



Original article

Invasive alien plant species in Romania of European Union concern

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ABSTRACT

An assesment of the alien plants of Romania was conducted which considered the requirements of Regulation 1143/2014 of the European Union (EU). Thus, available data about the presence, invasiveness, distribution, pathways of introduction and their known impact in the territory of Romania were analysed. We found that of 36 plant species of EU concern, four are already established in Romania and widespread, at least locally or regionally: *Ailanthus altissima*, *Asclepias syriaca*, *Elodea nuttallii* and *Impatiens glandulifera*. For *Humulus scandens* there are some reports, but its presence and status require confirmation. *Heracleum sosnowskyi* and *Ludwigia peploides* are confirmed for only one location for each species. The presence of *Cabomba caroliniana* and *Myriophyllum aquaticum* in Romania is not confirmed. Most of the records are intentional introductions for ornamental purposes. Regarding their invasiveness, given the geographical origin and history of invasion in warmer climate regions (e.g., tropical, subtropical), many of the species listed as being of EU concern do not currently constitute a real threat to Romania, for the time being, but may do in a climate change scenario for the 2070s. Data about the impact of alien plant species and their management in Romania are scattered or completely missing. Coordinated institutional efforts are needed to increase the efficiency of the management of alien species at national and local level. These efforts should include: enhancing the legislation and the capacity of public institutions to manage invasive species, increasing the research interest in the science of this topic and promoting real measures to mitigate, control and remove alien plants.

KEY WORDS: non-native plant species, distribution, pathways, Romanian flora

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1. Introduction

The rate of new alien plant taxa registrations for Europe was fast from the 16th to the 20th century (LAMBDOON ET AL., 2008, PYŠEK ET AL., 2017). Thus, about 6,250 alien plant taxa are reported growing wild in Europe (ARIANOUTSOU ET AL., 2021), their main introduction pathways being related to accidental escapes from ornamental and horticultural activities

(VAN KLEUNEN ET AL., 2018, ARIANOUTSOU ET AL., 2021). Some of these species, classified as invasive alien plant species (IAPS), form stable populations once in the wild, spread rapidly and produce significant negative impacts on biodiversity (RICHARDSON ET AL., 2011, EU, 2014), involving very high economic costs (MARAIS ET AL., 2008, ANGULO ET AL., 2021, HAUBROCK ET AL., 2021a). For Romania, the economic impact of alien invasive species has been estimated

at about US\$1.6 billion, an amount that places it among the Central European countries with the highest costs of these invasions relative to its gross domestic product (GDP) (HAUBROCK ET AL., 2021b). Invasive alien species (IAS) are regulated by the European Union (EU) through Regulation 1143/2014 on their prevention, management of their introduction and spread (EU, 2014).

According to the consolidated list of IAS of EU concern adopted by the Commission Implementing Regulation (EU) 2019/1262 (EC, 2019), there are 36 invasive alien plant species (IAPS). Their baseline distribution was published by TSIAMIS ET AL. (2017) and TSIAMIS ET AL. (2019). Analysis of the distribution of IAS at the country level reveals that plants such as *Impatiens glandulifera* are already established, or present, in most European countries (TSIAMIS ET AL., 2019), but there are plants that are not yet reported such as *Persicaria perfoliata* (TSIAMIS ET AL., 2017) or *Microstegium vimineum* (TSIAMIS ET AL., 2019). Updated information about IAPS of EU concern is recently available for Croatia (BORŠIĆ ET AL., 2018), Denmark (GROUSSET ET AL., 2018), Lithuania (GUDŽINSKAS ET AL., 2018), and Bulgaria (VLADIMIROV & GEORGIEV, 2019).

For Romania, IAPS are included in a preliminary list of 130 species (ANASTASIU ET AL., 2019a) that was developed for the project POIM2014+:120008, based on rich bibliographic material about their proven negative impact on biodiversity, the economy, and human health, and was based on expert opinion (ANASTASIU ET AL., 2019b). For these IAPS, measures to prevent and combat their negative impact on floristic structure and composition of natural habitats are also required, especially in protected natural areas where the most widespread plant species are *Ailanthus altissima*, *Ambrosia artemisiifolia*, *Amorpha fruticosa*, *Erigeron annuus* s.l., *Erigeron canadensis*, *Impatiens glandulifera*, *Reynoutria japonica*, *Robinia pseudoacacia* etc. (ANASTASIU ET AL., 2014, NEGREAN & CIORTAN, 2014, GOIA ET AL., 2014, ANASTASIU ET AL., 2017, SĂMĂRGHÎȚEAN ET AL., 2018, GRIGORESCU ET AL., 2020). Comprehensive data about the distribution of IAPS in Romania was published in 2011 (SÎRBU & OPREA, 2011). After this year, only data scattered in different scientific articles were published.

The purpose of this article is to bring up-to-date the information on IAPS of EU concern that are present in Romania, after the adoption of the consolidated Union list (EU) 2019/1262 (EC, 2019), aiming at providing information on their distribution, pathways, and their impact in accordance with the available data. In agreement with Regulation 1143/ 2014 (EU, 2014), data about the presence and distribution, about pathways and impact of alien species is necessary in order to establish a

surveillance system (Article 14), as well as to develop risk assessments (Article 5).

2. Study area

Romania is situated in the geographical centre of Europe (the south-east of Central Europe), to the north of the Balkan Peninsula, half way between the Atlantic Coast and the Urals, inside and outside the Carpathian Arch, on the lower course of the River Danube (1075 km) and bordering the Black Sea (ANDREI, 2021). Romania's landscape consists of the Carpathian Mountains with the highest altitude at 2,544 m, sub-Carpathian hills, plateaus, plains and the Danube Delta. The average of the multi-annual temperature ranges from 8°C in the north of the country and 11°C in the south (ANDREI, 2021). The precipitation ranges from over 600 mm in the west of the country to less than 500 mm in the East Romanian Plain and 450 mm in the Dobrogea region. In the mountain area the precipitation reaches 1,000-1,500 mm (ANDREI, 2021). There are five biogeographical regions that stretch across Romania: Black Sea (former Pontic), Steppic, Continental, Alpine, and Pannonian.

3. Material and methods

For each species considered in this article we summarize the following information: native distribution, life form, distribution in historical regions of Romania, distribution in biogeographical regions, pathways of introduction according to IUCN EICAT Categories and Criteria (IUCN, 2020), impact on natural and seminatural ecosystems, impact on ecosystem services, impact on health and economy, and date first reported in Romania. Distribution data are based on available scientific literature and personal communication between invasive plant experts.

The terminology used for alien species is according to RICHARDSON ET AL. (2000) and EU Regulation 1143/2014 (EU, 2014). The pathways are according to CBD (2014) and the accepted names of plant species are according to GBIF.org (2021).

4. Results and discussion

The updated list of IAS of EU concern comprises of 66 species (EC, 2019), of which 36 are plants. Among these, nine were already reported from Romania: *Ailanthus altissima*, *Asclepias syriaca*, *Cabomba caroliniana*, *Elodea nuttallii*, *Heracleum sosnowskyi*, *Humulus scandens*, *Impatiens glandulifera*, *Ludwigia peploides*, *Myriophyllum aquaticum* (Table 1).

Table 1. Alien plant species occurring in Romania of European Union concern, according to Regulation 1262/2019

Scientific name	Native distribution	Life form	Distribution in historical regions of Romania	Distribution in biogeographical regions	Pathways	Impact ENS	Impact Health & Economic	First report in Romania, according to Sîrbu & Oprea, 2011		
								Reference	Cultivated	(Sub) Spontaneous
<i>Ailanthus altissima</i> (Mill.) Swingle	As E	PhM	B, Cr, D, DD, MMMo, Mu, O, T	BS, ST, CO, AL, PA	d	YES	NA	Fuss 1866: Transilvania (cult.); Grecescu 1898: Romania	1866	1898
<i>Asclepias syriaca</i> L.	Am N	H	B, Cr, DD, MM, Mo, Mu, O, T	BS, ST, CO, PA	d	YES	Agr	Czihack 1836: Moldova [Kanitz 1879-1881]; Prodan 1939: Romania (without location)	1836	1939
<i>Cabomba caroliniana</i> A.Gray	Am N & S	HH	Cr	PA	d	NA	NA	Țopa 1955: "Ochiul Țiganilor" and Pețea Creek, near Băile 1 Mai (Oradea) (introduced in 1950)	1950	1955
<i>Elodea nuttallii</i> (Planch.) H.St.John	Am N	HH	B, D, DD, Mo, Mu O	BS, ST, CO	a	YES	NA	Ciocârlan et al. 1993: Danube Delta [Ciocârlan et al. 1997]		1993
<i>Heracleum sosnowskyi</i> Manden.	Caucaz	T	T	CO	d	NA	NA	Marușca & Pop 2001: halta Liteni, near Prejmer (BV)	1975	2001
<i>Humulus scandens</i> (Lour.) Merr.	As E	T	B, MM, Mu, O, T	CO, AL, PA	d	NA	NA	Prodan 1923: cult.; Morariu 1937; 1943: București	<1923	1937
<i>Impatiens glandulifera</i> Royle	As (Himalaia)	T	B, Cr, MM, Mo, Mu, O, T	CO, AL, PA	d	YES	NA	***** 1882: Sibiu (SB) [Balogh 2008]		1882
<i>Ludwigia peploides</i> (Kunth) P.H.Raven	Am	Hd	O		NA	NA	NA	Sîrbu et al. 2020		
<i>Myriophyllum aquaticum</i> (Vell.) Verdc.	Am S	HH	Cr	PA	NA	NA	NA	1947 in the thermal water of Pețea Creek		1947

Abbreviations: **Native distribution:** Am = America, As = Asia, Afr = Africa, Austr = Australia, Atl = Atlantic, Eur = Europa, Md = Mediteranean, Trop = Tropical, Subtrop = subtropical, C = Central, N- Nord, E = East, S = Sud, V = West; **Life form:** Ch - Chamaephyte; G - Geophyte; H - Hemcryptophyte; HH - Helohydrophyte; PhEp - Epiphytet; PhLi - Liana; PhM - Macrophanerophyte; PhN - Nanophanerophyte; T - Therophyte; TH - Hemitherophyte; **Distribution in historical regions of Romania:** T - Transilvania; B - Banat; Cr - Crișana; MM - Maramures; O - Oltenia; Mu - Muntenia; Mo - Moldova; D - Dobrogea; DD - Danube Delta; **Distribution in biogeographical regions:** BS = Black Sea, ST - Steppic, CO = Continental, AL = Alpine, PA = Pannonian; **Pathways:** a = accidentally, d = deliberately; **Others:** NA = data not available, ENS = natural and seminatural ecosystems, Agr = agriculture, San = health.

In Bulgaria, a country neighbouring Romania, there are five IAPS of EU concern: *Asclepias syriaca*, *Elodea nuttallii*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, *Pennisetum setaceum* (VLADIMIROV & GEORGIEV, 2018). For Hungary, another neighbouring country, the list of IAPS of EU concern is much longer: *Cabomba caroliniana*, *Eichhornia crassipes*, *Heracleum sosnowskyi*, *Hydrocotyle ranunculoides*, *Lagarosiphon major*, *Ludwigia grandiflora*, *Myriophyllum aquaticum* (TSIAMIS ET AL., 2017), *Asclepias syriaca*, *Elodea nuttallii*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, *Myriophyllum heterophyllum* (TSIAMIS ET AL., 2019), *Ailanthus altissima* (CSISZÁR ET AL., 2021). Croatia has records of five IAPS of EU concern, the first four are common with Bulgaria, and the fifth one is *Myriophyllum heterophyllum* (BORŠIĆ ET AL., 2018). In the West, Denmark has reported eight IAPS of EU concern: *Cabomba caroliniana*, *Elodea nuttallii*, *Heracleum mantegazzianum*, *Heracleum persicum*, *Heracleum sosnowskyi*, *Impatiens glandulifera*, *Lysichiton americanus* (GROUSSET ET AL., 2018). Lithuania has reported three species: *Asclepias syriaca*, *Heracleum sosnowskyi* and *Impatiens glandulifera* (GUDŽINSKAS ET AL., 2018).

Under climate change scenarios for the 2070s, the climate of Romania will be unsuitable for *Althernanthera philoxeroides* (EPPO, 2015a) and *Triadica sebifera* (EPPO, 2018a), and suitable for *Acacia saligna* in the Black Sea biogeographical region (BRANQUART ET AL., 2018), *Baccharis halimifolia* (EPPO, 2013), *Lespedeza cuneata* (EPPO, 2018b), *Ludwigia grandiflora* (EPPO, 2015b), *Lygodium japonicum* (EPPO, 2018c), *Lysichiton americanus* (EPPO, 2015c), *Pueraria montana* var. *lobata* (EPPO, 2015d), *Salvinia molesta* in Pannonian and Black Sea biogeographical regions (EPPO, 2018d). *Ludwigia grandiflora* is already reported from thermal waters of Hungary (LUKÁCS ET AL., 2014) and could easily migrate into thermal waters of western Romania. Currently, Romania is considered to be a country at risk for: *Hydrocotyle ranunculoides* (EPPO, 2015e), *Microstegium vimineum* (EPPO, 2014a), *Parthenium hysterophorus* (EPPO, 2014b), *Persicaria perfoliata* (EPPO, 2015f). *Hydrocotyle ranunculoides* is already invasive in thermal and cold waters of Hungary (LUKÁCS ET AL., 2014).

Ailanthus altissima (Mill.) Swingle, introduced as an ornamental, is the most widespread invasive alien plant of EU concern in Romania based on the chorologic data indicated by SÎRBU & OPREA (2011) (Fig. 1). In recent years many other reports have been added to the previous ones (FRINK, 2011; NICULESCU ET AL., 2011, ONETE & PAUCĂ-COMĂNESCU, 2011, ANASTASIU & LIȚESCU, 2012, TURCUȘ & DARABAN, 2012, DUMITRAȘCU ET AL., 2013, HERNEA ET AL., 2013,

ANASTASIU ET AL., 2014, BOSTAN ET AL., 2014, DOROFTEI & ANASTASIU, 2014, FĂGĂRAȘ & BERCU, 2014, GOIA ET AL., 2014, ROȘCA, 2015, ROVINĂ & ROVINĂ, 2015, SCHNEIDER-BINDER, 2016, AXINI & AL-AZKI, 2017, ANASTASIU & NEGREAN, 2018, CIOCĂNEA ET AL., 2018, COJOACĂ & NICULESCU, 2018, CONSTANTIN, 2018, MEMEDEMİN ET AL., 2018, NAGODĂ ET AL. 2018, NICULESCU & NUȚĂ, 2018, NICULESCU ET AL., 2018, ONETE ET AL., 2018, PESCOTT, 2018, URZICEANU ET AL., 2018, CRAINIC ET AL., 2019, DINUCĂ, 2021, PRICOP ET AL., 2021). Some recent data are for protected areas. Thus, in the Iron Gates Natural Park, *A. altissima* "is cultivated and used in forest plantations also in the Clisura area, but the species is well naturalized in riparian habitats, in particular in the Ogradena Valley where there is a large natural regeneration. In the management of the Iron Gates Natural Park, which includes many habitats of EU interest, including the priority habitat type 91E0*, thus this species needs to be treated with special attention because the tree of heaven is replacing the natural riparian vegetation (SCHNEIDER-BINDER, 2016). According to GOIA ET AL. (2014), in this protected area *A. altissima* "forms dense thickets that displace native vegetation and produces toxins that inhibit the growth of other plants". Other recent reports from protected areas include: Maramureș Mountains Natural Park (DUMITRAȘCU ET AL., 2014), Danube Delta Biosphere Reserve (DOROFTEI & ANASTASIU, 2014), Văcărești Natural Park (Bucharest) (ANASTASIU ET AL., 2014; NAGODĂ ET AL., 2018), Snagov Natural Protected Area (ANASTASIU & LIȚESCU, 2012), Lower Siret Floodplain (CIOCĂNEA ET AL., 2018), Măcin Mountains Natural Park (ROȘCA, 2015; MEMEDEMİN ET AL., 2018), Canaraua Feti Natural Reserve (MEMEDEMİN ET AL., 2018), and Grădiștea Muncelului - Cioclovina Natural Park (ROVINĂ & ROVINĂ, 2015).

A. altissima invades a wide range of habitats, from ruderal to seminatural and natural ones, with stony and sterile soils to alluvial ones (KOWARIK & SÄUMEL, 2007). In Romania, SÎRBU & OPREA (2011) identified *A. altissima* in xerophyllous grasslands, tall perennial herbs, anthropogenic forests, abandoned lands, road and railway edges, and ruderal places. DINUCĂ (2021) reports *A. altissima* from Natura 2000 habitats 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae), 91V0 Dacian Beech forests (Symphyto-Fagion), 9130 Asperulo-Fagetum beech forests, 91M0 Pannonian-Balkan turkey oak – sessile oak forests, this species influences the successional dynamics and the floristic composition of these forest habitats, occupying increasingly more and more space. The occurrence of *A. altissima* in forests and riverbanks have

already been reported in floodplains of the upper-middle section of the River Danube (GUTTE ET AL., 1987, DRESCHER ET AL., 2005).

A. altissima occurs in all five biogeographical regions of Romania, with fewer reports from the Alpine region. With regard to the introduction pathways, the main ones are: 1) Escape from confinement in botanical gardens; 2) Escape from confinement in forestry (including afforestation or reforestation); 3) Escape from confinement for ornamental purposes other than horticulture; 4) Transport – stowaway in vehicles (cars, trains); 5) Unaided: Natural dispersal across borders of invasive alien species that have been introduced through pathways 1 to 4. *A. altissima* is mentioned as

a cultivated plant in gardens, including botanical gardens, in the second half of the 19th century (SÎRBU & OPREA, 2011), from which it certainly escaped. It has also been cultivated for forestry purposes in the Danube Delta (pers. comm. Viorel Roșca for the Danube Delta) and in Iron Gate Natural Park (pers. comm. Marian Jiplea). The impact on natural and semi-natural habitats is only locally documented. Thus, in Iron Gate Natural Park the impact of *A. altissima* is assessed as high – 5, and the species is considered to be one of the ten most aggressive (GOIA ET AL., 2014). There is no available data for Romania regarding the impact of *A. altissima* on ecosystem services.

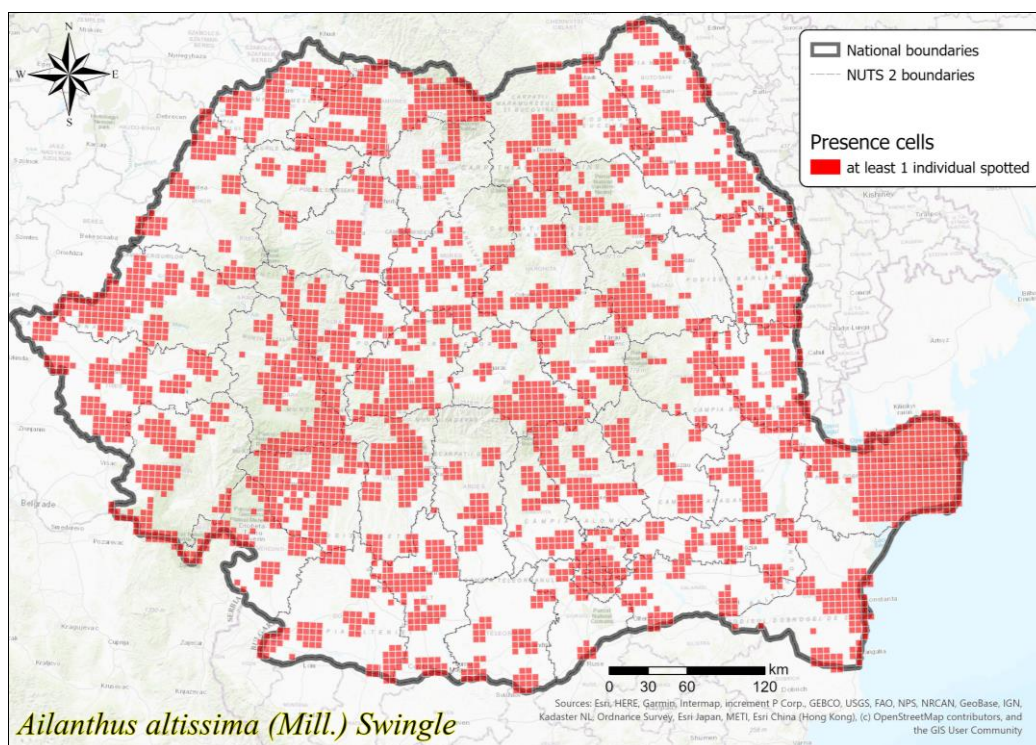


Fig. 1. *Ailanthus altissima* is the most widespread invasive alien plant in Romania

Asclepias syriaca L. is widespread in Europe, including the neighbouring countries of Romania (TSIAMIS ET AL., 2019, EPPO, 2020). In Romania, it was mentioned as being cultivated starting in the first half of the 20th century (CZIHACK, 1836, in: SÎRBU & OPREA, 2011). Now it is widespread especially in the Banat and Transylvania regions, but there are only a few data from other regions of the country (Fig. 2). Reports in the last ten years are from: Târnava Mare Natura 2000 site (AKERROYD & PAGE, 2011), Danube Delta – Sulina (ANASTASIU, 2011), Piatra Craiului Natural Park (POP ET AL., 2011), Breite Plateau (Sighișoara, Mureș County) (ÖLLERER, 2012), Carei Plain protected area (SZATMARI, 2012), River Mureș (TURCUȘ & DARABAN, 2012), Rastu Vechi (Dolj County) (RĂDUȚOIU & STAN,

2013), Lunca Mureșului Natural Park (TURCUȘ ET AL., 2013), Iron Gates Natural Park (GOIA ET AL., 2014), Cireșu (Mehedinți County) (NEGREAN & CIORTAN, 2014), Satchinez (Timiș County) (OTVES ET AL., 2014), Central Romania – Transylvania (ZIMMERMANN ET AL., 2015), Sălaj County (NEGREAN ET AL., 2017), ROSCI0227 Sighișoara – Târnava Mare (SĂMĂRGHIȚAN ET AL., 2018), Lunca Mureșului Natural Park (SĂRĂȚEANU ET AL., 2019), River Bistrița Basin (PRICOP ET AL., 2021).

Asclepias syriaca occurs in all five biogeographical regions, with most reports being from the Continental region. The main pathways for *A. syriaca* are: 1) Escape from confinement: Ornamental purpose other than horticulture; 2) Escape from confinement: Other escape from confinement (apiculture); 3)

Unaided: Natural dispersal across borders of invasive alien species that have been introduced through pathways 1 to 5.

The impacts of *A. syriaca* on habitats, ecosystem services and economy are not well documented for Romania. DRĂGULESCU (2007) reported this species as accompanying communities with *Salix alba* from

Transylvania. GOIA ET AL. (2014) evaluated *A. syriaca* from Iron Gates Natural Park as an “aggressive weed which contains toxic substances that may cause poisoning”, with medium impact – 3. In Carei Plain protected area, *Asclepias syriaca* “has numerous populations in the region, fully occupying the sand dunes” (SZATMARI, 2012).

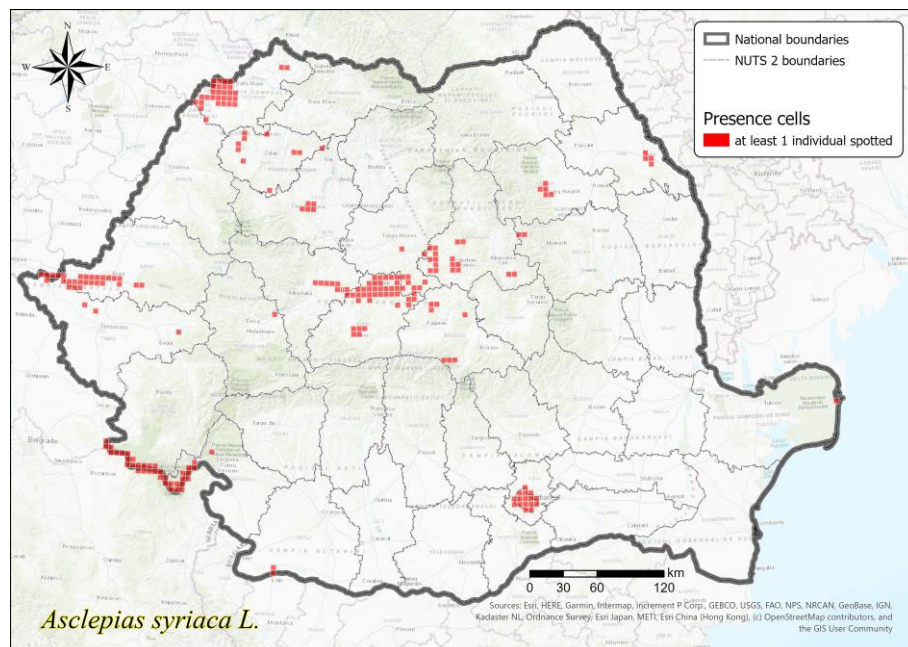


Fig. 2. *Asclepias syriaca* is reported especially from the centre and west of the country, with only a few recorded locations in the south, east or Danube Delta

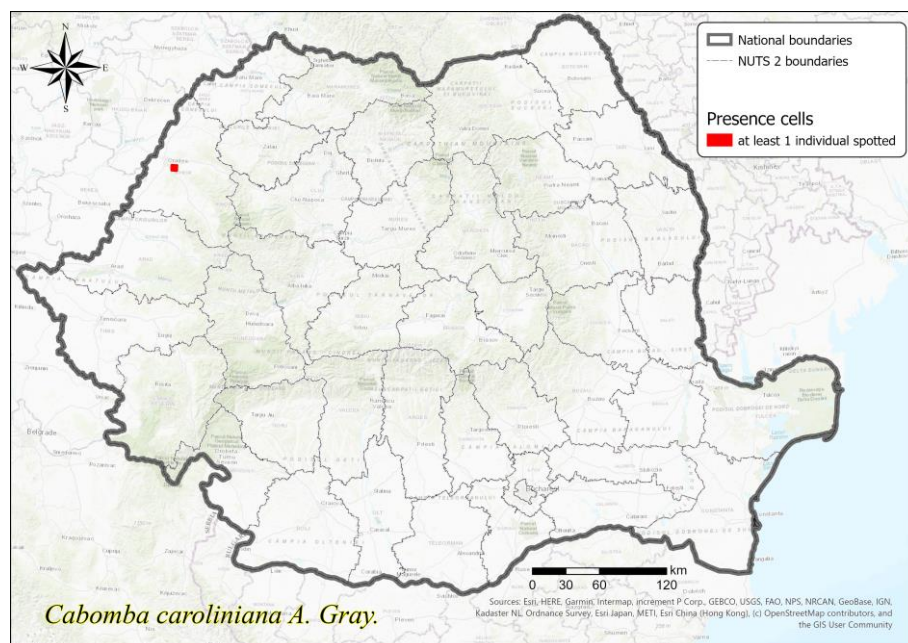


Fig. 3. *Cabomba caroliniana*, as well as *Myriophyllum aquaticum*, are reported from only one area located in the north-west of the country, in thermal waters near the city of Oradea

Cabomba caroliniana A. Gray was reported from the west of the country, from Ochiul Țiganilor Wetland and Pețea Creek near Băile 1 Mai (Bihar County) (TOPA, 1955) (Fig. 3). There are no recent data about the distribution of *Cabomba caroliniana*.

Moreover, the habitat from Pețea Creek has disappeared because of over-exploitation of thermal water in that area (COHUR & PAÁL, 2017). The same situation exists for *Myriophyllum aquaticum* (Vell.) Verdc. (syn. *Myriophyllum brasiliense* Cambess.).

This plant has been cultivated since 1947 in the thermal water of Pețea Creek (SÎRBU & OPREA, 2011). Some data indicated it as naturalized (OLTEANU-COSMA, 1959, BURESCU ET AL., 2004, OPREA, 2005), but there are no recent data about the status of this species in Romania. The main pathway for these two species is their Release in nature: Landscape/ flora/ fauna “improvement” in the wild. A recent study carried out in the Pețea Creek does not confirm the presence of *Cabomba caroliniana* or *Myriophyllum aquaticum* (pers. comm. Ecaterina Fodor & Ovidiu Hâruiță), but both species are reported from Hungary as naturalised in thermal waters, with 50 reports for *Cabomba caroliniana* and three reports for *Myriophyllum aquaticum* (LUKÁCS ET AL., 2014).

Elodea nuttallii (Planch.) H.St. John is widespread mostly in western Europe (TSIAMIS ET AL., 2019), but also in the countries neighbouring Romania (LUKÁCS ET AL., 2014, VLADIMIROV & GEORGIEV, 2018). It was probably an unintentional introduction into Romania, *E. nuttallii* occurs in aquatic habitats along the River Danube, as well as in the Danube Delta (Fig. 4). The first report for the country was in 1993 (CIOCÂRLAN ET AL., 1997). *E. nuttallii* is

already distributed in three biogeographical regions: Black Sea, Steppic and Continental. The reports in the last ten years are from: Văcărești Natural Park (Bucharest) (ANASTASIU ET AL., 2014, NAGODĂ ET AL., 2018), Iron Gates Natural Park (GOIA ET AL., 2014, GOIA & OPREA, 2014, OTVES ET AL., 2014), Arcuda (Giurgiu County) (SÂRBU ET AL., 2014), Danube River Corridor (PAUNOVIĆ ET AL., 2015), Ciuperca Lake (Tulcea, Tulcea County) (NĂSTASE ET AL., 2015), Olt River (BRAVO ET AL., 2016), Southern Oltenia (NICULESCU, 2016), Danube Delta (SCHNEIDER-BINDER, 2018), Fălcoiu (Olt County) (BURDUȘEL ET AL., 2020).

The main pathway for *E. nuttallii* is Unaided: Interconnected waterways/ basins/ seas. Its impact is documented for the Danube Delta where *E. nuttallii* often forms monodominant habitats, outcompeting the native species of aquatic ecosystems (SÎRBU & OPREA, 2011), “occupying at present a larger area and stable communities” (SCHNEIDER-BINDER, 2018). In Iron Gates Natural Park, *E. nuttallii* reduces biodiversity, replaces native species, and its impact is very high – 5 (GOIA ET AL., 2014) as it eliminates species such as: *Potamogeton* spp., *Myriophyllum spicatum*, *Ceratophyllum demersum*, *Marsilea quadrifolia* (OTVES ET AL., 2014).

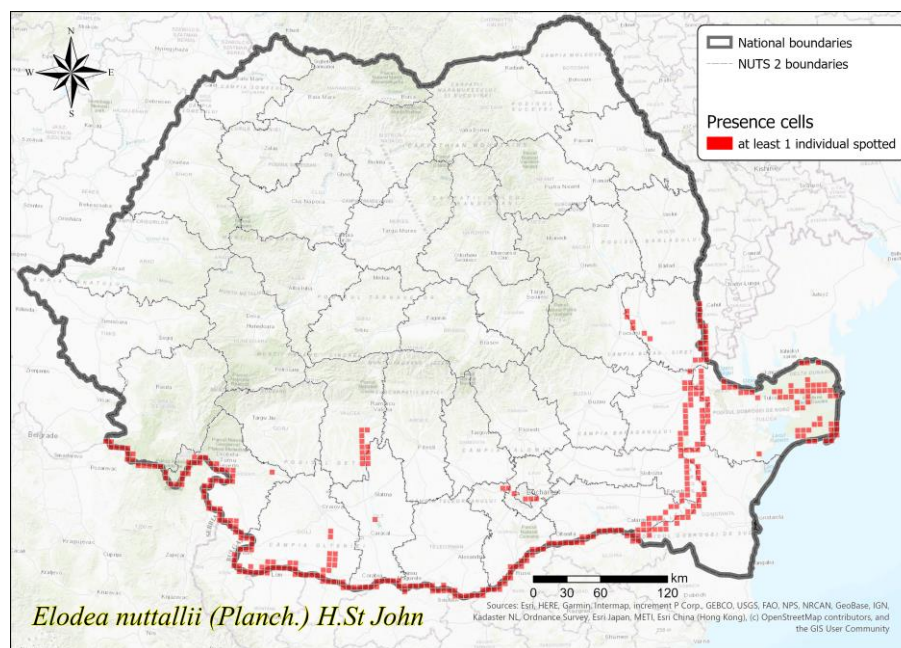


Fig. 4. *Elodea nuttallii* occurs along the River Danube and some tributaries

Data about the presence of *Heracleum sosnowskyi* Manden. in Romania were published in a previous article about alien species of EU concern in Romania (ANASTASIU ET AL., 2017). A recent study confirms the persistence of *Heracleum sosnowskyi* at Prejmer, in Brașov County (FRINK, 2021) (Fig. 5), but there are no other reports for the country. In Europe, this species occurs especially in Poland, where it is

established, and in the Baltic countries (TSIAMIS ET AL., 2017).

Humulus scandens (Lour.) Merr. (syn. *Humulus japonicus* Siebold & Zucc.) was reported as subsponaneous for Romania in 1937 (MORARIU, 1937). Presently, there are only a few reports of its occurrence (Fig. 6), but these should be checked to ensure that the species was correctly identified, and to confirm whether its populations persist.

Our recent work in the Iron Gates Natural Park and in Bucharest does not confirm the presence of *Humulus scandens* in these locations, but some recent studies confirm it in south-western and southern Romania (NICOLIN ET AL., 2021, URZICEANU ET AL., 2021). In Europe, this species occurs in Belgium, France, Italy, Hungary and Serbia (EPP0, 2018e). From Serbia, the report is from a bank of the Danube – Tisza – Danube channel, near Novi-

Sad (SAVIĆ ET AL., 2008). This could be a good source for dispersion along the inferior section of the River Danube. The main pathway for this species is: Escape from confinement: Ornamental purpose other than horticulture. There are no published data about the impact of *H. scandens* on Romanian habitats or on ecosystem services. In Romania, this plant is still available for sale in supermarkets.

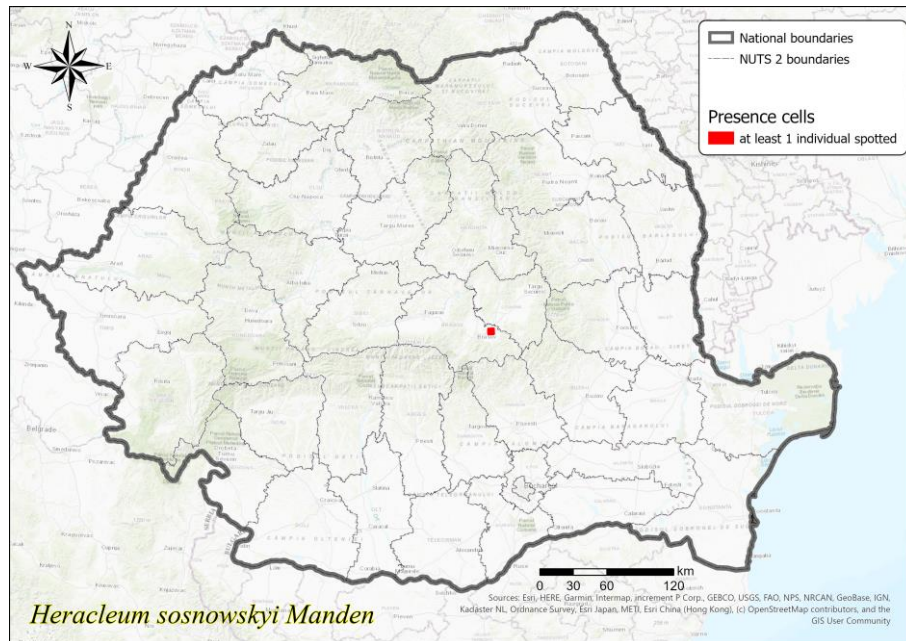


Fig. 5. *Heracleum sosnowskyi* is reported from only one locality, Prejmer in Braşov County

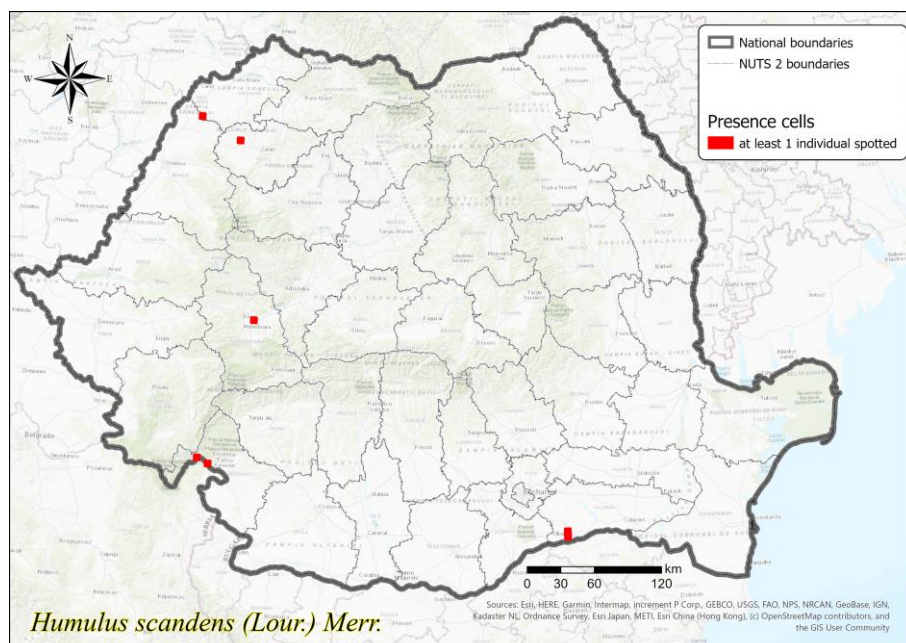


Fig. 6. *Humulus scandens* was reported from eight localities

Impatiens glandulifera Royle is one of the most widespread invasive plants in Europe, reported from 23 member states and from the UK (TSIAMIS ET AL., 2019). Introduced as an ornamental plant,

it is present in only three biogeographical regions: Alpine, Continental and Pannonian (Fig. 7). The reports on its occurrence in the last ten years are: Vâlcan Mountains (NICULESCU ET AL., 2011),

Piatra Craiului Natural Park (POP ET AL., 2011), Maramureş Mountains Natural Park (DUMITRAŞCU ET AL., 2014), Godeanu, Isverna, Seliştea (Mehedinţi County) (NEGREAN & CIORTAN, 2014), Surduc Lake (Timiş County) (NEACŞU ET AL., 2017), Sălaj County (NEGREAN ET AL., 2017), Arieş River (PESCOTT, 2018), Defileul Mureşului Natural Park (SĂMĂRGHIŢAN ET AL., 2018), Jiului Gorge (ANASTASIU ET AL., 2019), Upper Basin of the River Motru (DINUCĂ, 2021), River Bistriţa (PRICOP ET AL., 2021). Thus, the distribution of *I. glandulifera* is correlated with its

ecological features. The main pathways for this species are: 1) Escape from confinement: Ornamental purpose other than horticulture; 2) Unaided: Interconnected waterways/ basins/ seas; 3) Unaided: Natural dispersal across borders of invasive alien species that have been introduced through pathways 1 to 5. Its impact on habitats, ecosystem services and economy are not documented for Romania. In Piatra Craiului National Park, in moist areas, the cover of *Impatiens glandulifera* increased from 5% in 2005 to 79% in 2010 (POP ET AL., 2011).

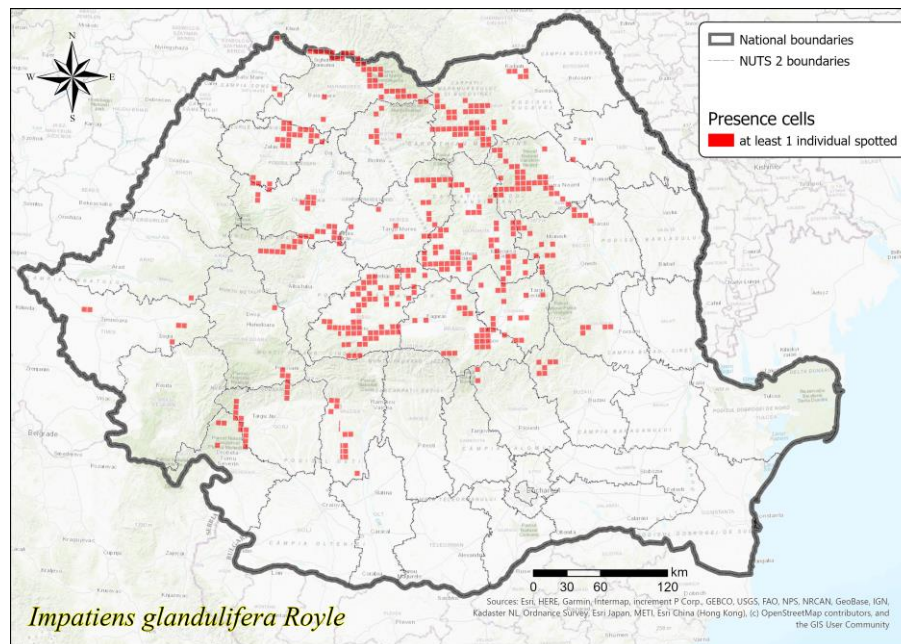


Fig. 7. *Impatiens glandulifera* occurs along rivers, especially in mountain areas

Ludwigia peploides (Kunth) P.H. Raven. is the most recent IAPS for Romania. For this plant an image was posted on social media in 2018. Its presence was confirmed recently by SÎRBU ET AL. (2021) from the River Sâi in southern Romania, in habitats with *Phragmites australis* and *Typha angustifolia*. It forms monodominant communities, but its impact on natural habitats has not yet been evaluated. The pathway is not known.

5. Conclusions

Numerous scientific works provide data about the occurrence of IAPS in Romania, but these should be urgently updated with new inputs from the field. Some information requires confirmation (e.g. the occurrence of *Cambomba caroliniana* and *Myriophyllum aquaticum*).

With regard to their invasiveness, given their geographical origin and history of invasion in regions with a warmer climate (e.g., tropical, subtropical), many of the species listed as being of EU concern do not currently constitute a real

threat in Romania, but only in climate change scenarios for 2070s. However, IAPS already recorded and established or invasive in neighbouring countries could migrate into the habitats of western Romania (e.g. *Ludwigia grandiflora*, *Hydrocotyle ranunculoides*).

Data about the impact of alien plant species and their management in Romania are scattered or completely missing.

Coordinated institutional efforts are needed to increase the efficiency of the management of alien species at national and local levels. These include enhancing the legislation and the capacity of public institutions to manage invasive species, increasing the research interest in the science on this topic and promoting real measures to mitigate, control and remove alien plants.

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