Scientific Papers. Series A. Agronomy, Vol. LXVI, No. 1, 2023
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

THE ALLUVIAL FOREST VEGETATION DISTURBED BY THE INVASIVE ALIEN PLANTS, IN THE DANUBE VALLEY, BETWEEN CETATE AND CALAFAT

Mariana NICULESCU

University of Craiova, Faculty of Agronomy, 19 Libertatii Street, Craiova, Romania

Corresponding author email: mniculescum@yahoo.com

Abstract

Invasive species have a negative impact on forest, grassland, and agricultural ecosystems around the world, sometimes associating and forming segetal or ruderal plant communities. Exotic species compete with native species and threaten ecosystem stability. The paper presents the results of the investigations carried out in the alluvial forest vegetation in the Danube Valley from Oltenia, between Cetate and Calafat. In this region, the intensive abiotic activity, but not only that, has brought about the invasion of allochtone (invasive alien) species plants in the natural and semi-natural degraded ecosystems, especially in alluvial forest habitats. The species has been found in the following types of natural habitats: 91E0 - Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae); 92A0 - Salix alba and Populus alba galleries; 91F0 - Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia along the great rivers (Ulmenion minoris); 91I0* - Euro-Siberian steppic woods with Quercus spp.*

Key words*: invasive species, habitats, Oltenia, biodiversity, alluvial vegetation.*

INTRODUCTION

Invasive species have a negative impact on forest, grassland, and agricultural ecosystems around the world, sometimes associating and forming segetal or ruderal plant communities. Exotic species compete with native species and threaten ecosystem stability.

The studies on alien species are of particular interest today to protect natural habitats and reduce or eliminate ecological and economic damage. Invasive species are one of the most serious threats to biodiversity (Niculescu et al., 2017). The territory under study, located in the Danube Valley between the towns of Cetate and Calafat, is characterized by the existence of a high and permanent anthropogenic impact due to intense river transport, agricultural activities in the area, household activities and not least those carried out for tourist and recreational purposes. Invasive plant species and more have taken over more and more extensive territories in this territory. Also, the floods of recent years have influenced their spread in all types of habitat.

The most affected habitats in the Danube Valley are forest and aquatic habitats, swamps and tall grasses. In order to stop the spread of invasive plant species, it is first necessary to carry out inventory and monitoring actions in order to be able to find and then apply the most correct and sustainable measures to combat and at the same time restore the favorable conservation status of the affected habitats.

MATERIALS AND METHODS

Study area

The paper presents the results of the investigations carried out in the alluvial forest vegetation in the Danube Valley from Oltenia, between Cetate and Calafat (Figure 1).

Most of this territory is located within the four protected natural areas in southern Romania: ROSAC0045 Coridorul Jiului and ROSAC0039 Ciuperceni-Desa și ROSPA 0013 Calafat-Ciuperceni-Dunăre, ROSPA0023 Jiu-Danube Confluence.

Methods

The conspectus of the invasive alien plants in the study area from Danube Valley has been elaborated on the basis of personal researches undertaken since april-september in the period 2019-2022, as well as the little bibliographical information regarding this field.

In order to identify the species and the inter-taxa, we looked into: Romanian Flora, vols. I-XII (1952-1976) and Flora Europaea, vols. I-V (Tutin et al., 1964-1980; 1993).
Also to identify the invasive alien plants in the area study protected area we used the: Plante adventive in flora României (Sîrbu & Oprea, 2011).

Figure 1. Map of study area
(Source: https://earth.google.com/)

For the classification of the vegetal associations, we have used synthesis papers by Rodwell et al. (2002).

RESULTS AND DISCUSSIONS

Regarding the the invasive alien plants we found in the study area from the Danube Valley a number of 49 species.
These species are found in the floristic composition of the following types of natural habitats:

- 91E0* - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-padion, Alnion incanae, Salicion albae*); CLAS. PAL.: 44.3, 44.2 and 44.13 (Gafta & Mountford - coord., 2008);
- 92A0 - *Salix alba* and *Populus alba* galleries, CLAS. PAL.: 44.141, 44.162 şi 44.6 (Gafta & Mountford - coord., 2008);
- 91F0 - Riparian mixed forests of *Quercus robur, Ulmus laevis* and *Ulmus minor, Fraxinus excelsior* or *Fraxinus angustifolia* along the great rivers (*Ulmenion minoris*), CLAS. PAL.: 44.4 (Gafta & Mountford - coord., 2008).

At the level of these habitats this invasive alien plants represents pressure and threats for the entire biodiversity.
Most of invasive species are highly aggressive and damaging ecosystems and is characterized by great dominance-abundance within some phytocoenotic (Niculescu et al., 2010; 2011).
The invasive alien plants identified in this area, after their introduction way, belong to two distinct categories: hemerophytes (deliberately introduced plants) and xenophytes (accidentally introduced plants) (Sîrbu, 2004; Sârbu & Oprea, 2011; Niculescu et al., 2012; 2016; Niculescu & Cismaru, 2013).
In Table 1 are presented the invasive alien plants identified in the alluvial forest vegetation, in the Danube Valley, between Cetate and Calafat.

Aspects regarding the vegetation edified by invasive alien plants in the in the studied territory

In phyto-sociological terms, the invasive alien plants can be one of the representative species, characteristic, dominant or accompanying to more plant communities:

1. *Stellario nemori-Alnetum glutinosae* (Lohmeyer,1957);
2. *Salicetum fragilis* (Passarge, 1957);
3. *Salicetum albae* (Issler, 1924);
4. *Quercetum roboris-pedunculiflorae* (Simon, 1960) (Syn.: *Fraxino angustifoliae-Quercetu pedunculiflorae* (Chifu et al., 1998; 2006);
5. *Fraxino pallisae-Quercetum pedunculiflorae* (Popescu et al., 1979; Oprea, 1997);
6. *Salici-Populetum* (Meijer-Drees, 1936; Rodwell et al., 2002).

The most aggressive species from an invasive point of view, which are represented by populations with many individuals, with a high spreading power, very prolific, with individuals that have a high reproductive power, very vigorous and with increased viability are: *Amorpha fruticosa, Ailanthus altissima, Ambrosia artemisiifolia, Phytolacca americana, Conyza canadensis, Aster lanceolatus, Reynoutria x bohemica, Echinocystis lobata, Helianthus* tuberosus

(Figure 2), *Erigeron annuus, Acer negundo, Sicyos angulatus* (Figure 3), *Lycium barbarum*, *Oenothera glazioviana.*
Invasive plant species were introduced intentionally (hemerophyte) or accidentally (xenophyte).

Figure 2. *Helianthus tuberosus* in the Danube Valley (foto: Mariana Niculescu)

Figure 3. *Sicyos angulatus* in the Danube Valley (foto: Mariana Niculescu)

Amorpha fruticosa (Figure 4) most often forms continuous strips of considerable width and very difficult to cross in meadow forest habitats, both at the edge and inside them.
Ambrosia artemisiifolia (Figure 5) is also a species with an extremely high invasiveness.
It is a phytosanitary quarantine species, very aggressive. The species is distributed both in grassy habitats and in forest and scrub habitats, changing the floristic composition of the plant communities in which it is found.
This species has in recent years conquered vast territories in the Danube meadow from the disputed territory and beyond, being a species that is very difficult to combat, continuously expanding and with negative effects not only in horticulture and agriculture, but also in terms of the condition of population health, since the number of people with allergies produced by this species is constantly increasing at the national and European level.

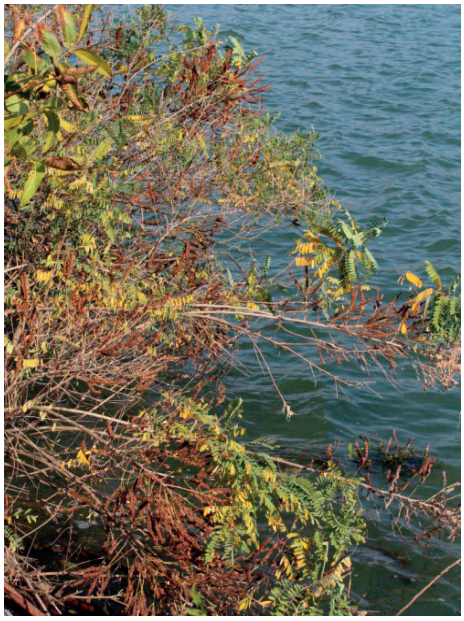

Figure 4. *Amorpha fruticosa* in the Danube Valley (foto: Mariana Niculescu)

Figure 5. *Ambrosia artemisiifolia* in the Danube Valley (foto: Mariana Niculescu)

Ailanthus altissima (Figure 6) has spread a lot in recent years in all habitats in the southwestern part of the country, being very difficult to combat due to the high content of seeds produced by a single plant and their very high germination powers as well as their very high adaptability to the climate changes of recent years.

Figure 6. *Ailanthus altissima* in the Danube Valley (foto: Mariana Niculescu)

Ailanthus altissima has spread a lot in recent years in all habitats in the southwestern part of the country, being very difficult to combat due to the high content of seeds produced by a single plant and their very high germination powers as well as their very high adaptability to the climate changes of recent years.

Table 1. Invasive plant species identified in forest habitats in the studied territory

Taxon	**Family**	**Introduction type**	**Natura 2000 Habitats**
Acer negundo L.	Aceraceae	hemerophyte	91E0*, 91F0
Alcea rosea L.	Malvaceae	hemerophyte	91E0*
Ailanthus altissima (Miller) Swingle	Simaroubaceae	hemerophyte	91E0*, 91F0, 92A0
Ambrosia artemisiifolia L.	Asteraceae	xenophyte	91E0*, 91F0, 92A0
Amorpha fruticosa L.	Fabaceae	hemerophyte	91E0*, 91F0, 92A0
Armoracia rusticana P. Gaertner, B. Meyer et Scherb	Brassicaceae	hemerophyte	92A0
Artemisia annua L.	Asteracea	xenophyte	Woodland light, forest edges, 91E0*, 91F0
Aster lanceolatus Willd.	Asteraceae	xenophyte	Woodland light, forest edges, 91E0*, 91F0
Bidens frondosa L.	Asteraceae	xenophyte	Woodland light, forest edges, 91E0*, 91F0, 92A0
Chenopodium ambosioides L	Chenopodiaceae	xenophyte	Woodland light, forest edges, 91E0*
Conyza canadensis (L.) Cronq. (L.) Cronquist	Asteraceae	xenophyte	91E0*, 91F0, 92A0
C. sumatremsis Retz.	Asteraceae	xenophyte	Woodland light, forest edges, 91E0*, 91F0, 92A0
Cosmos bipinnatus Cav.	Asteraceae	hemerophyte	Woodland light, forest edges, 92A0
Cyperus diformis L.	Cyperaceae	xenophyte	Woodland light, forest edges, canals and ponds in forests, 91E0*, 92A0
Datura wrightii Regel	Solanaceae	hemerophyte	Forest edges, 92A0
Echinocloa colona (L.) Link.	Poaceae	xenophyte	Forest edges, 92A0
Echinocystis lobata (Michx.) Torr. & A.Gray	Cucurbitaceae	hemerophyte	91E0*, 91F0, 92A0
Eclipta prostrata (L.) L. (*E. alba* L.) Hassk.)	Asteraceae	xenophyte	Forest edges, 92A0
Eigeron annuus (L.) Pers.	Asteraceae	xenophyte	91E0*, 91F0, 92A0
Fallopia dumetorum	Polygonaceae	hemerophyte	91E0*, 91F0, 92A0
Fraxinus pensylvanica Marshall (*F. pensylvanica* var. *lanceolata* (Borkh.) Sarg.; *F. lanceolata* Borkh.; *F. pubescens* Lam.)	Oleaceae	hemerophyte	91E0*, 91F0, 92A0
Galinsoga parviflora Cav.	Asteraceae	xenophyte	Woodland light, forest edges, canals and ponds in forests, 91E0*, 92A0
Galinsoga quadriradiata Ruiz et Pav.	Asteraceae	xenophyte	Woodland light, forest edges, canals and ponds in forests, 91E0*, 92A0
Helianthus tuberosus L.	Asteraceae	hemerophyte	Woodland light, forest edges, canals and ponds in forests, 91E0*, 92A0*
Ipomea purpurea Roth.	Convolvulaceae	hemerophyte	Forest edges, 92A0
Iva xanthifolia Rott.	Asteraceae	xenophyte	Forest edges, 92A0
Juncus tenuis Willd	Juncaceae	xenophyte	Woodland light, forest edges, canals and ponds in forests, 91E0*, 92A0*
Kochia scoparia (L.) Shrad. (*Bassia scoparia* (L.) A. J. Scott., *Chenopodium scoparia* (L.)	Chenopodiaceae	xenophyte	Forest edges, 92A0
Lycium barbarum L.	Solanaceae	hemerophyte	91E0*, 91F0, 92A0
Mentha spicata L. (*Mentha viridis* L.)	Lamiaceae	xenophyte	91E0*, 91F0, 92A0

Taxon	Family	Introduction type	Natura 2000 Habitats
Morus alba L.	Moraceae	hemerophyte	91E0*, 91F0, 92A0
Oenothera glazioviana Micheli	Onagraceae	xenophyte	91E0*, 92A0
Oxalix corniculata L.	Oxalidaceae	xenophyte	91E0*, 92A0
Oxalis stricta L. (*O. europaea* Jord.)	Oxalidaceae	xenophyte	91E0*, 92A0
Panicum capillare L.	Poaceae	hemerophyte	Forest edges, 92A0
Panicum miliaceum L.	Poaceae	hemerophyte	Forest edges, 92A0
Physalis alkekengi L.	Solanaceae	xenophyte	91E0*
Phytolacca americana L.	Phytolaccacea	hemerophyte	9130, 91E0*
Parthenocissus quinquefolia (L.) Planchon	Vitaceae	hemerophyte	91E0*
Polygonum orientale L.	Polygonaceae	hemerophyte	91E0*
Reynoutria x bohemica Houtt.	Polygonaceae	hemerophyte	91E0*, 92A0
Robinia pseudaccacia L.	Fabaceae	hemerophyte	91E0*, 92A0*
Solidago canadensis L.	Asteraceae	hemerophyte	Forest edges, 92A0*
Sicyos angulatus	Cucurbitaceae	hemerophyte	91E0*, 91F0, 92A0
Symphyotrichum lanceolatum Willd. (*Aster lanceolatum* (Willd.) G. L. Nesom)	Asteraceae	hemerophyte	91E0*, 92A0
Tanacetum parthenium (L.) Schultz Bip.	Asteraceae	xenophyte	Forest edges, 92A0*
Trigonella caerulea (Lam.) Ser. in DC	Fabaceae	xenophyte	Forest edges, 92A0*
Xanthium strumarium L.	Asteraceae	xenophyte	Woodland light, 91E0*
Xanthium orientale L. ssp. *italicum* (Moretti) Greuter	Asteraceae	xenophyte	Woodland light, 91E0*

CONCLUSIONS

Invasive species have a negative impact on forest, grassland, and agricultural ecosystems around the world, sometimes associating and forming segetal or ruderal plant communities. Exotic species compete with native species and threaten ecosystem stability.

The studies on alien species are of particular interest today to protect natural habitats and reduce or eliminate ecological and economic damage.

Numerous species identified in the researched territory develop explosively and have a very high tendency to destabilize the habitats from the point of view of physiognomy and floristic composition as well as from the syndynamic and conservative point of view.

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