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THE SPECIES RICHNESS OF WOODY PLANTS IN BRATISLAVA'S HISTORICAL LANDSCAPE PARKS

RÓŻNORODNOŚĆ GATUNKOWA ROŚLIN DRZEWIASTYCH W HISTORYCZNYCH PARKACH KRAJOBRAZOWYCH BRATYSŁAWY

Abstract

Trees and shrubs, native or alien, are the most significant part of spatial composition in gardens or parks. For this reason, knowledge of species composition and particularly development of species composition in the past represent an important starting point for maintenance, notably in historical gardens. A permanent part of the species composition in historical gardens consists of introduced species. Alien species offered new shapes, colours and textures, and they also fulfilled a desire for new and unknown things. The article will present the species composition of trees and shrubs in historical landscape parks in Bratislava: 1. Sad Janka Kráľa, 2. Horský Park, and 3. The Park v Rusovciach. Our research in these locations was compared with available data on the occurrence of alien species in the research work of different authors from 1968 to 2013. In addition to the development of the garden composition we evaluated the number of genera and species and also their biogeographical origin.

Keywords: *historical gardens*, *species composition*, *trees*, *shrubs*

Streszczenie

Drzewa i krzewy, rodzime lub obce, stanowią najbardziej znaczącą część kompozycji przestrzennej parków i ogrodów. Dlatego też wiedza na temat kompozycji gatunkowej, a zwłaszcza opracowania ich składu gatunkowego w przeszłości, stanowią ważny punkt wyjścia do ich obecnego utrzymania w historycznych ogrodach. Stałą częścią kompozycji przestrzennych w ogrodach historycznych stanowią rośliny introdukowane. Ich użycie było podyktowane wymaganiami zarówno architektonicznymi, jak i artystycznymi. W niniejszym artykule zaprezentowane zostaną kompozycje gatunkowe z drzew i krzewów, występujące w historycznych parkach krajobrazowych Bratysławy: Sad Janka Kráľa, Horský park i park w Rusovciach. Podjęte na tych obszarach współczesne badania były porównywane z dostępnymi informacjami dotyczącymi występowania gatunków obcych w pracach badawczych różnych autorów, prowadzonych w latach 1968–2013. Wraz z analizą kompozycji ogrodowej oceniano także ilościowe występowanie danego rodzaju i gatunku, a także ich biogeograficzne pochodzenie.

Słowa kluczowe: *ogrody historyczne*, *kompozycje gatunkowe*, *drzewa*, *krzewy*

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1. INTRODUCTION

Historic parks are an important part of the urban structure of towns and villages, thus representing a significant part of our cultural heritage. In the context of the historical development after WW II and the related social circumstances, the condition of historic parks in Slovakia is, on the whole, not at all satisfactory. It is not only the constructed elements that are deteriorating, but also the most important biotic part of the parks – woody plants – are on the decline. Most probably, this condition has been most influenced by lack of interest and neglect. Many garden compositions are disrupted or nonexistent, and it is necessary to reconstruct them. Therefore, it is necessary to identify the species of woody plants, since their planting was not coincidental – they were used in compositions as a part of the artistic intention.

The number of historic parks in Bratislava is one of the highest in Slovakia. Bratislava is among the towns which have the highest number of historic parks in Slovakia. The landscape parks of Janko Kráľ, Horský Park and the Park in Rusovce are the most significant and largest in Slovakia.

The Janko Kráľ Park (named after a 19th-century Slovak poet) was created as a public park in the area of former alluvial woods. During the first half of the 19th century, the original classicist octagonal star-like composition was rebuilt into a landscape park. The park was famous for its species richness – it showed a tendency toward plant collecting and the trees were labelled in three languages. The park has been protected since 1907; currently, it is listed as part of the National Cultural Heritage.

The Park in Rusovce is located near a famous chateau outside Bratislava, in the village of Rusovce. The original Baroque garden expanded into an extensively formed park which now also contains one of the original canals of the Danube. The species of trees were never very rich in variety here; most woody plants come from the original mixed ash-alder alluvial forests. The park is now a part of the national cultural heritage of the Chateau and Park in Rusovce.

Horský Park (Forest Park) is one of the youngest landscape parks in Bratislava. It was established in the 2nd half of the 19th century on the original site of the Carpathian oak--hornbeam forest. Species of woody plants were purposefully combined with alien species; a sensitively designed network of paths of the hilly site makes the park easy to access. Horský Park has been protected by the Nature and Landscape Protection Law since 1986; currently it is a protected site.

2. THE AIM OF RESEARCH

The aim of the research was to identify species of woody plants in the selected landscape parks in Bratislava. The focal point was not only the understanding of the current condition, but also the documentation of planting development of species via accessible documents, and clarification of trends in the use of non-native woody plants. The data – current and historic – are very important as a database for maintenance or for future possible reconstruction of the sites.

3. THE PRESENT STATE OF RESEARCH

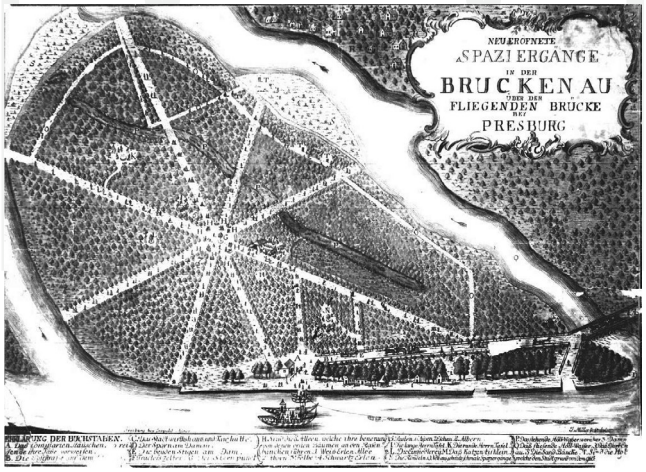
The Atlas of Non-native Species, which offers the most complex review of species richness in parks [1], records the condition in the 1970s and describes more than

400 sites. For research of the same kind as this, it offers a very good source of material for comparing and tracking dendrological development in the selected parks.

Until the first half of the 20th century, comprehensive information on the species of woody plants in these historic parks was very scarce; still, some partial information can be found in some documents [e.g. 2–4]. Several studies were carried out after WW II, e.g. by Tomaško, Kovalovský [5], who identified 591 species in various parks in Bratislava. Hošťáková [6] presented a detailed dendrological study of the Janko Kráľ Park and the Horský Park. An unpublished internal report from 1988 [7] contains detailed dendrological research of site locations with map projections. One of the most recent papers [8] outlines the species of woody plants only briefly, usually as a part of an architectural solution for a building, or simply points out the presence of exotic species. Many authors focused only on researching one site. The most information can be found on the Janko Kráľ Park, e.g. Paliga [9], identified 210 plant species, many of them being of dendrological interest, e.g. Sequoiadendron giganteum or Cunninghamia lanceolata (which do not exist in the park now). The inventory of woody plants which was conducted as a part of the revitalization of the Janko Kráľ Park in 2005 [10] identified 93 species and 2,457 woody plants altogether. Research results on the composition of species of woody plants at several historic sites were published by Reháčková [11–14].

4. DESCRIPTION OF THE RESEARCH

The basic methodology included a site study and the study of archive documents. The site study in selected parks mapped species of woody plants with the aim of recording their current condition. This up-to-date condition was then compared to



Il. 1. The classicist layout of the Janko Kráľ Park on the map of 1776 by I. Müller and L. Assner (source: Bratislava City Archive). The picture shows eight star-shaped avenues, in the legend marked by planted trees: alder, maple, willow, elm, ash, white poplar, and black poplar

Il. 1. Układ klasycystyczny Janko Kráľ Park na mapie 1776 z r. autorstwa I. Müllera i L. Assnera (Archiwum Miasta Bratysławy). Zdjęcie przedstawia osiem dróg w kształcie gwiazdy. W legendzie oznaczono posadzone drzewa: olcha, klon, wierzba, wiąz, jesion, topola biała i czarna topola

previous results of published and unpublished research findings which were collected during the research work in archives. Large scale maps were also used as supporting material, e.g. the plan of Janko Kráľ Park on an engraving of 1776 (Ill. 1), or a map of the park in Rusovce with the depiction of proposed planting of 1900.

5. RESEARCH RESULTS

During the research, 178 kinds of woody trees and their varieties were identified at the selected sites. The plants belong to 35 families and 81 genera. The most numerous are families of *Rosaceae*, *Cupressaceae* and *Pinaceae*. The family of *Rosaceae* is rich in decorative species which are very often used in landscaping. The popular *Rosa* family is rarely planted at present, but the no longer extant rosary in the Janko Kraľ Park, which was planted between 1933 and 1937, contained 500 species of roses and about 3000 plants [6]. The high number of *Cupressaceae* and *Pinaceae* proves the continuing popularity of coniferous trees in park landscaping. Besides common species, also represented are some rare taxa, e.g. *Calocedrus decurrens*, *Metasequoia glyptostroboides* or *Pseudolarix amabilis*, which was found only at one site in Slovakia [1]. Of 178 recorded taxa, there are 33 species (out of 18.5% of all species) at the three researched sites; the are listed in table 1.

Table 1

The list of woody plants at evaluated sites

	scientific name	author	origin	density
1	*Acer campestre*	L.	nv	***
2	*Acer platanoides*	L.	nv	***
3	*Acer platanoides* ‚Crimson King'	L.	cult	*
4	*Acer pseudoplatanus*	L.	nv	***
5	*Acer pseudoplatanus* ‚Atropurpureum'	L.	cult	*
6	*Aesculus hippocastanum*	L.	i	**
7	*Ailanthus altissima*	(Mill.) Swingle	i	*
8	*Buxus sempervierens*	L.	i	*
9	*Carpinus betulus*	L.	nv	***
10	*Celtis occidentalis*	L.	i	*
11	*Corylus avellana*	L.	nv	*
12	*Euonymus europeus*	L.	nv	*
13	*Fagus sylvatica* ‚Atropurpurea'	L.	cult	*
14	*Fraxinus excelsior*	L.	nv	***
15	*Hedera helix*	L.	nv	***
16	*Ligustrum vulgare*	L.	nv	**
17	*Philadelphus coronarius*	L.	i	**

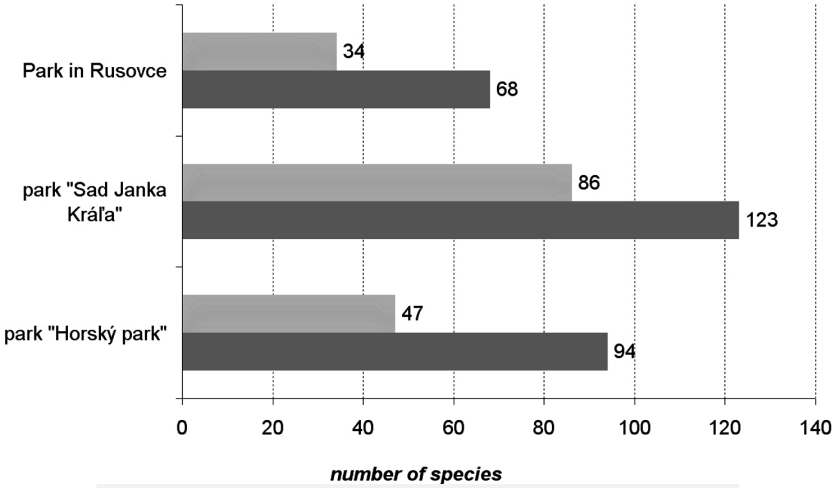
	scientific name	author	origin	density
18	*Pinus nigra*	J.F. Arnold	i	*
19	*Platanus* x *hispanica*	Münchh.	cult	*
20	*Platycladus orientalis*	(L.) Franco	i	*
21	*Prunus cerasifera*	Ehrh.	i	*
22	*Quercus robur*	L.	nv	***
24	*Robinia pseudoacacia*	L.	i	*
25	*Sambucus nigra*	L.	nv	*
26	*Swida sanguinea*	(L.) Opiz	nv	*
27	*Taxus baccata*	L.	d	**
28	*Thuja plicata*	Donn ex D. Don	i	*
29	*Tilia cordata*	Mill.	nv	**
30	*Tilia platyphyllos*	Scop.	nv	*
31	*Tilia* x *vulgaris*	Hayne	nv	**
32	*Ulmus glabra*	Huds.	nv	*
33	*Ulmus laevis*	Pall.	nv	*
34	*Ulmus minor*	Mill.	nv	*

Annotation: nv – natural vegetation; i – invasive species; cult – cultivar; *** dominant species; ** uncommon species; * rare species

The proportion of native and alien species

The list of identified species contains a specific combination of species which belong on the one hand to the native forest (low-land forests and Carpathian oak-hornbeam forests) which had a vegetation structure of the time when it was established; on the other hand, there are species which were planted in the parks by design. Some of the species mixture also includes plants which were planted via seed dispersal from the surrounding planting (they are of mechanical wind dispersal origin), e.g. *Celtis occidentalis* and *Sambucus nigra*, but also invasive woody plants such as *Ailanthus altissima* and *Robinia pseudoacacia*. It can be stated that the most numerous are domestic species of woody plants and their varieties; their share of the overall species richness is 37.7% of the species composition. Mostly, these are species of potential natural vegetation from the Carpathian oak-hornbeam forests and mixed ash-alder alluvial forests. Their varieties, mainly red foliage and weeping taxa, make up a little more than 9% of the share.

The alien species take a substantial proportion of the variety of species and they make up almost 62.2% of species richness. These represent uncommon and rare species which were planted at focal points or individually. The most valuable is *Aesculus hippocastanum*, *Platanus* x *hispanica*, and of the coniferous species *Pinus nigra*. Illustration 2 shows the proportion of native and alien species for each individual evaluated site.



Ill. 2. The proportion of domestic and alien species recorded at the researched sites (according to Reháčková 2012)

Il. 2. Proporcje pomiędzy roślinami rodzimymi i obcymi zaobserwowane w badanych parkach (oprac. T. Reháčková, 2012)

The number of identified alien species at the individual sites shows an interesting reflection on the collecting tendencies which were a part of landscape park design at the end of the19th century. It is also interesting to monitor the development of the number of alien species at the sites based on the data collected by various authors between the years 1968 and 2013 (Tab. 2). The number of species has been on the decline since the beginning of the evaluated period at almost all the sites. A substantial decline was recorded at the sites with a rich variety of species (the Janko Kráľ Park, Horský Park); the only site where the number of species has risen is the Park in Rusovce.

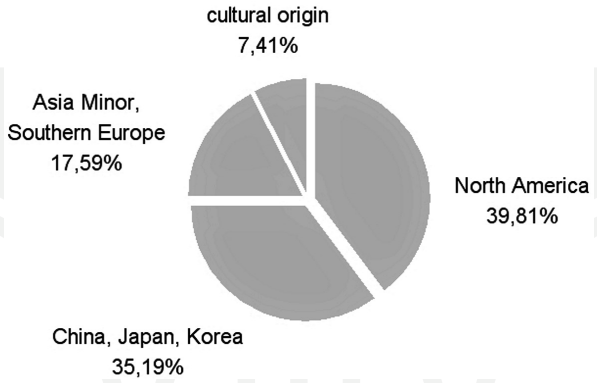
Table 2

The development of the number of alien species at individual sites based on published findings by various authors between 1968 and 2012

	Benčať 1968	Paliga 1969	Hoštálková 1973	Benčať 1982	Rešovská, Klučárová 1988	Závodný 1992	Holanská 1998	Hudeková, Reháčková 2007	Serbinová 2006	Reháčková 2007	Reháčková 2009	Reháčková 2012
Sad Janka Kráľa	223	88	217	210	112	90	0	0	61	96	0	84
Horský park	123	0	93	113	43	0	50	0	0	43	51	43
Rusovský park	25	0	0	25	62	0	0	36	0	40	0	34

Biogeographical origin

The composition of non-native woody plants in the evaluated historic parks comprises taxa of various geographic origins (Ill. 3). Species from North America prevail, accounting for almost 40% of species richness. Coniferous trees make up the highest number, e.g. *Thuja occidentalis*, *Thuja plicata*, as well as one of the most popular park planting trees *Picea pungens*. In the evaluated parks, the deciduous woody plants of North America are represented by *Celtis occidentalis*, *Catalpa bignonioides*, and *Negundo aceroides*. Some popular species have been identified there, as well as less frequent species such as *Liriodendron tulipifera*, *Maclura pomifera* or *Gymnocladus dioica*.



Ill. 3. The proportion of individual areas of origin of the alien species

Il. 3. Proporcje udziału poszczególnych obszarów pochodzenia gatunków obcych

East Asian species, which mainly originate in Japan, Korea and China, are the other numerous groups of species, but none of them wereplanted on a large scale. *Platycladus orientalis* and *Ailanthus altissima* can be found in all the parks. The magnificent 20-metre high *Pseudolarix amabilis* is a rarity; it is the only known of such size in Slovakia. Species which originate in Europe, in the Balkans and the adjacent areas of Asia Minor (Anatolia), are the third group; this comprises *Pinus nigra*, one of the most common conifers, and the very popular *Aesculus hippocastanum*.

6. CONCLUSION

The research has shown that the number of alien species in historic parks is decreasing. This trend itself is not perceived as negative, as long as it does not disrupt the composition and the original historical character of the park.

The Janko Kráľ Park has recorded the highest drop in the number of species (Tab. 2), down only to two fifths of the published data in the first research; the park has no concept of planting and new plant selection does not contain the original species. They are very often planted in unsuitable positions, which can disrupt the original composition. The Horský Park has the character of a forest, and, from specimen composition, alien species are continuously disappearing, although they are only few of them. This is the result of the understanding of the site, which is protected by

the law on Nature and Landscape Protection (protected area); therefore the park is managed as a natural site. The Park in Rusovce, as well the chateau, is managed by the Government Office. Because of its unsatisfactory condition, it is not open to the public, but is still visited by many. The maintenance interventions are limited; they are mostly conducted to ensure safety.

The results of the research on the woody plant species composition and its development in the historic parks provide, mainly for site management, information which can be used not only for the performance of the day-to-day maintenance, but also for mid-term and long-term management goals. The research findings presented can also be used when taking revitalizing or reconstruction measures in the future.

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