NEW AND RARE PLANTS FROM THE FLORA OF MOLDAVIA (ROMANIA)

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Received October 15, 2009

ABSTRACT - In this scientific paper, some vascular plants (Aster lanceolatus Willd., Aster novi-belgii L., Fraxinus pennsylvanica Marshall, Picris echioides L. and Festuca tenuifolia Sibth.) were shown as new species from the spontaneous flora of Moldavia. We have also analysed new data on some rare vascular species found in the flora of this region (Coreopsis tinctoria Nutt., Ulmus pumila L., Rudbeckia triloba L., Rudbeckia hirta L., Lupinus polyphyllus Lindl., Oenothera glazioviana Micheli and Rhus typhina L.). One of these species is native (Festuca tenuifolia Sibth.), while the others are alien plants. Among the alien species, Picris echioides L. is xenophyte (accidentally introduced) and the others are hemerophytes (intentionally introduced for different uses and, subsequently, escaped in the wild). Given the number of localities in which these species were found, we may consider that the following alien plants had an invasive tendency in Moldavia: Fraxinus pennsylvanica Marshall, Ulmus pumila L., Oenothera glazioviana Micheli, Rhus typhina L. and Lupinus polyphyllus Lindl. The other species may be considered naturalized (most of them), being able to form populations without human help. Except Festuca tenuifolia Sibth., which grew in natural grasslands, all the other identified species were integrated in anthropic habitats. Aster lanceolatus Willd., Rudbeckia triloba L., Rudbeckia hirta L., Lupinus polyphyllus Lindl. and Rhus typhina L. also penetrated into semi-natural habitats: forest edges, river banks and river meadows. As concerns Festuca tenuifolia Sibth., a very rare species in the flora of Romania, included in the Romanian Red List of Vascular Plants, its presence in Moldavia, to the South-Eastern limit of its natural area, is very interesting and encouraging.

Key words: alien plants, vascular flora of Romania

REZUMAT - Plante noi sau rare în flora Moldovei (România). În lucrare sunt prezentate câteva plante vasculare (Aster lanceolatus Willd., Aster novi-belgii L.,...

Cuvinte cheie: flora vasculară a României, plante adventive

INTRODUCTION

In the last decades, there is a continuous enrichment of flora with new elements, which are generally alien species, due to a better coverage of the Romanian territory with floristic studies and especially, because of the intensification of human pressure on habitat and the increase of the internal and international movement of people and goods. Therefore, new alien species have been reported in recent years, both in Moldavia (Sîrbu, 2006; Sîrbu & Oprea, 2008a, etc.) and in other historical provinces of Romania (Anastasiu & Negrean, 2007; Ciocârlan & Sike, 2006; Sîrbu & Oprea, 2008b, etc.).

This scientific paper shows information on occurrence, ways of introduction and ecology of some new or rare plant species in the flora of Moldavia (e.g. Aster lanceolatus, Aster novi-belgii, Fraxinus pennsylvanica, Picris echioides, Festuca tenuifolia, etc.).

MATERIALS AND METHODS

The floristic and chorological data are based on our recent field investigations, conducted in different localities of Moldavia. For each species identified by us, we show information concerning its previously reported occurrence in Romania, in Moldavia and their current distribution in the investigated area.

Herbarium specimens have been deposited in the general herbarium of the University of Agricultural Sciences and Veterinary Medicine of Iași. The species
nomenclature is done according to Flora Europaea (Tutin & al., 1964–1980 and Oprea, 2005). Terminology and definitions, recommended by Richardson & al. (2000) and Pyšek & al. (2004), were used for establishing the status of alien plants.

RESULTS AND DISCUSSION

During our field surveys in the recent years, we have identified five new species of vascular plants for the flora of Moldavia and other seven less known species in the spontaneous flora of this territory (Table 1).

One of these species is native (Festuca tenuifolia) and 11 are alien species (most of them originating from North America, one originating from South and Central Europe and one from Central and East Asia). Among the alien species, one is xenophyte, being introduced accidentally (Picris echioides), while the others were intentionally introduced by humans, for different uses (mainly as ornamental plants) and, subsequently, escaped from cultivation in the wild (hemerophyte species).

Given the number of localities in which these species were identified in Moldavia, the following species show an invasive tendency: Fraxinus pennsylvanica (eight localities), Ulmus pumila (eight localities), Oenothera glazioviana (seven localities), Rhus typhina (six localities) and Lupinus polyphyllus (five localities). The other species may be naturalized, because they form fertile seeds (most of them) or show a great capacity for the vegetative propagation (e.g. Aster lanceolatus, A. novi-belgii), being able to form stable populations, without human help.

Except Festuca tenuifolia, which grows in natural grasslands, all the other identified species are integrated into human habitats. Aster lanceolatus, Rudbeckia triloba, Rudbeckia hirta, Lupinus polyphyllus and Rhus typhina also penetrate into the semi-natural habitats: forest edges, riverbanks and river meadows (Table 1).

a) New Species in the Flora of Moldavia

Aster lanceolatus Willd. (Symphyotrichum lanceolatum (Willd.) G.L. Nesom)

This species originating from North America (Britton & Brown, 1970) was introduced in Europe as ornamental plant, in the early XIX-th Century (Witteberg (ed), 2005). It is now naturalized almost throughout the continent (Yeo, 1976). It is recorded as an invasive species in Austria (Essl & Rabitsch (eds), 2002) and as a potentially invasive species in France and Portugal (Witteberg (ed), 2005). The invaded habitats are wet meadows, riverbanks, openings and edges of floodplain forests, damp thickets and fields and roadside ditches. In addition, it grows in mesic to humid neglected fields and poorly managed pastures (Witteberg (ed), 2005).
Table 1 - New and rare plants in the flora of Moldavia (Romania) (H-hemerophyte, X-xenophyte, N-native)

<table>
<thead>
<tr>
<th>Species</th>
<th>Geographic origin</th>
<th>Category</th>
<th>Introduction way</th>
<th>Habitat type</th>
<th>Reproduction by seeds</th>
<th>Reproduction vegetative</th>
<th>Bibliographic data</th>
<th>New data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picris echoides L.</td>
<td>C&amp;S Eur</td>
<td>X</td>
<td>accidental</td>
<td>anthropic</td>
<td>+</td>
<td>-</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Aster lanceolatus Willd.</td>
<td>N Am</td>
<td>H</td>
<td>ornamental</td>
<td>anthropic, semi-natural</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Aster novi-belgii L.</td>
<td>N Am</td>
<td>H</td>
<td>ornamental</td>
<td>anthropic</td>
<td>-</td>
<td>+</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fraxinus pennsylvanica Marshall</td>
<td>N Am</td>
<td>H</td>
<td>ornamental, forestry and anti-erosion</td>
<td>anthropic</td>
<td>+</td>
<td>-</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Festuca tenuifolia Sibth.</td>
<td>C&amp;W Eur</td>
<td>N</td>
<td>-</td>
<td>natural</td>
<td>+</td>
<td>-</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Coreopsis tinctoria Nutt.</td>
<td>N Am</td>
<td>H</td>
<td>ornamental</td>
<td>anthropic</td>
<td>+</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ulmus pumila L.</td>
<td>C&amp;E Asia</td>
<td>H</td>
<td>ornamental</td>
<td>anthropic</td>
<td>+</td>
<td>-</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Rudbeckia triloba L.</td>
<td>N Am</td>
<td>H</td>
<td>ornamental</td>
<td>anthropic, semi-natural</td>
<td>+</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Rudbeckia hirta L.</td>
<td>N Am</td>
<td>H</td>
<td>ornamental</td>
<td>anthropic, semi-natural</td>
<td>+</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lupinus polyphyllus Lindl.</td>
<td>N Am</td>
<td>H</td>
<td>ornamental and fodder</td>
<td>anthropic, semi-natural</td>
<td>+</td>
<td>-</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Oenothera glazioviana Micheli</td>
<td>N Am</td>
<td>H</td>
<td>ornamental</td>
<td>anthropic</td>
<td>+</td>
<td>-</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Rhus typhina L.</td>
<td>N Am</td>
<td>H</td>
<td>ornamental</td>
<td>anthropic, semi-natural</td>
<td>+</td>
<td>+</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>
In Romania, this species was known only in Transylvania (Drăgulescu, 2003; Leocov & Țopa, 1986; Morariu & Nyárády, 1964; Oprea, 2005; Soó, 1940, quoted by Kovács, 2006), Banat (Morariu et al., 1969) and Maramureș (Oprea & Sîrbu, 2006).

This plant is easily escaped from gardens (Morariu & Nyárády, 1964), invading the river meadows, where it can form monodominant communities, like in Eastern Transylvania, for example (Kovács, 2006). In Sibiu County, it is increasingly met in the hilly regions (400-450 m altitude) (Drăgulescu, 2003). In addition, along the Tisa River, *A. lanceolatus* is one of the most frequent alien species (Oprea & Sîrbu, 2006).

In Moldavia, we have first identified a small population of *A. lanceolatus* naturalized in Valea Lupului (Iași County) near the railway, on a relatively wet ground (leg. Sîrbu, 5 September 2008). Later, we have found this species at Borniș (Neamț County) (leg. Sîrbu & Operas, 21 September 2008). In the second locality, the plant forms large, monodominant, mesophyllous communities, with other species, like *Rubus caesius*, *Lapsana communis*, *Inula helenium*, *Eupatorium cannabinum*, *Angelica sylvestris*, *Filipendula ulmaria*, *Agrostis stolonifera*, *Agrimonia eupatoria*, *Clinopodium vulgare*, *Artemisia vulgaris*, *Senecio erucifolius*, etc. In such places, *A. lanceolatus* successfully multiplies in a vegetative way by stolons.

*Aster novi-belgii* L. (Symphyotrichum novi-belgii (L.) G.L.Nesom)

This species originating from the Eastern coast of North America (Britton & Brown, 1970) was widely introduced and naturalised in Europe (Yeo, 1976). The plant was probably introduced in the XIX-th Century in the UK as an ornamental plant, but the earliest possible date of its introduction could be around 1710 (Wittemberg (ed), 2005).

In Austria, this invasive plant threatens natural habitats and vegetal communities (Essl & Rabitsch (eds), 2002).

In Romania, *A. novi-belgii* is cultivated as an ornamental plant, with late flowering and sometimes, it is sub-spontaneous, especially in Transylvania (Drăgulescu, 2003; Morariu & Nyárády, 1964; Oprea, 2005; Schneider-Binder, 1979; Schur, 1866) and Maramureș (Karácsonyi, 1995; Morariu & Nyárády, 1964; Resmeriță et al., 1971). It is also known as sub-spontaneous species in the Dubova Depression (Mehedinți County) (Dihoru et al., 1970) and along the Ialomița river meadow (Prahova County) (Negrean, 1972).

We have identified this plant on the neglected and relatively wet fields along the Bahlui River meadows, in Iași, close to the Nicolina Hospital (leg. Sîrbu, 6 September 2008) and along the C.A. Rosetti Street (leg. Sîrbu & Oprea, 26 September 2009). There, it forms relatively small but vigorous populations, with an obvious
tendency of vegetative spread, through stolons.

**Fraxinus pennsylvanica**

Marshall (**F. pubescens** Lam.)

It is a native species from Eastern North America, which was introduced in Europe for ornamental, forestry or anti-erosion uses (Dumitriu-Tătăranu, 1960), in 1780 (Csiszár & Bartha, 2008). It is met as an alien plant in numerous countries from Central Europe (Daisie, 2009; do Amaral & da Rocha Afonso, 1972). In Austria, *F. pennsylvanica* is an invasive plant, threatening native habitats and vegetal communities (Essl & Rabitsch (eds), 2002). In Hungary, it is also considered as one of the most invasive alien plants, being common everywhere (Csiszár & Bartha, 2008).

In Romania, the number of localities in which *F. pennsylvanica* is met (as a sub-spontaneous tree) has increased lately and therefore, it was recorded on the list of the invasive species from the country (Anastasiu & Negrean, 2007). It grows well on light, wet but well drained soils; it tolerates well the floods and the frost (Dumitriu-Tătăranu, 1960).

The authors have found more frequently this species in Moldavia in recent years, especially along the roads, railways, railway stations, as well as on the ruderal lands: Hanu Anceuței (Neamț County) (leg. Sîrbu, 5 September 2009), Miclăușeni (leg. Oprea & Sîrbu, 15 August 2009), Iași-Socola railway station (leg. Sîrbu & Oprea, 27 August 2009), and along the C.A. Rosetti Street (leg. Sîrbu & Oprea, 26 September 2009) (Iași County), Vaslui, Munteni de Jos, Bârlad (leg. Sîrbu & Oprea, 2 August 2009) and Sâlcioara (leg. Oprea, 15 August 2009) (Vaslui County). In almost all these places, the plant produces many fruits that are easily spread by wind.

**Picris echioides** L. (**Helminthia echioides** (L.) Gaertn.; **Helminthoteca echioides** (L.) Holub)

This species is originating from Central and South Europe and became naturalised (alien) in the other regions of the continent (including Romania), but with an inconstant occurrence (Sell, 1976). It is also an alien plant in North America (Britton & Brown, 1970). The tendency of increasing its area in Europe was noticed especially since the decades V and VI of the last century, in France, Hungary, former Yugoslavia, as well as in Romania and former USSR (where it was declared a quarantine weed) (Anghel et al., 1972).

In Romania, the plant was initially identified in Transylvania, at the middle of the XIX Century, in Cluj-Napoca (Landoz, in Simonkai, 1866). Later, it was rediscovered by Timuș (1940), who found the seeds of this species in samples of alfalfa from Sânicolaul Mare (Timiș County).

Today, *P. echioides* is known in Transylvania (rare plant) (Nyárády, 1965; Landoz, 1844, Simonkai, 1866), Banat (sporadic plant) (Anghel et al., 1960; Popescu & Bujoreanu, 1957; Timuș, 1940), Crișana (sporadic plant) (Anghel et al., 1960; Borza, 1947; Pop, 1962; Pop, 1968), Maramureș

As concerns the altitude, it grows from forest steppe to the floor of sessile oak forests (Ciocârlan et al., 2004). According to Anghel et al. (1972), the plant is more frequent in clover and alfalfa crops from Banat, but it grows also on tilled fields or ruderal places. *P. echioides* is a xeromesophyllous-mesophyllous, (sub-) termophyllous plant (Ciocârlan et al., 2004), less resistant to frost, which hinders its spread northward (Anghel et al., 1960).

The authors have identified this plant in Codăești (Vaslui County) (leg. Sîrbu & Oprea, 22 August 2009), where it grows on fallows, as an accompanying species within the phytocenoses of *Conyza canadensis* and *Lactuca serriola* (Erigeronto - Lactucetum serriolae Lohmeyer in Oberd. 1957 em. Mucina, 1978). There, *P. echioides* produces many seeds that spread easily in the anemochorous way. Therefore, it is expected that in the future this species will spread more in this region.

**Festuca tenuifolia** Sibth. (*F. capillata* Lam.)

This species has the main habitat in Central West Europe (Beldie, 1972; Ciocârlan, 2000) and is spread in Spain, Britain, Belgium, Netherlands, France, Germany, Switzerland, Italy, former Yugoslavia, Austria, former Czechoslovakia, Poland, Hungary, Romania, former USSR (Central and West regions), Denmark and Sweden (Markgraf-Dannenberg, 1980).

It is a very rare species in Romania, which is included in *Romanian Red List of Vascular Plants* (Oltean et al., 1994). So far, it is known only in Eastern Transylvania and Maramureș; Poiana-Brașov, at the base of the Piatra Mare Mountain, Prejmer (Brașov County) (Beldie, 1972; Schur, 1866), Bistrița-Năsăud County (Porcius, 1885), Crăciunesti (Maramureș County) (Resmeriță et al., 1975-1987, in Oprea, 2005), Ocna Șugatag (Maramureș County) (Oprea, 2006, personal observations). Only data from Maramureș are recent, while the indications for Eastern Transylvania are very old (of the nineteenth century). It grows on meadows, forest edges and glades, on poor, sandy or peaty soils (Beldie, 1972).

The authors have also identified this plant in Moldavia, near the northern border of Romania, in Suceava County, at Poiana Strâji (Straja) (47°54'50.00" N; 25°30'55.25" E; alt. 529 m) and Poiana Cerbului (Straja) (47°55'24.50" N; 25°29'14.925" E; alt. 782 m), in mesophyll meadows, on the slope of the left side of the Suceava River (leg. Sîrbu & Chidoșeț, 30 June 2008). In the first location, this species is represented by sporadic individuals, spread in a phytocenosis of *Festuco rubrae-Agrostietum capillaris* Horvat 1951, while in the second location, populations of *F. tenuifolia* have coverage of about 60% on areas of 30-40 m².
b) Alien Species (Hemerophytes) Identified in New Localities

**Coreopsis tinctoria** Nutt. (originating from North America, it was introduced as an ornamental plant). Previously reported in Viile (Galați County) (Mititelu et al., 1993) and Piatra Neamț-Cuejdi river meadow (Sîrbu & Oprea, 2008c), it has also been identified in Ciric-Iași in waste ground (Iași County) (leg. Sîrbu, 17 August 2008), and Agapia - on the riverside of the homonymous river (Neamț County) (leg. Oprea & Sîrbu, 23 August 2009).

**Ulmus pumila** L. (originating from Central and Eastern Asia, it was introduced as an ornamental tree). The species was previously known in Moldavia, only in Galați County (Borza, 1958; Mititelu et al., 1993; Popa & Chifu, 2006) and it was also found in Iași (near the railway station, leg. Sîrbu, 22 August 2008) and Socola (railway embankments, leg. Sîrbu & Oprea, 27 August 2009) (Iași County).

**Rudbeckia triloba** L. (originating from North America, it was introduced as an ornamental plant) was recently identified in the meadow of the Agapia River (Sîrbu & Oprea, 2009, unpublished) and it is also found in Iași (waste ground on Uzinei and Bucur streets, leg. Sîrbu, 1 August 2009), as well as in Ruginoasa (Iași County, leg. Sîrbu, 23 August 2009).

**Rudbeckia hirta** L. (originating from North America, it was introduced as an ornamental plant) was previously reported in the Cuejdi river meadow, upstream of Piatra Neamț (Sîrbu & Oprea, 2008c), it is also found on upstream of Agapia, on the riverside of homonymous river (Neamț County) (leg. Sîrbu & Oprea, 23.VIII.09).

**Lupinus polyphyllus** Lindl. (originating from North America, it was introduced as an ornamental and fodder plant). It was collected in 1952, in Fundu Moldovei locality (Suceava County) (IASI Herbarium, leg. anonymous) and then cited in several other localities of the same county: Moldovița-Ferăstrău (Morariu et al., 1969), Șarul Dornei (Mititelu et al., 1988) and Vama (Mititelu et al., 1989). We have found it in Vadu Negrilesei on the banks of a tributary of the Negrileasa River (Suceava County) (leg. Oprea & Sîrbu, 27 July 2009), where it grows abundantly and produces many fruits and fertile seeds.

**Oenothera glazioviana** Micheli (Syn.: *Oenothera erythrosepala* Borbás) (originating from North America, it was introduced as an ornamental plant). It was previously reported in Agapia and Piatra Neamț (Neamț County) (Sîrbu & Oprea, 2008c). We have also found it in Adjud (on the roadside), Urechești (roadside ditches) (Vrancea County) (leg. Sîrbu, 25.VII.09), Berheci (Galați County) (on the roadside, leg. Oprea & Sîrbu, 2 August 2009), Poieni (Iași County) (fallow, leg. Sîrbu & Oprea, 2 August 2009), Borșeni-Războieni (Neamț County) (roadside, leg. Sîrbu & Oprea, 2 June 2009).
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*Rhus typhina* L. (*R. hirta* (L.) Sudw.) (originating from North America, it was introduced as an ornamental tree). It was first mentioned as cultivated plant in Moldavia (Szabo, 1841), then as a sub-spontaneous species in Largamovileni (Grecescu, 1909), Botanic Garden of Iași (Leocov & Țopa, 1986), Ciric, Zagavia-Scobinți (Mititelu et al., 1995) (Iași County), as well as in Huși (Vaslui County) (Sîrbu, 2008). Recently, we have identified this species in Borniș (Neamț County) (leg. Sîrbu & Oprea, 2 June 2009). There, it forms some dense and large populations, at the edge of hazelnut trees.

**CONCLUSIONS**

All the species shown in this scientific paper, except *Festuca tenuifolia*, are alien plants (neophytes and hemerophytes). Some species are new for the flora of Moldavia, while others are quite rare for this region of Romania, but their exotic nature and because they can reproduce without human help are a warning as concerns their future evolution in this territory.

Regarding *Festuca tenuifolia*, a very rare species in the flora of Romania, included in the *Romanian Red List of Vascular Plants*, its presence in Moldavia, towards the south-eastern limit of its natural area, is very interesting and encouraging.

**Acknowledgements.** This work is a result of the PNCDI-PN II-IDEI Grant, contract No. 1110 / 2009: “Research over the migration and invasion of alien plants in some anthropic and natural habitats from Moldavia (Romania)”.

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