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THE IMPORTANCE OF THE ARBORETA AND BOTANICAL GARDENS OF SLOVAKIA FOR INTRODUCTION, GENE POOL CONSERVATION, AND UTILIZATION OF PLANTS*

Znaczenie arboretów i ogrodów botanicznych Słowacji dla introdukcji, ochrony zasobów genowych i wykorzystania roślin

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HISTORICAL FORMATION OF BOTANICAL GARDENS AND ARBORETA

Man used to surround himself with plants for their many-sided use already during the first periods of the civilization processes. At the beginning plants were a source of food and later he learned to ulilize their medicinal effects. Another reason for a concentrated use of plants was their aesthetic value. Old civilizations of China, India, Egypt, Mesopotamia, followed by Greece, Rome and then by Italy, France, England are typical representatives of garden and park arts. In gardens were concentrated countless quantities of home and foreign woody plants appealing both by their colour and shape. Gardens and parks in those period possessed a cultural, aesthetical, and social importance and in addition they concentrated rich species composition of most varied flowers and woody plants (Supuka, 1993).

Botanical gardens and arboreta were established especially during the period when the university system of schools and natural sciences were developing. One of the world's oldest and best known botanical gardens is the Oxford University Botanical Garden from the 16th century.

A marked break point enhancing the establishment of arboreta and botanical gardens was the discivery of America (1492). *Thuja plicata* was brougth from Canada to France already in 1534 and named Arbor vitae for its medicinal effects against scorbut. Since the North American woody species were spontaneously brought to European botanical gardens and mainly to England and France. Among the oldest botanical gardens of Europe are ranked e.g. Paris (1626), Edinburg (1670), Amsterdam (1682), Kew-London (1759). In the 16th century Central European gardens were enriched by a woody plant assortment from the south Europe and the Near East.

Introduction of woody plants from the Asian continent to Europe only began in the in the 18th century. First it was introduction from Siberia, then from the Far East, especially from China and Japan. The introduction process goes on from regions rich in gene pool and climatically and geographically related areas, mainly from Asia (Vetcička and Matoušová, 1992). If we add to it introduction of decorative woody plants from subtropical and tropical zones, which are kept under greenhouse conditions, or are used as decorative, residential (indoor) plants, or with pharmaceutical utilization, we may state that bo-

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Explanation: ▲1 - Botanical Garden at Comenius University in Bratislava
▲2 - Arboretum Mlynany, Slovak Academy of Sciences
▲3 - Arboretum Kysihybel, Forestry Arboretum at FRI Zvolen
▲4 - Arboretum Borova Hora at Technical University in Zvolen
▲5 - Botanical Garden at Medical Faculty in Martin
▲6 - Botanical Garden of Hight Tatras' Flora in Tatranska Lomnica
▲7 - Botanical Garden at P. J. Šafarika University in Košice

Fig. 1. Map of ditribution of most important Botanical Gardens and Arbortums on territory of Slovak Republic.

Ryc. 1. Rozmieszczenie najważniejszych ogrodów botanicznych i arboretów na terytorium Republiki Słowackiej.

tanical gardens and arboreta are historically and natural historically substantiated.

They had concentrated biological plant material, checked it up experimentally, investigated and utilized as natural biological sources for production of wood, fruits, materia medica, for decorative, and landscape creative purposes. At present the results obtained in the introduction of woody species are valorized in creation of vegetation formations in big urban and industrial agglomerations and in revitalization of territories damaged by intustry.

Phot. 1. Representativ clasicistic style castle built up in 1894 year in Arboretum Mlyňny SAV.

Fot. 1. Pałac w stylu klasycystycznym zbudowany w 1894 roku w Arboretum Słowackiej. Akademii Nauk w Mlynianach.

BOTANICAL GARDENS AND INTRODUCTION IN SLOVAKIA

Introduction of plants (farm crops, medicinal herbs, fruit trees, decorative plants, and forest woody species) in Slovakia was conditioned by the historical development and settlement of the territory, by cultural and socioeconomic development of the society and its inhabitants. First phases of the introduction were spontaneous by mediation of monasterial and apothecaries gardens, in the 18th century by means of historical parks and gardens and in 19th century it were botanical gardens and arboreta. Our contribution

Phot. 2. Main enter to Arboretum Mlyňany SAV with collection of evergreen woody plants on both sides.
Fot. 2. Główny wjazd do Arboretum Słowackiej Akademii Nauk w Mlynianach z kolekcją wiecznie zielonych roślin drzewiastych po obu stronach.

Phot. 4. The wiev to original ally of *Thuja occidentalis* 'Malonyna' selected in Arboretum Mlyňany SAV.
Fot. 4. Widok na oryginalną aleję *Thuja occidentalis* 'Malonyna' wyselekcjonowaną w Arboretum Słowackiej Akademii Nauk w Mlynianach.

will deal more with woody species than herb flora.

On the territory of Slovakia the first stage of introduction has been documented from the 5-12 centuries and it had an agricultural-fruit growing character. In the 5th century the Romans brought vine and edible chestnut to Slovakia, in 7th century *Morus alba*, *Armenicana vulgaris*, *Persica vulgaris*,*Juglans regia* were brought from Asia, and the decorative woody species *Buxus sempevirens* and *Ilex aquifoliun* were introduced from the Mediterranean region.

In the 16th century the so called apothecaries botanical collectioning activity was registered. In Slovakia such gardens can be seen at Červený Kláštor and Bratislava (Purkircherova záhrada in 1580). In the 17th century the North American coniferous and broad-leaves species gradually entered Slovakia. Botanical gardens of general conception only originated in the 18th century (e.g. University Botanical Garden Trnava in 1771). In the 18th century park style gardens originated in parallel and had a relatively rich assortiment of woody species such as Grasalkovičova záhrada (1770), Petržalka (1774) in Bratislava but also Jasov (1763), Betliar (1794), Voderany (1791) etc.

Phot. 3. Inside wiev to collection of evergreen woody plants in Arobortum Mlyňany SAV.
Fot. 3. Widok wewnętrzny na kolekcję wiecznie zielonych roślin drzewiastych w Arboretum Słowackiej Akademii Nauk w Mlynianach.

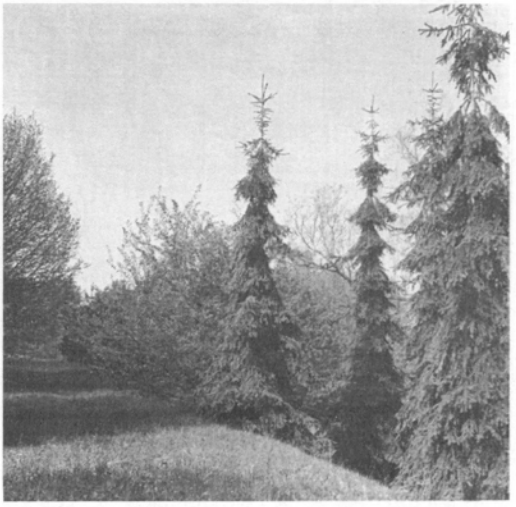
The 19th century Slovakia witnessed extended introduction from the North America and Asia. A fundation of Wilkensova záhrada (1809) for growing *Pinus strobus* attached to the Forestry-Minig Academy at Banská Štiavnica and Feinsmantlova záhrada at Kysihýbel (1830) go back to this period.

The Arboretum Kysihýbel - a forestry (!900) arboretum and the Arboretum Mlyňany - a collection of evergreen woody species (1892) are numbered among the most remarkable gardens of the end of the 19th century. The botanical garden attached to the University of J.A. Komenský originated as late as the 20th century (in 1988 the garden was reduced to its half area as a consequence of building a run-way through

Phot. 5. The collections of natural varieted forms of *Juniperus communis* in Arboretum Borová Hora in Zvolen. In the foreground *Picea abies* 'Inversa', on the left side metal constructions for climbing roses.
Fot. 5. Kolekcja naturalnych odmian *Juniperus communis* w Arboretum Borová Hora w Zwoleniu. Na pierwszym planie *Picea abies* 'Investa', z lewej strony metalowe konstrukcje dla róż pnących.

Mlynská dolina and a new botanical garden was established at Stupawa which is about 10 km far from Bratislava) and also the Botanical garden attached to the P.J. Šafárik University Košice, and Botanical garden attached to the Agricultural University at Nitra. The latest feature is the Arboretum Borová Hora attached to the Technical University Zvolen (from 1965) which is engaged in collecting original native woody species and their variable forms occurring in Slovakia. The botanical garden attached to TANAP at Tatranská Lomnica is the absolutely latest (from 1986) garden which concentrates alpine Tatra flora.

Besides the above there are another 17 large-area parks and botanical gardens in Slovakia which concetrate 100 taxa as a minimum (Piešťany) and 2000 taxa as maximum (Arboretum Mlyňany). Other dendro gene pool areas are represented by historical parks, there were registered 424 in Slovakia of which only 143 have a potential space conditions for reconstruction in the original historical style and the subsequent use (Benčať, 1982).



Phot. 6. *Picea abies* 'Pendula' collected from natural stands of Slovakia. Arborétum Borová Hora, Zwolen.
Fot. 6. *Picea abies* 'Pendula' pozyskana z naturalnych stanowisk w Słowacji. Arboretum Borová Hora, Zwoleń.

BOTANICAL GARDENS AND ARBORETA OF SLOVAKIA WITH A SCIENTIFIC-RESEARCH BASIS

It is beyond dispute that any botanical garden, arboretum, historical park or any other functional dendrological feature depending on its area and richness of collections possesses a concrete functional value of a higher or a lower degree (cultural, educational, historical, biological, scientific and research).

The following botanical gardens in Slovakia are enggaged both in collectioning and scientific research: botanical gardens attached to the universities in Bratislava, Nitra. Košice and the botanical garden of apline flora at Tatranská Lomnica. From the arboreta category they are the Arboretum Mlyňany, the Arboretum Borová Hora (attached to Zvolen), and the Arboretum Kysihýbel. Their scientific-research programme can by briefly characterized as follows:

a) Genetics and breeding - oriented to hybridization of woody plants, especially of the conifers (the genera *Pinus*, *Abies*) and of broad-leaves species (*Ulmus*, *Alnus* etc.) as well. A whole range of new hybrids has originated with enhanced growth-production abilities and with

Phot. 7. Crept form of *Picea abies* selected from natural spruce forests of Slovakia. Arborétum Borová Hora, Zvolen.
Fot. 7. Płożąca odmiana *Picea abies* wyselekcjonowana z naturlanych lasów świerkowych w Słowacji, Arboreum Borowa Hora, Zwoleń.

and enhanced resistance to the changed conditions of the environment and diseases.

b) Propagation of woody plants using explant culture methods. The importance was mainly laid on ppropagation of broad-leaves (the genera of *Magnolia,Castanea*, *Aesculus*, *Actinidia*, *Quercus*) and then on conifers (the *Pinus* genus)

c) Taxonomic ecological research- aimed at variability studies and learning the taxonomic value of native dendroflora species (the genera of *Corylus*, *Cornus*, *Swida*, *Rosa*, *Crataegus*, *Euonymus*, *Cotoneaster*, *Prunus*, *Quaecus*, *Viburnum* etc.).

d) Ecological-and-productive research - aimed at the research of the aboveground and belowground biomass production in pure and mixed stands of exotic woody plants and their mixtures with native species (e.g. the genera of *Castanea*, *Quercus*, *Pinus*, *Juglans*, *Carya*, *Robinia*, *Thuja* etc.).

e) Ecological research of woody plants in the urbanized and industrial environment - aimed at biomonitoring, evaluatiom of the effects of heterogenous matters on the growth, development, and resistance of woody plants, at cumulation of heterogenous matters in woody plants and urban soils, at sanitary and protective functions of woody plants and the influence of the changed conditions of the environment on the production dynamism and the composition of selected metabolites (saccharides, starch, terpens, etc.), at evaluation of the effects of de-icing salts on woody plants and evaluation of the climatic effects of windbreaks in farmscape, leaf biomass formation in urban environment etc.

f) A complex phytopathological research - aimed at woody plants in settlements, botanical gardens, and arboreta and at orchards of *Castanea sativa*. It is broad research range of fungal diseases, insect pests and mycorrhizal issues in the changed conditions of the environment.

g) The research of the endangered flora species of Slovakia - aimd both at woody and herb species.

Following from the data given by Maglocký and Feráková (1993) of the overall number of 2500 taxa of the flora of Slovakia, 31 taxa are considered extinct, 199 taxa endangered, 249 taxa most vulnerable, 261 taxa vulnerable, 297 rare, 92 taxa endemic, 197 taxa indeterminate.

Botanical gardens and arboreta search in natural conditions for endangered species, study their biology and reproductive processes, transef them into botanical gardens so that they are preserved and reintroduced into the nature. Of the woody species we may name such species as *Amygdalus nana*, *Cotinus coggygria*, *Daphne cneorum*, *Ephedra distachya*, *Staphylea pinnata* etc.

h) New introduction - aimed at acquiring of new taxa especialy from the Far East region.In this activity an important place was occupied by Arboretum Mlyňany (its collections contain 2000 taxa) where three expeditions to the natural areas of the North Korea had been organized and seeds of that region woody species were brought. They served as a source material for an exposition of the Korean dendroflora which concentrates on an area of 5.5 ha more than 300 taxa of woody plants. The expedition to China in 1960 was followed in this way.

i) Concentration of the assortment of the indigenous dendroflora - this type of ativity was udertaken by the Arboretum Borowá Hora attached to the Technical University at Zvolen.

The Arboretum have concentrated more than 1100 taxa and their variale forms found in the natural areas on the territory of Slovakia.

The activity of the arboreta and botanical gardens is methodologically coordinated through a jonit Association of the Slovak Republik and the Czech Republik.

The research gene pool, introduction and woody plants in the changed conditions of the environment of settlements, rural landscape and in forests goes on and we develop any activity also whihin our possibilities for international collaboration.

STRESZCZENIE

Rozwój europejskich ogrodów botanicznych był związany z odkryciem Ameryki w 1492 roku. Na przykład z Kanady do Francji sprowadzono żywotnik *Thuja plicata* jako roślinę leczniczą przeciwko szkorbutowi. Azjatyckie rośliny drzewiaste były sprowadzane do Europejskich ogrodów od początku XVIII wieku. Miało to duże znaczenie w uzyskaniu wielu nowych drzew i krzewów ozdobnych. Na teren Słowacji pierwsze udokumentowane nowe rośliny były sprowadzane od V wieku, kiedy Rzymianie przywieźli pierwsze kasztany jadalne. W VII wieku z Azji do Słowacji dotarły: *Morus alba*, *Armenicana vulgaris*, *Persica vulgaris*, i *Juglans regia*, a z rejonu Morza Śródziemnego sprowadzono pierwsze obce rośliny ozdobne: *Buxus sempevirens* i *Ilex aquifolium*. W XVI wieku założone zostały ogrody roślin leczniczych w Czerwonym Klasztorze i tzw. Purkircherovym ogrodzie w Bratysławie

Pierwszym słowackim ogrodem botanicznym był założony w 1771 roku ogród przy uniwersytecie w Trnavie. W XVIII wieku powstało także wiele stylowych parków z bogatymi kolekcjami drzew, a na początku XIX wieku powstały pierwsze arboreta przy Akademii Górniczej w Bańskiej Szczawnicy oraz w Kysihyblu (Ogród Feinsmantla).

Arboretum Leśne Kysihybel (1900) i Arboretum Młyniany powstałe w 1892 roku stały się szybko przodującymi w kraju z cennymi kolekcjami drzew, zwłaszcza iglastych. Oprócz tych zabytkowych arboretów w Słowacji założono ogrody botaniczne przy uniwersytetach w Bratysławie i Koszycach oraz przy Akademii Rolniczej w Nitrze. W 1965 roku powstało Arboretum Borowa Hora przy Uniwersytecie Technicznym w Zwoleniu. W Tatrzańskiej Łomnicy powstał w 1986 roku przy Tatrzańskim Parku Narodowym (TANAP) oryginalny ogród botaniczny w formie alpinarium gromadzącego florę Tatr.

Słowackie ogrody botaniczne i arboreta prowadzą różne badania, spośród których najważniejsze to:

- genetyka i hodowla drzew, zwłaszcza iglastych
- rozmnażanie roślin drzewiastych przy pomocy kultur tkankowych
- badania taksonomiczne i ekologiczne dendroflory Słowacji
- ekologia drzew w warunkach miejskich i przemysłowych
- problemy fitopatologiczne drzew
- badania nad zagrożonymi gatunkami roślin w Słowacji
- introdukcja nowych gatunków drzew, zwłaszcza z Dalekiego Wschodu
- gromadzenie rodzimych form i ekotypów lokalnych gatunków drzew i krzewów w formie banku genów

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