

## INVASIVE PLANTS IN THE FLORA OF MUREȘ COUNTY

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**Abstract:** Invasive plants are those species that are capable of rapidly spreading at great distances from parent plants. Because of them, agriculture pays a huge annual tribute. These invasive plants might shortly become the most widely spread and destructive, as they seem to take best advantage from climate changes. They have a high phytocoenological competition capacity and rapidly adapt to new life conditions to the detriment of native plants.

This paper aims to inform of the phenomenon of invasion of these alien plants, of their distribution and abundance in certain areas in Mureș County. If the monitoring of invasive plants receives particular international attention, in the Mureș County there is no concern for monitoring their invasion, for limiting their negative effects on the environment and human economy.

The most rapacious and common invasive plants in the studied territory are presented in the paper.

Because these species already occupy extremely large surfaces, the measures for fighting them are difficult and costly, and long-term measures for their control and elimination are required.

**Key words:** invasive plants, flora, Mureș County

### Introduction

Invasive species are an increasing major threat to indigenous biodiversity in Europe and worldwide.

Plant invasions are mainly caused by the intensification of economic branches such as transportation, trade, tourism, on the one hand, and by biological factors (absence of limiting factors) and climatological changes, on the other hand [ANASTASIU & NEGREAN, 2007; EASTWOOD, 2001].

Adventive plants are spontaneous or subspontaneous plants whose presence in a certain area is due to their accidental or intentional introduction as a result of human activity [RICHARDSON & al. 2000; PYŠEK & al. 2002].

Invasive plants are plants that are capable of rapidly spreading, at great distances from parental plants. Because of them, agriculture pays a huge annual tribute. Invasive plants might shortly become the most widely spread and destructive, as they seem to take best advantage from climate changes. They have a high phytocoenological competition capacity and rapidly adapt to new life conditions to the detriment of native plants.

These invasive plants manage to replace native species that have already adapted to local soil and climate conditions over the years, this invasion process being always correlated with the anthropic factor and inadequate ecosystem exploitation methods. Invasive species affect biodiversity by competing with other organisms and by changing the structure of the habitat [McNEELY & al. 2001], by the fact that they are toxic, carry parasites or are vectors for pathogenic agents, by hybridization with related species or

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varieties, by altering the local trophic network; for example, invasive plants change the availability of nutrients, disturbing pollination and causing the disappearance of indigenous species; they alter the ecosystem by changing energy and nutrient flows, as well as physical factors within habitats and ecosystems [LEVINE & al. 2003].

According to LAMBDON & al. (2008), 5789 alien vascular plant species have been so far identified in Europe, of which 2843 are alien to Europe. Of these 1507 and 872, respectively, are casual in all regions where they occur, and 29 and 8, respectively, cryptogenic; for 504 and 183 species, respectively, the naturalization status is uncertain. There are in total 3749 naturalized aliens recorded in Europe and 1780 alien to Europe. Of adventive species, approximately 65% are naturalized.

PYŠEK et al. (2009) emphasize the presence of a continuous influx of alien species in Europe over the past decades.

If the monitoring of invasive plants receives particular international attention, in Mureș County there is no concern for monitoring their invasion, for limiting their negative effects on the environment and human economy.

Because these species already occupy extremely large surfaces, the measures for fighting them are difficult and costly, and long-term measures for their control and elimination are required.

In Romania, adventive species represent 11.5% of the national flora [CIOCĂRLAN, 2000], and their number increases, new alien species being continuously reported [CIOCĂRLAN & al. 2004; SÎRBU & OPREA, 2008a; ANASTASIU & NEGREAN, 2008].

According to ANASTASIU & NEGREAN (2005, 2007), 435 adventive plant species were identified in the Romanian flora, of which 384 neophytes and 51 archaeophytes, and the most important plant families represented in the Romanian adventive flora are: *Asteraceae*, *Brassicaceae* and *Poaceae*. Also, according to these authors, more than 50% of these adventive species are annual, and the proportion between deliberately and accidentally introduced adventive plants is approximately equal. If archaeophytes are predominantly of Mediterranean origin, most neophytes are of American origin.

In other evaluations [DIHORU, 2004], 61 adventive plant species are considered to be invasive.

These evaluations are mainly based on the number of locations in which a plant was reported and on the estimation of its relative impact on the affected habitats.

This is why systematic monitoring researches of the populations in their habitats are required.

### Materials and methods

Mureș county is situated in central-northern Romania, having a surface area of 6696 km<sup>2</sup>, which slowly descends in steps from the volcanic peaks of the Călimani and Gurghiu Mountains to the middle of the Transylvanian Plateaux. Over the past decade, extensive surface areas occupied by invasive species to the detriment of native species have been identified. They settled in massively due to the fragmentation of arable lands, left uncultivated, representing real infestation foci.

The inventory of invasive plant species in Mureș County was elaborated based on personal researches performed in the period 2000-2011, as well as on bibliographic

information [OROIAN, 1998, 2009; OROIAN & SĂMĂRGIȚAN, 2006; PITEA, 1995, SĂMĂRGIȚAN, 2005].

The presentation of each species is accompanied by ecological, chorological, coenological data, information regarding their belonging to different groups of bioforms and the number of chromosomes.

The aspects of chorology, ecology, physiognomy and floristic composition, was made on the *Vademecum ceno-structural privind covorul vegetal din România* [SANDA & al. 2001]. The establishment of the bioforms, floristical elements, ecological indices and number of chromosomes was made on the basis of *Flora cormofitelor spontane și cultivate din România* [SANDA & al. 2004]. Seeds spreading types were established according to SOÓ (1964-1980).

The nomenclature of the species was given in accordance with *Flora Europaea* [TUTIN & al. 1964–1980, 1993] and OPREA (2005).

In order to establish the types of invasive plants, the terminology and the definitions recommended by RICHARDSON & al. (2000) and PYŠEK & al. (2004) were taken into consideration.

This study reports only the species with a significant degree of invasion.

Ecological indices used are:

U – humidity (1-1.5 xerophilous; 2-2.5 xero-mesophilous; 3-3.5 mesophilous; 4-4.5 meso-hygrophilous; 5-5.5 hygrophilous; 0 amphitolerant toward humidity)

T – temperature (1-1.5 cryophilous; 2-2.5 micro-termophilous; 3-3.5 micro-meso-termophilous; 4-4.5 moderate-termophilous; 5-5.5 termophilous; 0 amphitolerant toward temperature, eurythermic)

R – soil reaction (1-1.5 strong acidophilous; 2-2.5 acidophilous; 3-3.5 acid-neutrophilous; 4-4.5 low acid-neutrophilous; 5-5.5 basiphilous; 0 amphitolerant toward soil reaction, eurytonic).

## Results and discussions

In Mureș County, 21 invasive species (Tab. 1) were identified, more than 50% of these belonging to the Asteraceae family.

The most rapacious and most common invasive plants in the studied territory are:

*Amaranthus crispus* (L.) Desf. – *Sisymbrium*, *Onopordion*; Th, S-Am-Adv; 2n=34, D; U<sub>3</sub>T<sub>4</sub>R<sub>3</sub>; anemochory, epizoochory.

Frequently found at the edge of farming fields, in anthropized, ruderalized fields.

*Amaranthus retroflexus* L. – *Sisymbrium*, *Arction*; Th, N-Am (changed to Cosm); 2n=34, D; U<sub>3</sub>T<sub>3</sub>R<sub>0</sub>; anemochory, epizoochory.

It abundantly develops at the edge of farming fields in particular, but it is also present in semi-natural and natural habitats.

*Ambrosia artemisiifolia* L. – *Sisymbrietalia*, *Chenopodietalia albi*, *Eragrostetalia*, *Onopordetalia acanthi*; Th, Adv N-Am; 2n=36, P; U<sub>2</sub>T<sub>0</sub>R<sub>0</sub>; antropochory, anemochory.

It is of North American origin. It forms local clusters in ruderal territories, along roadsides, on railway embankments, and has a high tendency to extend. It was identified in the studied territory in Târgu-Mureș, along the railway.

*Conyza canadensis* (L.) Cronq. (*Erigeron canadensis* L.) – *Sisymbrium*; Th-TH, N-Am Adv; 2n=18, D; U<sub>2.5</sub>T<sub>0</sub>R<sub>0</sub>; anemochory, antropochory.

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This plant of North American origin occupies extensive territories in Mureș County, rapidly invades ruderalized territories, abandoned farming lands, and has a great capacity to spread.

***Echinocystis lobata*** (Michx) Torr. et Gray (*Echinocystis echinata* (Muhl.) Britt., Sterns et Poggenb.) – Car. *Calystegion sepium*; Th, Adv; 2n=32, P; U<sub>4</sub>T<sub>0</sub>R<sub>4</sub>.

Cultivated as an ornamental plant, the species prefers moist, shaded places, being frequently found on the bank of waters, as well as at the edge of forests, where it forms thick borders, in Târnavelor Plateaux and in the mountain area of the county.

***Erigeron annuus*** (L.) Pers. (*Stenactis annua* (L.) Nees) subsp. *annuus* (Fig. 4) – *Arction*, *Sisymbrium*, *Calystegion sepium*, *Salicetea*, *Alno-Ulmion*; Th, N-Am Adv; 2n=27, 36, P; U<sub>4</sub>T<sub>0</sub>R<sub>4</sub>; anemochory.

An annual-biannual-perennial plant, which produces rich, dense populations, occupying abandoned farming lands, present in both anthropic and semi-natural habitats, with a negative impact on the native flora.

***Galinsoga parviflora*** Cav. – *Polygono-Chenopodietaea*, *Panico-Setarion*; Th, S-Am Adv; 2n=16, D; U<sub>3,5</sub>T<sub>0</sub>R<sub>3</sub>; anemochory, epizoochory, anthropochory.

It is of South American origin (Peru). It seems to have immigrated to the Romanian flora during World War I. It proliferates as a commensal plant in hill and mountain weed crops, particularly corn crops. It can be frequently found in Mureș County, from the plain to the mountain area.

***Helianthus decapetalus*** L. – *Convolvulion*; H-G, N-Am-Adv; 2n=64, P.

It prefers moist soils in the river meadows. It occupies large surface areas along waters in the mountain area of the county. It was also reported in Târnavelor Plateaux.

***Helianthus tuberosus*** L. – *Convolvulion*; H-G, N-Am-Adv; 2n=102, D.

A plant introduced in cultivation for food purposes, which has become wild almost throughout the country. In Mureș County, it is frequently found along water courses, where it forms thick borders that affect the structure of the invaded ecosystems. It can be present even in farming lands.

***Impatiens glandulifera*** Royle (*Impatiens roylei* Walpers) (Fig. 3) – Car. *Salicion albae*, *Calystegion*; Th, Hymalaia (Adv); 2n=18,20, D; U<sub>4</sub>T<sub>4</sub>R<sub>4</sub>; autochory, epizoochory.

Introduced in cultivation for its ornamental qualities, the species can be frequently found on the banks of rivers in the mountain and hill area. It forms significant populations, affecting the development of autochthonous species.

***Juncus tenuis*** Willd. – Car. *Polygonion avicularis*; H, N-Am-Adv; 2n=84, P; U<sub>3,5</sub>T<sub>3</sub>R<sub>4</sub>; anemochory, frequently epizoochory.

An accidentally introduced, North American adventive plant, *Juncus tenuis* is widely spread in the research territory. It can affect indigenous plants by competition and can disturb valuable habitats.

***Lycium barbarum*** L. – *Arction lappae*, *Prunetalia*; mPh, Adv Asia; 2n=24-P; U<sub>3</sub>T<sub>4</sub>R<sub>0</sub>.

Of Chinese origin, it was used for ornamental purposes, in hedges, particularly in rural areas, from where it was naturalized. It forms thick groups, in anthropized places, where compost is stored. It does not have a rapid propagation capacity.

***Portulaca oleracea*** L. – *Polygono-Chenopodietaea*; Th, Asia-Temp-Adv; 2n=18,54, D-P; U<sub>3</sub>T<sub>0</sub>R<sub>0</sub>; autochory, mirmecochory.

*Portulaca oleracea* is an aggressive weed in the majority of the crops. Having a rapid germination capacity, it competes with autochthonous plants. It is found in Mureș

County, on abandoned farming lands in the plain and hill area, as well as in semi-natural habitats, and even in the mountain area.

**Reynoutria japonica** Houtt. – G, Adv-Jap; 2n=44, P.

It is frequently found on the banks of waters in the hill and mountain area, where it forms dense populations that replace autochthonous species.

**Robinia pseudacacia** L. – *Bromo sterili-Robinetum*; MPh, Adv-Am-N; 2n=22, D; U<sub>2,5</sub>T<sub>4</sub>R<sub>0</sub>; anemochory, endozoochory (spontaneous).

The species invades semi-natural and even natural habitats, at various degradation stages, particularly in the hill and plain area, but it can also be found in the mountain area of Mureș County. It can have beneficial effects in soil fixation, but its presence needs to be monitored, particularly in the proximity of valuable habitats.

**Rudbeckia laciniata** L. (Fig. 1) – *Calystegion sepium*, Car. *Senecion fluviatilis*; H, N-Am Adv; 2n=76, P; U<sub>4,5</sub>T<sub>4</sub>R<sub>4</sub>; anemochory.

A species of riparian habitats, which forms large groups that can suffocate other species. Having escaped from cultivation, it is extremely widespread in Mureș County, from the plain to the mountain area.

**Solidago canadensis** L. (Fig. 2) – *Calystegion sepium*, *Artemisietea*; H, Adv; 2n=18, D; U<sub>3,5</sub>T<sub>3</sub>R<sub>3</sub>.

This species was introduced in cultivation for ornamental purposes, from where it spread to semi-natural and anthropized habitats. It occupies large surface areas in the Transylvanian Plateau and is even found at the edge of forests. The rich, monodominant populations replace the indigenous species.

**Solidago gigantea** Aiton subsp. *serotina* (Kuntze) McNeill – *Alno-Ulmion*, *Salicetea*, Car. *Calystegion sepium*; H, Adv; 2n=36, P; U<sub>3,5</sub>T<sub>3</sub>R<sub>3</sub>.

Like *Solidago canadensis*, it was introduced for ornamental purposes and escaped from cultivation. It is frequently found in the Târnavelor Plateaux, forming compact groups on abandoned farming lands or degraded pastures.

**Veronica persica** Poiret (*Veronica buxbaumii* Ten.) – *Chenopodio-Scleranthea*, Car. *Polygono-Chenopodietalia*; Th, V-Asian (changed to Subcosmopolite); 2n=28, P; U<sub>3</sub>T<sub>0</sub>R<sub>4</sub>, anemochory, endozoochory.

This species is remarkably enduring under difficult environmental conditions, particularly in superficial, compact, polluted, dry soils. As a result, it spreads rapidly along roadsides and railways, being present in degraded, anthropized soils, in competition with less enduring autochthonous species.

**Xanthium italicum** Moretti – *Bidentetea*, *Sisymbrium*, Car. *Chenopodion fluviatile*; Th, S-Eur; 2n=36, P; U<sub>3,5</sub>T<sub>4</sub>R<sub>0</sub>; zoochory, antropochory.

It grows in ruderal places and highly grazed pastures, sometimes being found at the edge of farming fields.

**Xanthium strumarium** L. – *Sisymbrium*, *Onopordion*; Th, Cosm; 2n=36, P; U<sub>3,5</sub>T<sub>3,5</sub>R<sub>4</sub>; zoochory, antropochory.

It is frequently found in the studied area on degraded or abandoned lands, on overgrazed pastures or at the edge of farming lands.

The majority of the identified species are integrated in anthropic habitats. Some of them also occur in semi-natural habitats: forest edge, river banks, meadows, etc., frequently having a strong negative impact on these.

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Some of the invasive species are xenophytes, being accidentally introduced, while others were introduced by man for various purposes, particularly ornamental plants, and secondarily escaped from cultivation into the spontaneous flora (hemerophyte species).

Of the total number of invasive species described in Mureș County, 47.61% are xenophytes, and 52.38% are hemerophytes.

More than half of the identified invasive species are therophytes (57.14%), hemicryptophytes representing a third of these (28.57%).

The number of invasive plant species present in the studied locations is found to be correlated with the intensity of anthropic phenomena in the area. Thus, the greatest number of species was identified in urban areas such as Sighișoara (16 sp.), Saschiz (14 sp.), Reghin (11 sp.).

**Tab. 1.** The list of invasive species in Mureș county

Species	Geographic origin	Category	Way of introduction	Spreading area in Mureș County
<i>Ambrosia artemisiifolia</i>	N-Am	X	accidental	Târgu-Mureș
<i>Amaranthus crispus</i>	S-Am	X	accidental	Gurghiu, Reghin, Saschiz, Sighișoara;
<i>Amaranthus retroflexus</i>	N-Am	X	accidental	Band, Dubiște, Fărăgău, Morești, Reghin, Răstolița, Sighișoara;
<i>Conyza canadensis</i>	N-Am	X	accidental	Aluniș, Bereni, Daneș, Dubiște, Fărăgău, Herghelia, Ibănești, Lăpușna, Mihai Viteazu, Morești, Răstolița, Saschiz, Sighișoara, Sovata, Șilea Nirajului;
<i>Echinocystis lobata</i>	N-Am	H	ornamental	Apold, Daia, Daneș, Dubiște, Răstolița, Reghin, Saschiz, Sighișoara, Solovăstru, Stejărenii, Vânători;
<i>Erigeron annuus</i> subsp. <i>annuus</i>	N-Am	H	ornamental	Aluniș, Apold, Archita, Băla, Beica de Sus, Cașva, Cloașterf, Cozma, Criș, Daia, Daneș, Dubiște, Herghelia, Jabeșița, Gurghiu, Lăpușna, Lunca Mureșului, Miercurea Nirajului, Mihai Viteazu, Morești, Reghin, Răstolița, Saschiz, Săbed, Sighișoara, Stejărenii, Șaeș, Șilea Nirajului, Ulieș, Valea Secuieu;
<i>Galinsoga parviflora</i>	S-Am	X	accidental	Brădețel, Daneș, Dubiște, Dulcea, Fărăgău, Gălăoia, Gurghiu, Gura Fâncel, Herghelia, Lăpușna, Păuloaia, Răstolița, Saschiz, Sighișoara, Sovata, Valea Secuieu;
<i>Helianthus decapetalus</i>	N-Am	H	ornamental	Apold, Borzia, Daia, Daneș, Ibănești, Răstolița, Reghin, Saschiz, Sighișoara;
<i>Helianthus tuberosus</i>	N-Am	H	food	Livezeni, Luduș, Morești, Reghin, Sântana de Mureș, Sâncraiu de Mureș, Solovăstru, Târgu-Mureș;
<i>Impatiens glandulifera</i>	Asia Himalaya	H	ornamental	Daneș, Dubiște, Gălăoia, Lunca Bradului, Răstolița, Saschiz, Sighișoara;

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<i>Juncus tenuis</i>	N-Am	X	accidental	Archita, Band, Daia, Deda, Fărăgău, Gurghiu, Ibănești Pădure, Jabeșița, Lăpușna, Lunca Bradului, Saschiz, Șarpatoc, Valea Sălardului, Vulcan;
<i>Lycium barbarum</i>	Asia (China)	H	ornamental	Apold, Băla, Cozma, Ercea, Luduș, Ogra, Sânpaul, Sighișoara, Ulieș;
<i>Portulaca oleracea</i>	Asia	X	accidental	Apold, Band, Cloașterf, Daneș, Deda, Gurghiu, Jabeșița, Reghin, Saschiz, Sânpaul, Sighișoara, Stejărenii;
<i>Reynoutria japonica</i>	Japan	H	ornamental	Apold, Daneș, Dulcea, Glăoia, Ibănești, Răstolița, Sighișoara;
<i>Robinia pseudacacia</i>	N-Am	H	ornamental	Adămuș, Adrian, Aluniș, Androneasa, Apold, Band, Beica de Sus, Bereni, Bistra-Mureșului, Cloașterf, Daneș, Deda, Dubiște, Fărăgău, Gălăoia, Gurghiu, Herepea, Herghelia, Ibănești, Iod, Lunca Bradului-Sălard, Miercurea Nirajului, Morești, Răstolița, Săbed, Saschiz, Sighișoara, Sovata, Sângeorgiu de Mureș, Șilea Nirajului, Târgu-Mureș, Zau de Câmpie, Vânători, Ulieș;
<i>Rudbeckia laciniata</i>	N-Am	H	ornamental	Band, Brâncovenești, Cașva, Gurghiu, Lăpușna, Reghin, Sighișoara, Solovăstru;
<i>Solidago canadensis</i>	N-Am	H	ornamental	Apold, Daneș, Saschiz, Sighișoara, Șaeș, Stejărenii;
<i>Solidago gigantea</i> subsp. <i>serotina</i>	N-Am	H	ornamental	Daia, Saschiz;
<i>Veronica persica</i>	V-Asia	X	accidental	Gurghiu, Lunca Bradului, Răstolița, Reghin;
<i>Xanthium italicum</i>	Am	X	accidental	Apold, Daia, Reghin;
<i>Xanthium strumarium</i>	N-Am	X	accidental	Aluniș, Bălăușeri, Cașva, Daia, Fărăgău, Gălăoia, Gurghiu, Herghelia, Jabeșița, Răstolița, Reghin, Săbed, Saschiz, Sighișoara, Sighișoara-Platoul Breite, Șaeș, Târgu-Mureș, Ulieș

Am – America; N – North, V – West, S – South; X – xenophyte; H – hemerophyte

### Conclusions

In Mureș County were identified 21 invasive plant species.

Given the number of localities in which they were identified, we may consider that the most widespread species are: *Conyza canadensis*, *Erigeron annuus* subsp. *annuus*, *Galinsoga parviflora*, *Juncus tenuis*, *Robinia pseudacacia*, *Xanthium strumarium*.

The species with the best cover, with high density are: *Erigeron annuus* subsp. *annuus*, *Reynoutria japonica*, *Rudbeckia laciniata*, *Solidago canadensis*, *Solidago gigantea* subsp. *serotina*.



**Fig. 1.** *Rudbeckia laciniata* (Gurghiu) – photo Silvia Oroian



**Fig 2.** *Solidago canadensis* (Târnavelor Plateaux) – photo Silvia Oroian





**Fig. 3.** *Impatiens glandulifera* (Răstolița) – photo Silvia Oroian



**Fig. 4.** *Erigeron annuus* subsp. *annuus* (Târnavelor Plateaux) – photo Silvia Oroian

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