Exotic woody plants inclining to escape in the Buda Arboretum under strong urban effect in Budapest

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Summary: The Buda Arboretum of the Szent Istvan University is situated in the western-middle part of the city of Budapest. It contains 1640 taxa of woody plants on an area of 7.5 ha. The sheltered position and the urban micro- and meso-climate is favourable for warm-loving, even subtropical plants, of which many species not simply stay alive, but flower, bear fruits and are spreading by seedlings in suitable spots. These instances call our attention to the possibilities that urban climate offers for landscapers, but also to over 110 species, which can be garden escapes in the future. Full list of plants, which tend to escape in the Arboretum is given in the paper.

Introduction and review of literature

The Buda Arboretum of the Szent István University is situated in the western-middle part of Budapest at the southern slope of Gellért Hill between the streets Villányi út–Szüret u.–Somlói út. It belongs to the south-eastern part of the Buda Hills at the border of the Great Plain and the Transdanubian Hills. Annual precipitation is 600–620 mm, the local climate is slightly arid. The majority of the plants thrive well only with irrigation. For sustaining water regime equilibrium, irrigation water equivalent of 150–200 mm precipitation is given during the vegetation period.

The soil forming rock is partly limestone and dolomite, but the most common are loamy, clayey chalky deposits. In this latter humus-carbonate and in some places brown forest soils have been developed. The original soil meanwhile has strongly eroded, the uppermost layers now are B or C. The present soil of the arboretum is therefore clayey, rich in Ca (8–10%), poor in humus and alkaline (around pH 8.0). Around the central building there are many bankings, the original profile cannot be separated.

The climate is much warmer than the country average, summers are hot, winters are mild, there are no frosts in May and in September. The vegetation period is therefore extended by 3–5 weeks in the autumn and in spring *(Schmidt,* 1993 and 1994; *Hámori,* 2000).

The territory of the Arboretum was once covered by vineyards, which were destroyed by the phylloxera-disease (root aphids) in the last century. First plantings were started during the winter of 1893–1894. That time about 1000 taxa of trees and shrubs were planted. Some of them are still alive, they are more than 100 years old *(Schmidt, Keller & Pintér* 2000). Currently there are 1640 woody taxa on a 7.5 hectares area in the arboretum among which heat-loving and frost-sensitive exotic species are one of the main attractions. Many of them tend to "escape" from culture: produce viable seed, which germinate and give rise to a secondary vegetation inside and sometimes also outside the borders of arboretum. *Udvardy* (1999a) studied the subspontaneous spreading of two interesting subtropical species, *Diospyros lotus* and *Smilax excelsa* in the arboretum.

The aim of the present paper is to study which (and which geobotanical groups) of exotic woody plants tend to breed by themselves and to escape in the strong urban environment of the Buda Arboretum created by the metropolis of Budapest.

Material and method

Several annotations have been made during the vegetation period for about 20 years. Seedlings of varieties and cultivars were identified upon the distance measured from the parent specimen and according to their frequency classified into one of the groups as follows:

1 – 1–2 seedlings per year
2 – few seedlings
3 – many seedlings in some places
4 – many seedlings all over the Arboretum

The name of the plants are given according to the nomenclature of the Index Kewensis *(Jackson* et al., 1991).

Results

The results of observations concerning spreading and escape of woody alien plants are shown in *Table 1*.

According to the hardiness map of *Krüssmann* (1986–1986) Hungary is situated in winter-hardiness zones 6 and partially 7. As seen on table 1., quite a lot of southern

Table 1 Spreading tendency of exotic trees and shrubs in the Buda Arboretum (legend of columns 2–3–4 on page 5)

1 Plant name	2	3	4
Acer negundo L.	4	O	5
Acer saccharinum L.	1	E	4
Aesculus hippocastanum L.*	2	O	7
Ailanthus altissima (Mill.) Swingle	4	O,S	4
Albizia julibrissin Durazz.**	1		8
Amelanchier canadensis Medik.	1		4
Amygdalus nana L.	1	S	4
Andrachne colchica Fisch. et Mey.	1	S	5
Berberis julianae Schneid.*	1	E	5
Berberis thunbergii DC.	1		4
Biota orientalis (L.) Endl.*	2	E	5
Broussonetia papyrifera (L.) L'Hérit. in Vent.*	1	E	7
Buddleja davidii Franch.*	2	E	7
Campsis radicans (L.) Seemann	1	S	4
Catalpa bignonioides Walter	1	O	5
Celtis australis L.*	1		7
Celtis occidentalis L.	3	O	4
Cerasus × yedoensis (Matsum.) I. Tóth	1		
Cerasus serrulata (Lindl.) G. Don	1		5
Cercis siliquastrum L.*	2	O	7
Cercis siliquastrum L. 'Roseum'*	1		7
Clerodendrum bungei Steud.**	2	S	8
Clerodendrum trichotomum Thunb.**	1	S	6
Cornus alba L.	2		2
Cornus stolonifera Michx.	2		2
Corylus colurna L.*	1	E	6
Cotoneaster acutifolius Turcz.	2		4
Cotoneaster bullatus Bioss	3		5
Cotoneaster dammeri Schneid.*	2		6
Cotoneaster dielsianus Pritz.	3		4
Cotoneaster divaricatus Rehd. ex Wils.	3	O	4
Cotoneaster hebephyllus Diels	3		4
Cotoneaster horizontalis Dcne.	2	O	3
Cotoneaster insignis Pojark.	3	O	4
Cotoneaster integerrimus Med.	2		6
Cotoneaster multiflorus Bunge	3	O	6
Cotoneaster nebrodensis (Guss.) K. Koch.	2		6
Cotoneaster niger (Thunb.) Fries	2		6
Cotoneaster nitens Rehd. et Wils.	3	O	5
Cotoneaster racemiflorus (Desf.) K. Koch	3		5
Cotoneaster salicifolius Franch.	2		6
Crataegus crus-galli L.	2		3
Crataegus flabellata (Bosc) K. Koch	1		3
Crataegus prunifolia (Poir.) Pres	1		3
Diospyros lotus L.**	3		8
Elaeagnus angustifolia L.	2	O	7
Euodia hupehensis Dode *	2	E	7
Euodia velutina Rehd et Wils.*	1		7
Fraxinus pennsylvanica Marsh.	3	O	4
Ginkgo biloba L.*	1	F	4
Gleditsia triacanthos L.	1	E	3
Hedera hibernica (Kirchner) Bean *	4	O	5
Hibiscus syriacus L.**	2		7
Ilex aquifolium L.*	1		5
Koelreuteria paniculata Laxm.*	2	O	7
Laburnum alpinum (Mill.) Bercht. et Presl	1		6
Laburnum anagyroides Medik.	2	E	6
Laurocerasus officinalis Roem.*	3		8
Lavandula angustifolia Mill.**	1		8

1 Plant name	2	3	4
Ligustrum amurense Carr.	1		3
Ligustrum delavayanum Hariot	1		4
Ligustrum ovalifolium Hasskarl *	2		6
Lonicera × amoena Zabel 'Alba' Zabel	1		
Lonicera × purpusii Rehd.	2	F	
Lonicera fragrantissima Lindl. et Paxt.	1		7
Lonicera japonica Thunb. 'Halliana'*	1		8
Lonicera korolkowii Stapf	1		4
Lonicera maackii (Rupr.) Maxim.	1		3
Lonicera morrowii A. Gray	1		3
Lonicera nitida Wils.**	2		7
Lonicera standishii Jacq. f. lancifolia Rehd.	1		7
Lonicera tatarica L.	3	O	3
Lycium barbarum L.	1	O	4
Mahonia aquifolium (Pursh) Nutt.	3	O	4
Malus × purpurea (Barbier) Rehd.	3		
Malus × zumi (Matsum.) Rehd.	1		
Malus baccata (L.) Borkh.	1		3
Malus floribunda Van Houtte	1		4
Morus alba L.*	3	O	6
Morus rubra L.*	1		6
Paeonia suffruticosa Andrews	1		5
Paliurus spina-christi Mill.*	1		7
Parrotia persica (DC.) C. A. Mey.*	1		7
Parthenocissus inserta (Kern.) Fritsch	2	E	4
Parthenocissus quinquefolia (L.) Planch. var. engelmannii Koehne et Graebn.	1		3
Parthenocissus tricuspidata (S. et Z.) Planch.*	3	O	7
Paulownia tomentosa (Thunb) S. et Z. in St.**	2	O	7
Platanus hybrida Brot.	1	O	7
Populus × canadensis Mönch	2	O	
Populus × canescens (Ait.) Sm.	1		4
Populus alba L.	1		4
Populus nigra L.	1		3
Populus nigra L. 'Italica'	1		
Prinsepia sinensis (Oliv.) Oliv.	1		4
Prunus cerasifera Ehrh. (P. divaricata Led.)*	3	O	6
Ptelea trifoliata L.	2	E	3
Pyracantha coccinea Roemer **	3	E	7
Pyracantha hybrids	3		7
Pyrus elaeagrifolia Pall.	1		4
Rhamnus utilis Dcne.	1		5
Rhodotypos scandens (Thunb.) Makino	1		3
Robinia luxurians (Dieck) Schneid.	2	S	5
Robinia pseudoacacia L.	2	O	4
Rosa nitida Willd.	1		3
Smilax excelsa L.**	3		8
Sophora japonica L.*	2	O	7
Sorbus aria (L.) Cranitz	2		4
Spartium junceum L. **	1		8
Spiraea × schinabeckii Zabel in Wittm.	1	S	
Symphoricarpos rivularis Suksdorf var. laevigatus (Fern.) Blake	2		3
Taxus baccata L.	2	O	6
Trachycarpus fortunei Wendl. **	1		9
Toona sinensis (syn. Cedrela s. A. Juss.) Roem.	3	S	6
Xanthoceras sorbifolium Bunge	1	F	6
Zanthoxylum simulans Hance.*	1		7

Figure 1 General view of the Buda Arboretum in the spring on the southern slope of the Gellért Hill (background) and the sorrounding houses of the town Budapest. (In foreground: collection of flowering crabapples and Japanes cherries)

Figure 2 The Buda Arboretum in the autumn

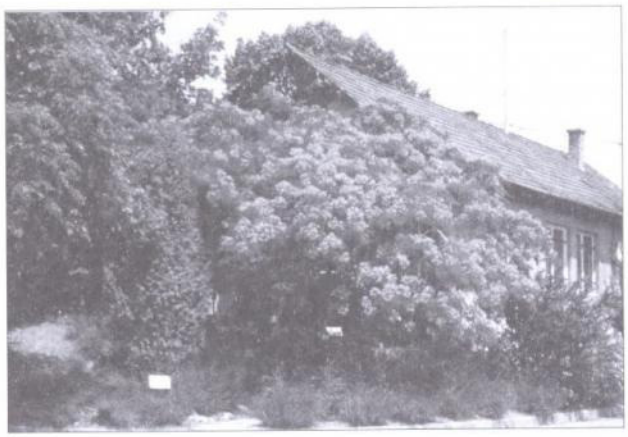

Figure 3 Flowering *Albizia julibrissin* Durazz. tree in early July

Figure 4 *Paliurus spina-christi* Mill.

Figure 5 *Laurocerasus officinalis* Roem (syn. *Prunus laurocerasus*) varieties come almost true from seed, because they are generally representatives of geografical ecotypes

Figure 6 *Smilax excelsa* L. fruits in late October. This plant is behaving either as wintergreen or decidious, depending on the year.

Figure 7 *Ligustrum delavayanum* Hariot. is in fruit from September through December

Figure 8 *Zanthoxylum simulans* Hance. fruited pricky branch. Seeds germinate freely, but most of them die in the first winter.

Legend:
Column 2: 4 – many seedlings all over the Arboretum
3 – many seedlings in some places
2 – few seedlings
1 – 1–2 seedlings per year
Column 3: O – seedlings can be found outside the garden too
E – seedlings are common elsewhere outside the garden.
S – spreading by sprouts
F – 1–2 specimens for 6–8 years
Column 4: the numbers indicate the hardiness zone of the plant defined by *Krüssmann* (1986–1986).

One asterisk (*) or two (**) after the author's name in column 1 shows, that the northern border of the plant's natural distribution area is in zone **8** or **9**, which is **one** or **two** zones more south than that of Hungary.

elements (from climatic zones 8 or 9) have the tendency to escape and almost naturalise in the Buda Arboretum. This clearly shows the greenhouse effect of the city of Budapest *(Schmidt* 1986) and the additional effect of the southern slope and the sheltered position in which the Arboretum is situated *(Schmidt* 1994).

The phenomenon of escaping from culture is common with many other non-native plants and was thoroughly studied and discussed from the botanical point of view by *Priszter* (1944, 1960, 1963, 1997) and *Udvardy* (1997, 1998a, 1998b, 1999b). The mentioned authors consider the "escaping" exotic plants as potential weeds and (therefore) dangerous to native vegetation.

Bartha (1994) and *Bartha* and *Mátyás* (1995) on the other hand made studies on the state of exotic trees in Hungarian arboreta taking them into account as potential reserves for afforestation and/or landscaping under extreme and urban conditions.

Most probably both sides have their right depending on the actual place of application or subspontaneous distribution of the given plants.

Anyway the results suggest a different approach to the urban plantings in Hungary with a stronger emphasise on heat-loving (and therefore heat-tolerant) woody plants. On the other hand the 110 species listed in table 1 can be also garden escapes in the future.

Following species have been planted, but do not spread in the Arboretum by themselves in spite of the observations of *Udvardy* (1997): *Amygdalus communis* L., *Amorpha fruticosa* L., *Cydonia oblonga* Mill em. Beck, *Juglans nigra* L., *Padus serotina* (Ehrh.) Borkh., *Reynoutria aubertii* (L.) Henry ex Hedberg Moldenke, *Rhus hirta* (L.) Sundw.

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