ADVENTIVE SPECIES IN THE DANUBE FLOODPLAIN BETWEEN CALAFAT AND BECHET (OLTENIA, ROMANIA)

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Abstract. In this paper 20 adventive species are presented, being located in the Danube floodplain between Calafat and Bechet. The large number of these species in the studied area is directly proportional with a practice of an improper agriculture. Most of these plants are growing widely, having the tendency of expansion (*Conyza canadensis*, *Xanthium saccharatum*, *Ambrosia artemisiifolia*) due to humans. Few species experience a slight reduction in the number of individuals (*Veronica peregrina*). A high percentage of the analysed plants are annual, only few are biennial or perennial.

Keywords: adventive species, Danube floodplain, Oltenia, Romania.

Rezumat. Specii adventive din Lunca Dunării între Calafat şi Bechet (Oltenia, România). În lucrarea de faţă sunt prezentate 20 de specii adventive identificate în Lunca Dunării între Calafat şi Bechet. Prezenţa în număr mare a acestor specii în suprafaţa analizată este direct proporţională cu practicarea unei agriculturi necorespunzătoare. O mare parte dintre aceste plante se dezvoltă în exemplare numeroase, manifestând în acelaşi timp şi tendinţa de expansiune (*Conyza canadensis*, *Xanthium saccharatum*, *Ambrosia artemisiifolia*) datorită omului. Puţine sunt cele care cunosc o uşoară reducere a numărului de indivizi (*Veronica peregrina*). Un procent ridicat din plantele analizate sunt anuale, puţine sunt bienale sau perene.

Cuvinte cheie: plante adventive, Lunca Dunării, Oltenia, România.

INTRODUCTION

The idea of studying this class of plants came along with the detailed research of the Danube sector within an international research contract which has focused on the study of aquatic plants. The *Amorpha fruticosa* (LINNAEUS, 1753) species widely spread on the Romanian bank of the Danube made me study all the plants in the Danube floodplain, especially the adventive ones.

The adventive plants are species which are present in a certain place due to their introduction, intentionally or circumstantially (accidentally), by humans. They are also known as synanthropic, alien, imported, introduced or anthropophyte species (DIHORU, 2004).

Their classification differs from one author to another. A simpler classification is made by KORNAŚ (1978). He divides them into: apophyte (native species that grow in anthropogenic habitats) and anthropophyte (species introduced from distant flora) plants.

An older classification (HOLUB & JIRÁSEK, 1967), but recently taken into account (PYŠEK et al., 2002), is firstly considering how they were introduced. According to this they are divided into hemerophytes (plants introduced intentionally (consciously)) and xenophytes (plants introduced unintentionally (accidentally, unconsciously)).

From what we know, in Oltenia the special concerns in this area are rare (COSTACHE & RĂDUŢOIU 2005; RĂDUŢOIU & COSTACHE, 2008; RĂDUŢOIU, 2009). Data indicating some adventive species are sporadic in this part of the country.

MATERIAL AND METHODS

To carry out a complete floristic inventory of the adventive species from this part of the country, there were done many field trips in all the seasons to observe the plants in all the stages of development. This thing allowed an accurate determination and an observation of their dynamics for almost 10 years.

The determination of the studied species was done using the specific national or international literature (MORARIU, 1952; NYÁRÁDY, 1957; GHIŞA, 1960a; GHIŞA, 1960b; SĂVULESCU et al., 1964; TUTIN et al., 1976; BELDIE, 1977, 1979; CIOCÂRLAN, 2000, 2009 etc.).

For the taxa whose objective determination was not possible in the field, fresh material was sampled in separate bags for immediate determination in the laboratory.

The identified material was compared in some cases with the holotypes and exiccates existent in the Herbarium of the University of Craiova (CRA).

The authors' abbreviations were done after BRUMMITT & POWELL (1992).

RESULTS AND DISCUSSIONS

In our researches 20 adventive species have been identified in the studied area. Their presentation is done in alphabetical order to ease the finding of a taxon.

Amaranthus albus (LINNAEUS 1753) – White Amaranth (Fam. Amaranthaceae)

It is an annual plant, adventive from North America, and today is spread all over the continents, in the warm areas. It was mentioned about 50 years ago as "being feral in the meadows" (NYÁRÁDY, 1957, after ANASTASIU & NEGREAN, 2007). It is a species well-adapted to the climatic and soil conditions from this part of Romania. In the studied area, the plant was found in grapevines (in the localities: Rast, Negoi, Catane, Piscu Vechi, Ciupercenii Noi, Dunăreni), in heaths (in almost all the heaths from the Danube floodplain, in our studied area) as isolated individuals or occupying small, exclusive areas up to 3 m^2. Its participation in the weed encroachment, in the whole vineyards, is not too high.

Amaranthus deflexus (LINNAEUS 1753) – low amaranth (Fam. Amaranthaceae)

It is a weed that multiplies easily by generative way. This species was found in a few localities between Bechet and Calafat (Calafat, Nebuna, Rast and Negoi), as isolated specimens. It differs from the earlier species by the fruit, which does not open at maturation, by acute leaves and puberule stems.

Amaranthus powellii (S. WATSON 1875) – Powell amaranth = green pigweed and *A. retroflexus* (LINNAEUS 1753) – Redroot amaranth (Fam. Amaranthaceae).

They are from North America and are the most common species of amaranth in the studied area. Basically they are in all the corn crops. Their control is difficult due to the large number of seeds that one individual can produce (up to 1 million seeds / plant (IONESCU SIȘEȘTI, 1955). In some vineyards these plants are important or characteristic species in the formation of nitrophile associations (*Amarantho – Chenopodietum albi* MORARIU 1943).

Ambrosia artemisiifolia (LINNAEUS 1753) – common ragweed (Fam. Asteraceae)

It is an annual summer plant, with a specific physiognomy. It is adventive from North America, Europe, and Asia. It prefers drier, sunny places along roadside, but also crops and meadows. In some areas of the floodplain forest in the studied area, this plant gave the physiognomy of the grass layer (Rast), but after the floods in 2006, its place was taken by other species, the high humidity on a long period of time leading to major reductions of the specimens in these areas.

Amorpha fruticosa (LINNAEUS 1753) – False Indigo (Fam. Fabaceae)

It is a species found throughout the studied area, forming a thicket hard to go through on the bank of the Danube, a true "riparian jungle" (DIHORU 2004), especially in the places where man has interfered by plantations or workings. It multiplies very much both by seeds and especially by root suckers.

The only advantage of this species in the studied area is that it takes part in the consolidation of the dyke.

Bidens frondosa (LINNAEUS 1753) - devil's beggartick (Fam. Asteraceae)

It is an annual plant with origins in North America. It is present in the Danube floodplain of the studied area on the Danube bank or at the edge of holms, ponds and canals. In some areas, it is almost exclusive (in ponds and canals of the former rice plantations from Rast). It multiplies by achenes. The setae on these fruits have stiff bristles that serve for hanging and dissemination.

Conyza canadensis (LINNAEUS 1753) CRONQUIST 1943 – Canadian horseweed (Fam. Asteraceae)

It is an annual plant with origins in North America. It is growing at the edge of crops, garden, ruderalized field and even street. It was brought to Europe in 1655 and in Romania it was frequently mentioned starting with 1814 (ANASTASIU & NEGREAN 2007). It was found that a well-developed single plant can produce over one million fruits, which gives it the status of a nitrophilous invasive plant of the first rank (DIHORU, 2004).

Datura stramonium (LINNAEUS 1753) – Jimson weed (Fam. Solanaceae)

It is an annual species of late spring or summer, common in most ruderalized places and crops (hoeing crops) in the studied area. In the Danube floodplain, it is commonly seen in waste places (Calafat, Rast, Bechet, Dunăreni, Nebuna, Bistreț, Negoi, Catane, Piscu Vechi, Tunari etc.). It is therefore a thermophilous, nitrophilous and heliophilous taxon (GHIȘA, 1960). A plant can produce 90 to 2,000 (30,000) seeds (CIOCÂRLAN, 2009).

Elodeea nuttallii ((PLANCHON 1848) H. ST. JOHN 1920) – Nuttall's pondweed (Fam.Hydrocharitaceae)

It is an aquatic plant found in some of the ponds in the Danube floodplain (Rast, Bistreț, Ghidici, Dunăreni). It is from North America. In Europe, it seems it was originally cultivated in aquariums. The presence of this species in Romania was first reported in 1992 in the Danube Delta. In the water where it is found, it covers almost all the volume of water, preventing the growth of other species of aquatic plants and even hindering fishing.

Erigeron annuus (LINNAEUS 1753) PERS. 1807 – annual fleabane (Asteraceae)

It is an annual plant, sometimes biennial or perennial, white-blue, of medium stature that extended very much in the past years in the studied area, especially in the abandoned infields. In Oltenia it was first mentioned by POPESCU (1968). It multiplies exclusively by seeds. It forms part of the plants category that produce a large number of seeds. The only biological control would be the pulling of young plants before fructification.

Galinsoga ciliata ((RAFIN.) BLAKE 1922) – Field Basil (Fam. Asteraceae)

It is a plant of South American origin. It is a commensal plant in the hoeing crops, especially of the corn ones. It develops largely in the low-groomed gardens. It is used by locals as fresh fodder for pigs and poultry. The success of this annual plant is ensured by the large number of produced germs and by rapid growth.

Galinsoga quadriradiata (RUIZ et PAVON s. str. 1798) – shaggy soldier (Fam. Asteraceae)

It is a taxon that morphologically is very similar to the previous species. For a long time in Romania it was mentioned under *G. ciliate.* CIOCÂRLAN is the first who sees differences between the two species in 2004. In Oltenia, the first citation was made by COSTACHE & RĂDUȚOIU (2005). It is present in almost all the gardens from the studied area but also as isolated specimens in hoeing culture.

Humulus lupulus (LINNAEUS 1753) – hop (Fam. Cannabaceae)

In the literature, it is mentioned as a North American, Eurasian species (GRINȚESCU, 1952; CIOCÂRLAN, 2009). It is found in the studied area, in almost all the forests from the Danube floodplain. In some parts it forms thickets that can hardly be crossed.

Oxalis corniculata (LINNAEUS 1753) – creeping woodsorrel (Fam. Oxalidaceae)

In the literature this taxon has different origins. Some authors say that it is of Southern European origin (BELDIE, 1977), others consider it as an adventive (Mediterranean) plant (CIOCÂRLAN, 2009).

It is commonly found in ruderalized areas and roadside crops.

Oxalis dillenii (JACQUIN 1913) – slender yellow woodsorrel (Fam. Oxalidaceae)

It is an annual-perennial species; with North American origin. It differs from *Oxalis corniculata* by the ascending stems, not lifted at nodes, by opposite leaves ± whorl leaves, with little or no stipules.

In the studied area it has been identified only in Rast locality. In fact this species is considered rare at the national level (CIOCÂRLAN, 2009).

Veronica peregrina (LINNAEUS 1753) – neckweed (Fam. Scrophulariaceae) (Fig. 1)

It is a plant with South American origin. It is a small plant, found only in Rast locality, in the studied area. It appeared in this part of the country after the catastrophic floods in 2006, floods that have affected this sector of the Danube. It appeared in the courtyard of a household damaged by the flood. Initially the population of this species had numerous specimens on an area of 10 m^2, currently its number has declined significantly.

Figure 1. General aspect with *Veronica peregrina* in Rast.
Figura 1. Aspect general cu *Veronica peregrina* în localitatea Rast (original).

Veronica persica (POIRET 1808) – Birdeye Speedwell (Fam. Scrophulariaceae)

This taxon gives the physiognomy of the vineyards during spring. It is present in all the other crops in the area (rarely in the cultures of cereals (CIOCÂRLAN et al., 2004)). It is an annual plant, with solitary flowers, original from the southwest of Asia. It flowers and ripens several times during a single vegetation season. Unlike other species of Veronica in the area it is among the few that roots at nodes.

Xanthium saccharatum WALLROTH (Fam. Asteraceae)

It is an annual species, of late spring-summer. It has North American origins, but in Romania this taxon has been confused for a long time with *Xanthium italicum* MORETTI. It has a great development in the heaths of all the localities from the studied area. It multiplies by seeds. Their spread is facilitated by the presence of thorns on the fruits, thus hanging easily to animals. In some localities (Rast, Catane, Negoi), where there are sheepfold in the Danube floodplain, the species caused poisoning to animals by eating it during young stage. Also, some areas have a desolate aspect because of the dry debris of the plant.

Xanthium spinosum (LINNAEUS 1753) – Cholera (Fam. Asteraceae)

It is of South American origin, being present nowadays in all the continents (CIOCÂRLAN, 2004). It is easily distinguished from the other species of Xanthium by the presence of trifurcate thorns at the base of the leaves. It is common in the studied area, in trashy places or heaths. In younger stages this plant is avoided by animals because of odour and at the maturity due to the trifurcate thorns at the base of the petiole. If at this thing there would be also added the fact that a single individual can produce up to 1800 achenes, we can say that the success of this plant in the area is provided.

CONCLUSIONS

Analysing the adventive species in the studied area and comparing their number to the total number of adventive species from the flora of Romania, we can say that in a so small area (if we consider the national level) there were found about a quarter of the adventive species from our country.

Some of them become invasive, eliminating the other species (*Heliotropium europeum, Ajuga chamaepytis, Gypsophila muralis, Vaccaria hispanica, Lappula squarrosa, Hypericum perforatum* and other) they live together with (*Conyza canadensis*, *Xanthium saccharatum*, *Amaranthus retroflexus* or *Ambrosia artemisiifolia*) and others are rare (*Veronica peregrina, Oxalis dillenii*).

The family with the most adventive species in the studied area is the Asteraceae. They are numerous both as number of species and as individuals.

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