanthium orientale* L. subsp. *italicum* (Moretti) Greuter, *Xanthium spinosum* L., *Xanthium strumarium* L., *Zinnia elegans* Jacq.
Balsaminaceae: *Impatiens glandulifera* Royle, *Impatiens parviflora* DC.
Berberidaceae: *Mahonia aquifolium* (Pursh) Nutt.
Bignoniaceae: *Campsis radicans* (L.) Seem., *Catalpa bignonioides* Walter
Brassicaceae: *Armoracia rusticana* P. Gaertn., B. Mey. & Scherb., *Brassica juncea* (L.) Czern., *Brassica nigra* (L.) K. Koch, *Brassica oleracea* L., *Brassica rapa* L., *Lunaria annua* L., *Sinapis alba* L.
Buxaceae: *Buxus sempervirens* L.
Cannabaceae: *Cannabis sativa* L.
Caprifoliaceae: *Lonicera japonica* Thunb., *Symphoricarpos albus* (L.) S. F. Blake
Caryophyllaceae: *Agrostemma githago* L., *Dianthus barbatus* L., *Dianthus caryophyllus* L.
Chenopodiaceae: *Bassia scoparia* (L.) A. J. Scott, *Atriplex hortensis* L., *Atriplex micrantha* Ledeb., *Dysphania botrys* (L.) Mosyakin & Clemants
Commelinaceae: *Commelina communis* L.
Convolvulaceae: *Cuscuta campestris* Yunck., *Ipomoea purpurea* (L.) Roth
Cucurbitaceae: *Cucumis sativus* L., *Cucurbita pepo* L., *Sicyos angulatus* L.
Cupressaceae: *Juniperus virginiana* L., *Platycladus orientalis* (L.) Franco, *Taxodium distichum* (L.) Rich.
Cyperaceae: *Cladium mariscus* (L.) Pohl
Elaeagnaceae: *Elaeagnus angustifolia* L.
Euphorbiaceae: *Euphorbia maculata* L.
Fabaceae: *Amorpha fruticosa* L., *Caragana arborescens* Lam., *Cercis siliquastrum* L., *Colutea arborescens* L., *Cytisus scoparius* (L.) Link, *Gleditsia triacanthos* L., *Gymnocladus dioica* (L.) K. Koch, *Lathyrus aphaca* L., *Medicago sativa* L., *Pisum sativum* L., *Robinia hispida* L., *Robinia pseudoacacia* L., *Spartium junceum* L., *Styphnolobium japonicum* (L.) Schott, *Vicia sativa* L., *Wisteria sinensis* (Sims) Sweet

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Fagaceae: *Castanea sativa* Mill., *Quercus rubra* L.
Ginkgoaceae: *Ginkgo biloba* L.
Grossulariaceae: *Ribes aureum* Pursh, *Ribes rubrum* L.
Hemerocallidaceae: *Hemerocallis fulva* (L.) L.
Hippocastanaceae: *Aesculus hippocastanum* L.
Hydrangeaceae: *Philadelphus coronarius* L.
Hydrocharitaceae: *Elodea canadensis* Michx., *Elodea nuttallii* (Planch.) H. St. John, *Vallisneria spiralis* L.
Juglandaceae: *Juglans regia* L.
Juncaceae: *Juncus tenuis* Willd.
Lamiaceae: *Elsholtzia ciliata* (Thunb.) Hyl., *Lavandula angustifolia* Mill., *Melissa officinalis* L.
Liliaceae: *Tulipa gesneriana* L.
Linaceae: *Linum usitatissimum* L.
Lythraceae: *Punica granatum* L.
Malvaceae: *Abutilon theophrasti* Medik., *Alcea rosea* L., *Hibiscus syriacus* L.
Moraceae: *Ficus carica* L., *Maclura pomifera* (Raf.) C. K. Schneid., *Morus alba* L., *Morus nigra* L.
Oleaceae: *Fraxinus americana* L., *Fraxinus pennsylvanica* Marsh., *Syringa persica* L.
Onagraceae: *Oenothera biennis* L., *Oenothera glazioviana* Micheli
Oxalidaceae: *Oxalis corniculata* L., *Oxalis dillenii* Jacq., *Oxalis stricta* L.
Paulowniaceae: *Paulownia tomentosa* Steud.
Phytolaccaceae: *Phytolacca americana* L.
Pinaceae: *Pinus ponderosa* Douglas ex C. Lawson, *Pinus strobus* L., *Pseudotsuga menziesii* (Mirb.) Franco
Plantaginaceae: *Antirrhinum majus* L., *Cymbalaria muralis* P. Gaertn., B. Mey. & Scherb., *Veronica persica* Poir.
Platanaceae: *Platanus* x *acerifolia* (Aiton) Willd.
Poaceae: *Eriochloa villosa* (Thunb.) Kunth, *Panicum capillare* L., *Panicum milliaceum* L., *Sorghum halepense* (L.) Pers., *Zea mays* L.
Polygonaceae: *Persicaria orientalis* (L.) Spach, *Reynoutria x bohemica* Chrtek et Chrtková, *Reynoutria japonica* Houtt.
Portulacaceae: *Portulaca grandiflora* Hook., *Portulaca oleracea* L.
Ranunculaceae: *Aquilegia vulgaris* L., *Clematis viticella* L.
Rosaceae: *Chaenomeles japonica* (Thunb.) Lindl. ex Spach, *Crataegus germanica* (L.) Kuntze, *Cydonia oblonga* Mill., *Kerria japonica* (L.) DC., *Prunus armeniaca* L., *Prunus cerasifera* Ehrh., *Prunus domestica* L., *Prunus laurocerasus* L., *Prunus persica* (L.) Batsch, *Prunus serotina* Ehrh., *Rosa centifolia* L., *Rosa rugosa* Thunb., *Sorbaria sorbifolia* (L.) A. Braun, *Spiraea* x *vanhouttei* (Briot) Carrišre, *Spiraea japonica* L. f.
Rutaceae: *Ptelea trifoliata* L.
Salicaceae: *Populus x canadensis* Moench, *Populus simonii* Carriére, *Salix babylonica* L.
Salviniaceae: *Azolla filiculoides* Lam.
Sapindaceae: *Acer negundo* L., *Acer saccharinum* L., *Koelreuteria paniculata* Laxm.
Scrophulariaceae: *Buddleja davidii* Franch.
Simaroubaceae: *Ailanthus altissima* (Mill.) Swingle

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Solanaceae: *Capsicum annuum* L., *Datura stramonium* L., *Lycium barbarum* L., *Lycopersicon esculentum* Mill., *Petunia integrifolia* (Hook.) Schinz & Thell., *Physalis alkekengi* L., *Solanum tuberosum* L.
Tamaricaceae: *Tamarix tetrandra* Pall. ex M. Bieb.
Ulmaceae: *Ulmus pumila* L.
Violaceae: *Viola* x *wittrockiana* Gams
Vitaceae: *Parthenocissus inserta* (A. Kern.) Fritsch, *Parthenocissus quinquefolia* (L.) Planch., *Parthenocissus tricuspidata* (Siebold & Zucc.) Planch.

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