



INTRODUCING NEW SPECIES AND CULTIVARS ACCORDING TO CLIMATE, DEMOGRAPHIC AND ECONOMIC CHANGES IN POLAND – HORTICULTURAL VIEW

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Summary

In 2002 the nurseries associated in Polish Nurserymen Association offered 4597 species and cultivars of woody plants and perennials, whereas 14 years later the number of available plants increased to 6361 taxa. During this time 1781 new species and cultivars were introduced and this means that every year 162 new taxa appeared on the market. During this period of time the number of climbers offered to gardeners was doubled, also number of conifers and broad leaved plants increased significantly, respectively 57,6 % and 48,2 %. However, with respect to the range of products and still increasing list of species, Polish nurserymen offer twice fewer plants than their colleagues from Holland or Germany. Import of new species and cultivars is the main source of plants so far unknown in Poland. Results of presented studies show that the number of holdings which import new plants from abroad increases proportionally to the expanding area of nursery production. The import of new species poses risk for the local environment and landscape, particularly the rural areas, because some of the foreign species are known as invasive. Results of the survey questionnaire show that the issues of invasive alien species are quite well known in the nurserymen's circles. Above half of questioned producers are aware of what this risk involves. However, this knowledge is positively correlated with the growers' education. This issue is a bit less obvious when individual invasive alien species must be named or when this kind of information should be transferred to the customers purchasing the plants.

Key words: range of nursery products, invasive plants, new species in the culture

INTRODUCTION

The range of ornamental nursery products increases every year, not only with respect to the number of cultivars but also species (Marosz 2002). New species or cultivars, so far not cultivated, are introduced, the others, e.g. *Paxistima canbyi*, have been known only from collections of scientific centres. Formerly known but forgotten species and cultivars are introduced a new and their popularity has been growing again. Plants like *Lycium barbarum*, *L. chinense*, *Lonicera caerulea* var. *kamtchatica* are promoted due to their new cultivation, consumption and medicinal properties. Plant species and cultivars, such as *Caryopteris*, *Ceanothus*, *Cryptomeria*, *Sequoiadendron*, which 20-30 years ago still posed growing problems due to insufficient winter hardiness, nowadays are frequently planted outside where their cultivation does not pose any problems for many years, because winters are increasingly milder. About 3500 vascular plant species grow in the natural environment of Poland, of which alien plants constitute as much as 30% (Tokarska-Guzik et al. 2012). Such high share of alien species results from increasing human pressure on the environment but also from economic reasons (Marosz 2013). However, a part of alien plants has currently posed a hazard to Polish nature. These are so called invasive species constituting about 1.5% of Polish flora. They negatively affect the environment through, among others, transformation of habitats, displacement of native species or even reducing animal feed base (Tokarska-Guzik et al. 2012). The effect is particularly poignant in natural or semi-natural ecosystems, such as riverside communities, forests, meadows, pastures, agricultural lands or protected areas (Gurevitch and Padilla 2004). Some invasive species may also cause economic losses and even pose threats to human and animal health (Pimintel et al. 2005).

Nowadays ecologists think that agriculture, particularly horticulture but also forestry are the main sources of alien plants expansion and that invasive species lead to extinction and reduction of native species (Tokarska-Guzik et al. 2012, Didham et al. 2005). However, opinions vary, since according to Gurevitch and Padilla (2004) only several species make up a list of seriously invasive plants and these cause that cultivation of many plants is more and more often viewed negatively.

Presented research aimed at an analysis of the range of ornamental nursery products in view of climatic, demographic and economic changes in Poland in 2002-2014.

MATERIAL AND METHODS

Basic source materials were offers of nurseries – members of Polish Nurserymen Association (PNA) from the years 2002-2014 and summary reports on

the assortment of offered species and cultivars sent to the Author every year since 2002 directly from PNA office. The number of associated farms in 2002 and 2004 was similar, respectively 112 and 117. The assortment of cultivated plants was analysed vertically (comparison in individual years) and the species invasive and potentially invasive for the native environment were identified. In 2013-2014 survey studies were planned in ornamental plant nurseries to assess the main reasons of on-going extension of the assortment and the knowledge about the invasiveness of alien species in the environment. The analysis of the material included also papers and materials issued by the General Directorate of the Natural Environment Protection (GDNEP) – i.e. Code of Good Practices “Horticulture versus invasive alien plants” and the papers by the author engaged in the Code development, who represented horticulturists.

Survey studies used two different surveys: one addressing the issues of invasiveness of alien species for the native environment and the other addressing economic, marketing and economic issues affecting the range of nursery products. A total of 119 persons were surveyed (in which 70 were associated with PNA and 49 were not associated). The surveys were divided into three groups according to the nursery owner’s education (vocational, secondary or tertiary) or into 4 groups according to the cultivated area (small nurseries – 0-1ha, medium – sized nurseries 1.1 – 2ha, big nurseries 2.1-5ha and large – 5 ha). The results were elaborated using descriptive statistics methods.

RESULTS AND DISCUSSION

Economic and marketing factors

Assortment changes in nurseries and introducing new plant cultivars are enforced by consumer market constantly requiring new products – such opinion was expressed by 87.6% of the surveyed producers. On the other hand, in the opinion of 65% of the surveyed, each nurseryman wants to offer something different than the competition. In both cases a diverse offer is necessary to attract customers. According to Hoffman (2012), also plant breeders and breeding firms maintain the tendency for the on-going growth of the new cultivars assortment perceiving a chance for their own development. Sizeable incomes from introducing new cultivars are associated with license sales and exclusive rights for a given variety propagation, as has been stated by 57.8% of the surveyed nurserymen. In 2002 ornamental plant nurseries associated in Polish Nurserymen Association offered 4579 species and cultivars of ornamental and fruit plants, whereas 12 years later in 2014 only 6361 taxa (Tab.1). During this period 1781 species and cultivars were introduced, which means an average of 162 taxa annually. The number of available climber taxa doubled over the analysed period, but the offer of conifers and broad leaved plants also dynamically increased by respectively

57.6% and 48,2% (Tab.1). However, regarding the available plant assortment, producers in Poland still offer over twice fewer nursery plants than growers in the Netherlands or Germany, although the list of species and cultivars is extending continuously. According to Cecot (2012) introduction of a new species or variety is greatly important and commonly used in marketing as an added value. The “novelty” slogan used in the offer of products attracts clients to the product in a different way and allows to sell the product at a higher price. It is a kind of magnet attracting clients to the firm.

Table 1. Number of species and cultivars offered by nurseries associated in Polish Nurserymen Association in the years 2002-2014

Year	number / index ¹	Plant group							
		conifers	broad-leaved	heathers	climbers	roses	perennials	fruit	total
2002	number	787	1401	529	237	233	1214	178	4579
	Index	100	100	100	100	100	100	100	100
2006	number	1021	1631	755	359	137	1328	191	5422
	Index	129.7	116.4	142.7	151.5	58.8	109.4	107.4	118.4
2010	number	1179	1961	782	398	78	1443	210	6051
	Index	115.5	120.2	103.6	110.8	56.9	108.6	109.9	111.6
2014	number	1240	2077	725	478	149	1449	227	6361
	Index	105.2	105.6	92.7	120.1	191.0	100.4	108.1	105.1
	Index: 2002=100	157.6	148.2	137.0	201.7	63.9	119.3	127.5	138.9

1) index with variable base: preceding year = 100

* Author's own studies based on PNA nurseries offer

The main source of origin of new species and cultivars is import. The bigger the nursery, the more common the import of new taxa (Tab.2). In the presented survey studies 73% of the nurseries with acreage of 5 ha confirm the import of new species and cultivars for production from abroad. In small nurseries the import constitutes only 3.8%. Every second nurseryman thinks that the offer of foreign nurseries is wider and more interesting. On the other hand, small family nurseries buy on secondary domestic market. The interest in own breeding is growing, perceptible especially for bigger nurseries, of over 2ha (Tab.2). Breeding a new valuable variety allows to improve the economic situation of the nursery owing to the exclusive right for breeding or the licence sale. Considering the fruit production, the following new species have been currently used for commercial plantings: *Actinidia arguta*, *Amelanchier alnifolia*, *Lonicera caerulea* var. *kamtschatica*, *Rosa* ‘Karpattia’, ‘Konstancian’, *Rosa rugosa*. Introduction

of these plants to large-scale culture initiated a growth of breeders' interest in seeking new valuable cultivars bearing fruit of better taste, appearance and easier to store, like e.g. high bush berry (Pliszka and Krupa 2004). A considerable interest of amateurs in *Lycium* and *Schisandra* genera has been observed. Introducing species to horticultural production involves not only a chance or nursery production development but leads to considerable transformations in the agricultural landscape associated with the appearance of new species in the environment on a large scale. In this case the localisation of plantations is particularly important considering protection of valuable natural areas.

In most EU countries the share of people aged 65 and more increases. Consumer studies show clearly that plant cultivation and consumption of fruit and vegetables, as well as new and medicinal plants is most important beside family income, due to pro-health reasons (Zmarlicki et al. 2014).

Table 2. Main source of origin and introduction to the nursery production of new species and cultivars

Specification	Size of nursery ha*				Total
	Small	Medium	Big	Large	
Import of new species and cultivars from abroad	3.8	20.0	48.4	73.0	40.3
Purchase from other nurseries in Poland	65.4	44.0	35.5	18.9	38.6
Own breeding and selection	3.8	4.0	9.7	16.2	9.2
The range of products offered by foreign nurseries is more interesting	34.6	40	51.6	67.6	50.4

Source: Author's own studies, * N= 119 (small 0-1 ha – 26; medium 1.1-2ha – 25; big 2.1-5 ha – 31; large, area over 5ha – 37)

Climatic factors

Global climatic changes observed over several dozen of years indicate that the average temperature raises and vegetation season in many European countries prolongs slightly. Distribution of natural species slowly moves north (Balkene et al. 2002). These factors affect not only native ornamental species cultivated in gardens. For instance, in the Netherlands, species such as *Viburnum tinus*, *Magnolia grandiflora*, *Ceanothus thyrsiflorus*, no longer freeze when cultivated in the field and have ceased to be seasonal plants as they used to be even several decades ago (Hoffman 2012). Climatic factors, particularly milder winters also in Poland allow for a wider cultivation of plants, which even 20-30 years ago was doomed to fail. The climate has not changed as much as to allow for a completely safe cultivation of such plants in Poland, but made it possible even for a few years during milder winters, when the temperatures below 20°C were not registered. In the first years of cultivation these plants require some

protection and shelter, whereas later on in good microhabitat conditions they will be able to survive for many years.

Table 3. Cultivated and wild plant genera growing in Poland with identified invasive and potentially invasive plants

Specification	Herb plants		Woody plants	
	number	percent	number	percent
Invasive genera banned from sale	14	1.5	1	0.5
Invasive genera which should not be for ale	3	0.3	4	2.1
Potentially invasive genera for which precaution measures are recommended	9	1	12	6.2
Other cultivated or wild species growing in Poland	826	97.2	176	91.2
Total	851	100	193	100

* Author's own studies on the basis on: Code of Good Practices „Horticulture versus invasive plants, Szafer et al. 1988; offer of nurseries PNA 2014

Natural and environmental factors

Currently there is an increasingly stronger necessity of the natural environment protection against invasive plant and animal species. The problem becomes more and more perceptible in many parts of the world, where alien species, free from natural enemies, find conditions favourable for their development and immediately threaten local ecosystems. In Poland invasiveness concerns only some herb plants, such as *Solidago*, *Reynoutria*, *Echinocystis lobate*, *Impatiens gladiifera* or *Impatiens capensis* or *Asclepias syriaca*. A review of publications of Polish Plants comprising the wild or feral vascular species growing, or cultivated in Poland gives 756 plant genera (Szafer et al. 1988). When this list has been supplemented by new genera of woody and herb plants introduced by the offer of horticultural holdings, the number of genera in Poland may be estimated for about 1044 cultivated or wild ones, including 193 woody genera and 851 herb or perennial genera (Table 3). The invasive genera prohibited for sale by the Decree of the Minister of the Natural Environment Protection of 9 September 2011 comprise 14 genera, i.e. 1.4% of all indicated in an estimate presented in Table 3. Invasive plant genera whose sale by horticultural holdings (on voluntary basis) was discouraged by the Code of Good Practices comprise 3 herb genera and 4 woody genera. The initial project presented by GDNEP, the Code of Good Practices recommended withdrawal from sale or special precautions for 39 genera, including such important fruit plants as *Vaccinium corymbosum*, *Vaccinium macrocarpon*, *Juglans regia* and other. Finally the team working on and

consulting the Code of Good Practices accepted 28 genera, including 16 woody ones (Table 3). Thus, horticulturists should feel satisfied in this respect.

Table 4. Knowledge about alien species invasiveness for the natural environment among ornamental nursery material producers (per cent of answers)

Specification	Owner's education level			Total
	vocational	secondary	tertiary	
I am aware what alien species invasiveness in the native environment involves	28.5	41.0	64.4	50.4
I know alien species invasive for the native environment	23.8	38.7	45.7	32.8
I inform consumers about invasive species and hazards they pose	9.5	20.5	30.5	23.5
I pay attention to invasiveness of new species which I introduce to nursery cultivation	4.7	17.9	23.7	18.5

N= 119 (vocational education – 21; secondary education – 39; tertiary education – 59)

Invasiveness of alien species and their influence on the environment and the economy

One of the activities currently conducted in the European Union is a development of a special legal instrument concerning invasive alien species. Poland, as a member state will be obliged to implement the instrument as well. Counteracting the invasion of alien species is at the same time one of 6 key objectives of the European Union Biodiversity Protection Strategy to 2020. In Poland, the species directly causing economic losses comprise the *Reynouria* species, known for a considerable growth strength of shoots growing from rhizome. These shoots are capable of growing through the surface covered with cobbles or asphalt. So far, no analyses of economic losses due to the spread of invasive alien species have been conducted in Poland. The cost estimates are usually limited to the estimated costs of some species control. For example, in 2012 a mechanical removal of *Heracleum sosnowskyi* specimens (uprooting and cutting) in the area of about 30 ha in Łężyce region in the Góry Stołowe Mts. protection zone was estimated for over 400 thousand zlotys per year (Tokarska-Guzik et al 2012). Pimentel et al. (2005) report that these costs may considerably differ for various environments. Among the most expensive measures is combating invasive species in water and weed control in field crops.

In case of woody plants invasiveness of at least two species should be mentioned, which were brought to Europe still in the 17th century. These comprise: *Acer negundo* and *Robinia pseudoacacia*. Also *Quercus robur*, *Prunus serotina*

and *Amelanchier spicata* spread fast, particularly on forest peripheries. Another fast spreading species, which was commonly used for planting along roads is *Fraxinus pennsylvanica*, which as yet has not caused economic losses in forests. Regulation of the European Parliament and the Council (UE) 114/2014 indicates about 12 thousand alien species in Europe and by the estimates between 10 and 15% reveals symptoms of invasiveness. It is 10 times more than Tokarska-Guzik et al. (2012) stated for Poland. Horticultural producers are alarmed by the fact that activities in this respect are too restrictive and may lead to reducing the cultivation of all invasive plants throughout the EU. European Nurserymen Association (ENA) strives to call the European Commission's attention to the fact that many invasive species were brought to Europe on purpose, whereas their invasiveness in many cases has been and remains greatly desired (reclamation of post-industrial and degraded areas, oxygen production and carbon dioxide assimilation, cleaning the environment, biomass generation, or soil anti-erosion protection). Therefore, the organisation thinks that application of invasive species should not be strictly prohibited in anthropogenically transformed environment in the industrial, urbanised or environmentally degraded areas where the native species are unable to survive or do not fulfil their natural functions to the same extent as alien species. In case of plant organisms ENA thinks that accepting a list of invasive alien species of the Union concern may lead to a ban on cultivation of many valuable plant species in these countries, where due to climatic conditions the plants do not have the features of invasiveness. Proposed EU regulations do not foresee any exclusions or exemptions for these species varieties obtained through breeding aimed at producing sterile and non-invasive forms. Horticulturalists are sure that it will reduce the list of cultivated plants, not only ornamentals but also fruit crops, like e.g. *Juglans regia* or *Vaccinium macrocarpon*. According to ENA the list of invasive alien species of the Union concern should contain only the species absolutely threatening biodiversity all over the EU, such as, e.g. *Heracleum mantegazzianum* or *Reynoutria japonica*, whereas the other lists should be composed for invasive species in individual countries.

As results from the investigations, invasiveness of alien species is well known to nursery material producers, as over the half of the surveyed persons is aware of the nature of the threat. This knowledge is correlated with education (Table 4). More specific knowledge about the species already known to be invasive or regarded as potentially invasive for the environment is much poorer. Also disseminating this information among the customers purchasing plants for their gardens is insufficient. Many nurserymen are afraid that full information about such plant passed to retail customers would discourage them from cultivating such plants in their gardens, while a nurseryman will not sell the products. Using marketing traps, it is easier to claim that the plant is easy to cultivate, grows

fast and is resistant to a number of stressors or has small soil requirements, than pointing out that it is a potentially invasive species, spreading fast and easily becoming arduous for gardeners over a short period of time and in a small area. Many customers possessing this information will never decide to cultivate such plant. Therefore, educational and information measures involving the development of Code of Good Practices by GDNEP are most desired.

CONCLUSION

Introducing new species and cultivars becomes increasingly easier due to a worldwide trade, tremendous progress in breeding and climatic changes. Economic factors and marketing which aim mainly at product sale and the best possible financial result of a firm cause that producers do not watch too closely the plants they are already producing or introducing to their offer. Plants, which reveal the symptoms of invasiveness, but have not been put on the official lists of invasive plants, should be watched closely. These comprise, e.g. *Akebia quinata*, *Celastrus orbiculatus*, *Parthenocissus inserta*, *Rhus typhina*, *Sorbaria sorbifolia*, *Pleioblastus pygmeus*, *Lysimachia thyrsoiflora* and many other. Their careless handling in gardens allows them to spread fast beyond the garden. New plants should be introduced according to the current trends using “health”, “stress control”, “close to nature” or “be Eco” slogans, moreover marketing conceptions, posters, advertisements or TV programmes should not only stimulate sales but also draw customers’ attention to invasiveness of some species and involved environmental problems. Shelterbelts using new native varieties and totally avoiding alien species should be introduced in the suburban and agricultural areas, especially in the terrains where large area farms are operating. Producers still have vast opportunities to initiate new applications for the already produced plants without enlarging their offer by new species. Plants may be used as occasional or ecological products (particularly when the existence of a small farm in agricultural areas or living in the city are involved), fruit or medicinal products (little known species), as well as products improving social relationships or economic results in retail trade (Wolf 2003). These objectives may be realised using currently available range of products (Table 1) without the necessity to introduce new, particularly potentially invasive species.

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REFERENCES

- Balkenes M., Alkemade J.R.M., Ihle F., Leemans R., Latour J.B. (2002) *Assessing effects of forecasted climate change on the diversity and distribution of European higher plants for 2050*. *Global Change Biology* 8, p 390-407.
- Cecot A. (2012) *Materiał szkółkarski jako towar – pomysły na marketing i ożywienie sprzedaży*. Materiały Międzynarodowej Konferencji „szkółkarstwo – perspektywy rozwoju. Ożarów Mazowiecki 17-18 listopada 2012, s 45-52.
- Didham R.K., Tylianalis J.M., Hutchinson M.A., Ewere R.M., Gemmill N.J. (2005) *Are invasive species the drivers of ecological change*. *Trends in ecology and Evolution*, 20, p 470-474
- Hoffman M. (2012) *Rośliny przyszłości – tendencje w hodowli drzew, krzewów i bylin dla różnych zastosowań*. Materiały Międzynarodowej Konferencji „szkółkarstwo – perspektywy rozwoju. Ożarów Mazowiecki 17-18 listopada 2012, s 29-33.
- Kodeks Dobrych Praktyk – *Ogrodnictwo wobec roślin inwazyjnych obcego pochodzenia* <http://www.gdos.gov.pl/dobre-praktyki-w-ogrodnictwie>, ss. 76
- Marosz A. (2002) *Asortyment drzew i krzewów uprawianych w szkółkach w Polsce w latach 1999-2000*. *Rocznik Dendrologiczny*. 50, s 165-176. (2)
- Marosz A. (2013) *Changes in ornamental nursery production following Polish integration with the European Union*. *Annals of Warsaw University of Life Science – SGGW, Horticulture and Landscape Architecture*. 34, s. 51-59.
- Tokarska-Guzik B., Dajdok Z., Zajac M., Zajac A., Urbisz A., Danielewicz W., Hołdyński Cz. (2012) *Rośliny obcego pochodzenia w Polsce ze szczególnym uwzględnieniem gatunków inwazyjnych*. Generalna Dyrekcja Ochrony Środowiska, Warszawa, ss. 106.
- Gurevitch J., Padilla D.K. (2004) *Are invasive species a major cause of extinctions?* *Trends in ecology and Evolution* 19, p. 470-474
- Pimentel D., Zuniga R., Morrison D. (2005) *Update on the environmental and economic costs associated with alien-invasive species in the United States*. *Ecological Economics* 52, p. 273-288.
- Pliszka K., Krupa T. (2004) *Nowe odmiany borówki wysokiej*. *Szkółkarstwo*, 4, p 70-73
- Rozporządzenie Parlamentu Europejskiego i Rady (UE) Nr 1143/2014 z dnia 22 października 2014 r. w sprawie działań zapobiegawczych i zaradczych w odniesieniu do wprowadzania i rozprzestrzeniania inwazyjnych gatunków obcych.
- Szafer W., Kulczyński S., Pawłowski B. *Rośliny Polskie cz. I i II*. Państwowe Wydawnictwo Naukowe Warszawa, 1988.
- Wolf K.L. (2003) *Freeway roadside management, the Urban forest Beyond the white Line*. *Journal of Arboriculture*, s 127-137.
- Zmarlicki K., Brzozowski P., Karmańska M. *Analiza czynników demograficznych kształtujących poziom obecnej i przyszłej konsumpcji owoców w Polsce i innych krajach UE*. http://www.inhort.pl/files/program_wieloletni/wykaz_publicacji/obszar3/3.1_Analiza%20_1_2014.pdf

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