

**TWO ALIEN SPECIES IN THE SPREADING  
PROCESS IN ROMANIA: *REYNOUTRIA X BOHEMICA*  
*CHRTEK & CHRTKOVÁ* AND *GRINDELIA*  
*SQUARROSA* (PURSH) DUNAL**

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**ABSTRACT** - This paper presents two alien plant species, recently immigrated in Romania (*Reynoutria x bohemica* Chrtek & Chrtková and *Grindelia squarrosa* (Pursh) Dunal). For each species, the following information was provided: occurrence in Romania, way of migration, their distribution in Romania, Europe and other continents, general aspects regarding their biology, ecology and invasive character. *Reynoutria x bohemica* was mentioned in the flora of Romania by Kovács (2004) and Fenesi (2004), as an important element of the perennial synanthropic vegetation of mesic habitats. In our recent field investigations (between 2004 and 2007), we have also identified this alien species in Moldavia (Romania), where it was not known until now, especially along watercourses from the mountainous region (Bistrița and Moldova Rivers). Moreover, the study of samples from some herbaria (I, IAGB and IASI) allowed us to find out that, although the occurrence of this species in Romania was discovered a short time ago, it had already been collected since the second half of the last century, but was erroneously determined as *Polygonum cuspidatum* Sieb. & Zucc. In the conquered habitats, *Reynoutria x bohemica* manifested a marked invasive character, forming well-developed phytocoenoses (2-4 m high and 100% coverage), which replaced the native vegetal communities on large areas. The second species, *Grindelia squarrosa* (reported in 1998 for the first time in the flora of Romania), can be also considered as an invasive alien plant in Romania. It invaded the disturbed habitats (especially ruderal places in the proximity of railways), both in the North-East and South of Moldavia (Iași and Galați).

**Key words:** alien plants, plant invasion, Romania, vascular flora, weeds

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**REZUMAT** - Două specii adventive pe cale de răspândire în România: *Reynoutria x bohemica* Chrtek & Chrtková și *Grindelia squarrosa* (Pursh) Dunal. Lucrarea prezintă două specii de plante adventive recent imigrate în România (*Reynoutria x bohemica* Chrtek & Chrtková și *Grindelia squarrosa* (Pursh) Dunal). Pentru fiecare specie, sunt redată următoarele informații: prezența în România, calea de migrație, răspândirea în România, în Europa și în alte continente, aspecte generale privind biologia, ecologia și caracterul lor invaziv. *Reynoutria x bohemica* a fost menționată în flora României de către Kovács (2004) și Fenesi (2004), de-a lungul unor cursuri de apă din Transilvania, ca un element important al vegetației perene sinantropice din habitate mezice. În cercetările noastre recente de teren (între 2004 și 2007), am identificat această specie adventivă și în Moldova (România), unde nu era cunoscută până în prezent, în principal de-a lungul unor cursuri de apă din regiunea montană (râurile Bistrița și Moldova). Mai mult, examinarea specimenelor din unele herbarii (I, IAGB, IASI) ne-a permis să constatăm că, deși prezența acestei specii în România a fost descoperită de scurtă vreme, ea a fost colectată încă din a doua jumătate a secolului trecut, dar determinată eronat ca *Polygonum cuspidatum* Sieb. & Zucc. În habitatele invadate, *Reynoutria x bohemica* manifestă un marcant caracter invaziv, formând fitocenoză bine dezvoltate (de 2-4 m înălțime și acoperire de 100%), ce înlocuiesc comunitățile vegetale native pe mari suprafețe. Cea de-a doua specie, *Grindelia squarrosa* (raportată în 1998 pentru prima oară în flora României), poate fi, de asemenea, considerată o plantă invazivă în România. Ea invadează habitatele perturbate (în principal locurile ruderales din vecinătatea căilor ferate), atât în nord-estul, cât și în sudul Moldovei (Iași și Galați).

**Cuvinte cheie:** plante adventive, invazia plantelor, România, flora vasculară, buruieni

## INTRODUCTION

The invasive alien species are largely recognized as a major threat to the native biodiversity (Pauchard & Alaback, 2006), ecosystem structure and functions (Levine et al. 2003, Zedler & Kercher, 2004; Stinson et al. 2006) and conservation of the protected areas (Pauchard & Alaback, 2006), requiring enormous costs in agriculture, forestry, fisheries and other human activities, as well as in human health (Pimentel et al., 2000; Wittenberg & Cock, 2001; Lowell & Stone, 2005, etc).

This paper refers to two alien plant species, which have recently immigrated into the Romanian flora: *Reynoutria x bohemica* and *Grindelia squarrosa*.

## MATERIALS AND METHODS

The presence, distribution in Romania and invasive character of these two plant species are based on our recent field investigations (2004-2007). Data from some herbarium collections (I, IAGB and IASI) and information from the literature were also used. The herbarium samples have been stored in the general herbarium of the University of Agricultural Sciences and Veterinary Medicine of Iași.

## RESULTS AND DISCUSSION

1. *Reynoutria x bohemica* Chrtek & Chrtková, Čas. Nár. Muz. Praha, ser. nat., 152: 120 (1983) (= *Reynoutria japonica x Reynoutria sachalinensis*) (Syn.: *Fallopia x bohemica* (Chrtek & Chrtková) J. Bailey; *Polygonum × bohemicum* (Chrtek & Chrtková) Zika & Jacobson).

Although known for a short time in Romania (Kovács, 2004; Kovács, 2006), *Reynoutria x bohemica* has already been identified in over 78 localities from Eastern Transylvania, being designated as recognition species (together with *Reynoutria japonica*) for the perennial synanthropic vegetation of mesic habitats (*Galio-Urticetea*), of “*Fallopia japonica* agg. (DC.)” type, which are frequent in this part of the country (Kovács, 2004; Kovács, 2006; Fenesi 2004).

We found this species (initially, determined as *Reynoutria japonica*) (Oprea & Sîrbu, 2006), three years ago (2004), on the left bank of the Tisa River (the Romanian side), between the villages Valea Vişeuului and Piatra, then in Lăpuş Gorges, Valea Vinului, Rodna (2006), and, recently, in the Arieş Valley - Apuseni Mountains (2007).

Along these watercourses, *Reynoutria x bohemica* presents a marked invasive character, forming (together with *Reynoutria japonica*, *Helianthus tuberosus*, *Solidago gigantea* subsp. *serotina*, *Rubus caesius*, *Artemisia vulgaris*, *Erigeron annuus* s.l., *Tanacetum vulgare*, *Agrostis stolonifera*, as companions) well-developed phytocoenoses (2-4 m high and 100% coverage), which replace the native vegetal communities on large areas (Oprea & Sîrbu, 2006).

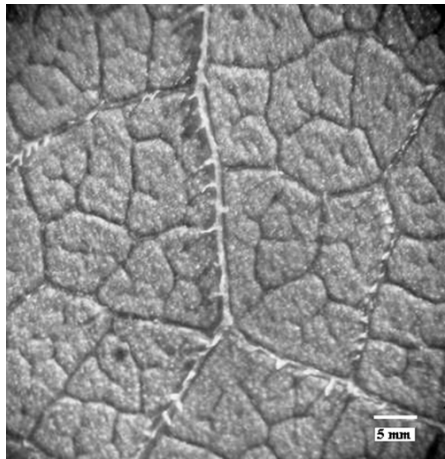
In Moldavia (between the Eastern Carpathians and the Prut River), this species has not been known until now. As a result of our recent field investigations, we have also found this species in this province, mainly along the riverside in the mountain regions - along the Bistriţa River and its effluents (at Vatra Dornei, Pietroasa, Crucea, Broşteni, Galu, Piatra Neamţ, Ceahlău, Bicz, Biczul Ardelean, Bicz-Chei, Ticoş, Taşca) (leg. Sîrbu & Oprea, 2004-2007), Moldova River (at Gura Humorului, Negruleasa), but also in the Moldavian Plain (in Iaşi, escaped from culture, on the Florilor Street, leg. Sîrbu, 2006).

Moreover, examining some herbarium materials, we have noticed that, although the occurrence of this species in Romania was discovered a short time ago, it had been collected since the second half of the last century, but erroneously determined as *Polygonum cuspidatum* Sieb. & Zucc., as in the following instances: Lunca Bistricioarei (Neamţ County) (leg. Zanoschi 1969, Herb. IASI-13385); Lacu Roşu (Harghita County) (leg. Burduja. & Sârbu 1969, Herb. I-42894; Ţopa 1973, Herb. IAGB 29442); Lacu Roşu-Pârâul Oilor (Harghita County) ( leg. Dobrescu 1969, Herb. I-50687; 50688); Baia Mare (Maramureş County) (leg. Ţopa 1969, Herb. IAGB-3970), Gurahonţ (Arad County) (leg. Ţopa 1941, Herb. IAGB-28537), etc.

Taking into consideration the above aspect, it is possible that many chorological data referring to *Reynoutria japonica* (= *Polygonum cuspidatum*) from Romania must be reconsidered and assigned to *Reynoutria x bohemica*. As a result, we consider that the real spreading of this plant in Romania is not completely known yet, further investigations for establishing its real invasive area being necessary.

**Description.** *Reynoutria x bohemica* is distinct from *Reynoutria japonica* (with which it was confused in Romania, in the past) by a bigger habitus (- 4 m high), bigger leaves (up to 23 cm long and 19 cm wide) with slightly cordate or truncated base, and 2-3-cellular, acute hairs on the veins from the underside of leaf (*Figure 1*).

*Reynoutria japonica* has not hairs on its leaves, but heavily ornamented single cells (Bailey et al., 1996); panicle is commonly shorter than the subtending leaf length (Barney et al., 2006).



**Fig. 1 - *Reynoutria x bohemica*: hairs on the underside of leaf**

**Historical considerations and general spreading.** In 1983, Chrtek & Chrtková described *Reynoutria x bohemica* from the Central Bohemia (Czech Republic), as a new species in science. Nevertheless, its presence in Europe dated since the second half of the 19<sup>th</sup> century. In 1872, it was cultivated in English gardens (under one of its parents' names), the oldest herbarium records originating from the Manchester Botanic Garden (Bailey & Conolly, 2000 quoted by Mandák et al., 2004). In the Czech Republic, there were data about the presence of this species (cultivated as ornamental) since 1942 (Pyšek et al., 2002), but at present, in this country, *Reynoutria x bohemica* is reported as a wild plant in over 381 localities (Mandák et al., 2004).

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Nowadays, it is cited in the majority of the central and western European countries: Great Britain and Ireland (Webb, 1993; Bailey et al., 1996), Czech Republic (Chrtěk & Chrtěková, 1983; Mandák et al., 2004), Slovakia (Eliáš et al., 2001; Eliáš, 2004), Poland (Fojcik & Tokarska-Guzik, 2000), France (Kerguelen, 1993; Brunel & Tison, 2005; Schnitzler & Bailey, 2005), Switzerland (Gerber, 2006; Shaw & Schaffner, 2006), Belgium (Tiébré & Mahy, 2005), Germany (Kowarik & Schepker, 1998), Hungary (Balogh, 1988, cited by Balogh & Bailey, 2003; Balogh, 2003), as well as in Bulgaria (Vladimirov, 2005) and Ukraine (Tisa Basin) (Drescher et al., 2003). It is also known in North America (Zika & Jacobson, 2003; Barney et al. 2006, FNA) and Japan (Bailey, 2003, cited by Mandák et al., 2004).

**The immigration way in Romania.** Regarding the way of this species immigration in Romania, there are two hypotheses: either it was directly imported from Central Europe (under the name of *Reynoutria japonica* or *Polygonum cuspidatum*), to be cultivated as ornamental, and then it escaped from gardens, or it spread on natural ways from west to east, along watercourses (Tisa, Someș, Mureș, etc.), first in Transylvania, then in Moldavia, along the intra-mountain corridors.

**Biology and ecology.** *Reynoutria x bohemica* is a geophyte (with rhizome), generally hexaploid ( $2n=66$ ) (but tetraploid and octoploid clones may also be found) (Bailey et al., 1996; Mandák et al., 2003), mezophyllous-mezohigrophyllous; it flowers during July-October. The flowers are hermaphrodite or female; the hermaphrodite ones are generally self-incompatible, that is they are unable to form seed without an additional source of pollen (Bailey et al., 1996; Balogh & Bailey, 2003).

The main mode of reproduction is the vegetative one (with rhizomes, less aerial stems) (Bímová et al., 2003; Pyšek et al., 2003; Balogh & Bailey, 2003; Mandák et al., 2004), but the regeneration rate and final shoot mass are significantly affected by genotype (Pyšek et al., 2003).

It invades riparian habitats, especially riversides and various anthropic disturbed habitats (roadsides, railways, waste places, uncultivated fields, etc.); it often spreads the natural or semi-natural vegetation (Mandák et al., 2003; Zika & Jacobson, 2003; Balogh & Bailey, 2003; Gerber, 2006; Kovács, 2004; Kovács, 2006; Fenesi, 2004; Oprea & Sîrbu, 2006). It is more frequent in hilly (Balogh & Bailey, 2003) or mountainous regions.

From the phytocoenological point of view, the populations of this species enter the structure of some vegetal communities of *Galio-Urticecea* class, *Convolvuletalia sepium* order, *Senecion fluviatilis* alliance (Kovács, 2004; Kovács, 2006; Fenesi, 2004; Oprea & Sîrbu, 2006).

**The invasive character.** Together with its parental species, native from East Asia, *Reynoutria x bohemica* is one of the most important invasive species in Europe (Balogh & Bailey, 2003, Mandák et al., 2003) and North America (Zika &

Jacobson, 2003; FNA), replacing all other vegetation from the invaded habitats. In many European countries, the deliberate spread in the environment of these species is rigorously prohibited (Shaw & Schaffner, 2006).

2. *Grindelia squarrosa* (Pursh) Dunal. Mémoires du Museum d'Histoire Naturelle. Paris, 5: 50 (1819) (Syn.: *Donia squarrosa* Pursh, Fl. Am. Sept. II. 559 (1814)) (Figure 2).



**Fig. 2 – A-Ruderal vegetation with *Grindelia squarrosa* at Galați (E Romania); B-Detail with anthodiums**

Native from North America, where it is a common weed of prairies (Britton & Brown, 1970; Correll & Johnston, 1970; Darbyshire, 2003), it was introduced in Europe in 1804, as a cultivated plant, in the Royal Garden of Madrid (under the name of *Aster spathulatus* Hort.) (Steyermark, 1937). Nevertheless, it seems that in Europe its naturalization took place only to the middle of the last century, when it was reported as a wild plant (in 1949) in the Ukraine-Mykolayiv Region (Protopopova et al., 2006).

At present, the immigration domain of this species includes a significant part from Eastern, Central and Western Europe, being introduced into the following countries: Russia (C, E) (naturalized) (Tamamşian, 1959; Hansen, 1976; Greuter, 2005-2007), Ukraine (invasive) (Protopopova & Shevera, 1999; Mosyakin & Yavorska, 2002), Republic of Moldova (invasive) (Mîrza et al., 1987), Estonia (casual) (Kukk, 1999), Lithuania (casual) (Gudzinskas, 1997), Czech Republic (casual) (Kubát et al., 2002, cited by Pyšek et al., 2002), Belgium, Sweden, Latvia (casual) (Greuter, 2005-2007), Ireland (casual) (Reynolds, 2002).

In Ukraine and Republic of Moldova, *Grindelia squarrosa* is considered a very aggressive plant; here, it is naturalized in steppe, petrophytic, coastal,

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riparian, xerophytic and shrubby communities, pastures, abandoned arable lands, and severely degraded habitats, along roadsides and railways, as well as in the river basins (Protopopova & Shevera, 1999; Protopopova et al., 2006; Mîrza et al., 1987; Negru (ed) 2006), or even in natural reservations (Ursu (ed) 2005).

It is also considered as potentially invasive in Spain (Sanz Elorza et al., 2001).

In Romania, this species has been recently identified in the ruderal places of the siding lines from the Socola-Iași railway station (Sîrbu & Oprea, 1998; Ciocârlan, 2000; Sîrbu, 2004; Oprea, 2005). Meantime, the population from the Socola-Iași station has been notable extended, conquering an area of thousand square meters and becoming an important constituent of the anthropic vegetation from those ruderal places.

Recently, in September 2006, we have also found this species in the South of Moldavia (Romania), at Galați, where it vegetates under prosperous conditions, on some tens of hectares, along railway embankment, as well as on ruderal places around railway, along Portului Street, and the surroundings of Galați-Larga station. We suppose that in this location, as well as in Socola-Iași, this plant arrived from the Republic of Moldova, with goods or passenger trains.

At present, *Grindelia squarrosa* can be thus considered fully naturalized in Romania, having an evident invasive character.

## CONCLUSIONS

This paper is a contribution to the knowledge of the distribution of two alien species (*Reynoutria x bohemica*, and *Grindelia squarrosa*), both recently detected in the flora of Romania.

*Reynoutria x bohemica*, known in Europe as a very important invasive species, is cited now for the first time in Moldavia (between the Eastern Carpathians and the Prut River). *Reynoutria x bohemica* presents a strong invasive character, forming well-developed phytocoenoses, which replace the native vegetal communities on large areas, especially along watercourses, in Transylvania and in Moldavia.

*Grindelia squarrosa*, previously reported in 1998, at the Socola-Iași railway station (for the first time in the flora of Romania), was also found, in 2006, at Galați, in the Southern Moldavia (Eastern Romania), where it presents an evident invasive character in the anthropic habitats.

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