

Invasive alien plant species of the southern part of the Nowogard Plain (NW Poland)

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Abstract: Investigations on the distribution of selected invasive plant species in southern part of the Nowogard Plain were conducted in the vegetation seasons of years 2008-2010. Field studies were based on the cartogram method. The article shows the distribution of twelve selected invasive plant species: *Echinocystis lobata*, *Heracleum sosnowskyi*, *Impatiens glandulifera*, *Impatiens parviflora*, *Padus serotina*, *Reynoutria japonica*, *Robinia pseudacacia*, *Solidago canadensis*, *Solidago gigantea*, *Quercus rubra*, *Rosa rugosa* and *Acer negundo* in the study area.

Key words: kenophytes, neophytes, vascular plants, maps

1. Introduction

Non-native species that have been intentionally or unintentionally introduced into new areas, outside of their natural geographical range, sometimes find new home in those unoccupied territories. That conscious or unconscious biogeographical barrier crossing is always associated with human activity (Fudali 2009). Some of the naturalized species are useful for humans, others become pests and bring large losses in the economy (Nawrot 2009). New, favorable environmental conditions and no natural limits promote easy expansion. The rapid spread and increasing ranges of alien plant species may present risks to native species in these areas. The effect of this activity is a global loss of biodiversity at species and genetic levels (McNeely 2001). Biological invasions are gaining attention as a major threat to biodiversity and an important element of global change (Kraľova & Masarovičova 2006).

Invasive taxa are characterized by fitness homeostasis and phenotypic plasticity to exploit new environments, high fertility, anemochory, rapid growth in youth and high rate of population growth, resistance to environmental conditions and the ability to adapt to new conditions (Faliński 2004; Sharma *et al.* 2005; Rejmánek *et al.* 2005). They are expansive, conquering new territories and transforming ecosystems that, under human impact, became vulnerable to invasion by impoverishment of species composition, pollution and habitat frag-

mentation (Solarz 2007). Invasive neophytes, mainly of North American and East Asian origin, penetrate into various communities and transform them in varying degrees (Matuszkiewicz 2006). They disturb biocenotic relationships (Solarz 2007) and change the whole landscape, often creating monospecific phytocoenoses (Gniazdowska 2005). Interspecific competition between native and alien plants is stronger than intraspecific competition between native plants but weaker than intraspecific competition between alien plants (Vila & Weiner 2004). Agricultural areas are particularly at risk – unstable, strongly transformed, long time populated with plants that are naturally absent (Miklaszewska & Pałowska 2007). Of the approximately 300 kenophytes occurring on Polish territory, nearly half species enter the natural and semi-natural communities (Solarz 2007). About 30 species are considered as invasive plants (Dajdok *et al.* 2007).

The aim of this paper is to show the presence and distribution of selected invasive plant species in the flora of Poland, in the area of southern part of the Nowogard Plain (Fig. 1). No research on the subject has been carried out so far in that area.

2. Study area

The study area covers 531.25 km² and is located in large square 100 x 100 km denoted by AB symbol and in 9 smaller square units 10 x 10 km, AB: 56, 57, 66,

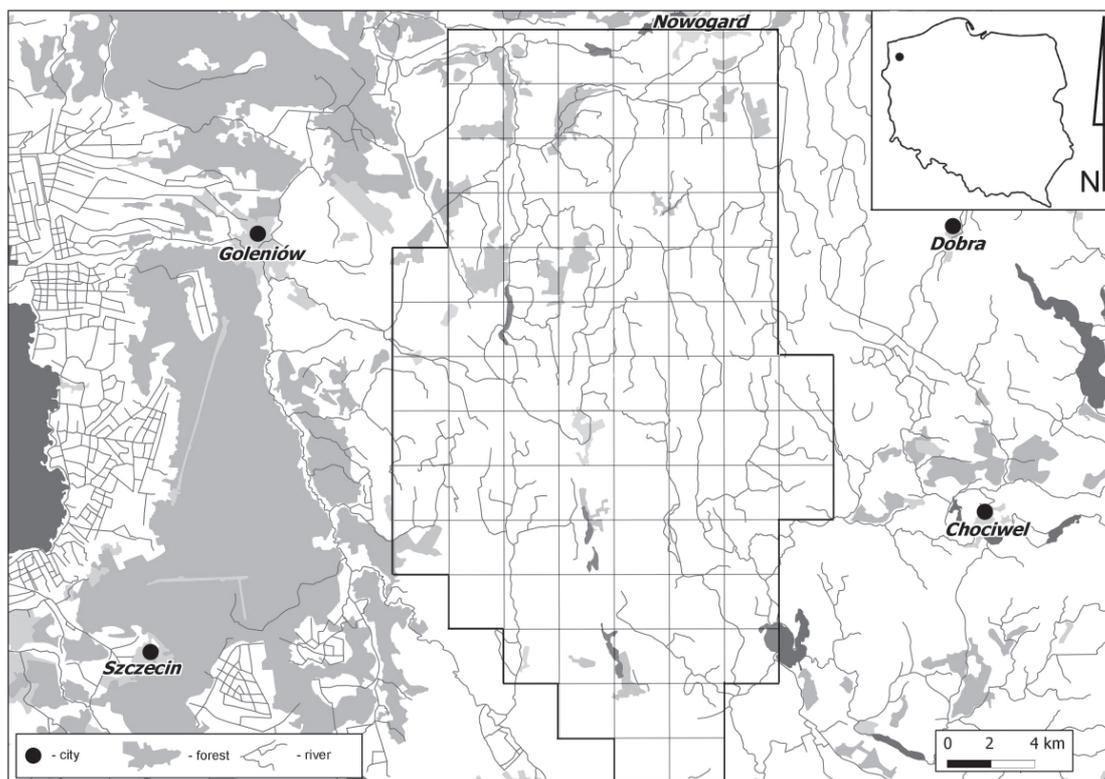


Fig. 1. Localization of the study area

67, 76, 77, 86, 87, 97. According to physical-geographic division of Poland, the investigated area is a southern part of the Nowogard Plain mesoregion, in the macroregion of the Zachodniopomorskie Lake District area (Kondracki 2002). According to climatic regionalization, the Nowogard Plain mesoregion is classified to the Zachodniopomorski Region. The mild climate is characterized by a large number of sunny days without rain and less frequent frost and freeze days (Borówka 2003; Woś 1999). The study area is characterized by a remarkable agricultural land use which is consistent with natural conditions prevailing here. Agriculture land covers the average of 75% of the total study area, while agricultural use is decreasing in the north. The landscape is a mosaic of fields, meadows, pastures and forests.

3. Material and methods

Studies on the occurrence of invasive plant species in southern part of the Nowogard Plain were carried out during the growing seasons of 2008-2010. As stated in the aim, the focus was on the following twelve alien species: *Echinocystis lobata* (Michx.) Torr. & Gray, *Heracleum sosnowskyi* Manden., *Impatiens glandulifera* Royle., *Impatiens parviflora* DC., *Padus serotina* (Ehrh.) Borkh., *Reynoutria japonica* Houtt., *Robinia pseudacacia* L., *Solidago canadensis* L., *Solidago gigantea* Aiton., *Quercus rubra* L., *Rosa rugosa* Thunb. and *Acer negundo* L. The definition of invasive plants was taken

from Pyšek *et al* (2004). The cartogram method was used during the studies and the investigated area was divided into 85 cartogram units of 2.5×2.5 km adopted from ATPOL system (Zajac 1978). Each record of species in a small square is adopted as one locality. For not frequent species (up to 30 localities) a selection of localities (one locality per one 5 × 5 km square) was listed and for more common species only a selection of localities (one locality per one 10 × 10 km square) was indicated. For each locality, the number of the square in the ATPOL system (Zajac 1978) and a short description was given. For each described species, types of habitats were listed.

Nomenclature of plant species was given according to Mirek *et al.* (2002), the systematic order according to Rutkowski (2007) and the origin of non-native species was after Zajac *et al.* (1998).

4. Results and discussion

All described species except *Heracleum sosnowskyi*, *Echinocystis lobata* and *Padus serotina*, belong to the most widespread alien plant species in Europe (Lambdon *et al.* 2008). They belong to kenophytes (=neophytes) in the flora of Poland and are highly invasive. They are included on the *Invasive alien species in the flora of Poland* list and belong to the category of „transformers” (Tokarska-Guzik 2005), i.e., a subset of invasive plants that change the character, conditions, form or nature of ecosystems over a substantial area (Pyšek

Table 1. Selected alien invasive plant species in the southern part of the Nowogard Plain area

Species	Family	Origin	Number of localities
<i>Acer negundo</i> L.	Aceraceae	North America	58
<i>Echinocystis lobata</i> (Michx.) Torr. & Gray	Cucurbitaceae	North America	3
<i>Heracleum sosnowskyi</i> Manden.	Apiaceae	Asia, Caucasus	17
<i>Impatiens glandulifera</i> Royle.	Balsaminaceae	Asia, Himalayas	34
<i>Impatiens parviflora</i> DC.	Balsaminaceae	Central Asia	85
<i>Padus serotina</i> (Ehrh.) Borkh.	Rosaceae	North America	47
<i>Quercus rubra</i> L.	Fagaceae	North America	40
<i>Reynoutria japonica</i> Houtt.	Polygonaceae	East Asia	10
<i>Robinia pseudacacia</i> L.	Fabaceae	North America	77
<i>Rosa rugosa</i> Thunb.	Rosaceae	East Asia	56
<i>Solidago canadensis</i> L.	Asteraceae	North America	77
<i>Solidago gigantea</i> Aiton.	Asteraceae	North America	70

et al 2004). The group of analysed species contains seven plants of American origin and five of Asian origin (Table 1).

Most of the studied species are very frequent in the study area (Fig. 2), occur in different habitats and in disturbed areas like roadsides, railway tracks, irrigation ditches, wastelands, gravel-pits and built-up areas. *Echinocystis lobata* is representative mainly of the east-central distribution type in Europe (Lambdon *et al.* 2008). In Poland, it is most frequently recorded in south-eastern part of the country (Zajac *et al.* 2008; Zajac & Zajac 2001). *E. lobata* is not a frequent species in the study area and has only three localities:

AB 7611, Radzanek, shrub near lake. AB 6611, Węgorzyce, shrub near lake 0.5 km SW. AB 6610, Mosty, wasteland near allotments. The species is mainly associated with waterside habitats.

Heracleum sosnowskyi is representative mainly of the Baltic distribution type in Europe (Lambdon *et al.* 2008) and is one of the most dangerous invasive species in Poland (Miklaszewska & Pagowska 2007). It generally occurs in areas which were formerly cultivated, but its great expansiveness makes it to be found a few dozen kilometers from the place of cultivation (Wojtkowiak *et al.* 2008). That species was found in the northern part of the study area. It occurs abundantly along roadsides, on wasteland in midfield thickets, along watercourses and on forest edges; also it grows in built-up areas very often.

Localities: AB 6610, Przepólko, on the roadside. AB 5710, Nowogard, on the roadside 2.3 km S. AB 6700, Długołęka, on the roadside 1.5 km NE. AB 6601, Stare Wyszomierki, at the edge of the forest. AB 6600, Krzywice, on the roadside 1.6 km E. AB 6611, Węgorzyce, in large numbers in the village. AB 6710, along the road between the villages: Godowo-Redło. AB 7601, Wisławie, near a pond in the forest.

Impatiens glandulifera is present in Poland currently; it is most common in the south of the country (Zajac &

Zajac 2001). In the investigated area, it occurs in thickets along watercourses and ditches, in the vicinity of lakes and fish ponds, in areas of exploitation and after exploitation of gravel and sand pits, on wet meadows.

Localities: AB 56, Kościuszki, along a drainage ditch 1.2 km NW. AB 67, Długołęka, on a wet meadow 1.5 km N. AB 66, Maciejewo, on a wet meadow near the Stepnica river. AB 76, Mosty, on the gravel pit. AB 77, Bielice, near pond 1.5 km SW. AB 86, Warchlino, scrub near lake. AB 87, Krzywnica, near pond.

Impatiens parviflora is widespread over the whole Polish territory, common in the south and minimum number of localities in the north-east (Zajac & Zajac 2001; Tokarska-Guzik 2002). *I. parviflora* is a very common species in the study area, with localities in every square. It occurs in a variety of habitats and has become currently the most frequent alien plant in central European forests (Kowarik 2003). It was recorded in all forest and scrub communities, on edges of cultivated fields, balk and ground road borders, parks and built-up areas.

Localities: AB 56, Kościuszki, forest near Kościuszkowskie Lake. AB 66, Burowo, in large number in the forest. AB 76, Radzanek, in large numbers in a park. AB 77, Dębice, on the roadside along a field. AB 86, Małkocin, in a manor park. AB 87, in the forest near Grabowskie Lake. AB 97, Kiczarowo, shrub near lake 1 km SW.

Padus serotina is representative of the north-western distribution type in Europe (Lambdon *et al.* 2008) and is widespread over the whole country; it rarely occurs only in the north-east and south-east parts of Poland (Zajac & Zajac 2001). Initially grown as a decorative tree in parks, since the late 19th century, it was also grown in forests (Tokarska-Guzik 2005). It grows in the undergrowth of pine forests on poor, sandy soils and in mixed forests. In the study area, commonly seen in forest complexes.

Localities: AB 56, Redostowo, in the forest 0.7 km NE. AB 57, Nowogard, in the forest 2 km SE. AB 66, Przepólko, in

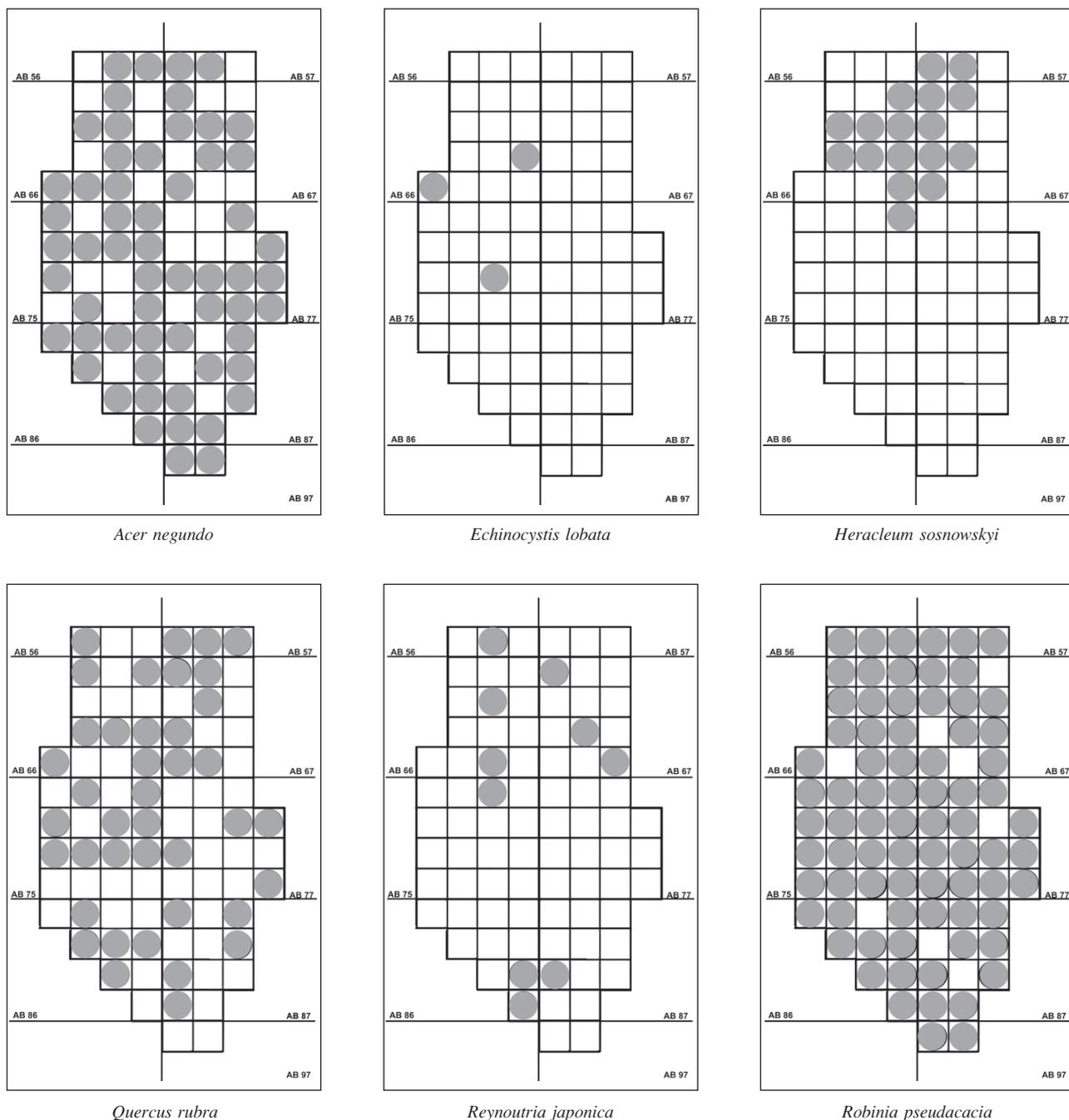


Fig. 2. Distribution maps of selected alien invasive plant species in the southern part of the Nowogard Plain area

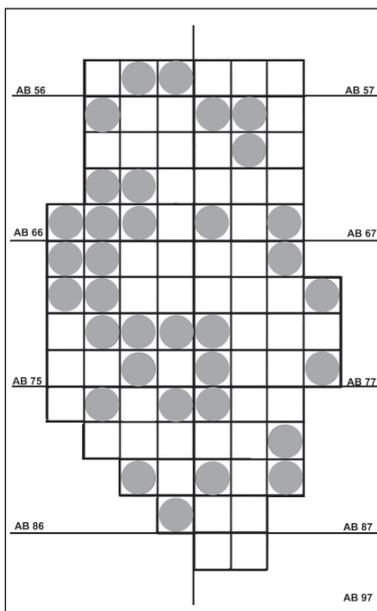
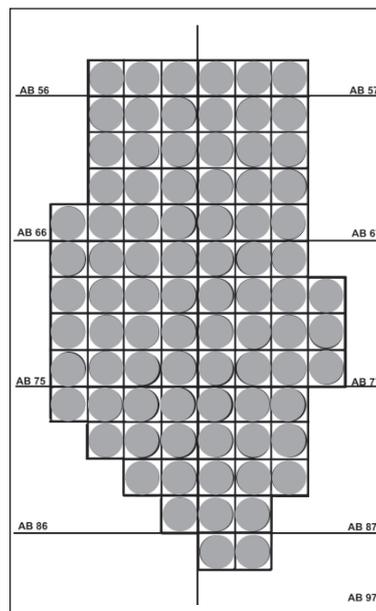
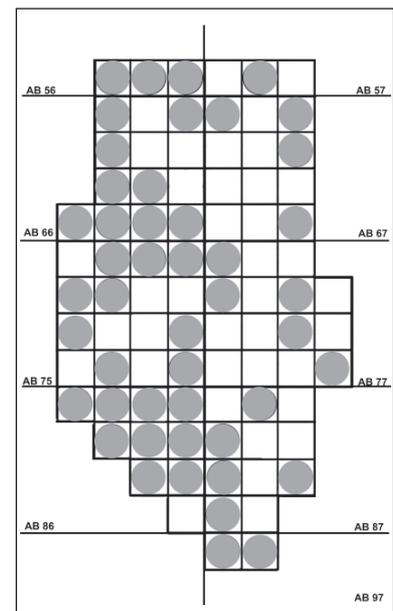
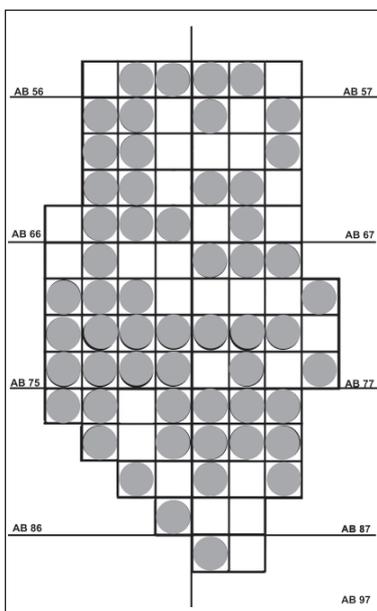
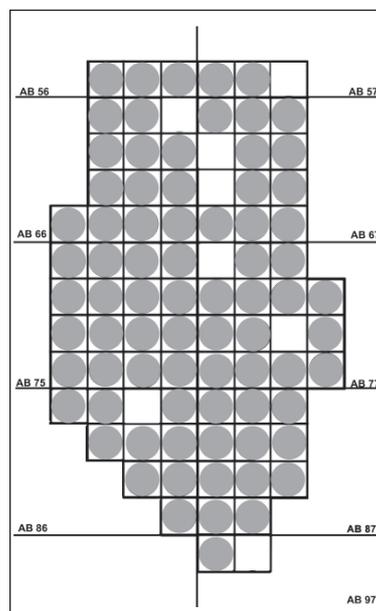
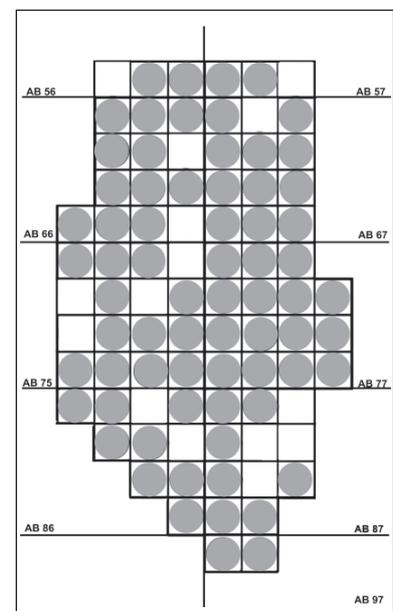
Explanation: ● – presently existing locality

the forest 1.2 km NE. AB 67, Sapolnica, in the forest 1 km NE. AB 76, Danowo, in the forest 1.5 km E. AB 77, Stodólska, at the edge of the forest 1 km N. AB 86, Warchlino, in the forest 1.4 km NW. AB 87, Nowa Dąbrowa, in the forest 1.2 km E. AB 97, Kolonia Kiczarowo, in the forest by the main road No. 20

Reynoutria japonica is widespread over the whole national territory with the greatest concentrations in the south-western and southern parts of Poland (Zajac & Zajac 2001; Tokarska-Guzik 2005). It is one of the most dangerous alien invasive plants in Poland, because it can decrease biodiversity, especially in river valley eco-

systems (Dajdok *et al.* 2007). It is not a frequent species in the study area and its sites are located mainly near lakes and along rivers where it grows in small phytocoenoses.

Localities: AB 5611, thickets along the Stepnica river bank. AB 6700, Wyszomierz, in the village. AB 6601, Osina, thickets along the Leśnica river. AB 6710, Korytowo, in the village along Bukowina stream. AB 6711, Wrześno, in the village. AB 6611, Maciejewo, near Lechickie Lake. AB 7601, Budzieszowce, near Budzieszowickie Lake by the main road No. 113. AB 8710, near Grabowskie Lake. AB 8611, Grabowo, near ponds 0.8 km S.

*Impatiens glandulifera**Impatiens parviflora**Padus serotina**Rosa rugosa**Solidago canadensis**Solidago gigantea*

Robinia pseudacacia is a widely distributed alien species, with the lowest localities in north-eastern part of the country (Zajac & Zajac 2001). *R. pseudacacia* is changing the whole species composition and building a new community in the forest. Nitrogen accumulation by *R. pseudacacia* promotes nitrophilous species and changes the chemical, physical and biological characteristics of the soil (Sykora 1990). It was recorded in forests, along roads and in built-up areas in the investigated area.

Localities: AB 56, Redostowo, at the edge of the forest. AB 57, Olchowo, in the village. AB 66, Przepólko, in the forest

1 km NE. AB 76, Sapolnica, on the roadside. AB 76, Mosty, on the gravel pit. AB 77, Maszewko, in the village. AB 86, Warchlino, in the village. AB 87, in the forest near Grabowskie Lake. AB 97, Kolonia Kiczarowo, in the village.

Rosa rugosa is a widely distributed species, with the greatest concentrations in north-eastern part of the country (Zajac & Zajac 2001). In the study area, it was recorded on roadsides, along railway tracks and in thickets.

Localities: AB 56, Kościuszki, on the roadside. AB 57, Nowogard, thicket near Nowogardzkie Lake. AB 66, Wyszomierz, along the railway track. AB 67, Sapolnica, in

the village. AB 76, Maszewo, shrub near ponds. AB 77, Maszewko, in the village. AB 86, Storkówko, along the railway track. AB 87, Stara Dąbrowa, on the roadside. AB 97, Kolonia Kiczarowo, on the roadside.

Solidago canadensis and *Solidago gigantea* are widespread over the whole national territory: *S. gigantea* mainly in south-eastern part and *S. canadensis* in the west and south (Zajac & Zajac 2001). These species are currently common in many regions of Europe and are considered to be “aggressive” invaders on abandoned fields and river banks (Tokarska-Guzik 2005). Both species are common in the investigated area, especially *S. canadensis* occurs often on roadsides and wastelands on large areas.

Localities: AB 57, Nowogard, wasteland on the outskirts of the town. AB 56, Kościuszki, on the wasteland 1 km NE. AB 66, Krzywice, near gravel pit. AB 67, Korytowo, on the wasteland. AB 76, Pogrzymie, wasteland along the main road No. 113. AB 77, Nastazin, on the wasteland 2 km SE. AB 86, Kolonia Grabowo, on the roadside. AB 87, Kicko, on the wasteland. AB 97, Kolonia Kiczarowo, shrubs along the main road No. 20.

S. gigantea was recorded on meadows and wastelands mainly.

Localities: AB 56, Kościuszki, on a meadow 1.8 km NW. AB 57, Olchowo, on a wet meadow. AB 66, Maciejewo, on a wet meadow in the Stepnica river valley. AB 67, Godowo, on a wet meadow. AB 76, Radzanek, on a wet meadow in the Stepnica river valley. AB 77, Sokolniki, on a meadow. AB 86, Storkówko, shrub near the midfield ponds 0.8 km S. AB 87, Kicko, on a meadow along a drainage ditch. AB 97, Kolonia Kiczarowo, on the wasteland.

Acer negundo is common in most territory of Poland, but rarer in the north, particularly rare in the north-east and at higher elevations in the mountains (Zajac & Zajac 2001; Tokarska-Guzik 2005). As an invasive species, *A. negundo* spreads along river valleys, penetrating forests and riparian scrub, where it begins to dominate (Dajdok *et al.* 2007). *A. negundo* was often recorded

along rivers, waterways, near lakes and ponds, in wet thickets in the study area.

Localities: AB 56, Kościuszki, near Kościuszkowskie Lake. AB 57, Olchowo, in the village. AB 66, Mosty, near lake 0.3 km SE. AB 67, Korytowo, in the village. AB 76, Radzanek, near lake. AB 77, Mokre, in the village. AB 86, Łęczyca, near lake. AB 87, Krzywnica, near ponds. AB 97, Kolonia Kiczarowo, near lake.

Quercus rubra is a common species in most regions of the country, mass scale planted in forest areas as a biocenotic indicator in pine and mixed forests (Dajdok *et al.* 2007). It was often found in forest complexes and along roads in the investigated area.

Localities: AB 56, Redostowo, in the forest along the main road No. 6. AB 57, Nowogard, in the forest along the road No. 106 N. AB 66, Przepólko, in the forest 1 km NE. AB 67, Korytowo, in the forest near Bukowina stream. AB 76, Radzanek, in woodlot near lake. AB 77, Chlebowo, in a park. AB 86, Warchlino, in the village. AB 87, in the forest near Grabowskie Lake.

Invasive plant species: *Impatiens glandulifera*, *Impatiens parviflora*, *Padus serotina*, *Reynoutria japonica*, *Robinia pseudacacia*, *Solidago canadensis*, *Solidago gigantea*, *Quercus rubra*, *Rosa rugosa*, *Acer negundo*, *Echinocystis lobata* were taxa often recorded in areas of Pomerania (Celiński 1964; Piotrowska 1966; Ćwikliński 1988; Chmiel 1993; Zajac *et al.* 1993; Piotrowska *et al.* 1997; Więclaw 2006b; Sobisz & Truchan 2008). It is worth mentioning a number of localities of *Heracleum sosnowskyi* in the flora of the southern part of the Nowogard Plain that was found in the Middle Pomerania region, too (Sobisz 2007; Sobisz & Truchan 2008), but not recorded in any published flora of the north-west Poland parts. Moreover, localities of other dangerous invasive alien species *Heracleum mantegazzinum* and *Reynoutria sachalinensis* were not found in the study area, even though they were recorded in other areas of Pomerania by Sobisz & Truchan (2008), Chmiel (1993), Więclaw (2006a), Zajac *et al.* (1993).

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