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Alien vascular plants in the Silesian Upland of Poland: distribution, patterns, impacts and threats

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Abstract: Symptoms of anthropogenic changes in the flora include processes of extinction in some species and spread in others. These tendencies have increased in magnitude in recent centuries, adversely affecting natural biodiversity on a regional, national and continental scale. The main idea behind the project presented here was to investigate the diversity of the alien vascular flora at the regional scale and to update the list of invasive alien species for the Silesian Upland. The aim of this study is also to provide a synthesis of the knowledge accumulated to date on the conditions for their occurrence, their distribution patterns and the possible threat they might pose. The distribution of particular species at the regional scale was investigated by mapping the species on a 2 km x 2 km grid. The study showed that the list of alien plant species for the Silesian Upland encompasses 338 species, including 125 archaeophytes, 195 kenophytes (=neophytes) and 18 species of an uncertain status in the Polish flora. A threat evaluation was performed for particular species on the basis of the number of localities, the diversity of preferred habitats recorded, and their current (over the last decade) tendency to colonise new localities. As a result, a final list of 101 invasive species has been selected. Among the alien plant species considered to be invasive in the area of the Silesian Upland, 20 species are identified as 'weeds' (13 archaeophytes and 7 kenophytes), another 25 (exclusively kenophytes), penetrating into natural habitats, are defined as 'transformers'.

Key words: alien flora, distribution, range expansion, invasive plants, biological invasions, southern Poland

1. Introduction

Globalization increases trade, travel and transport and leads to an unprecedented homogenization of the world's biota by the introduction and subsequent establishment of organisms beyond their natural ranges. Some of these alien species become invasive and pose threats to the environment and human economy and health (e.g. Elton 1958; Kornaś 1990; Vilà *et al*. 2000; Pimental 2002; European Commission 2004; Hulme *et al*. 2009). These trends have increased in magnitude in recent centuries and they adversely affect natural biodiversity on a regional, national and continental scale (Cronk & Fuller 2001; Kornaś & Medwecka-Kornaś 2002; Faliński 2004; Tokarska-Guzik & Dajdok 2004; Tokarska-Guzik 2005a and literature cited therein). All signatories to the Convention on Biological Diversity (CBD), including Poland, have agreed to prevent the introduction of, and to control or eradicate, those alien species which threaten ecosystems, habitats or species (Alien Invasive Species – IAS).

For these reasons, it is an important task to compile a dataset on the current status and distribution pattern of alien species at different scales, in order to provide a background for the assessment of their impact and management.

Based on the abundant Polish literature on the subject it may be stated that the main directions of research on species of alien origin have focused on recording the appearance of new species and on the collection of information on their localities. Much attention has been devoted to classifying plants which accompany humans (the so-called synanthropic plants, made up of native apophytes and those of alien origin: archaeophytes and kenophytes = neophytes) and to preparing lists of alien species occurring in Poland (Tokarska-Guzik 2005a and

literature cited therein). An overview concerning the origin, history and establishment of a group of alien plant species – kenophytes – in Poland was published in 2005 by one of the co-authors of the present study, and a little earlier – in 2001 – the *Distribution Atlas of Vascular Plants in Poland* (Zając & Zając 2001) was published, which includes distribution maps for 338 naturalized alien plant species. From these sources and some others (Zając 1979, 1983, 1987a, 1987b, 1988; Zając *et al*. 1998; Mirek *et al*. 2002) it appears that up to 29% of the Polish flora consists of alien species. Amongst the alien species, the most numerous group consists of casual (=ephemeral) species which are not well-established in the flora, with the addition of those species which have been known occasionally to escape from cultivation. The more convincingly naturalized aliens include 160 archaeophytes and 300 kenophytes (neophytes) (Tokarska-Guzik 2005a). Recently the number of alien species recorded for Poland has increased in all these groups.

At a regional scale, many scientific institutions and non-governmental organizations gather information on alien invasive species. For example in our own Department, among other scientific interests, the most important include research fields focused on monitoring changes in the flora and recording the distribution of plant species, including aliens. However, there still appears to be insufficient research to adequately characterise the impact of alien species on indigenous biological diversity or, in many cases, to combat alien species efficiently.

The task of describing the current state of the invasion process in the Silesian Upland was first undertaken by the authors of the present study in a paper, in which the main goals were to compile a list of invasive plants in the flora of the Silesian Upland and to determine the degree of threat posed by these species to the native plant cover in this region of the country (Tokarska-Guzik *et al*. 2008). The aforementioned research focused exclusively on kenophyes (neophytes) recognised as invasive species at a regional scale. The aim of the present study is to provide an up-to-date list of naturalized alien vascular plant species for the Silesian Upland, explain patterns in their distribution at the regional scale, discuss impacts, and give general recommendations for the management of invasive alien species.

2. Materials and methods

2.1. Study area

The Silesian Upland area, located in the southern part of Poland, forms a part of the Central Poland Upland Belt and occupies an area of more than 4000 km^2. The area was described in details by Tokarska-Guzik *et al*. (2008). It is characterized by a diverse geological structure and consequently high diversity of soil types. The Silesian Upland, which encompasses the Katowice conurbation, continues to be the most industrial and urbanized region of Poland. Numerous communication links provide one of many different types of pathways for the introduction and spread of new alien plants. At the same time, other human activities such as river and stream canalization, the expansion of built-up areas and many others facilitate both the establishment of new alien plant species and their future spread.

2.2. Field studies and data analysis

For the purpose of the present study it was necessary to create an original and up-to-date catalogue of alien plants occurring in the Silesian Upland with a special focus on species classified as invasive. This was developed on the basis of previously published lists (Zając *et al*. 1998; Mirek *et al*. 2002; Tokarska-Guzik 2005a, 2005b), sub-regional studies (Urbisz An. 1996; Nowak 1999; Tokarska-Guzik 1999, 2003a; Tokarska-Guzik & Nowak 2001; Urbisz Al. 2001; Węgrzynek 2003a, 2003b, 2003c, 2005, 2006; Urbisz Al. & Urbisz An. 2005; Urbisz An. & Urbisz Al. 2005, 2008; Tokarska-Guzik *et al*. 2007, 2009) and original distribution data.

Botanical recording had already been carried out at a regional scale in the Silesian Upland and surrounding areas during the growing seasons for the last 15 years. The data were stored in the regional database ATPOL *Silesia*, which is fully compatible with the database of the *Atlas of distribution of vascular plants in Poland* (ATPOL). In ATPOL, the basic cartogram unit is a square of 10 x 10 km; these are combined in 'large' 100 x 100 km squares (Zając 1978). The area of the Silesian Upland is limited to two ATPOL large squares designated as CF and DF. Each ATPOL square of 10 x 10 km is subdivided into 25 smaller squares of 2 x 2 km, which are the basic units in ATPOL *Silesia* cartograms. The total number of these smaller squares in the Silesian Upland is 1040.

Input sources for the database include original data, published papers and unpublished manuscripts as well as herbarium data. Data accumulated for the Silesian Upland were supplemented by data gathered in the database devoted to alien newcomers (kenophytes or neophytes), the *Distribution Atlas of Vascular Plants in Poland – Kenophytes* – ATPOL-KENO (Tokarska-Guzik 2001, 2005a).

The listing of alien and invasive species for the Silesian Upland was compiled on the basis of field studies conducted by the authors of this paper and available literature. It includes species belonging to the so-called archaeophytes, the older-arrival synanthropic species and kenophytes=neophytes, the recent-arrival synanthropic

Table 1. Frequency of species occurrence

Frequency class	% squares	Frequency description
1	0.02-1.0	rare
2	1.1-10.0	occasional
3	10.1-20.0	occasional, locally frequent
4	20.1-40.0	frequent, locally abundant
5	40.1-60.0	abundant
6	60.1-100.0	common

species (Kornaś 1968; Zając 1979, 1987a, 1987b, 1988; Zając *et al*. 1998; Tokarska-Guzik 2005a, Zając *et al*. 2009) as well as a group of species with an uncertain status in the Polish flora, likely to be anthropophytes (Appendix 1). The list of naturalized aliens for the Silesian Upland does not include those archaeophytes which have not been observed since 1945. Species considered not to be permanently established and species with an uncertain status were not included in the analysis.

Based on the number of ATPOL 'small' squares, it was possible to establish categories of frequency in relation to the overall number of squares for the Silesian Upland (n = 1040), i.e. categories 1 to 6 represent species recorded in the following numbers of squares (Table 1).

Threat evaluation was performed on the basis of the number of localities and the diversity of preferred habitats recorded for a particular species, as well as any tendency that the species has shown recently (in the last decade) to colonise new localities.

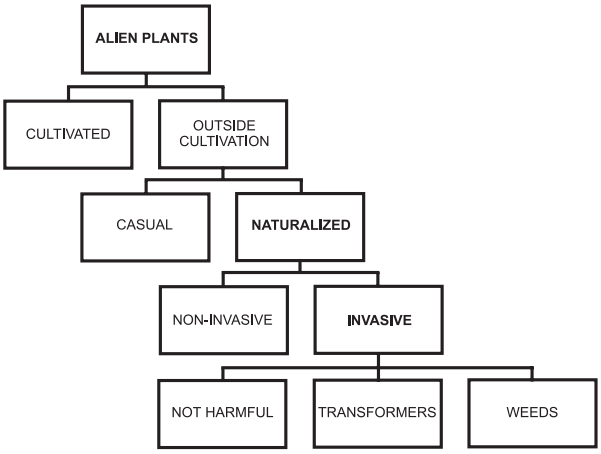

Fig. 1. Hierarchical scheme for the classification of alien plants sugested by Pyšek *et al*. (2004). Groups of plants referred to in this paper are indicated in bold
Explanations: see Table 2

In the present study the terminology used in the Polish literature was adapted to that recommended by Richardson *et al*. (2000) and Pyšek *et al*. (2004) (compare Fig. 1, Table 2). Alien species are defined as species that are not indigenous to the territory of Poland,

Table 2. A comparison of terminologies for the classification of synanthropic plants proposed by Richardson *et al*. (2000), adopted in this study, with that used in Poland

Recommended terminology by Richardson *et al.* 2000	Definition	Term used in Polish studies	Definition
		A. Apophytes	Native species occurring in man-made habitats
Alien plants	Plant taxa in a given area whose presence there is due to intentional or accidental introduction as a result of human activity	B. Anthropophytes	Alien plant species
Casual alien plants	*Alien plants* that may flourish and even reproduce occasionally in an area, but which do not form self-replacing populations, and which rely on repeated introductions for their persistence	I. Diaphytes	Not permanently established (it includes ephemeral species and cultivated species more often escape from cultivation)
Naturalized plants	*Alien plants* that reproduce consistently and sustain populations over many life cycles without direct intervention by humans (or in spite of human intervention); they often recruit offspring freely, usually close to adult plants, and do not necessarily invade natural, semi-natural or human made ecosystems	II. Metaphytes	Permanently established/settled
Invasive plants[1]	*Naturalised plants* that produce reproductive offspring, often in very large numbers, at considerable distances from parent plants (approximate scales: > 100 m; < 50 years for taxa spreading by seeds and other propagules; > 6 m/3 years for taxa spreading by roots, rhizomes, stolons, or creeping stems), and thus have the potential to spread over a considerable area	1. Archaeophytes 2. Kenophytes (=Neophytes *sensu* most Central European studies)	Introduced before 1500 Introduced after 1500
		a. Epecophytes	Established in man-made habitats
Transformers	A subset of *invasive plants* which change the character, condition, form or nature of ecosystems over a substantial area relative to the extent of that ecosystem	b. Agriophytes (=Neophytes *sensu* Faliński)	Penetrating into natural habitats

Explanations: source Kornaś (1968), Kornaś & Medwecka-Kornaś (2002), Tokarska-Guzik (2001, 2005a), Richardson *et al*. (2000), Pyšek *et al*. (2004); [1] – the Authors of the cited definition suggest that „invasive" should be used with reference to the 'biogeographic/demographic' status of a species without any connotation of impact. Richardson *et al*. (2000) also include in their recommended terminology the well-established term for harmful plants, i.e. „weeds" – plants (not necessarily alien) that grow in sites where they are not wanted and which usually have detectable economic and environmental effects

regardless of their origin (they can be native to another European country or another continent). The understanding of invasive alien species follows the Polish scientific literature in this field, in which most authors consider invasion to be "a spectacular form of massive expansion of a recently arrived alien species which appears suddenly and so abundantly that it can cause significant ecological disturbances and severe economic losses" (e.g. Kornaś & Medwecka-Kornaś 2002). It also takes into account the recent *European strategy on invasive alien plants*, which uses the definitions agreed on by the Conference of the Parties to the Convention on Biological Diversity for the purposes of the CBD Guiding Principles and understands *invasive alien species* as an alien species whose introduction and/or spread threaten biological diversity (Genovesi & Shine 2004). For practical purposes (which have to be taken into account when creating national, regional and local lists of invasive species), apart from scientific categories, "extrascientific" criteria of plant appraisal are often used, such as 'species that lead to specific economic losses', 'species harmful to human and/or animal health', etc. (Tokarska-Guzik 2005a, 2005b).

The following two categories were distinguished within naturalized aliens, i.e. non-invasive and invasive. Invasive species were then classified as not harmful, weeds and transformers (Fig. 1, Table 2). For some species, adopting a concept introduced by Pyšek *et al*. (2002), the 'post-invasive' status was distinguished. Species that recently (over the last decade) have shown a clear tendency to colonize new localities are also indicated.

In the present paper both groups of naturalized alien species, i.e. archaeophytes and kenophytes (neophytes), are grouped together and their cumulative species map is presented. Also distribution maps are shown for selected species represented both the above-mentioned groups.

Scientific plant names were used after Mirek *et al*. (2002) and names of plant communities were given according to Matuszkiewicz (2001).

3. Results

3.1. Geographical and ecological characteristics of naturalized alien flora in the Silesian Upland

The list of alien plant species for the Silesian Upland encompasses 320 species (Appendix 1; Table 3). The archaeophyte list includes 125 species, the kenophyte list comprises 195 species, while 18 are classified as species of an uncertain status in the Polish flora.

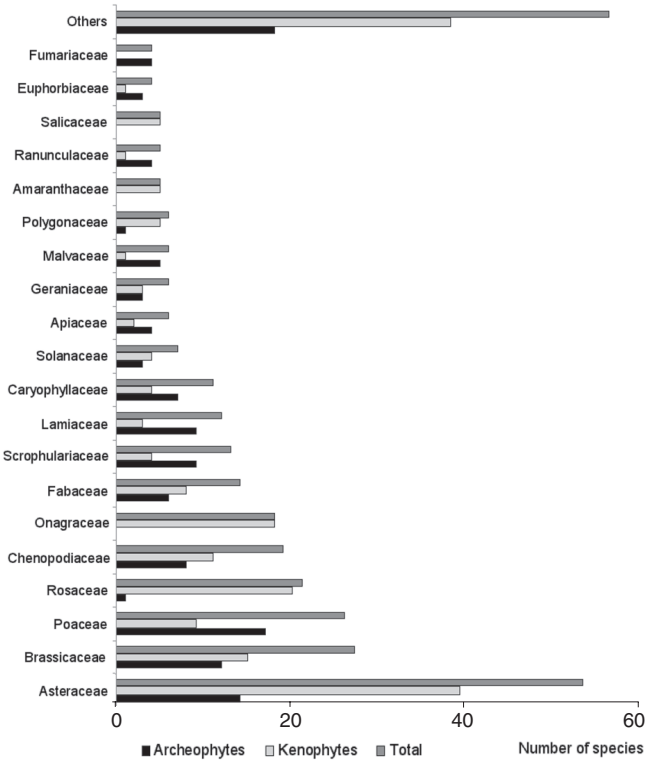

Fig. 2. Families most frequently represented in the naturalized alien flora of the Silesian Upland

Alien species are represented by 73 families, of which Asteraceae (53 species), Brassicaceae (26) and Poaceae (26) are the most important (Fig. 2). Differentiation at the family level is higher in the kenophyte

Table 3. Composition of the vascular flora of Poland and two adjacent regions of southern Poland

Group of species	Number of species		
	Poland	Silesian Upland	Kraków-Częstochowa Upland
Native	2537	1400	1135
Alien	1780	536	426
Casual	1320*	216**	140****
Naturalized	460	320	286
archaeophytes	160	125***	124
kenophytes	300	195	162
Species with uncertain status	46	18	20
Total	4363	1954	1581

Explanations: * – including 420 ephemeral species and *ca*. 900 most often escaping from cultivation, ** – including 45 ephemeral species and 171 species more frequently escaped from cultivation, *** – excluding species considered as extinct in the Silesian Upland, **** – including 12 ephemeral species and 128 species more frequently escaped from cultivation; number of species for Poland according to Mirek *et al*. (2002) and own sources; number of species for the Kraków-Częstochowa Upland after Urbisz (2008)

group (47 families) comparing with the archaeophytes (26). It also appears that some families are more specifically associated with one of the two groups of aliens, namely Poaceae, Scrophulariaceae, Lamiaceae, Malvaceae, Euphorbiaceae and Fumariaceae for archaeophytes, but Asteraceae, Rosaceae, Onagraceae, Polygonaceae, Amaranthaceae and Salicaceae for kenophytes (Fig. 2).

herbaceous chamaephytes, hemicryptophytes, geophytes, hydrophytes with 91 species) and woody plants (incl. phanerophytes and chamaephytes – 41 species) (Fig. 3). Archaeophytes are represented mainly by annuals, while kenophytes – by annuals, long-lived perennial herbs and woody plants.

The naturalized alien species occurring in the Silesian Upland originate from five continents. A ma-

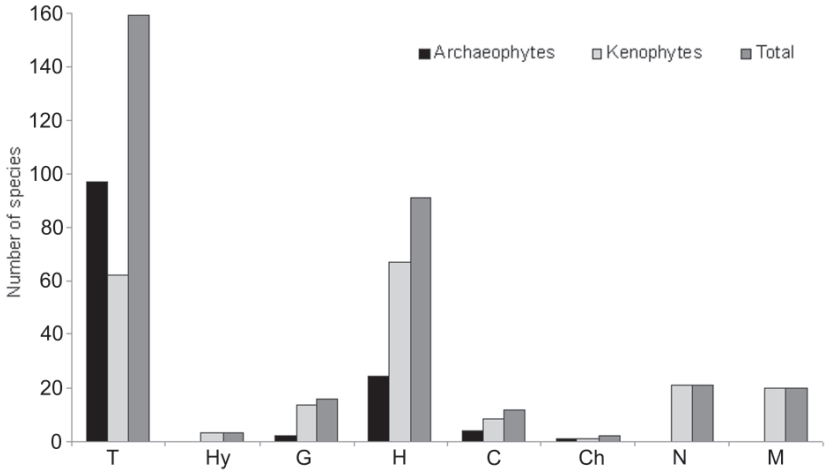

Fig. 3. The participation of life-forms in the naturalized alien flora of the Silesian Upland
Explanations: T – therophytes, Hy – hydrophytes, G – geophytes, H – hemicrypthophytes, C – herbaceous chamaephytes, Ch – chamaephytes, N – nanophanerophytes, M – megaphanerophytes

The alien flora established in the Silesian Upland is characterised by the preponderance of annuals (therophytes – 155 species), long-lived perennial herbs (incl.

jority of species has their primary ranges in Europe and Asia (82) or come from different regions of Europe (80 species) (Fig. 4). An identifiable major group among

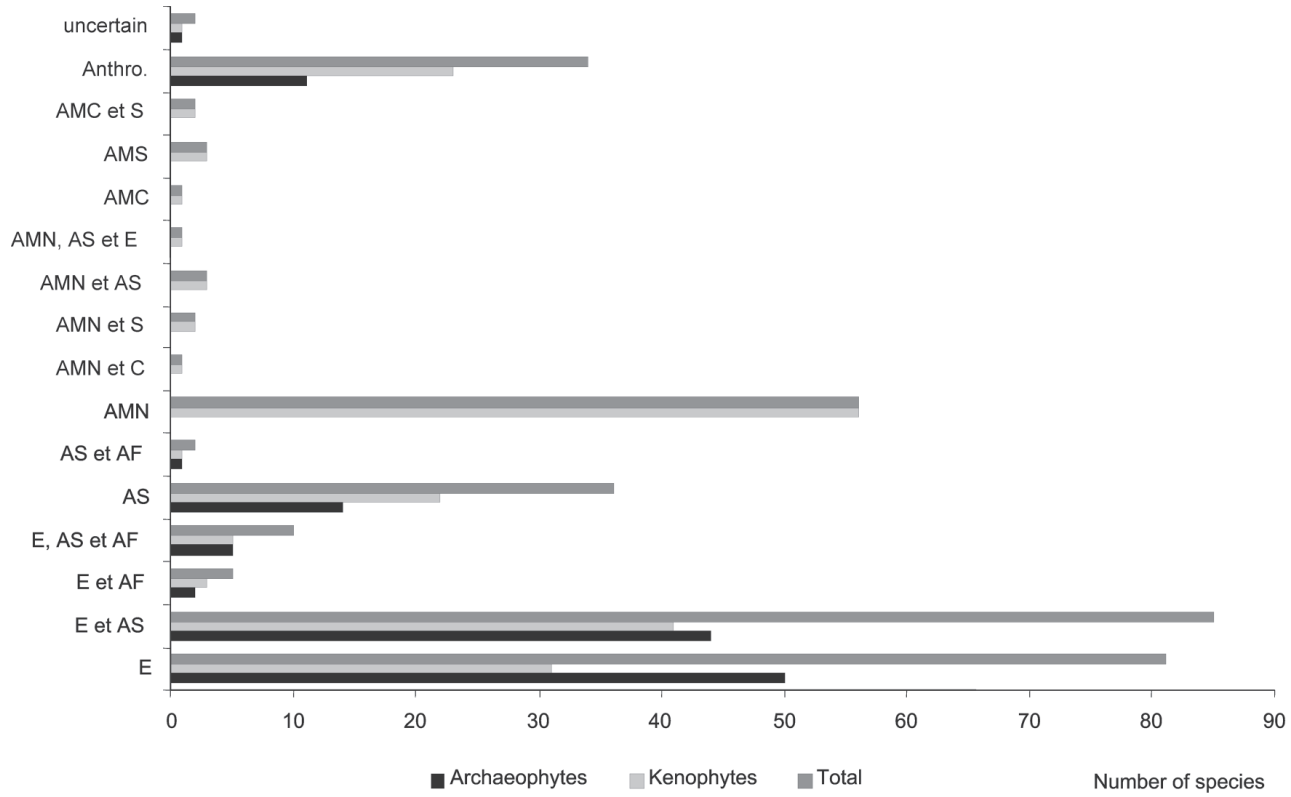

Fig. 4. Geographical origin of naturalized alien flora in the Silesian Upland
Explanations: AF – Africa, AMC – Central America, AMN – North America, AMS – South America, AS – Asia, E – Europe, Anthro. – taxon of anthropogenic origin

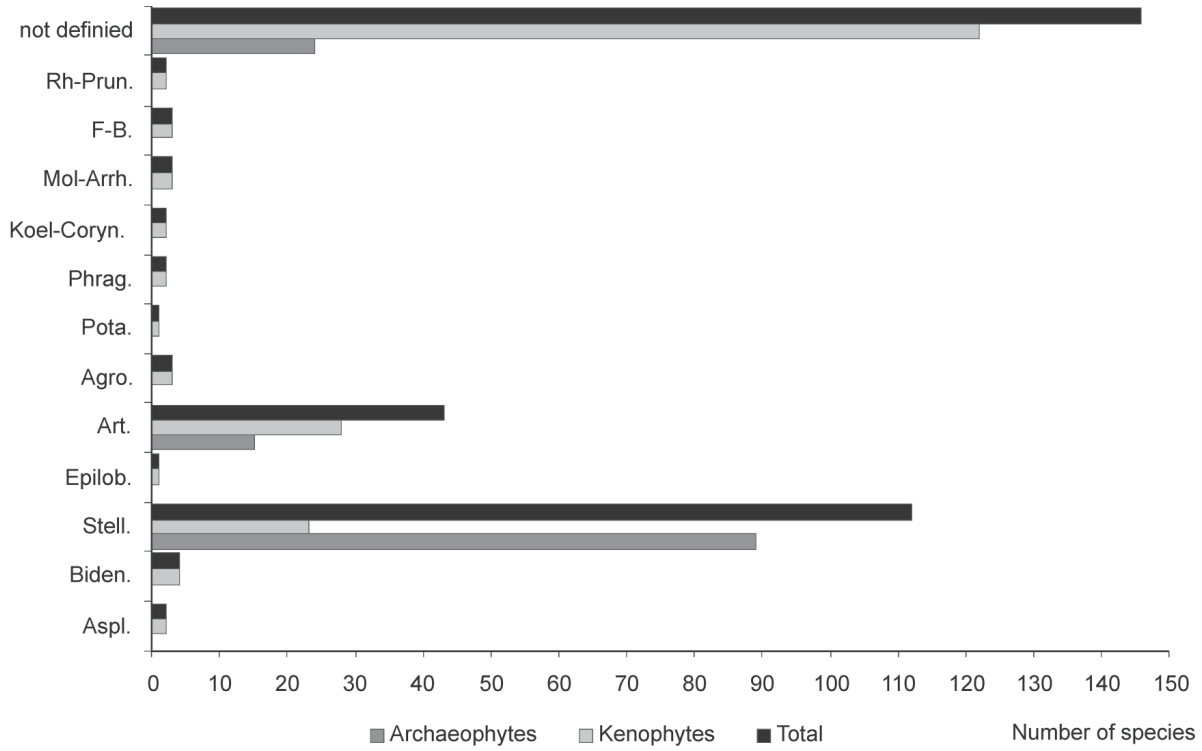

Fig. 5. Occurrence of naturalized alien species in phytosociological units
Explanations: syntaxa in which the species commonly occurs, according to Matuszkiewicz (2001), Agro. – *Agropyretea intermedio-repentis*, Art. – *Artemisietea vulgaris*, Aspl. – *Asplenietea rupestria*, Biden. – *Bidentetea tripartiti*, Epilob. – *Epilobietea angustifolii*, F-B. – *Festuco-Brometea*, Koel-Coryn. – *Koelerio glaucae-Corynephoretea canescentis,* Mol-Arrh. – *Molinio-Arrhenatheretea*, Phrag. – *Phragmitetea*, Pota. – *Potametea*, Q-F. – *Querco-Fagetea*, Rh-Prun. – *Rhamno-Prunetea*, Sal purp. – *Salicetea purpureae*, Stell. – *Stellarietea mediae*, Thla. – *Thlaspietea rotundifolii,* Tri-Ger. – *Trifolio-Geranietea sanguinei*

the archaeophytes comprises species of European origin (including those of southern Europe), while among kenophytes there is one North American species.

According to a Polish vegetation classification based on the Braun-Blanquet system (Matuszkiewicz 2001), a majority of naturalized alien species cannot be associated with any particular plant community (146 species). A significant number of archaeophytes, the group of aliens established in the Polish flora for a long time, are classified as associated with plant communities from

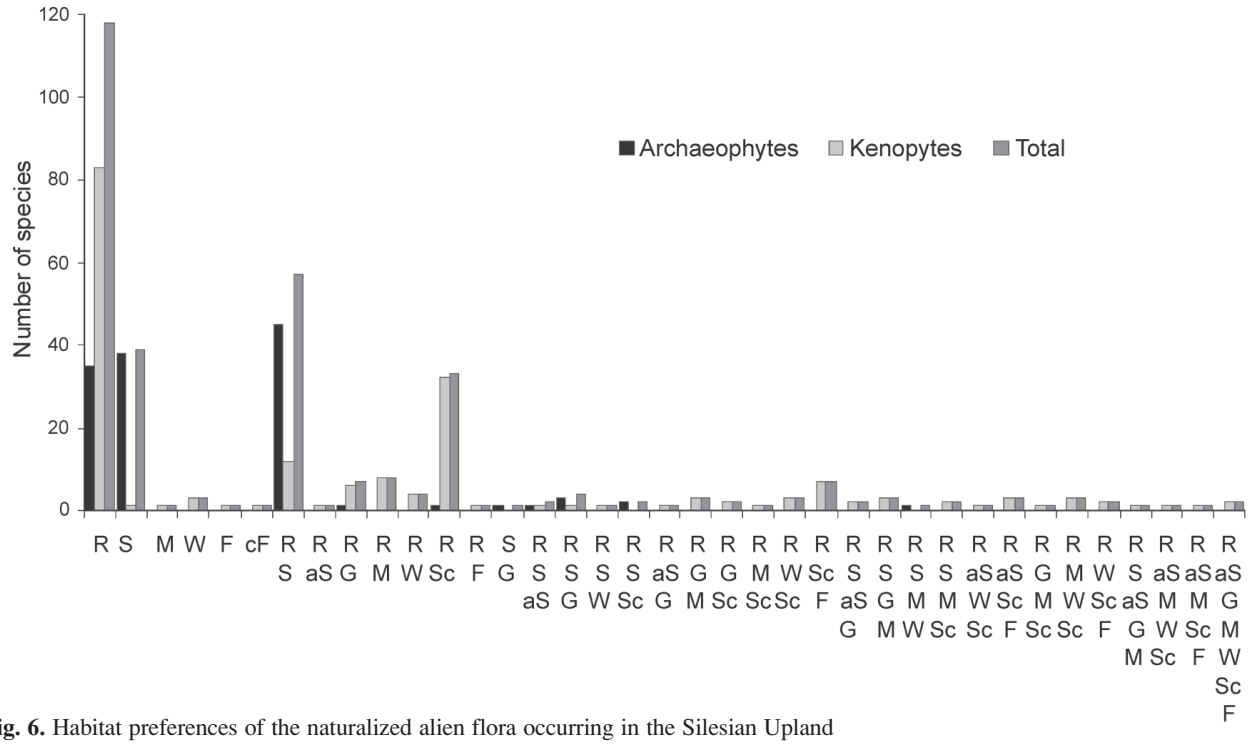

Fig. 6. Habitat preferences of the naturalized alien flora occurring in the Silesian Upland
Explanations: type of habitat, R – ruderal (human-made), S – segetal (arable land), aS – abandoned arable fields, G – grasslands, M – meadows, W – water and waterside, Sc – scrub, F – forests, cF – forests clearings

the class *Stellarietea mediae* (87), being segetal weeds, and with plant communities from the class *Artemisietea vulgaris* (15) as ruderal plants. The synecological affiliations of kenophytes are more diverse. Some representatives of this group are associated not only with ruderal or segetal plant communities, but also with natural ones (Fig. 5).

Almost two thirds of aliens recorded in the Silesian Upland limit their occurrence to anthropogenic habitats: ruderal (118), segetal (35) or both (57). This is particularly true for archaeophytes, which representatives are characterized by rather narrow ecological tolerances. Among kenophytes one can find examples of species capable of concurrent colonization of semi-natural and natural habitats (Fig. 6). The group of species with wider ecological amplitudes includes mainly kenophytes such as *Acer negundo*, *Helianthus tuberosus*, *Heracleum mantegazzianum*, *Padus serotina* (recorded in 5 different habitat types) and species from the *Solidago* genus: *S. canadensis* and *S. gigantea* (7 types) (compare Appendix 1). Least numerous are the species which established themselves in natural and semi-natural communities, by-passing the stage of colonizing anthropogenic ones (e.g. *Acorus calamus*, *Beckmannia eruciformis* and *Elodea canadensis*).

The species recorded in less than 10% of the total number of 2-km ATPOL squares (category of frequency: 1 and 2) are the most numerous (185 species), whereas the species recorded in more than 60% up to 100% of squares (i.e. on a large scale, or the whole of the Silesian Upland; category of frequency: 5 and 6) are least numerous (43 species) (Fig. 7).

Seven species among the older arrivals are common (occurring in 60-80% of 2 x 2 km squares) and six species are found among the newcomers. The distribution data for twenty six kenophytes needs to be verified and for about forty species distribution maps still need to be produced. For example for *Reynoutria* (*Fallopia*) ×*bohemica* distribution maps still have not been developed, either at national or regional scale. Maps for the parental species from *Reynoutria* genus still need to be updated.

The most abundant alien species among archaeophytes are: *Capsella bursa-pastoris* (828 localities), *Matricaria maritima* subsp. *inodora* (723), *Viola arvensis* (681), *Fallopia convolvulus* (675), *Sisymbrium officinale* (661), *Apera spica-venti* (638) and *Centaurea cyanus* (628), while among kenophytes the most abundant are *Conyza canadensis* (796), *Chamomilla suaveolens* (780), *Galinsoga parviflora* (721), *Robinia pseudoacacia* (693), *Solidago canadensis* (636), and *Galinsoga ciliata* (630) (Appendix 1).

The first, tentative list of invasive alien plants (kenophytes=neophytes) for Poland was proposed by Tokarska-Guzik (2005a, 2005b) and at the regional scale a further such list, devoted exclusively to neophytes, was published by Tokarska-Guzik *et al.* (2008). Eventually, for the purpose of the present study, a final list of 101 invasive species was selected (Appendix 1). Among alien plant species considered as invasive in the area of the Silesian Upland, 20 species are classified as 'weeds' (13 archaeophytes and 7 kenophytes), while another 25 (exclusively kenophytes) penetrating into natural habitats are classified as

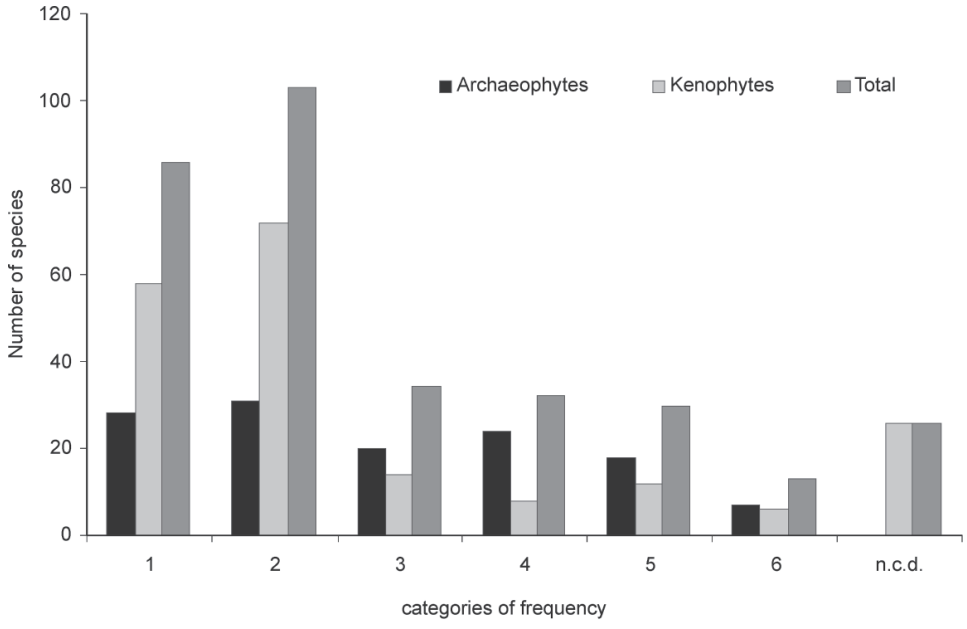

Fig. 7. Frequency distribution of naturalized alien flora in the Silesian Upland
Explanations: categories of frequency, 1 – rare, 2 – occasional, 3 – occasional, locally frequent, 4 – frequent, locally abundant, 5 – abundant, 6 – common; for more explanation see chapter 2

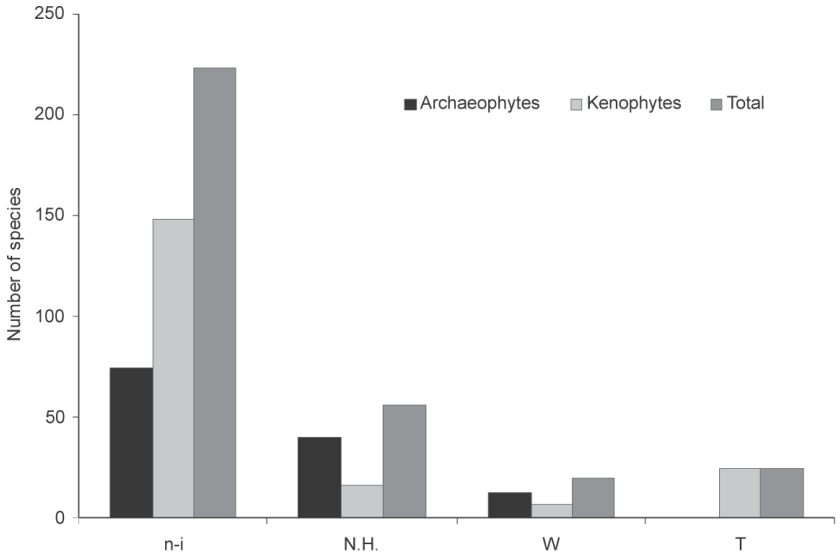

Fig. 8. Status of naturalized alien species in the flora of the Silesian Upland
Explanations: n.i. – non-invasive; invasive: N. H. – not harmful, W – weed, T – transformer

'transformers' (Fig. 8). Three species were labeled as 'post-invasive', namely *Agrostemma githago*, *Acorus calamus* and *Elodea canadensis*, and nineteen as having expanded their ranges at a regional scale during the last decade (Appendix 1).

3.2. Alien species naturalized and spreading in the Silesian Upland (examples)

In order to show the current state of advancement of the regional atlas, distribution maps are presented here for selected species of alien origin. All naturalized alien species confirmed at a regional scale are scattered throughout the whole study area with visible concentration in some parts used for agricultural purposes and in the large urban centres (Fig. 9).

Here seven species were selected to illustrate the current distribution and the probable course of expansion within the territory of the Silesian Upland. *Agrostemma githago* and *Setaria pumila* are examples of species scattered throughout the whole region with concentra-

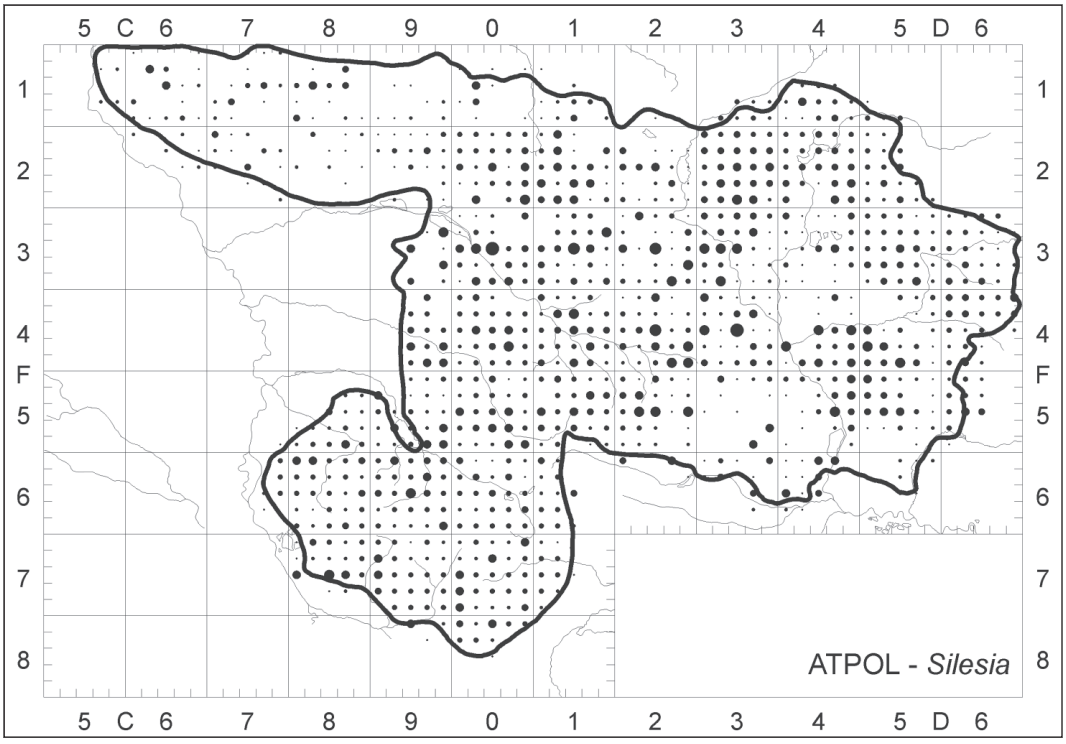

Fig. 9. Concentration of naturalized alien species: archaeophytes and kenophytes (neophytes) in the Silesian Upland
Explanations: the size of dots shows the number of the species occurring in each cartogramme unit (2 x 2 km square)

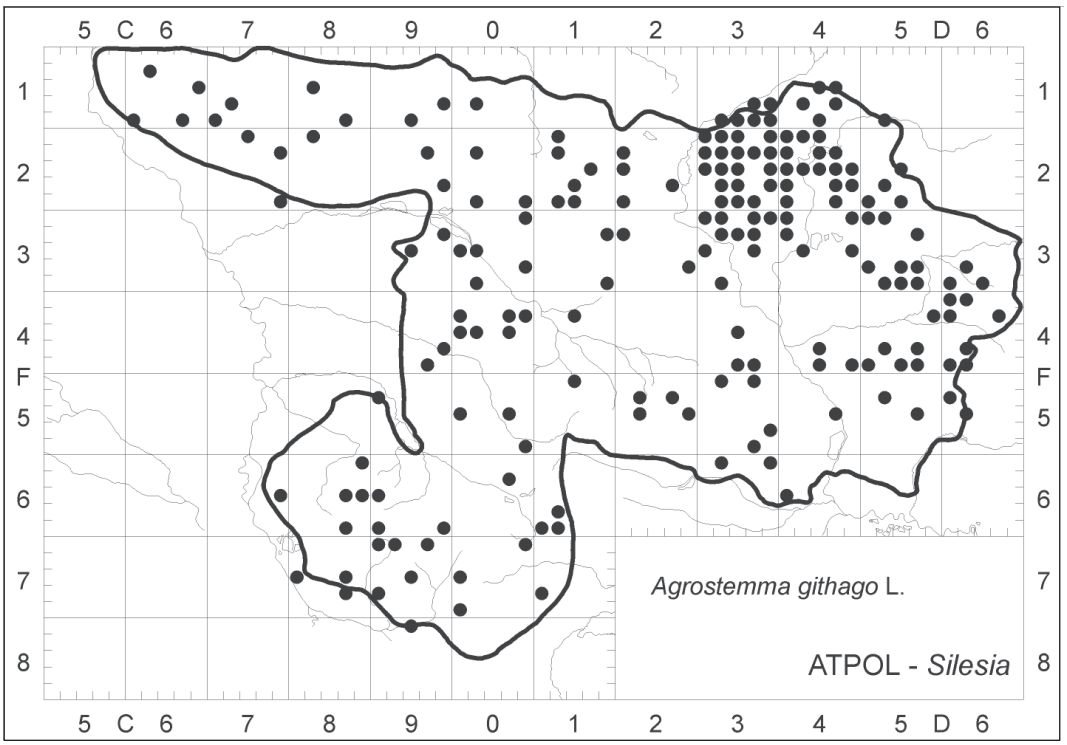

Fig. 10. Current distribution of *Agrostemma githago* in the Silesian Upland

tions of localities in its different parts. For *Agrostemma githago* a concentration of localities is visible in the north-eastern part (Fig. 10), while for *S. pumila* it is in the south-western part of the study area (Fig. 11). Both species were assigned the 'weed' status, but *A. githago* is connected exclusively with arable fields and has recently been considered as 'post-invasive', while *S. pumila* is colonizing both segetal and ruderal habitats

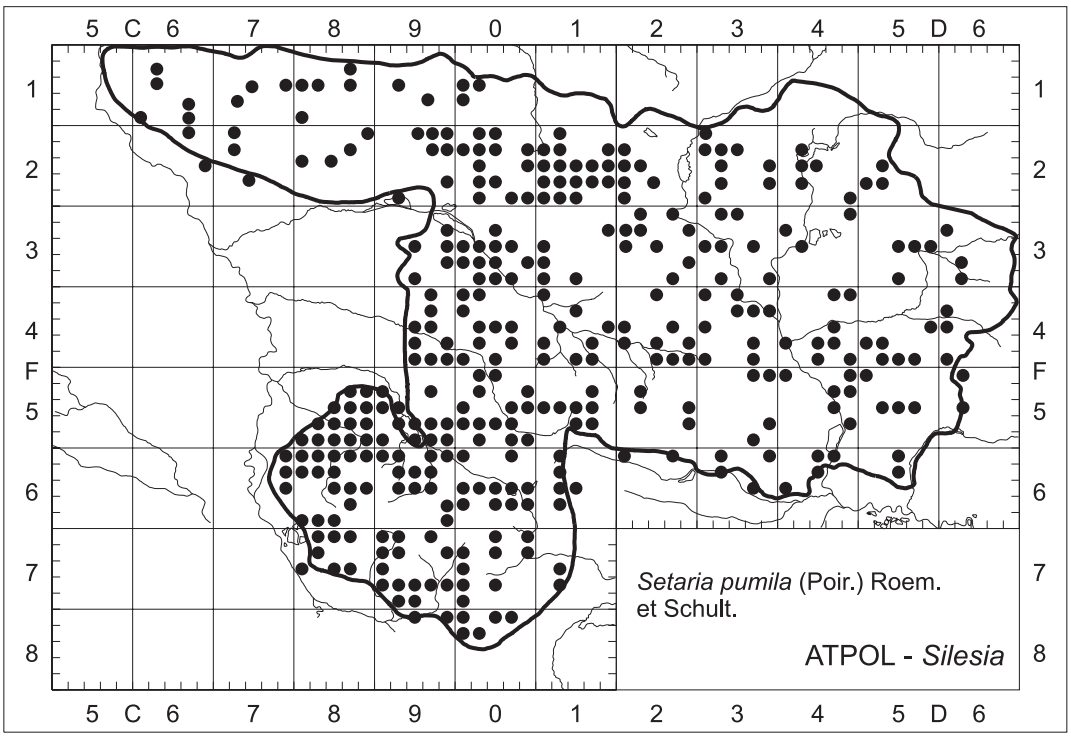

Fig. 11. Current distribution of *Setaria pumila* in the Silesian Upland

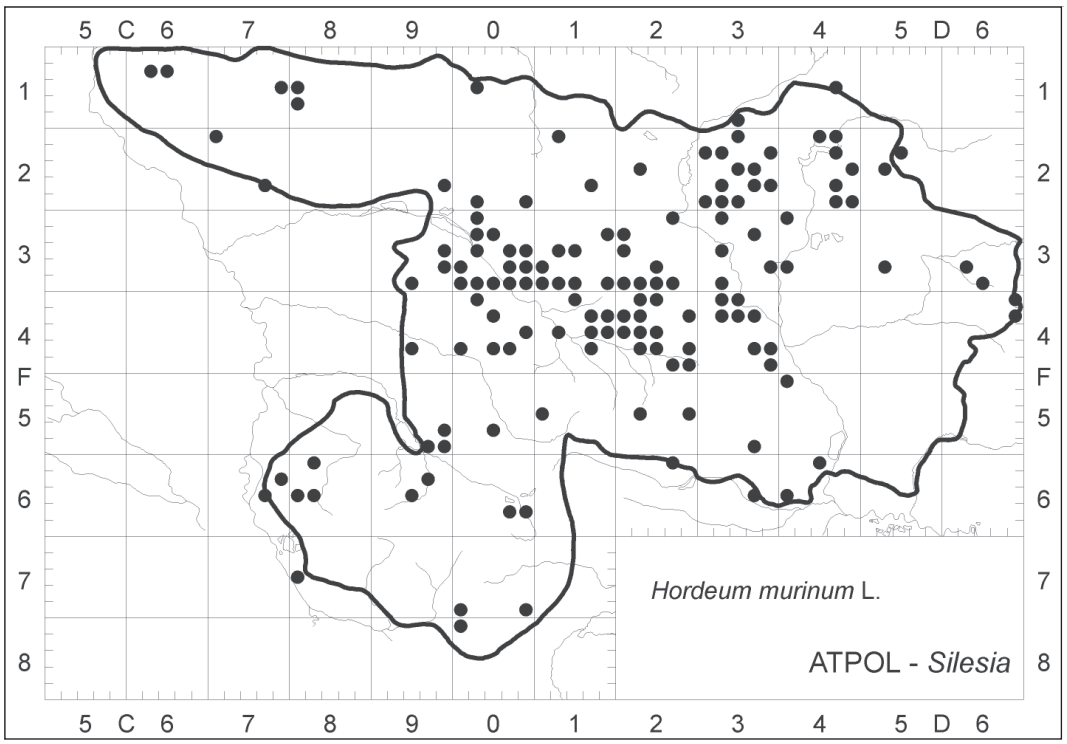

Fig. 12. Current distribution of *Hordeum murinum* in the Silesian Upland

and is capable of occupying new ones. The next two examples are grass species: *Hordeum murinum* – an archaeophyte (Fig. 12) and *Eragrostis minor* – a kenophyte (Fig. 13). Both species originate from south-eastern Europe and western Asia and show a similar tendency in their spread at the regional scale. Sparsely distributed, but locally frequent to date, they are in the process of occupying new sites, especially spreading in built-up areas. *Bunias orientalis* originally comes from eastern Europe and central Asia and has gradually en-

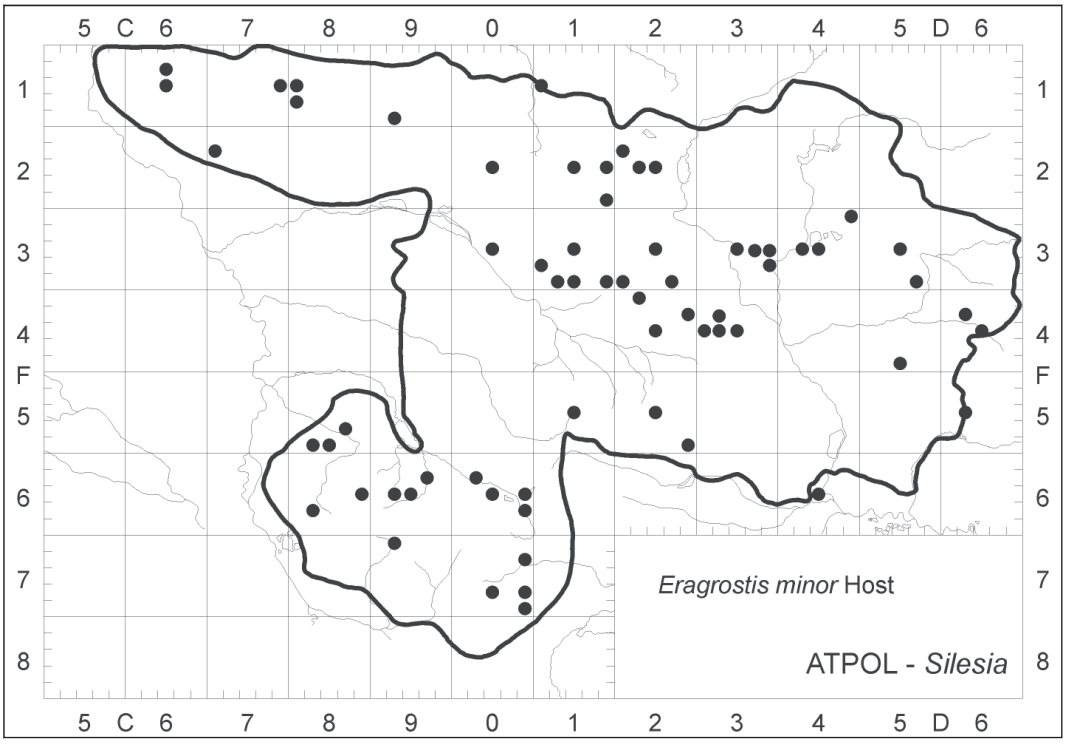

Fig. 13. Current distribution of *Eragrostis minor* in the Silesian Upland

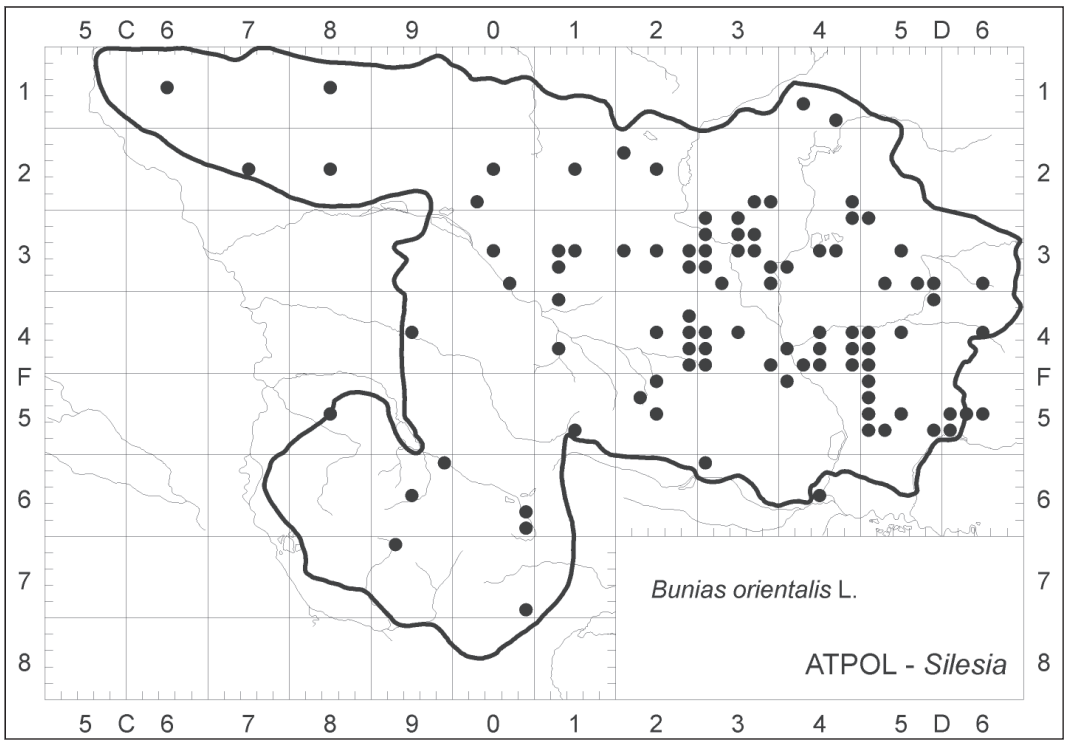

Fig. 14. Current distribution of *Bunias orientalis* in the Silesian Upland

larged its range westwards to include the territory of the whole country (Tokarska-Guzik 2005a). However, it is still an occasional species in the Silesian Upland (9% of squares occupied), with the same tendency also seen at a regional scale (Fig. 14). *Impatiens glandulifera* and *I. parviflora* are among the 25 invasive kenophytes in the regional flora considered as ‚transformers' and posing a threat to native species. *Impatiens parviflora* is among the most abundant kenophytes in the Silesian Upland, colonizing both anthropogenic and natural habi-

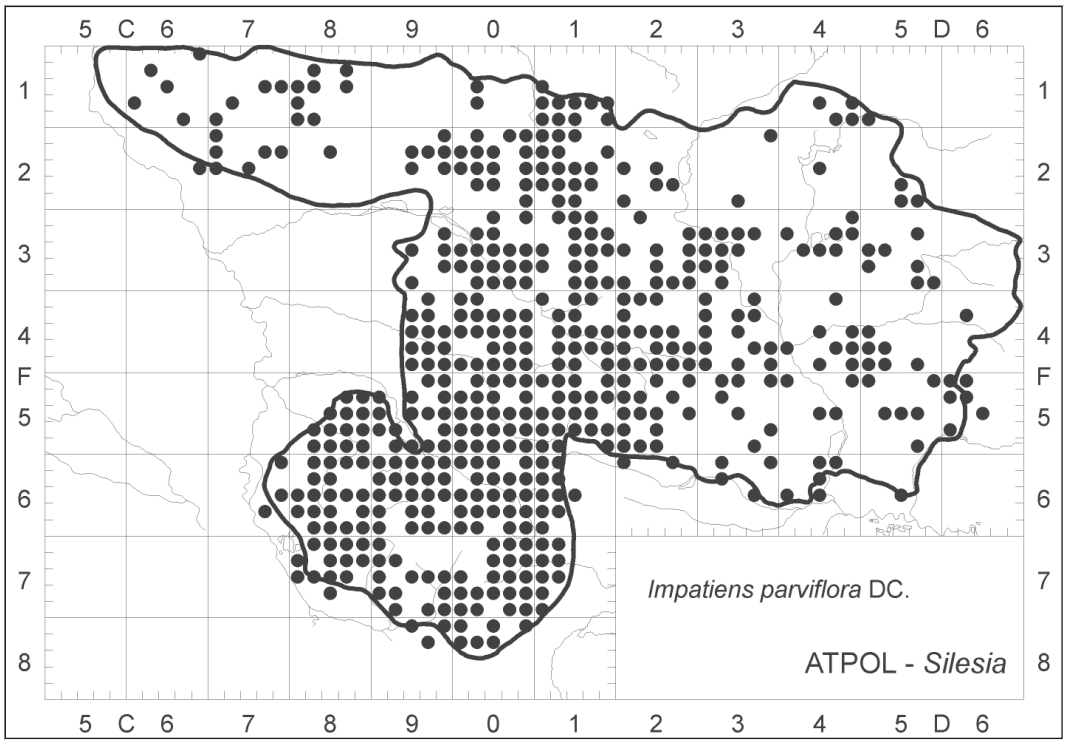

Fig. 15. Current distribution of *Impatiens parviflora* in the Silesian Upland

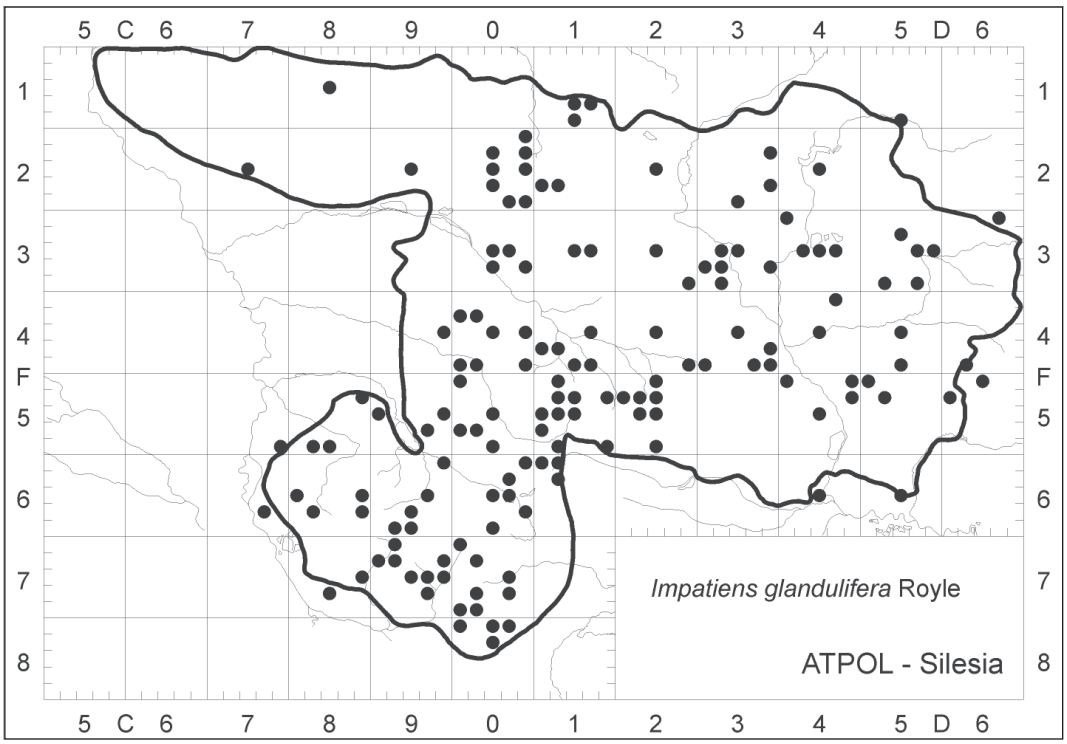

Fig. 16. Current distribution of *Impatiens glandulifera* in the Silesian Upland

tats. Across the region it occurs in several different types of forest (Fig. 15). *Impatiens glandulifera* grows more often in ruderal habitats and also occurs along rivers and forest edges. It is not as abundant as the previous species, but shows a tendency to expand its range at a regional scale (Fig. 16).

4. Discussion

If we look at the participation of alien plant species in the flora of Europe and selected regions of the continent, we find that in Europe the number of naturalized aliens is three times higher than that recorded for Poland. A significant fact is that the number of naturalized aliens for Europe has doubled during the last 10 years (Weber 1997). Comparing particular regions of Europe it can be seen that the number of naturalized aliens in Poland is similar to that number in the Czech Republic and also, less evidently, to that in the Ukraine (Lambdon *et al*. 2008). Trying to compare the particular lists in detail one can also find that there are considerable differences between the regions in the complements of alien species. Nevertheless, these figures suggest that the constant monitoring of appearing new species is to be recommended. In Poland, as in other European countries, information on alien species is gathered at different scales. One such a source of information is the database of "Alien species in Poland" established by the Institute of Nature Protection, Polish Academy of Sciences in Cracow (www.iop.krakow.pl/ias).

To assess whether the impact of alien plants on the indigenous flora is of significant importance it is necessary to gather detailed information at regional or even local scales. The Silesian Upland, because of encroaching urban development and the growth of industry and transport, is exceedingly vulnerable to the infiltration of alien species, which may subsequently migrate from transformed habitats and enter natural communities, often out-competing native species (Tokarska-Guzik 2005a; Urbisz Al. & Urbisz An. 2005; Tokarska-Guzik *et al*. 2008; Urbisz An. & Urbisz Al. 2008). Therefore it might have been expected to find that the proportion of naturalized aliens for the Silesian Upland is closer to the figures determined for the whole country (Table 3) whereas summing up the flora of the Silesian Upland, established alien species amount to 17% of the regional flora and they constitute *ca*. 70% of all naturalized aliens in Poland. A comparison of the floras of the Silesian Upland and the adjacent Kraków-Częstochowa Upland shows similar proportions (Table 3). The only slight difference is in the number of kenophytes, which is higher for the Silesian Upland (196) when compared with the bordering, but more natural Kraków-Częstochowa Upland (162 species) (Urbisz An. 2008).

Due to our growing knowledge on alien plant species in Poland, the lists for particular groups of alien plant species can be modified (Zając *et al*. 2009). For example, *Hyssopus officinalis* and *Marrubium vulgare*, previously classified as newer arrivals (kenophytes) (Zając *et al*. 1998; Tokarska-Guzik 2005a), on the ground

of historical sources were described as "the oldest arrivals among the kenophytes", present in the 16th and 17th century flora of Poland (Tokarska-Guzik 2005a; Zając *et al*. 2009). In the present study these species were included in the list of archaeophytes. As a result of recent field recording, two new species were added to the kenophyte list, namely *Eragrostis albensis*, appearing by roadsides and particularly in cracks between flagstones, and *Typha laxmannii*, colonizing watersides of reservoirs (Baryła *et al*. 2005; own data). Constant monitoring can also result in the documentation of the first stages of naturalization for some casual species, which reveal tendencies to become established, so that when natural conditions are appropriate they may become able to survive at one place even for many years (e.g. *Abutilon theophrasti*, *Cynodon dactylon*, *Chenopodium pumilo*, *Rapistrum perenne* or *Sisymbrium irio*) (Urbisz Al. & Urbisz An. 2005).

The geographical and ecological characteristics of the regional alien flora are similar to those of the other regions of the country and for Poland as a whole (e.g. Kucharczyk 2003; Tokarska-Guzik 2005a; Urbisz An. 2008). The pattern of distribution for alien plants is affected by many factors, including historical influences (time of introduction and pathways), factors related to biological properties of the species (e.g. life strategy, means and rate of dispersion) and by the specific conditions a species encounters in the new homeland (e.g. climatic factors, land relief, soil types, presence of water courses, land use) and existing ecological corridors (Tokarska-Guzik, Zając & Zając 2008; Zając *et al*. 2009). At a regional scale the most important factors facilitating establishment and spread of alien plants appear to be soil types and land use. Archaeophyte distribution and spread frequently exhibit a high correlation with the soil type (Tokarska-Guzik, Zając & Zając 2008; Zając *et al*. 2009; Wegrzynek & Nowak 2010), while in kenophytes they often correlate with land use and other human activities (Tokarska-Guzik 2003b, 2005a).

Many alien species occurring in the Silesian Upland have stations distributed throughout the whole region and thus they do not represent any particular type of range. They are among species which have ceased their spread throughout Poland as a whole and have colonized all accessible habitats (Tokarska-Guzik 2005a; Tokarska-Guzik, Zając & Zając 2008). Only some species show certain patterns of distribution associated with local habitat conditions or human activity. For example, species such as *Acorus calamus* or *Elodea canadensis* have for a long time been well-established species in natural habitats in the Silesian Upland. These species do not have a tendency for massive spread, while species such as *Echinocystis lobata* are colonizing new stations and probably have not yet finished their spread in the region. The present and future spread of some alien species at a regional scale is facilitated in the Silesian Upland by specific features typical of this region, such as large built-up and industrialized areas, a dense transportation network and a significant contribution of abandoned fields. These circumstances are well-illustrated by the spread of such alien species as *Acer negundo*, *Bunias orientalis*, *Fraxinus pennsylvanica* and species from the genera *Heracleum* and *Solidago*. *Bunias orientalis* and *Rumex confertus*, which originated from eastern Europe and central Asia, have established themselves in south-eastern and central parts of Poland and are expanding their distribution area throughout Poland (Tokarska-Guzik 2005a; Tokarska-Guzik *et al*. 2009). This is also evident in the area of the Silesian Upland. They prefer different habitat types, but their spread is attributed to the presence of transportation routes. The great adaptation possibilities and wide ecological tolerance, enabling *Bunias orientalis* to invade a variety of plant communities in different habitats, are of great importance (Bąba & Kompała-Bąba 2008), which can be sufficient for spread in the case of many other alien species.

Even though the Silesian Upland is one of the areas in Poland most strongly transformed by humans, it is characterised by a significant biological diversity, with many natural contrasts – next to sites radically transformed by human activity, we can stumble upon areas that are only weakly changed and have a rich flora and fauna (Tokarska-Guzik *et al*. 2005, 2008). Knowledge on the distribution patterns of plant species is necessary for the protection of native biological diversity against invasions by alien plant species.

In the present study 101 invasive species were listed for the region. Most of these species have been also classified as invasive plants both for Poland as a whole (Tokarska-Guzik 2005a) and for other regions (Urbisz An. 2008; Urbisz An. & Urbisz Al. 2009). Their role in the plant cover of the region is diverse. Some species occur exclusively in man-made (anthropogenic) habitats, while others also enter semi-natural and natural habitats. Some species from the archaeophyte group have been reported as very expansive and troublesome weeds. They are almost exclusively members of the Poaceae family, e.g. *Apera spica-venti, Avena fatua, A.* ×*vilis, Echinochloa crus-galli, Setaria pumila* and *S. viridis* (Węgrzynek 2009 and literature cited therein). The same species, as in other regions of Poland, should be considered as causing a serious economical threat at the regional scale. From the point of view of nature conservation a management programme should be developed for several kenophytes classified as 'transformers'. In the flora of the Silesian Upland the most invasive and, at the same time, visible species in the landscape include *Solidago canadensis* (636 squares), *S. gigantea* (561), *Impatiens parviflora* (517),

Reynoutria japonica (460) and the following woody plants: *Padus serotina* (428), *Quercus rubra* (460) and *Acer negundo* (322). Within this group three species are of greater importance: *Impatiens parviflora* recorded predominantly in deciduous forests and the trees *Padus serotina* and *Quercus rubra* found in different types of forests (Tokarska-Guzik *et al*. 2008). Among the numerous invasive alien plants, of particular interest in many regions of the world there are species having significant impact not only on the indigenous flora and fauna, but also on human health, namely species from the genera *Heracleum* and *Ambrosia*. Representatives of both genera occur in the Silesian Upland. Pollen of *Ambrosia artemisiifolia* (common ragweed) is a strong allergen considered to be one of the most dangerous pollen allergens in the world. Being a serious hazard to human health, it is also considered as an "environmental weed" causing an economic threat and it is now listed on the List of invasive alien plants for Europe at the European and Mediterranean Plant Protection Organization (EPPO); http://www.eppo.org/. In Poland common ragweed is not currently spreading on a large scale. Although ragweed is included in the quarantine weed list in Poland, it does not yet constitute a major threat. It nevertheless requires alert attention in Poland due to the tendency to spread which it is currently showing in neighbouring countries. Therefore our team started to investigate changes in the distribution of *A. artemisiifolia* on the regional scale. At the regional scale it has been recorded in several new localities, particularly along roads. The size of local populations at particular stations ranges from several plants to thousands of individuals. Such data provide scientific background for the planning of nature protection-related activities, as well as phytosanitary alerts at the regional scale (Tokarska-Guzik *et al.* in press).

International documents on nature protection (the Convention on Biological Diversity; the Bern Convention) ratified by Poland, as well as our country's accession to the European Union, require the development of a complex strategy on alien species management. This task is also recommended for implementation in the *National Strategy and Action Plan for the Conservation and Sustainable Use of Biological Diversity* (KSO iUURB 2003), which was accepted by the Council of Ministers in 2003. The strategies should encompass the preparation of a framework of organizational, legal and financial solutions, facilitating control over the introduction of new alien species and alleviating the negative influence of those alien species, which have already been introduced.

Recently, there has been even stronger pressure to establish legal grounds in Poland for combating alien invasive species and preventing their spread. The Polish Ministry of Environment initiated actions for preparing and publishing the "National Strategy on Invasive Alien Species". Similar documents will also be an important part of the nature conservation strategy to be prepared at the regional (provincial) scale. Regional databases would then be of significant importance.

5. Conclusions

Catalogues of alien species and syntheses of data concerning individual regions make a significant contribution to our knowledge on invasion phenomena, which together might constitute the basis for practical action. Aside from their scientific value, the results of comprehensive distribution surveys are important for regional nature conservation and for introducing control protocols.

Due to the extent of anthropogenic changes in the plant cover, the monitoring of species of alien origin has acquired an ever-increasing importance in recent times. It is crucial to control quantitative changes in the population size of these species, not only from the point of view of the natural sciences, but also from economic and medical perspectives.

However, one will not be able to prevent the spread of such species without knowledge on their biology and habitat requirements, as well as their geographical ranges of distribution. Another important task is to identify new and potential invasive alien species (and to establish clear identification criteria) and to classify them for the purpose of selecting appropriate management options.

Detailed recording at a regional scale indicates the potential ability of a species to spread and shows the main vectors, which may be attributed to its accidental introduction into built-up areas or on railway routes and along roads. Many authors have concluded that linear corridors such as the network of major roads and railways facilitate the invasion of 'weedy' alien species (e.g. *Ambrosia*, *Bunias*, *Rumex*).

As global trade and travel increase every year, so do the many invasive species hitching a free ride, such as *Ambrosia artemisiifolia*. These circumstances, together with global warming, may contribute to the future spread of this species (and many others) in Poland. Detailed and comprehensive collections of floristic data are of considerable practical importance. They provide a scientific background for the planning of nature protection-related activities as well as phytosanitary alerts at the regional scale.

Extensive knowledge on the biology and ecology of a species under particular environmental conditions can provide a basis for the development of methods for its effective control. Both traditional methods of monitoring the spread of alien plant species and new approaches, such as genetic studies and modeling, will play an in-

creasingly important role in solving problems associated with invasions and in finding improved and novel ways to deal with them.

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Appendix 1. List of naturalized alien plant species in the Silesian Uplands together with their ecological-geographical characteristic

A. Archaeophytes

Species name	Fam.	L.f.	Origin	Syntx.	Hab.								Nrs of loc.	Fr.	Status
					R	S	aS	G	M	W	Sc	F			
Adonis aestivalis L.	Ran	T	E AS	Stell.	.	S	.	.	.	.	.	.	6	1	n-i
Aethusa cynapium L. subsp. *agrestis* (Wallr.) Dostál	Api	T	Anthro.	Stell.	.	S	.	.	.	.	.	.	22	2	n-i
Agrostemma githago L.	Car	T	E	Stell.	.	S	.	.	.	.	.	.	193	3	W*
Alopecurus myosuroides Huds.	Poa	T	E AS	Stell.	.	S	.	.	.	.	.	.	5	1	n-i
Anagallis arvensis L.	Pri	T	AS AF	Stell.	R	S	.	.	.	.	.	.	352	4	N. H.
Anagallis foemina Mill.	Pri	T	E	Stell.	.	S	.	.	.	.	.	.	7	1	n-i
Anthemis arvensis L.	Ast	T	E	Stell.	R	S	.	.	.	.	.	.	430	5	N. H.
Anthemis cotula L.	Ast	T	E	-	R	S	.	.	.	.	.	.	143	3	n-i
Apera spica-venti (L.) Beauv.	Poa	T	E AS	Stell.	r	S	.	.	.	.	.	.	638	6	W
Aphanes arvensis L.	Ros	T	E	Stell.	.	S	.	.	.	.	.	.	109	3	n-i
Armoracia rusticana P. Gaertn., B. Mey et Scherb.	Bra	G	E	Art.	R	s	.	.	M	w	.	.	521	5	N. H.
Atriplex nitens Schkuhr	Chen	T	AS	Stell.	R	.	.	.	.	.	.	.	73	2	n-i
Atriplex rosea L.	Chen	T	E AS	Stell.	R	.	.	.	.	.	.	.	2	1	n-i
Avena fatua L.	Poa	T	AS	Stell.	r	S	.	.	.	.	.	.	334	4	W
Avena strigosa Schreb.	Poa	T	Anthro.	-	.	S	.	.	.	.	.	.	55	2	W
Avena ×vilis Wallr.	Poa	T	Anthro.	-	.	S	.	.	.	.	.	.	112	3	W
Ballota nigra L.	Lam	C H	E	Art.	R	.	.	.	.	.	.	.	408	4	N. H.
Bromus secalinus L.	Poa	T	Anthro.	Stell.	.	S	.	.	.	.	.	.	101	2	n-i
Bromus sterilis L.	Poa	T	E AS	Stell.	R	.	.	.	.	.	.	.	157	3	n-i
Bromus tectorum L.	Poa	T	E AS	Stell.	R	.	.	.	.	.	.	.	303	4	N. H.
Camelina microcarpa Andrz. subsp. *sylvestris* (Wallr.) Hittonen	Bra	T	E AS	Stell.	.	S	.	.	.	.	.	.	103	2	n-i
Capsella bursa-pastoris (L.) Medik.	Bra	T	E	Stell.	R	S	.	.	.	.	.	.	828	6	N. H.
Carduus acanthoides L.	Ast	H	E	Art.	R	.	.	.	.	.	.	.	261	4	N. H.
Carduus nutans L.	Ast	H	E	Art.	R	.	.	.	.	.	.	.	3	1	n-i
Centaurea cyanus L.	Ast	T	E	Stell.	r	S	.	.	.	.	.	.	628	6	W
Chamomilla recutita (L.) Rauschert	Ast	T	E	Stell.	R	s	.	.	.	.	.	.	362	4	N. H.
Chenopodium bonus-henricus L.	Chen	C	E	Art.	R	.	.	.	.	.	.	.	150	3	n-i
Chenopodium ficifolium Sm.	Chen	T	AS	-	R	.	.	.	.	.	.	.	24	2	n-i
Chenopodium hybridum L.	Chen	T	Anthro.	-	R	.	.	.	.	.	.	.	142	3	n-i
Chenopodium murale L.	Chen	T	E AS	-	R	.	.	.	.	.	.	.	12	2	n-i
Chenopodium urbicum L.	Chen	T	E AS	-	R	.	.	.	.	.	.	.	8	1	n-i
Chenopodium vulvaria L.	Chen	T	E AS	-	R	.	.	.	.	.	.	.	20	2	n-i
Chrysanthemum segetum L.	Ast	T	E AF	Stell.	.	S	.	.	.	.	.	.	3	1	n-i
Cichorium intybus L. subsp. *intybus*	Ast	H	E AS	Art.	R	.	.	.	.	.	.	.	485	5	N. H.
Conium maculatum L.	Api	H T	E AS AF	Art.	R	.	.	.	.	.	.	.	9	1	n-i
Consolida regalis S. F. Gray	Ran	T	E AS	Stell.	R	S	.	.	.	.	.	.	251	4	N. H.
Descurainia sophia (L.) Webb ex Prantl	Bra	T	AS	Stell.	R	s	.	.	.	.	.	.	407	4	N. H.
Digitaria sanguinalis (L.) Scop.	Poa	T	AS	Stell.	R	S	.	.	.	.	.	.	123	3	n-i
Echinochloa crus-galli (L.) P. Beauv.	Poa	T	AS	Stell.	R	S	.	.	.	.	.	.	498	5	W
Euphorbia exigua L.	Euph	T	E	Stell.	.	S	.	.	.	.	.	.	48	2	n-i
Euphorbia helioscopia L	Euph	T	E	Stell.	R	S	.	.	.	.	.	.	462	5	N. H.
Euphorbia peplus L.	Euph	T	E	Stell.	R	S	.	.	.	.	.	.	280	4	N. H.

Species name	Fam.	L.f.	Origin	Syntx.	Hab.								Nrs of loc.	Fr.	Status
					R	S	aS	G	M	W	Sc	F			
Fallopia convolvulus (L.) Á. Löve	Poly	T l.	E AS	Stell.	R	S	.	.	.	.	.	.	675	6	W
Fumaria officinalis L.	Fum	T	E	Stell.	R	S	.	.	.	.	.	.	204	3	n-i
Fumaria rostellata Knaf.	Fum	T	E	-	R	S	.	.	.	.	.	.	5	1	n-i
Fumaria schleicheri Soy.-Will.	Fum	T	E AS	-	R	S	.	.	.	.	.	.	5	1	n-i
Fumaria vaillantii Loisel.	Fum	T	E AS	-	R	S	.	.	.	.	.	.	26	2	n-i
Gagea arvensis (Pers.) Dumort.	Lil	G	E AF	-	.	S	.	.	.	.	.	.	2	1	n-i
Galium spurium L.	Rub	T l.	E AS	Stell.	.	S	.	.	.	.	.	.	27	2	n-i
Geranium dissectum L.	Ger	T	E	Stell.	R	s	.	.	.	.	.	.	57	2	n-i
Geranium molle L.	Ger	T	E	-	R	.	.	.	.	.	.	.	33	2	n-i
Geranium pusillum Burm. f. ex. L.	Ger	T	AS	Stell.	R	S	.	.	.	.	.	.	435	5	N. H.
Herniaria hirsuta L.	Car	H	E AS	-	R	.	.	G	.	.	.	.	15	2	n-i
Hordeum murinum L.	Poa	T	E AS	Stell.	R	.	.	.	.	.	.	.	143	3	N. H.**
Hyoscyamus niger L.	Sol	H T	AS	Stell.	R	.	.	.	.	.	.	.	58	2	n-i
Hyssopus officinalis L.	Lam	Ch	E AS	Art.	R	.	.	.	.	.	.	.	4	1	n-i
Kickxia elatine (L.) Dumort.	Scr	T	E	Stell.	.	S	.	.	.	.	.	.	16	2	n-i
Lactuca serriola L.	Ast	H T	E AS	Stell.	R	s	.	.	.	.	.	.	534	5	N. H.
Lamium album L.	Lam	H	E AS	Art.	R	.	.	.	.	.	Sc	.	407	4	N. H.
Lamium amplexicaule L.	Lam	T	E AS	Stell.	R	S	.	.	.	.	.	.	266	4	N. H.
Lamium purpureum L.	Lam	H T	E	Stell.	R	S	.	.	.	.	.	.	599	5	N. H.
Lathyrus tuberosus L.	Fab	H	E AS	Stell.	R	S	.	.	.	.	.	.	135	3	n-i
Leonurus cardiaca L.	Lam	H	E AS	Art.	R	.	.	.	.	.	.	.	121	3	n-i
Lepidium campestre (L.) R. Br.	Bra	T	E	-	R	.	.	.	.	.	.	.	161	3	n-i
Lepidium ruderale L.	Bra	H T	AS	Stell.	R	.	.	.	.	.	.	.	347	4	N. H.
Lithospermum arvense L.	Bor	T	E AS	Stell.	R	S	.	.	.	.	.	.	315	4	N. H.
Lolium remotum Schrank	Poa	T	Anthro.	Stell.	.	S	.	.	.	.	.	.	4	1	n-i
Lolium temulentum L.	Poa	T	E	Stell.	.	S	.	.	.	.	.	.	25	2	n-i
Malva alcea L.	Mal	H	E	-	R	s	.	g	.	.	.	.	236	4	N. H.
Malva crispa L.	Mal	T H	AS	-	R	.	.	.	.	.	.	.	3	1	n-i
Malva neglecta Wallr.	Mal	H T	AS	Stell.	R	.	.	.	.	.	.	.	438	5	N. H.
Malva pusilla Sm.	Mal	H T	Anthro.	Stell.	R	S	.	.	.	.	.	.	19	2	n-i
Malva sylvestris L.	Mal	H T	E	Art.	R	.	.	.	.	.	.	.	249	4	N. H.
Marrubium vulgare L.	Lam	C H	E AS AF	(Stell.)	R	.	.	.	.	.	.	.	8	1	n-i
Matricaria maritima L. subsp. *inodora* L. Dostál	Ast	H T	Anthro.	Stell.	R	S	.	.	.	.	.	.	723	6	W
Melandrium noctiflorum (L.) Fr.	Car	T	E AS	Stell.	.	S	.	.	.	.	.	.	41	2	n-i
Misopates orontium (L.) Raf.	Scr	T	E	Stell.	.	S	.	.	.	.	.	.	8	1	n-i
Myosotis arvensis (L.) Hill	Bor	H T	E AS	Stell.	R	S	.	.	.	.	.	.	568	5	N. H.
Nepeta cataria L.	Lam	C H	E AS	Art.	R	.	.	.	.	.	.	.	82	2	n-i
Neslia paniculata (L.) Desv.	Bra	T	E AS	Stell.	.	S	.	.	.	.	.	.	183	3	n-i
Nigella arvensis L.	Ran	T	E	Stell.	.	S	.	.	.	.	.	.	11	2	n-i
Odontites verna (Bellardi) Dumort.	Scr	T pp	Anthro.	Stell.	.	S	.	.	.	.	.	.	24	2	n-i
Onopordum acanthium L.	Ast	H	E AS	Art.	R	.	.	.	.	.	.	.	124	3	n-i
Papaver argemone L.	Pap	T	E AS	Stell.	R	S	.	.	.	.	.	.	219	4	N. H.
Papaver dubium L.	Pap	T	E AS	Stell.	R	S	.	.	.	.	.	.	147	3	n-i
Papaver rhoeas L.	Pap	T	E AS	Stell.	r	S	.	.	.	.	.	.	501	5	N. H.
Parietaria officinalis L.	Urt	H	E		R	.	.	.	.	.	.	.	5	1	n-i
Pisum sativum L. subsp. *arvense* (L.) Asch. et Gr.	Fab	T	E AS	Stell.	.	S	.	.	.	.	.	.	15	2	n-i
Portulaca oleracea L. subsp. *oleracea*	Por	T	AS AF	Stell.	R	s	.	.	.	.	.	.	7	1	n-i
Ranunculus arvensis L.	Ran	T	E AS	Stell.	.	S	.	.	.	.	.	.	13	2	n-i
Raphanus raphanistrum L.	Bra	T	E	Stell.	R	S	.	.	.	.	.	.	544	5	W
Scandix pecten-veneris L.	Api	T	E AS AF	Stell.	.	S	.	.	.	.	.	.	1	1	n-i
Scleranthus annuus L.	Car	T	E	Stell.	R	S	.	G	.	.	.	.	387	4	N. H.
Senecio vulgaris L.	Ast	H T	E	-	R	S	.	.	.	.	.	.	580	5	N. H.
Setaria italica (L.) P. Beauv.	Poa	T	E AS	-	R	.	.	.	.	.	.	.	1	1	n-i
Setaria pumila (Poir.) Roem. et Schult.	Poa	T	AS	Stell.	R	S	.	.	.	.	.	.	363	4	W
Setaria verticillata (L.) P. Beauv.	Poa	T	AS	-	R	.	.	.	.	.	.	.	4	1	n-i
Setaria viridis (L.) Beauv.	Poa	T	E AS	Stell.	R	S	.	.	.	.	.	.	299	4	W
Sherardia arvensis L.	Rub	T	E	Stell.	.	S	.	.	.	.	.	.	122	3	n-i
Silene gallica L.	Car	T	E	Stell.	.	S	.	.	.	.	.	.	19	2	n-i
Sinapis arvensis L.	Bra	T	E	Stell.	R	S	.	.	.	.	.	.	522	5	W
Sisymbrium officinale (L.) Scop.	Bra	T	E	Stell.	R	s	.	.	.	.	.	.	661	6	N. H.
Solanum luteum Mill.	Sol	T	E	-	R	.	.	.	.	.	.	.	2	1	n-i
Solanum nigrum L. em. Mill.	Sol	T	E	Art.	R	.	.	.	.	.	.	.	147	3	n-i
Sonchus asper (L.) Hill	Ast	T	E	Stell.	R	S	.	.	.	.	.	.	337	4	N. H.
Sonchus oleraceus L.	Ast	H T	E	Stell.	R	S	.	.	.	.	.	.	587	5	N. H.
Spergula arvensis L.	Car	T	E	Stell.	R	S	.	.	.	.	.	.	398	4	N. H.
Stachys annua (L.) L.	Lam	T H	E AS	Stell.	r	S	.	.	.	.	.	.	60	2	n-i
Thlaspi arvense L.	Bra	T	AS	Stell.	R	S	.	.	.	.	.	.	494	5	N. H.
Urtica urens L.	Urt	T	E	Stell.	R	.	.	.	.	.	.	.	324	4	N. H.

Species name	Fam.	L.f.	Origin	Syntx.	Hab.								Nrs of loc.	Fr.	Status
					R	S	aS	G	M	W	Sc	F			
Vaccaria hispanica (Mill.) Rauschert	Car	T	E	Stell.	.	S	.	.	.	.	.	.	5	1	n-i
Valerianella dentata (L.) Polich	Val	T	E	Stell.	.	S	.	.	.	.	.	.	45	2	n-i
Valerianella locusta Laterr. em. Betcke	Val	T	E	Stell.	.	S	.	.	.	.	.	.	7	1	n-i
Valerianella rimosa Bastard	Val	T	E	Stell.	.	S	.	.	.	.	.	.	15	2	n-i
Verbena officinalis L.	Ver	H T	E AS	Art.	R	.	.	.	.	.	.	.	128	3	n-i
Veronica agrestis L.	Scr	T	E	Stell.	.	S	.	g	.	.	.	.	11	2	n-i
Veronica arvensis L.	Scr	T	E	-	R	S	.	.	.	.	.	.	469	5	N. H.
Veronica opaca Fr.	Scr	T	E	Stell.	.	S	.	.	.	.	.	.	6	1	n-i
Veronica polita Fr.	Scr	T	E AS	Stell.	.	S	.	.	.	.	.	.	9	1	n-i
Veronica triphyllos L.	Scr	T	Anthro.	Stell.	R	S	.	G	.	.	.	.	64	2	n-i
Vicia hirsuta (L.) S. F. Gray	Fab	T l.	E	Stell.	R	S	.	.	.	.	Sc	.	429	5	N. H.
Vicia sativa L.	Fab	T l.	Anthro.	Stell.	R	S	aS	.	.	.	.	.	165	3	n-i
Vicia tetrasperma (L.) Schreb.	Fab	T l.	E	Stell.	R	S	.	.	.	.	Sc	.	375	4	N. H.
Vicia villosa Roth	Fab	H T l.	E	Stell.	.	S	.	.	.	.	.	.	220	4	N. H.
Viola arvensis Murray	Viol	T	?	Stell.	R	S	.	.	.	.	.	.	681	6	N. H.

B. Kenophytes

Species name	Fam.	L.f.	Origin	Syntx.	Hab.								Nrs of loc.	Fr.	Status
					R	S	aS	G	M	W	Sc	F			
Acer negundo L.	Ace	M	AMN	-	R	.	aS	.	.	W	Sc	F	322	4	T
Acorus calamus L.	Ara	Hy	AS	Phrag.	.	.	.	.	.	W	.	.	174	3	T*
Aesculus hippocastanum L.	Hipp	M	E	-	R	.	.	.	.	.	.	F	393	4	N. H.
Ailanthus altissima (Mill.) Swingle	Sim	M	AS	-	R	.	.	.	.	.	.	.	11	2	N. H.**
Amaranthus albus L.	Ama	T	AMN	Stell.	R	.	.	.	.	.	.	.	49	2	n-i
Amaranthus blitoides S. Watson	Ama	T	AMN	-	R	.	.	.	.	.	.	.	16	2	n-i
Amaranthus chlorostachys Willd.	Ama	T	AMC *et* AMS	Stell.	R	S	.	.	.	.	.	.	27	2	n-i
Amaranthus lividus L.	Ama	T	E AF	-	R	S	.	.	.	.	.	.	16	2	n-i
Amaranthus retroflexus L.	Ama	T	AMN *et* AMC	Stell.	R	S	.	.	.	.	.	.	422	5	W
Ambrosia artemisiifolia L.	Ast	T	AMN	-	R	.	.	.	.	.	.	.	21	2	W**
Ambrosia psilostachya DC.	Ast	H	AMN	-	R	.	.	.	.	.	.	.	2	1	n-i
Amelanchier spicata (Lam.) K. Koch.	Ros	N	AMN	-	R	.	.	.	.	.	Sc	F	n.c.d.	-	n-i
Anaphalis margaritacea (L.) Benth.	Ast	C	AMN	-	R	.	.	.	.	.	.	.	2	1	n-i
Anthemis ruthenica M. Bieb.	Ast	T	E	Art.	R	.	.	.	.	.	.	.	21	2	n-i
Anthoxanthum aristatum Boiss.	Poa	T	E	Stell.	R	S	.	.	.	.	.	.	25	2	n-i
Artemisia annua L.	Ast	T	E AS	-	R	.	.	.	.	.	.	.	26	2	n-i
Artemisia austriaca Jacq.	Ast	Ch	E AS	-	R	.	.	.	.	.	.	.	19	2	n-i
Artemisia dracunculus L.	Ast	H	AMN AS	-	R	.	.	.	.	.	.	.	2	1	n-i
Asclepias syriaca L.	Asc	H	AMN	-	R	.	.	.	.	.	.	.	2	1	n-i
Aster lanceolatus Willd.	Ast	H	AMN	Art.	R	.	.	.	.	.	Sc	.	19	2	n-i
Aster novae-angliae L.	Ast	H	AMN	Art.	R	.	.	.	.	W	Sc	.	13	2	n-i
Aster novi-belgii L.	Ast	H	AMN	Art.	R	.	.	.	M	W	Sc	.	186	3	T
Aster × *salignus* Willd.	Ast	H	AMN	Art.	R	.	.	.	M	W	Sc	.	60	2	T
Aster tradescantii L.	Ast	H	AMN	Art.	R	.	.	.	.	.	Sc	.	8	1	n-i
Atriplex hortensis L.	Chen	T	AS	-	R	.	.	.	.	.	.	.	51	2	n-i
Atriplex oblongifolia Waldst. et Kit.	Chen	T	E AS AF	Stell.	R	.	.	.	.	.	.	.	8	1	n-i
Atriplex tatarica L.	Chen	T	E AS	Stell.	R	.	.	.	.	.	.	.	13	2	n-i
Beckmannia eruciformis Host	Poa	H	E AS	Mol-Arrh.	.	.	.	.	M	.	.	.	1	1	n-i
Bidens connata H. L. Mühl.	Ast	T	AMN	Biden.	R	.	.	.	.	W	.	.	8	1	n-i
Bidens frondosa L.	Ast	T	AMN	Biden.	R	.	.	.	.	W	.	.	411	4	T
Brassica nigra (L.) W. D. J. Koch	Bra	T	E	-	R	.	.	.	.	.	.	.	22	2	n-i
Brassica rapa L. subsp. *rapa*	Bra	T	Anthro.	-	R	.	.	.	.	.	.	.	70	2	n-i
Bromus carinatus Hook. et Arn.	Poa	T	AMN	-	R	S	.	.	m	.	sc	.	150	3	N. H.**
Bromus japonicus Thunb. ex Murr	Poa	T	E AS	-	R	.	.	.	.	.	.	.	4	1	n-i
Bromus squarrosus L.	Poa	T	E AS	-	R	.	.	.	.	.	.	.	n.c.d.	-	n-i
Bryonia alba L.	Cuc	H l.	E AS	-	R	.	.	.	.	.	Sc	.	16	2	n-i
Bryonia dioica Jacq.	Cuc	H l.	E	-	R	.	.	.	.	.	Sc	.	6	1	n-i
Bunias orientalis L.	Bra	H	E AS	Agro.	R	.	aS	G	.	.	.	.	97	2	T**
Calendula arvensis L.	Ast	T	E AS	-	R	.	.	.	.	.	.	.	3	1	n-i
Calystegia sylvatica (Kit.) Griseb.	Con	G H l.	E	-	R	.	.	.	.	.	Sc	.	24	2	n-i
Cardaria draba (L.) Desv.	Bra	G H	E AS	Agro.	R	.	.	.	.	.	.	.	68	2	n-i
Centaurea diffusa Lam.	Ast	T H	E AS	Art.	R	.	.	.	.	.	.	.	27	2	n-i
Cerasus mahaleb (L.) Mill.	Ros	M	E AS	-	R	.	.	.	.	.	Sc	.	11	2	n-i
Cerasus vulgaris Mill. subsp. *vulgaris*	Ros	M	E AS	-	R	.	.	.	.	.	Sc	.	n.c.d.	-	n-i
Chamomilla suaveolens (Pursh) Rydb.	Ast	T	AMN AS	Mol-Arrh.	R	.	.	.	.	.	.	.	780	6	N. H.
Chenopodium botrys L.	Chen	T	AS	Biden.	R	.	.	.	.	.	.	.	8	1	n-i
Chenopodium pedunculare Bertol.	Chen	T	E	-	R	.	.	.	.	.	.	.	5	1	n-i

Species name	Fam.	L.f.	Origin	Syntx.	Hab.							Nrs of loc.	Fr.	Status
Chenopodium strictum Roth	Chen	T	AS	Stell.	R	.	.	.	.	.	.	106	3	n-i
Chenopodium suecicum Murr	Chen	T	AMN E AS	-	R	.	.	.	.	.	.	5	1	n-i
Clematis vitalba L.	Ran	N l.	E AS AF	Rh-Prun.	R	.	.	.	.	.	Sc	44	2	n-i
Conyza canadensis (L.) Cconquist	Ast	H T	AMN	Stell.	R	s	aS	G	.	.	.	796	6	W
Cornus alba L.	Cor	N	E AS	-	R	.	.	.	.	.	Sc	n.c.d	-	n-i
Crataegus flabellata (Bosc ex Spach) K. Koch	Ros	M N	AMN	-	R	.	.	.	.	.	Sc	n.c.d.	-	n-i
Crataegus pedicellata Sarg.	Ros	M N	AMN	-	R	.	.	.	.	.	.	n.c.d.	-	n-i
Cuscuta campestris Yunck.	Cus	T p.	AMN	-	.	S	.	.	.	.	.	3	1	n-i
Cymbalaria muralis P. Gaertn., B. Mey et Schr.	Scr	C H	E	Aspl.	R	.	.	.	.	.	.	6	1	n-i
Datura stramonium L.	Sol	T	AMN	Stell.	R	.	.	.	.	.	.	67	2	n-i
Dianthus barbatus L. s. s.	Car	C	E	-	R	.	.	.	.	.	.	33	2	n-i
Digitalis purpurea L.	Scr	H	E	Epilob.	R	.	.	.	.	.	.	16	2	n-i
Diplotaxis muralis (L.) DC.	Bra	T	E AF	-	R	.	.	.	.	.	.	98	2	n-i
Diplotaxis tenuifolia (L.) DC.	Bra	C H	E AF AS	Agro.	R	.	.	.	.	.	.	18	2	n-i
Echinocystis lobata (F. Michx.) Torr. et A. Gray	Cuc	T l.	AMN	Art.	R	.	.	.	.	W	Sc	244	4	T**
Echinops sphaerocephalus L.	Ast	H	E AS	Art.	R	.	.	.	M	.	.	85	2	n-i
Elaeagnus commutata Bernh. ex Rydb.	Elae	N	AMN	-	R	.	.	.	.	.	Sc	n.c.d.	-	n-i
Elodea canadensis Michx.	Hyd	Hy	AMN	Pota.	.	.	.	.	.	W	.	172	3	T*
Elsholtzia ciliata (Thunb.) Hyl.	Lam	T	AS	-	R	.	.	.	.	.	.	18	2	n-i
Epilobium ciliatum Raf.	Ona	H	AMN	Stell.	R	.	.	.	.	.	.	232	4	N. H.
Eragrostis albensis Scholz	Poa	T	?	-	R	.	.	.	.	.	.	3	1	n-i
Eragrostis minor Host	Poa	T	E AS	Stell.	R	.	.	.	.	.	.	65	2	N. H.**
Erechtites hieraciifolia (L.) Raf. ex DC.	Ast	T	AMN *et* AMS	-	.	.	.	.	.	.	cF	n.c.d.	-	N. H.**
Erigeron annuus (L.) Pers.	Ast	H	AMN	-	R	.	.	G	M	.	.	280	4	N. H.
Erigeron ramosus (Walters) Britton, Sterns et Poggenb.	Ast	H	AMN	Art.	R	.	.	G	M	.	.	14	2	n-i
Erucastrum gallicum (Willd.) O. E. Schulz	Bra	H T	E	-	R	.	.	.	.	.	.	3	1	n-i
Erysimum marschallianum Andrz. ex M. Bieb.	Bra	H	E AS	-	R	.	.	.	.	.	.	7	1	n-i
Fraxinus pennsylvanica Marshall	Olea	M	AMN	-	R	.	aS	.	.	.	.	143	3	T**
Galinsoga ciliata (Raf.) S. F. Blade	Ast	T	AMC	Stell.	R	S	.	.	.	.	.	630	6	W
Galinsoga parviflora Cav.	Ast	T	AMC *et* AMS	Stell.	R	S	.	.	.	.	.	721	6	W
Geranium bohemicum L.	Ger	T	E	-	R	.	.	.	.	.	.	2	1	n-i
Geranium divaricatum Ehrh.	Ger	T	E AS	Art.	R	.	.	.	.	.	.	2	1	n-i
Geranium pyrenaicum Burm. f.	Ger	H	E	Art.	R	.	.	.	M	.	Sc	37	2	n-i
Helianthus decapetalus L.	Ast	G	AMS	-	R	.	.	.	.	.	Sc	3	1	n-i
Helianthus × *laetiflorus* Pers.	Ast	G	Anthro.	-	R	.	.	.	.	.	Sc	5	1	n-i
Helianthus tuberosus L.	Ast	G	AMN	Art.	R	.	as	.	.	W	Sc	F	170	3	T**
Heracleum mantegazzianum Sommier et Levier	Api	H	AS	-	R	.	aS	.	M	W	Sc	.	11	2	T**
Heracleum sosnovskyi Manden.	Api	H	AS	-	R	.	aS	.	.	W	Sc	.	19	2	T**
Hesperis matronalis L. subsp. *matronalis*	Bra	H	E	-	R	.	.	.	.	.	Sc	.	34	2	n-i
Hordeum jubatum L.	Poa	T	AMN AS	-	R	.	.	.	.	.	.	.	1	1	n-i
Impatiens glandulifera Royle	Bal	T	AS	Art.	R	.	.	.	.	W	Sc	.	150	3	T**
Impatiens parviflora DC.	Bal	T	AS	Art.	R	.	.	.	.	W	Sc	F	517	5	T
Inula helenium L.	Ast	H	E AS	-	R	.	.	.	.	W	Sc	F	11	2	n-i
Iva xanthiifolia Nutt.	Ast	T	AMN	Art.	R	.	.	.	.	.	.	.	7	1	n-i
Juglans regia L.	Jug	M	AS	-	R	.	.	.	.	.	Sc	F	n.c.d.	-	N. H.**
Juncus tenuis Willd.	Jun	H	AMN	Mol-Arrh.	R	S	.	.	.	W	.	.	432	5	T
Kochia scoparia (L.) Schrad.	Chen	T	E AS	-	R	.	.	.	.	.	.	.	50	2	n-i
Lepidium densiflorum Schrad.	Bra	H T	AMN	Stell.	R	.	.	.	.	.	.	.	71	2	n-i
Lepidium virginicum L.	Bra	T	AMN	Stell.	R	.	.	.	.	.	.	.	35	2	n-i
Linum austriacum L.	Lin	H	E	F-B.	R	.	.	.	M	.	.	.	2	1	n-i
Linum perenne L.	Lin	H	E	-	R	.	.	.	M	.	.	.	3	1	n-i
Lolium multiflorum Lam.	Poa	H T	E AF AS	-	R	.	.	.	M	.	.	.	185	3	n-i
Lonicera caprifolium L.	Cap	N l.	E	-	R	.	.	.	.	.	Sc	.	n.c.d.	-	n-i
Lonicera tatarica L.	Cap	N	E AS	-	R	.	.	.	.	.	Sc	.	8	1	n-i
Lupinus polyphyllus Lindl.	Fab	H	AMN	-	R	.	aS	.	.	.	Sc	F	453	5	T
Lycium barbarum L.	Sol	N	E AS	-	R	.	.	.	.	.	Sc	.	145	3	n-i
Lycopersicon esculentum Mill.	Sol	T	AMS	Art.	R	.	.	.	.	.	.	.	n.c.d.	-	n-i
Lysimachia punctata L.	Pri	H	E	Art.	R	.	.	.	.	.	Sc	.	5	1	n-i
Malus domestica Borkh.	Ros	M	Anthro.	-	R	.	.	.	.	.	Sc	.	n.c.d.	-	n-i

Species name	Fam.	L.f.	Origin	Syntx.	Hab.	Nrs of loc.	Fr.	Status
Malva moschata L.	Mal	H	E	Art.	R	6	1	n-i
Medicago sativa L.	Fab	C H	AS	Art.	R s . G M . . .	570	5	N. H.
Medicago ×varia Martyn	Fab	H	Anthro.	Stell.	R s . G M . . .	n.c.d.	-	N. H.**
Melilotus wolgica Poir. in Lam.	Fab	T H	E AS	Stell.	R	1	1	n-i
Mentha rotundifolia (L.) Huds	Lam	H	E	-	R . . . M . . .	n.c.d.	-	n-i
Mentha spicata L. emend. L.	Lam	H	Anthro.	-	R . . . M . . .	23	2	n-i
Mercurialis annua L.	Euph	T	E	Stell.	R	2	1	n-i
Mimulus guttatus DC.	Scr	H Hy	AMN	Phrag.	R . . . . W . .	9	1	n-i
Oenothera acerviphila Rostański	Ona	H	Anthro.	-	R	2	1	n-i
Oenothera acutifolia Rostański	Ona	H	Anthro.	-	R . . G	47	2	n-i
Oenothera canovirens E. S. Steele	Ona	H	AMN	-	R	11	2	n-i
Oenothera depressa Greene	Ona	H	AMN	-	R . . G	51	2	n-i
Oenothera fallax Renner emend. Rostański	Ona	H	Anthro.	-	R	3	1	n-i
Oenothera flaemingina Hudziok	Ona	H	Anthro.	-	R	8	1	n-i
Oenothera glazioviana Micheli in Mart.	Ona	H	AMN	-	R	13	2	n-i
Oenothera hoelscheri Renner ex Rostański	Ona	H	Anthro.	-	R . . G	24	2	n-i
Oenothera juterbogensis Hudziok	Ona	H	Anthro.	-	R	1	1	n-i
Oenothera paradoxa Hudziok	Ona	H	Anthro.	-	R . . G	89	2	n-i
Oenothera pseudochicaginensis Rostański	Ona	H	Anthro.	-	R	4	1	n-i
Oenothera punctulata Rostański et Gutte	Ona	H	Anthro.	-	R	1	1	n-i
Oenothera pycnocarpa Atk. et Bartl. in Bartl.	Ona	T H	AMN	-	R	4	1	n-i
Oenothera royfraseri R. R. Gates	Ona	H	AMN	-	R	6	1	n-i
Oenothera subterminalis R. R. Gates	Ona	H	AMN	-	R . . G	50	2	n-i
Oenothera victorini R. R. Gates et Catches in R. R. Gates	Ona	H	AMN	-	R	18	2	n-i
Oenothera wienii Renner ex Rostański	Ona	H	Anthro.	-	R . . G	12	2	n-i
Onobrychis viciifolia Scop.	Fab	H	E	F-B.	R S . G	52	2	n-i
Ornithogalum boucheanum Asch.	Hya	G	E	-	R	2	1	n-i
Oxalis corniculata L.	Oxa	T	E AS	-	R S	2	1	n-i
Oxalis fontana Bunge	Oxa	G	AMN	Stell.	R S	475	5	W
Padus serotina (Ehrh.) Borkh.	Ros	M	AMN *et* AMS	-	R . aS . M . Sc F	428	5	T
Parthenocissus inserta (A. Kern.) Fritsch	Vit	N l.	AMN	-	R . . . . . Sc F	78	2	N. H.**
Petrorhagia saxifraga (L.) Link	Car	C	E	F-B.	R . . G M . . .	4	1	n-i
Physalis alkekengi L.	Sol	H	E AS	-	R . . . . . Sc .	36	2	n-i
Picris echioides L.	Ast	T	E AF	-	R	1	1	n-i
Polycnemum heuffelii Lang	Chen	T	E	-	R	1	1	n-i
Polycnemum majus A. Br.	Chen	T H	E AS	-	R	5	1	n-i
Populus ×berolinensis (K. Koch) Dippel	Sal	M	Anthro.	-	R	n.c.d.	-	n-i
Populus ×canadensis Moench	Sal	M	Anthro.	-	R	n.c.d.	-	n-i
Populus 'NE 42'	Sal	M	Anthro.	-	R	n.c.d.	-	n-i
Populus nigra L. 'Italica'	Sal	M	Anthro.	-	R	n.c.d.	-	n-i
Potentilla intermedia L. non Wahlenb.	Ros	H	E AS	(Art.)	R	48	2	n-i
Prunus cerasifera Ehrh.	Ros	M	E AS	-	R . . . . . Sc .	n.c.d.	-	n-i
Prunus domestica L. subsp. *domestica*	Ros	M N	Anthro.	-	R . . . . . Sc .	n.c.d.	-	n-i
Pyrus communis L.	Ros	M	Anthro.	Rh-Prun. Q.rob.	R	492	5	N. H.
Quercus rubra L.	Fag	M	AMN	-	R . . . . . Sc F	460	5	T
Reseda luteola L.	Res	H	E AS	Art.	R	12	2	n-i
Reynoutria japonica Houtt.	Poly	G	AS	Art.	R . . . . W Sc .	460	5	T
Reynoutria sachalinensis (F. Schmidt) Nakai	Poly	G	AS	Art.	R . . . . W Sc .	108	3	T**
Reynoutria ×bohemica Chrtek et Chrtková	Poly	G	Anthro.	-	R . . . . W Sc .	50	2	T**
Rhus typhina L.	Ana	N M	AMN	-	R . . . . . Sc .	n.c.d.	-	n-i
Robinia pseudoacacia L.	Fab	M	AMN	-	R . . . . . Sc F	693	6	T
Rosa glauca Pourr.	Ros	N	E	-	R . . . . . Sc .	24	2	n-i
Rosa multiflora Thunb.	Ros	N	AS	-	R . . . . . Sc .	39	2	n-i
Rosa rugosa Thunb.	Ros	N	AS	-	R . . g . . Sc .	230	4	N. H.
Rosa spinosissima L.	Ros	N	E AS	-	R . . . . . Sc .	2	1	n-i
Rubus armeniacus Focke	Ros	N	AS	-	R	n.c.d.	-	n-i
Rubus odoratus L.	Ros	N	AMN	-	R	n.c.d.	-	n-i
Rudbeckia laciniata L.	Ast	H	AMN	Art.	R . . . m w Sc .	181	3	T**
Rumex confertus Willd.	Poly	H	E AS	-	R . . . M . . .	39	2	n-i
Rumex longifolius DC.	Poly	H	E	-	R	7	1	n-i
Salix acutifolia Willd.	Sal	N	E AS	-	R . . G . . Sc .	78	2	n-i

Species name	Fam.	L.f.	Origin	Syntx.	Hab.							Nrs of loc.	Fr.	Status
Salsola kali L. subsp. *ruthenica* (Iljin) Soó	Chen	T	E AS	-	R	.	.	.	.	.	.	n.c.d.	-	n-i
Sedum album L.	Cra	C	E AF AS	Aspl.	R	.	.	.	.	.	.	5	1	n-i
Sedum spurium M. Bieb.	Cra	C	AS	-	R	.	.	.	.	.	.	14	2	n-i
Senecio vernalis Waldst. et Kit.	Ast	H T	E AS	Koel-Coryn.	R	s	.	G	M	.	.	184	3	n-i
Sicyos angulata L.	Cuc	T l.	AMN	Art.	R	.	.	.	.	Sc	.	6	1	n-i
Silene conica L.	Car	T	E AS	Koel-Coryn.	R	S	.	.	.	.	.	8	1	n-i
Silene dichotoma Ehrh.	Car	H	E AS	-	R	S	.	.	.	.	.	14	2	n-i
Sinapis alba L.	Bra	T	E	-	R	S	.	.	.	.	.	49	2	n-i
Sisymbrium altissimum L.	Bra	H T	E AS	Stell.	R	.	.	.	.	.	.	235	4	N. H.
Sisymbrium loeselii L.	Bra	H T	E AS	Stell.	R	.	.	.	.	.	.	207	3	N. H.
Sisymbrium wolgense M. Bieb. ex E. Fourn.	Bra	H	E	-	R	.	.	.	.	.	.	5	1	n-i
Sisyrynchium bermudiana L. em. Farw.	Iri	G	AMN	-	R	.	.	.	M	.	.	7	1	n-i
Solidago canadensis L.	Ast	G H	AMN	Art.	R	.	aS	G	M	W	Sc	F	636	6	T
Solidago gigantea Aiton	Ast	G H	AMN	Art.	R	.	as	G	M	W	Sc	F	561	5	T
Solidago graminifolia (L.) Elliott	Ast	G H	AMN	-	R	.	.	G	M	.	Sc	.	7	1	n-i
Sorbaria sorbifolia (L.) A. Braun	Ros	N	AS	-	R	.	.	.	.	.	Sc	.	43	2	n-i
Spiraea ×pseudosalicifolia Silverside	Ros	N	Anthro.	-	R	.	.	.	.	.	Sc	.	n.c.d.	-	n-i
Spiraea tomentosa L.	Ros	N	AMN	-	.	.	.	.	.	.	.	F	n.c.d.	-	n-i
Symphoricarpos albus (L.) S. F. Blake	Cap	N	AMN	-	R	.	.	.	.	.	Sc	F	83	2	n-i
Syringa vulgaris L.	Olea	N	E	-	R	.	.	.	.	.	Sc	.	54	2	n-i
Tanacetum parthenium (L.) Sch. Bip.	Ast	H	E AS	-	R	.	.	.	M	.	Sc	.	90	2	n-i
Typha laxmannii Lepech.	Typ	Hy H	AS	-	R	.	.	.	.	W	.	.	2	1	n-i
Veronica persica Poir.	Scr	T	AS	Stell.	R	S	aS	.	.	.	.	.	443	5	W
Vicia dasycarpa Ten.	Fab	H T l.	E	-	R	S	aS	G	.	.	.	.	96	2	n-i
Vicia grandiflora Scop.	Fab	T l.	E AS	-	R	S	aS	g	m	.	.	.	30	2	n-i
Xanthium albinum (Wildder) H. Scholz	Ast	T	AMN	Biden.	.	.	.	.	.	W	.	.	20	2	n-i
Xanthium spinosum L.	Ast	T	AMS	-	R	.	.	.	.	.	.	.	10	1	n-i
Xanthium strumarium L.	Ast	T	E AS	-	R	.	.	.	.	.	.	.	17	2	n-i

C. Taxa of uncertain status in the Polish flora

Species name	Fam.	L.f.	Origin	Syntx.	Hab.								Nr of loc.	Fr.	Status
					R	S	aS	G	M	W	Sc	F			
Anchusa officinalis L.	Bor	H	E AS	Stell.	r	S	.	.	.	.	.	.	133	3	n-i
Berteroa incana (L.) DC.	Bra	H T	E AS	Art.	R	.	.	.	.	.	.	.	413	4	N. H.
Bidens radiata Thuill.	Ast	T	?	Biden.	R	.	.	.	.	W	.	.	n.c.d.		n-i
Bromus inermis Leyss.	Poa	H	?	Agro.	R	.	.	.	M	.	.	.	417	5	N. H.
Cirsium vulgare (Savi) Ten.	Ast	H	E AS	Art.	R	.	.	.	.	.	.	.	716	6	N. H.
Corispermum leptopterum (Asch.) Iljin	Chen	T	E AS	Art.	R	.	.	.	M	.	.	.	33	2	n-i
Digitaria ischaemum (Schreb.) H. L. Mühl	Poa	T	E	Stell.	r	S	.	.	.	.	.	.	115	3	N. H.**
Erysimum cheiranthoides L.	Bra	T	E AS	Art.	R	S	.	.	.	.	.	.	537	5	N. H.
Euphorbia epithymoides L.	Euph	H	E	(Trif-Ger.)	.	.	.	G	.	.	Sc	.	7	1	n-i
Euphorbia virgata Waldst. et Kit.	Euph	H	?	-	R	.	.	G	.	.	.	.	37	2	n-i
Galeopsis ladanum L.	Lam	T	E	Thla.	R	.	.	.	.	.	.	.	135	3	n-i
Geranium columbinum L.	Ger	T	E	-	R	s	.	.	.	.	.	.	52	2	n-i
Ligustrum vulgare L.	Olea	N	?	Rh-Prun.	R	.	.	.	.	.	.	.	229	4	N. H.
Melandrium album (Mill.) Garcke	Car	T	?	Art.	R	S	.	.	.	.	.	.	785	6	N. H.
Polycnemum arvense L.	Chen	T	E AS	Stell.	R	S	.	.	M	.	.	.	9	1	n-i
Rumex thyrsiflorus Fingerh.	Poly	H	?	Mol-Arrh.	R	.	.	.	.	.	.	.	118	3	n-i
Sorbus intermedia (Ehrh.) Pers.	Ros	M	?	(Q-F.)	R	.	.	.	.	.	.	.	15	2	n-i
Viola odorata L.	Viol	H	E AS AF	Art.	R	.	.	.	.	.	.	.	63	2	n-i

Explanations to Appendix 1 (A, B *et* C): **Source**, database ATPOL *Silesia*, 2010; **Species name**, species are arranged alphabetically within the distinguished groups. Species names nomenclature according to Mirek *et al*. (2002). The following information is given for each species, if available, **Fam. –** Family, codes are formed by initial letters of the family name; **L.f.** – Life forms, M – megaphanerophytes, N – nanophanerophytes, Ch – chamaephytes, C – herbaceous chamaephytes, H – hemicryptophytes, G – geophytes, Hy – hydrophytes, T – therophytes, l. – lianas, p. – parasites, pp. – semi-parasites; **Origin**, AF – Africa, AMC – Central America, AMN – North America, AMS – South America, AS – Asia, E – Europe, Anthro. – taxon of anthropogenic origin, ? – uncertain; **Syntaxa** in which the species occurs, according to Matuszkiewicz (2001), Agro. – *Agropyretea intermedio-repentis*, Art. – *Artemisietea vulgaris*, Aspl. – *Asplenietea rupestria*, Biden. – *Bidentetea tripartiti*, Epilob. – *Epilobietea angustifolii*, F-B. – *Festuco-Brometea*, Koel-Coryn. – *Koelerio glaucae-Corynephoretea canescentis,* Mol-Arrh. – *Molinio-Arrhenatheretea*, Phrag. – *Phragmitetea*, Pota. – *Potametea*, Q-F. – *Querco-Fagetea*, Rh-Prun. – *Rhamno-Prunetea*, Sal purp. – *Salicetea purpureae*, Stell. – *Stellarietea mediae*, Thla. – *Thlaspietea rotundifolii,* Tri-Ger. – *Trifolio-Geranietea sanguinei*, () – syntax. according to Zarzycki *et al*. (2002), (-). – not defined; **Hab.** – type of habitat colonized, R – ruderal (human-made), S – segetal (arable land) aS – abandoned arable fields, G – grasslands, M – meadows, W – water and waterside, Sc – scrub, F – forests, cF – forests clearings, small letter indicates occasional colonization of particular habitat type; **Nrs of loc.** – number of localities understand as number of 2 km x 2 km squares, n.c.d. – not complete data; total number of squares for the Silesian Upland – 1040; **Fr.** – categories of frequency, 1 – rare, 2 – occasional, 3 – occasional, locally frequent, 4 – frequent, locally abundant, 5 – abundant, 6 – common, for more explanation see chapter Materials and methods; **Status** in the studied area, n.i. – non-invasive, invasive, N. H. – not harmful, W – weed, T – transformer, post-invasive status is indicated by an asterix, species that recently (last decade) shows tendency to colonize new localities is indicated by the two asterixs