

INVASIVE ALIEN PLANT SPECIES (IAPS), IDENTIFIED IN THE POLOG REGION – REPUBLIC OF NORTH MACEDONIA

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Abstract. This paper presents the invasive alien plant species in the Polog region, North Macedonia. As a result of the floristic research of this area, during the period 2021-2023 and based on the preliminary data of local and foreign botanists, 12 invasive alien plant species have been found, 7 of which belong to the Asteraceae family, while the other species belong to the following families: Solanaceae, Fabaceae, Amaranthaceae, Anacardiaceae and Poaceae. Excepting the species *Sorghum halepense* (L.) Pers., native to northeast Africa (and, probably, western and central Asia), all the other invasive plant species identified in the study region are of American origin (North, Central and South America). The alien invasive species identified in the Polog region belong to three life forms, where Therophytes (T) predominate (66.66%) among the identified species, while Geophytes (G) and Phanerophytes (P) represent only 16.67% each.

Key words: Invasive alien plants; Polog region; Republic of North Macedonia.

INTRODUCTION

The Polog region is situated in the northwest part of North Macedonia, with an area of 2,416 km². It covers the Polog valley, Mavrovo plateau, Bistra mountain range and the valley of the river Radika (Fig. 1). The Polog valley is divided into Upper and Lower Polog and is surrounded by the mountain massifs: Shar Mountains, Zeden and Suva Gora. In general, the territory of North Macedonia is characterized with a very rich flora. As a result of continuous research, first by foreign authors and later by local authors, so far about 3700 vascular plant species have been found [11, 13, 16-18, 23, 25]. In addition to the endemic plants of the Balkans, the flora of North Macedonia is also characterized by a large number of local endemic plants, about 111 species, which are found only in the territory of North Macedonia [24]. As a result of continuous floristic research in this territory, several new species have been discovered [6, 9, 10, 12, 15, 20-22, 26, 37, 38], among them also endemic species, therefore this number is significantly higher today. Even the region of Polog is one of the richest floristic regions and most of the plants known for the general territory of North Macedonia are spread in this region. This study focuses on invasive alien plant species more widespread or frequently in the Polog region. The majority of naturalized invasive alien species occur in industrial habitats, on arable land and in parks and gardens [29, 32]. The total number of invasive alien species in North Macedonia is 44 [14], while 12 species have been identified in the Polog region. Most of the invasive species of this region are also found in the territory of Kosovo [30]. These invasive alien species are dominated by large global plant families which have a weedy tendency in temperate regions (Asteraceae, Poaceae, Fabaceae, Solanaceae). All invasive alien species identified in the Polog region are from North, Central and South America, while *Sorghum halepense* (L.) Pers., is the only species originating from Asia and North Africa. Most of them are neophytes, mainly annual herbs, while only two

species, *Rhus typhina* L. and *Robinia pseudoacacia* L., are trees or shrubs. *Erigeron canadensis* L., *Helianthus tuberosus* L. and *Robinia pseudoacacia* L., are the most widespread invasive alien species.



Figure 1. The study area of the Polog region in Republic of North Macedonia

MATERIAL AND METHODS

The new data presented in this paper are result of the floristic researches of the invasive alien plant species in the Polog region, North Macedonia, during the period 2021-2023. Using the data obtained from the field surveys and the literature reviewed, we have provided information on taxonomic family affiliations, life forms, native origin and type of habitat(s) for each invasive plant species in the Polog region. My floristic research in this area dates back to 2004, where the object of research has been Compositis (Asteraceae). This has helped me to collect continuous data on most of the invasive alien species, 7 of which belong to the Asteraceae family, regarding their frequency and ability to spread [5-8]. The morphological and systematic description of the species is based on relevant taxonomic citation. Plant nomenclature and taxonomy is consistent with Euro+Med Plant base [3].

RESULTS

As a result of the floristic research in Polog region, during the period 2021-2023 and based on the preliminary data of local and foreign botanists, 12 invasive alien plant species have been found, 7 of which belong to the Asteraceae family: *Galinsoga parviflora* Cav., *Galinsoga quadriradiata* Ruiz & Pav. (syn: *Galinsoga ciliata* (Raf.) S. F. Blake), *Erigeron canadensis* L., *Erigeron annuus* (L.) Desf., *Helianthus tuberosus* L., *Xanthium strumarium* L. („sensu lato”) and *Xanthium spinosum* L. This was expected since the Asteraceae family is one of the most widespread families in this area and is represented by 262 taxa [4-8]. *Galinsoga parviflora* Cav., native to South America, it is one of the most widespread invasive species on cultivated soils, waste places, etc. [5, 7]. *Galinsoga quadriradiata* Ruiz & Pav., native to Central and South America, was found for the first time in Upper Polog on cultivated soils [6, 7], while in 2009 it was also found in Lower Polog, in Tetovo, along roads, and waste places [37]. The most common invasive alien species across Europe and in the studied area is *Erigeron canadensis* L., native to North America. It is the most widespread invasive species in Polog region, along roads, wasteland, railways, etc. [6, 7]. *Erigeron annuus* (L.) Desf. is native to North and Central America. It is common in most of the studied area and is widespread along roads, wastelands, on cultivated soils, etc. [6, 7, 28]. *Helianthus tuberosus* L., native to North America, is widespread on Vardar river banks, including its source area to the Lower Polog, on waste places, along roads, especially on the right side of the highway, near Gostivar [6, 7]. *Xanthium strumarium* L. originates in the Americas but was an early introduction to Eurasia [7]. It is widespread on wastelands and cultivated soils, especially in the Polog Valley [6, 7]. *Xanthium spinosum* L., native to Central and South America. It is very widespread in the Polog Region, on waste places, along roads and cultivated soils [6, 7]. Other alien invasive species identified in the Polog region belong to different families. *Datura stramonium* L. (Solanaceae), native to Central and North America, is very widespread in the Polog Region, on cultivated soils, along roads and waste places. *Robinia pseudoacacia* L. (Fabaceae), native to

North America, is cultivated a lot, but today it is a widespread plant almost throughout the territory of North Macedonia [19]. It is very widespread along roads, river banks, on waste places, etc., while has it also penetrated the oak and beech forests. *Amaranthus retroflexus* L. (Amaranthaceae), native to Central and Eastern North America, is a widespread plant along river banks, along roads, waste places, etc. It is known for the gorge of the Radika river [22]. *Rhus typhina* L. (Anacardiaceae), native to North America, can be considered a relict of horticultural cultivation in this region (spreads invasively by seeds and rhizomes). It usually grows on dry, rocky, or gravelly soils and is present at several locations near the roads, on open uplands, forest edges, etc. This species has been recorded in several localities of the researched area, on the right side of the road near the Hydropower in the village of Raven in Gostivar, along the road in the village of Duf and Leunovo in Mavrova, in several localities on the banks of the Vardar River, along its course through Gostivar, etc. A large number of staghorn sumac trees were present in these locations [31], along with a large number of young sprouts. *Sorghum halepense* (L.) Pers. (Poaceae), native to Asia and northern Africa, is widespread along roads and cultivated soils, especially in the Polog Valley.

The alien invasive species identified in the Polog region belong to three life forms, where Therophytes (T) predominate (66.66%) among the identified species, while Geophytes (G) and Phanerophytes (P) represent only 16.67% each (Table 1, Fig. 2).

DISCUSSION

The total number of invasive alien plant species in North Macedonia is 44 [14], while 12 species have been identified in the Polog region. Most of the invasive species of this region, about 9 species, are also found in the territory of Kosovo [30]. The invasive alien species *Helianthus tuberosus* L., also was recorded near Gradište and along the regional road R 1204 (Gradište, Skačkovce, Dobrošane and Kumanovo) in the northern mountainous part of the Republic of North Macedonia [27]. These localities are outside the researched area. The alien invasive species *Galinsoga quadriradiata* Ruiz & Pav. (syn: *Galinsoga*

Table 1. Invasive alien plant species in the Polog region

Species	Family	Life form
<i>Galinsoga parviflora</i> Cav.		Therophytes (T)
<i>Galinsoga quadriradiata</i> Ruiz & Pav.		Therophytes (T)
<i>Erigeron canadensis</i> L.		Therophytes (T)
<i>Erigeron annuus</i> (L.) Desf.	Asteraceae	Therophytes (T)
<i>Helianthus tuberosus</i> L.		Geophytes (G)
<i>Xanthium strumarium</i> L.		Therophytes (T)
<i>Xanthium spinosum</i> L.		Therophytes (T)
<i>Datura stramonium</i> L.	Solanaceae	Therophytes (T)
<i>Robinia pseudoacacia</i> L.	Fabaceae	Phanaerophytes (P)
<i>Amaranthus retroflexus</i> L.	Amaranthaceae	Therophytes (T)
<i>Rhus typhina</i> L.	Anacardiaceae	Phanaerophytes (P)
<i>Sorghum halepense</i> (L.) Pers.	Poaceae	Geophytes (G)

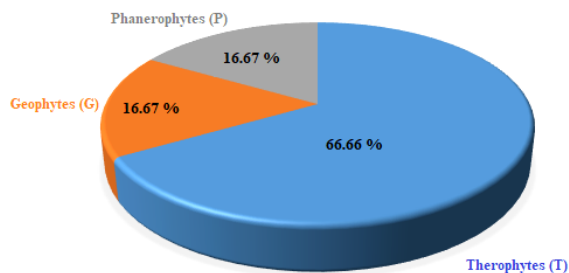


Figure 2. Life form spectrum of invasive alien plant species in the Polog region

ciliata (Ref.) S. F. Blake) was recorded for the first time for the flora of North Macedonia, near Skopje [15], while within the researched area it was later recorded in two localities [6, 37]. Within the wider region, the alien invasive species *Rhus typhina* L. is also known for the flora of Serbia. This species has been recorded in Mount Avala, where it can only be found in a few localities [2]. According to preliminary data, the number of invasive alien species for the eastern region of Kosovo is 20 [30], 37 for Albania [39], 51 for Serbia [35, 36], 64 for Croatia, 50 for Bosnia and Herzegovina, 50 for Montenegro [30], 130 for Romania [1, 32, 33], 61 for Bulgaria and 50 invasive alien species for Greece [30].

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