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**Natural regeneration of alien trees and shrubs
at Rogów Arboretum of Warsaw University of Life Sciences**

Naturalne odnawianie się obcych drzew i krzewów w Arboretum SGGW w Rogowie

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ABSTRACT. The list of 46 self-sowing alien woody plant taxa in Rogów Arboretum is presented, which is an expansion of the list from 1992 when the first article on spontaneous regeneration of alien tree and shrub taxa in the Arboretum was published. Most of species described are rather infrequently found in Polish collections and are known to produce self-seedlings not capable of sexual reproduction, however *Abies grandis* can be included into group of plants that could produce seedlings capable of sexual reproduction.

Key words: spontaneous regeneration, self-sowing, alien species, natural reproduction of trees

Introduction

The first paper on natural regeneration of trees and shrubs at Rogów Arboretum was published in 1992 (Tumiłowicz 1992). It contained a list of 87 alien tree and shrub species, which included 15 conifers and two colour-leaved forms of maple and oak. The additional list of 19 self-sowing Polish native species not native to the Rogów area with their cultivars as well as those naturally occurring in the vicinity Rogów was presented.

For the purpose of the present survey we described habitat characteristics and cultivation methods in collection sections. It is necessary to highlight the fact that the arboretum has a forest character with typical mixed forest undergrowth without regularly mowed lawns. Depending on the method of the collections or forest experimental plots establishment (under shade, semishade or on open area) the undergrowth can develop spontaneously as a green cover making good conditions for self-sowing, or in some extreme cases it is overgrown by competitive weeds making natural regeneration very difficult. In dense young plantations and stands the undergrowth is absent or is scarce. The undergrowth in the area occupied by botanical collections is mown 2-4-times a year and the workers are instructed to leave the visible self-seedlings.

Authors own scale of seedling number was used. It was also used in later observations. The occurrence of seedlings when compared to the parent plants location was characterized descriptively.

Results

The observations of spontaneous generative regeneration of trees and shrubs were conducted every year, noted were the locality, number of seedlings and the distance to parent specimens. A list of 46 alien tree and shrub species regenerating by seeds, new to the Arboretum compared with the results described in the previous article (Danielewicz, Maliński 2003), is presented in Table 1.

Among conifers the most prolific species is *Abies grandis*, which is cultivated on numerous forest experimental plots of different provenances 45-60 years of age. For the last several years the number of new self-seedlings has been rapidly increasing although the mature specimens in fruit have been observed for few decades. There are for instance thousands of 1-10-year old seedlings at one of the plots with trees 49 years of age, covering the area of 0.1 ha. They germinated both under trees and in their vicinity at a distance from parent trees equal to the tree height. They grow much healthier there due to better light conditions. Two oldest 15-year old trees are now 7 m tall.

Table 1. Natural regeneration of alien tree and shrub species at the Rogów Arboretum

Taxon	Number of seedlings				
	1-3	4-10	11-50	51-100	>100
CONIFEROPHYTINA					
* <i>Abies xarnoldiana</i> Nitz.					
<i>A. balsamea</i> (L.) Mill.					
* <i>A. cephalonica</i> Loudon × <i>A. nordmanniana</i> (Steven) Spach					
<i>A. concolor</i> (Gordon et Glend.) Lindl. ex Hildebr.					
<i>A. grandis</i> (Douglas ex D. Don) Lindl.					
* <i>Cephalotaxus sinensis</i> (Rehder et E. H. Wilson) H. L. Li					
* <i>Tsuga caroliniana</i> Engelm.					
* <i>T. heterophylla</i> (Raf.) Sarg.					
MAGNOLIOPHYTINA					
* <i>Acer barbinerve</i> Maxim.					
* <i>A. cissifolium</i> (Siebold et Zucc.) K. Koch					
* <i>A. xconspicuum</i> van Gelderen et Oterdoom					
* <i>A. diabolicum</i> Blume ex K. Koch					
* <i>A. griseum</i> (Franch.) Pax					
* <i>A. henryi</i> Pax					
* <i>A. pseudosieboldianum</i> (Pax) Kom.					
<i>A. saccharinum</i> L.					
* <i>A. sieboldianum</i> Miq.					
<i>A. tataricum</i> L. subsp. <i>tataricum</i>					
* <i>A. tegmentosum</i> Maxim.					
* <i>A. tschonoskii</i> Maxim.					
* <i>A. velutinum</i> Boiss.					
<i>Carya ovata</i> (Mill.) K. Koch					
* <i>Castanea dentata</i> (Marshall) Borkh.					
<i>Cornus walteri</i> Wangerin					
<i>Corylus americana</i> Marshall					
* <i>Eleutherococcus</i> sp.					
* <i>Euonymus macropterus</i> Rupr.					
<i>E. oxyphyllus</i> Miq.					
<i>Gleditsia triacanthos</i> L.					
* <i>Ilex verticillata</i> (L.) A. Gray					
<i>Liriodendron tulipifera</i> L.					
* <i>Maackia amurensis</i> Rupr. et Maxim.					
* <i>Magnolia kobus</i> DC.					
<i>Mahonia aquifolium</i> (Pursh) Nutt.					
* <i>Oplanax horridus</i> (Sm.) Miq.					
<i>Ptelea trifoliata</i> L.					
* <i>Pterostyrax corymbosus</i> Siebold et Zucc.					
<i>P. hispidus</i> Siebold et Zucc.					
<i>Pyracantha coccinea</i> M. Roem.					
* <i>Quercus dentata</i> Thunb.					
* <i>Rhododendron purdomii</i> Rehder et E. H. Wilson					
* <i>Smilax sieboldii</i> Miq.					
* <i>Stewartia pseudocamellia</i> Maxim.					
* <i>Styrax obassia</i> Siebold et Zucc.					
* <i>Symplocos paniculata</i> (Thunb.) Miq.					
* <i>Viburnum dentatum</i> var. <i>lucidum</i> Aiton					

* plants not included in the paper by Danielewicz and Maliński (2003)

Among firs there are two hybrids that produce a high number of spontaneous seedlings. *A. cephalonica* × *A. nordmanniana* is particularly prolific, however until now only very young seedlings have been found within the range of the forest plot with 60-year old trees, without any taller specimens. Consider the general vigour of growth of different tree hybrids, the future rate of spontaneous regeneration can be even higher.

Three shrubby specimens of *Cephalotaxus sinensis*, including two females, grow close to each other and bear seeds almost every year. Seedlings are found under shrubs only.

The group of self-regenerating 14 maple species is now enlarging into 27 with 13 new self-seeding taxa. The biggest surprise was quite large number of self-sown plants of *Acer griseum* which germinated in 2004 and 2007 under four 35-year old trees. The seeds were also harvested, stratified and sown into boxes in the nursery and they germinated quite well. The possibility of cross-pollination has probably greatly influenced that. Within a range of crowns of two 30-year old *Acer diabolicum* a few seedlings were observed during last years.

In a site where 55-year old *Acer davidii* Franch. and *A. pensylvanicum* L. grow closely together a number of fast growing seedlings of intermediate character can be found which can be identified as *A. ×conspicuum*.

From the group of species rare in botanical collections a few are worth mentioning. Six of them – *Euonymus macropterus*, *E. oxyphyllus*, *Maackia amurensis*, *Pterostyrax corymbosus*, *Styrax obassia* and *Symplocos paniculata* – produce quite abundantly self-seedlings under the maternal specimens, and *Eleutherococcus* sp., *Oplopanax horridus*, *Stewartia pseudocamellia* and *Liriodendron tulipifera* have single seedlings growing no further than 20 meters from parent plants. In most of cases the self-seedlings are under or close to fruiting trees and shrubs. The exceptions are seedlings of *Mahonia aquifolium*, *Pyracantha coccinea*, *Magnolia kobus*. Unfortunately identification of numerous *Magnolia* seedlings was nearly impossible. They were very similar both to *M. kobus* and *M. stellata*, but at a very young

age both species look alike and spontaneous seedlings were found not far from fruiting specimens of both species, but most often close to mature trees of *M. kobus*.

The number of spontaneous seedlings of some species described in 1992 has markedly increased. It is particularly the case of *Ilex aquifolium* L., whose numerous 1-2-year old seedlings were observed in 2006 as well as single older plants rather far from parent plants. The number of seedling has significantly increased also in case of the following species: *Chamaecyparis lawsoniana* Parl., *Pseudotsuga menziesii* Franco, *Acer argutum* Maxim., *Carya laciniosa* Loud., *Castanea sativa* Mill. and *Quercus libani* Oliv. If falling fruits of *Acer rubrum* L. in June would coincide with rainy weather, hundreds of seedlings can be found, but the majority usually dies in the same year.

Danielewicz and Maliński (2003) published a comprehensive article, where they presented a list of 317 self-sowing alien woody plant taxa in Poland. The list was prepared based on literature (55 papers) and the authors own field research. They classified the taxa into three stages of domestication process (I-III) and specified the habitats of spontaneous seedlings occurrence (botanical gardens, parks, cities and forests). All new species listed in the Rogów Arboretum should be included in stage I (species producing self-seedlings that are not capable of sexual reproduction) except *Abies grandis*, which should be included in stage II in future (species whose self-seedlings grow to be a generation of plants capable of sexual reproduction, supported only by man-made habitats).

References

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