

Invasive vascular plant species in the south-western part of the Silesian Upland (south Poland)

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Abstract: The main goal of this study is to present a diversity of invasive plants occurring in the south-western part of the Silesian Upland and to estimate their impact on transformation of the native plant cover. Among 101 species considered to be invasive, three groups were distinguished: “not harmful” (46 species), “weeds” (32) and “transformers” (23). Subsequently, their characteristics is given (origin, geographical-historical groups, life forms, frequency of occurrence) and they are briefly compared. Special attention is paid to the species included in the “transformers” group which enter natural and semi-natural habitats and transform the native plant cover to the largest extent. It has been determined that these are usually large perennial plants or trees, of predominantly North American origin, with numerous localities in which they often form compact patches occupying large areas.

Key words: invasive species, alien plants, Rybnik Plateau, Katowice Upland, Silesian Upland, Poland

1. Introduction

Until 1945, floristic studies in the south-western part of Silesian Upland had been conducted predominantly by German botanists. After the World War II they have been carried on by Polish florists, mainly from Wrocław, Opole and Katowice scientific centres. Detailed studies on the flora of some mesoregions of the Silesian Upland – including the Rybnik Plateau and the south-western part of the Katowice Upland – have been published only in recent years (Urbisz 1996; Urbisz 2001). Hitherto, no work has been published dealing exclusively with invasive plants in this region and with estimation of the threat they pose to the native plant cover.

2. Characteristics of the study area

The study area (Fig. 1), measuring ca. 1250 km², encompasses the Rybnik Plateau and the south-western part of the Katowice Upland (Kondracki 1988). It is an extensively industrialised region and therefore its plant cover is subjected to strong anthropopressure. Apart from natural terrain surface forms, anthropogenic forms also exist here. They are usually formed as a result of mining activity and development of housing and transport facilities. The analysed area is located at an

average altitude of 250-300 m a.s.l. Podzolic and brown soils dominate here. Water conditions in the study area are determined among others by its location on the main watershed of the upper Oder and Vistula basins. The vicinity of the Oder river, forest complexes in the eastern part of Opole province and the Pogórze region as well as the relatively short distance from the mouth of

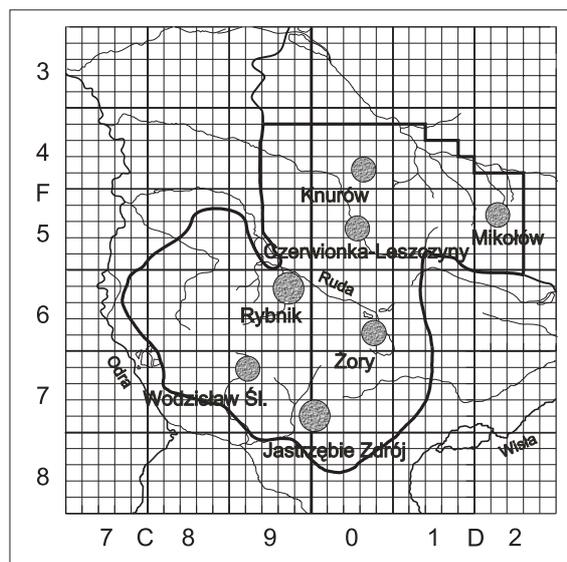


Fig. 1. Borders of the study area with ATPOL square grid (after Zajac 1978)

Moravian Gate all combine to cause milder climate conditions in the study area. The influence of densely built-up areas, especially large cities, on the climate is also to be reckoned with.

3. Material and methods

Literature records and herbarium collections were used during the floristic studies conducted between 1986

and 1999. The method applied for data collection included preparation of cartogrammes based on a square grid with 2 km side (310 squares in total), according to the methodological convention of *Distribution Atlas of Vascular Plants in Poland* (ATPOL) (Zajac 1978). Observations were carried out using floristic lists which were used to record plant species occurring in individual cartogramme squares. The definition and classification of invasive species was adopted from Pyšek *et al.*

Table 1. The invasive species of south-western part of Silesian Upland

Species name	No. loc.	Species name	No. loc.
"not harmful"		<i>Avena fatua</i>	43
<i>Armoracia rusticana</i>	205	<i>Centaurea cyanus</i>	237
<i>Asclepias syriaca</i>	2	<i>Chamomilla recutita</i>	169
<i>Ballota nigra</i>	59	<i>Echinochloa crus-galli</i>	209
<i>Bromus carinatus</i>	90	<i>Euphorbia helioscopia</i>	82
<i>Bromus sterilis</i>	27	<i>Euphorbia peplus</i>	79
<i>Bromus tectorum</i>	44	<i>Fallopia convolvulus</i>	252
<i>Bunias orientalis</i>	9	<i>Galinsoga ciliata</i>	299
<i>Capsella bursa-pastoris</i>	307	<i>Galinsoga parviflora</i>	227
<i>Chamomilla suaveolens</i>	301	<i>Lithospermum arvense</i>	35
<i>Chenopodium strictum</i>	69	<i>Matricaria maritima</i> ssp. <i>inodora</i>	305
<i>Cichorium intybus</i>	102	<i>Myosotis arvensis</i>	195
<i>Clematis vitalba</i>	10	<i>Papaver rhoeas</i>	123
<i>Descurainia sophia</i>	46	<i>Raphanus raphanistrum</i>	250
<i>Echinops sphaerocephalus</i>	25	<i>Scleranthus annuus</i>	110
<i>Eragrostis minor</i>	13	<i>Setaria pumila</i>	124
<i>Erigeron annuus</i>	89	<i>Setaria viridis</i>	29
<i>Geranium pusillum</i>	159	<i>Sinapis arvensis</i>	154
<i>Helianthus tuberosus</i>	54	<i>Spergula arvensis</i>	190
<i>Hordeum murinum</i>	15	<i>Thlaspi arvense</i>	130
<i>Juglans regia</i>	104	<i>Veronica arvensis</i>	144
<i>Lactuca serriola</i>	249	<i>Veronica persica</i>	109
<i>Lamium album</i>	26	<i>Vicia dasycarpa</i>	65
<i>Lamium purpureum</i>	273	<i>Vicia hirsuta</i>	173
<i>Lepidium ruderales</i>	69	<i>Vicia sativa</i>	86
<i>Lolium multiflorum</i>	69	<i>Vicia tetrasperma</i>	117
<i>Malus domestica</i>	193	<i>Vicia villosa</i>	45
<i>Malva alcea</i>	42	<i>Viola arvensis</i>	287
<i>Malva neglecta</i>	92	"transformers"	
<i>Malva sylvestris</i>	62	<i>Acer negundo</i>	75
<i>Medicago sativa</i>	228	<i>Acorus calamus</i>	19
<i>Parthenocissus inserta</i>	61	<i>Aesculus hippocastanum</i>	172
<i>Populus 'NE 42'</i>	151	<i>Aster novi-belgii</i>	52
<i>Populus ×canadensis</i>	157	<i>Bidens frondosa</i>	211
<i>Rosa rugosa</i>	92	<i>Conyza canadensis</i>	292
<i>Rudbeckia laciniata</i>	54	<i>Echinocystis lobata</i>	116
<i>Senecio vernalis</i>	11	<i>Elodea canadensis</i>	32
<i>Senecio vulgaris</i>	192	<i>Epilobium ciliatum</i>	161
<i>Sisymbrium altissimum</i>	47	<i>Fraxinus pennsylvanica</i>	76
<i>Sisymbrium loeselii</i>	31	<i>Heracleum sosnowskyi</i>	15
<i>Sisymbrium officinale</i>	255	<i>Impatiens glandulifera</i>	66
<i>Sonchus asper</i>	83	<i>Impatiens parviflora</i>	240
<i>Sonchus oleraceus</i>	235	<i>Lupinus polyphyllus</i>	186
<i>Sorbaria sorbifolia</i>	25	<i>Oxalis fontana</i>	171
<i>Spiraea ×pseudosalicifolia</i>	63	<i>Padus serotina</i>	143
<i>Symphoricarpos albus</i>	163	<i>Quercus rubra</i>	209
<i>Urtica urens</i>	59	<i>Reynoutria japonica</i>	154
"weeds"		<i>Reynoutria sachalinensis</i>	18
<i>Amaranthus retroflexus</i>	65	<i>Robinia pseudoacacia</i>	262
<i>Anthemis arvensis</i>	49	<i>Solidago canadensis</i>	169
<i>Anthoxanthum aristatum</i>	10	<i>Solidago gigantea</i>	283
<i>Apera spica-venti</i>	271	<i>Solidago graminifolia</i>	5

Explanation: No. loc. – number of localities (grid squares)

(2004). Names of plant species are taken from Mirek *et al.* (2002), geographical origin of species is taken from Zajac (1979) and Zajac *et al.* (1998), while life forms are cited from Zarzycki *et al.* (2002).

4. Results and discussion

Flora of the study area numbers 101 invasive plant species (including 55 new arrivals, so-called kenophytes, and 46 older arrivals – archaeophytes). Within this number, 46 species are considered to be “not harmful”, 32 species belong to the group of “weeds”, while 23 are included in the group of “transformers” (Table 1). The list includes 28 species of American origin, 67 arrivals from Europe or Asia, 3 species of anthropogenic origin and 3 species of unknown origin. A majority of analysed species are therophytes (59%), phanerophytes (16%) as well as hemicytrophytes (13%). Geophytes constitute 8%, while hydrophytes and chamaephytes – 2% each of the total number of species. There is a clear preponderance of frequent, very frequent and common species, which together account for 84% of the total number. Localities of invasive species are concentrated in the outskirts of larger cities as well as along river valleys and main transport pathways (Fig. 2).

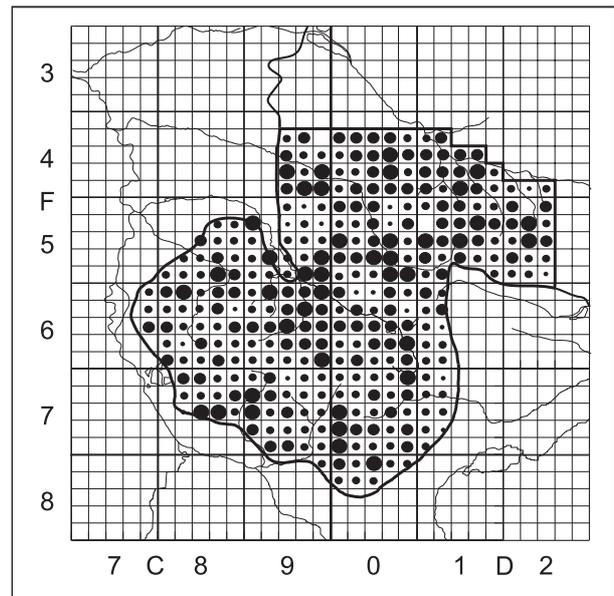


Fig. 2. The concentration of invasive species localities in the study area (circles diameter is proportional to the number of species occurring in a given square – from 0 to 82)

The comparison of spectra for geographical-historical groups, the origin, occurrence frequency and life forms for the distinguished groups of invasive species was shown on figures 3 a, b, c, d.

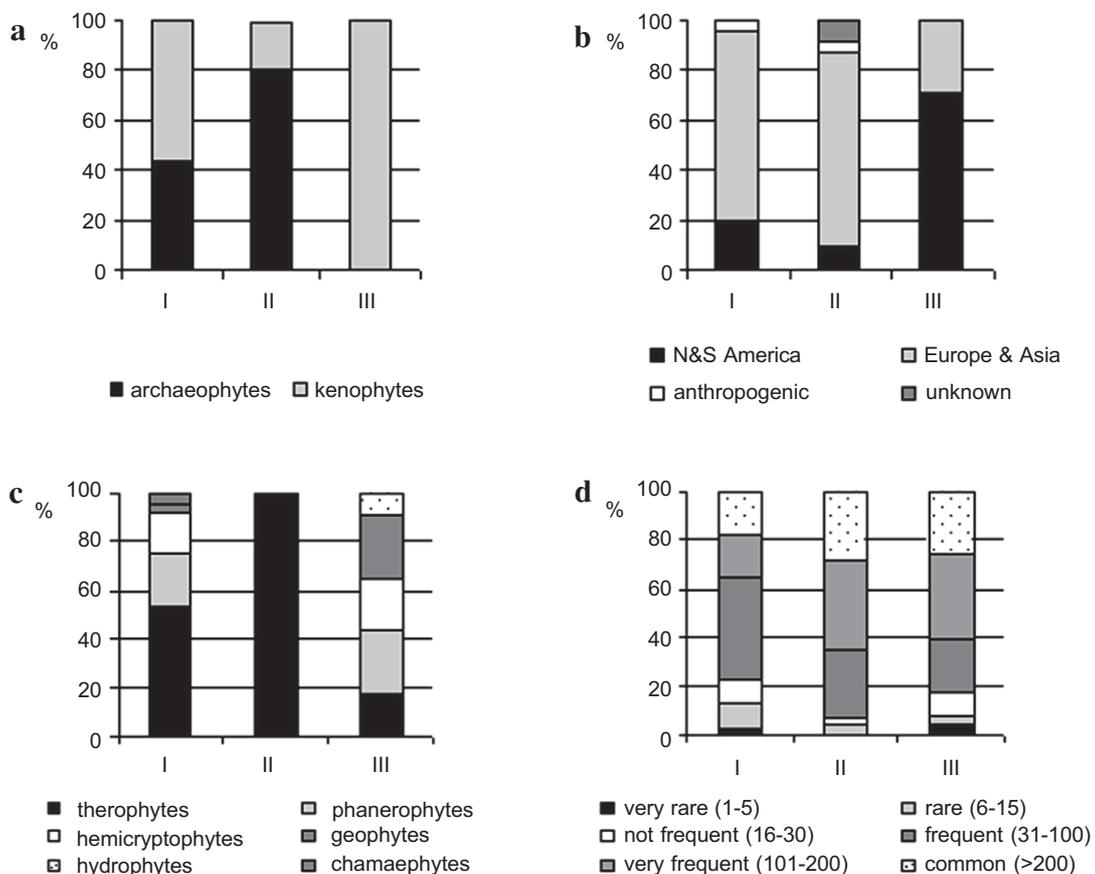


Fig. 3. The comparison of spectra for a – geographical-historical groups, b – origin, c – life forms, and d – species frequency in distinguished groups (I – not harmful, II – weeds, III – transformers)

Group of “not harmful” species contains plants diverse in relation to comparative factors. This group varies from the other groups of species by significantly lower participation of very frequent and common species. This mainly results from lack of adaptability to habitat conditions in the area given, revealed by these plants. Species belonging to this group have not hitherto posed a major threat to the native plant cover and they are not too troublesome for a man.

In the “weeds” group archaeophytes distinctly dominate, however American species are only few. The highest number of frequent, very frequent and common species appears in that particular group and their participation achieves almost 94%. Also the average number of localities is the highest in the “weeds” group (146), while “transformers” occur in 136 grid squares and “not harmful” – in 102 squares. “Weeds” are tightly linked with agricultural arable land where they are often

actively combated due to their abundant occurrence. As therophytes these plants are in the majority of cases not able to adapt into conditions created by natural habitats where the plant cover is usually dense, therefore indigenous flora is not significantly threatened by them.

Species counted to the group of “transformers”, which are capable of transforming the plant communities of natural origin, are characterized by the following features: (i) they belong to kenophytes, most often of North American origin; (ii) they occur in numerous localities; (iii) they form compact patches which often occupy a large surface; (iv) they are mainly large perennial plants or trees.

The highest threat to the native flora is caused by the following species: *Bidens frondosa*, *Echinocystis lobata*, *Impatiens parviflora*, *Lupinus polyphyllus*, *Padus serotina*, *Quercus rubra*, *Reynoutria japonica*, *Robinia pseudoacacia*, *Solidago canadensis*, *S. gigantea*.

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