

## Development, changes and assessment of tree alleys in town streets

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### Abstract

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Street tree alleys were started to plant as a part of great reconstruction of European and world cities after industrial revolution from the beginning of 19<sup>th</sup> century. Important participation at first street alleys plantation have had decoration associations organised at town's of Slovakia territory on 2<sup>nd</sup> half of 19<sup>th</sup> century. Street tree alleys and river embankments have wide spectrum of functions useful for man and improving of environmental conditions. In a new terminology we are talking on services those should be classified as follow: supporting, provisioning, regulating and cultural services. Street trees have high value at designing of the pedestrian zones and new squares. In Nitra town conditions we have assessed 26 most important street tree alleys. For this purpose was elaborated a new methodical approach, where besides basic biometrical dates the following tree characteristics were assessed: potential of environmental adaptability, potential of biology-ecological value, potential of culture value, potential of disturbing and undesirable influences. Each group of characteristics was valued in three following levels of significance (1) low, (2) medium, (3) high. There were assessed 22 woody plant species and cultivars mapped at Nitra town streets.

### Key words

street trees, changes, Nitra town, service assessment

### Introduction

The street free alleys represent important component in vegetation structure of town settlements (SUPUKA et al., 2008). Tree alleys were in the past used as a component part of designed landscape, planted especially along with roads and as internal composition element of historical gardens and parks or prolongation element from those parks into open country.

Street alleys as town design element were mainly established after industrial revolution during urban reconstruction of larger cities for instance Paris, where spacious street boulevards and alleys were constructed in time after beating up Bastila in 1779. Since that time establishment of new public parks has been dated (KALUSOK, 2004; KUPKA, 2010). Moreover, such reconstructions were realised at other European cities also including Bratislava which was succeeded by creation of new esplanades, reconstruction of former market squares to the public spaces. Since period of the 2<sup>nd</sup>

half of 18<sup>th</sup> century, establishment the first public park – Aupark has been dated in central European countries in Bratislava (in 1775, nowadays as Sad Janka Kráľa in Petržalka). There are registered plantations of street trees and alleys such as locust-tree, linden, maple, and plane. At tree plantings was importantly participated city's decorative association (TOMAŠKO, 1967).

Activities related to Nitra town reconstruction, mainly after revolution during 1948–1949 years, were aimed to the construction of new buildings of state and public governance, theatre and other objects of culture, recreation, amusement and military services (barracks). The new streets were paved, installed public lighting and planted trees at streets and squares under active participation of Nitra decorative association, which was established in 1888s by 123 founding members (FUSEK and ZEMENE, 1998). Activity of decorative associations passed over progressive development in Slovakia and at present time, the care of cities green areas including street trees passed under leadership of the city authority

profession departments. Street tree alleys, at river embankments and bank side roads have wide spectrum of functions, those in a new terminology are classified as services for man and improving of environmental conditions. Basically they might be divided into four groups as are supporting, provisioning, regulating and cultural services (REYERS et al., 2009; YONG, 2010). Particular classification and quantification of functional importance and effectiveness of green spaces including street trees have been published by SUPUKA et al. (1991). Accent is given on environmental quality improving (climate, physical, chemical, micro-organism air quality, and water regime), ecological aspects of urban spaces (biodiversity, ecological stability, ecological and green nets), social and cultural ones (trees as urban design elements, aesthetic, culture, education, recreation effect). Moreover most actual research articles at international level have presented functional and service tree's values in urban environment. Green spaces and trees in USA cities have absorbed annually 711 thousand tons of allochthonous components on average, especially glasshouse gases such as ozone, carbon, nitrogen and sulphur oxides (NOWAK et al., 2006). Climate improving like shade, refrigeration, air humidity up to 10% effectiveness was published in other article (ARMSON et al., 2012; TOMAŠKO, 1996). The negative influences of woody plants in the relation to human body where a lot of woody species have caused allergy sickness were published as well (ZLÍNSKA, 1996). Assessment of the landscape gardening values and healthy conditions of poplar-trees in Nitra streets and green spaces has been published by VEREŠOVÁ (1999), tree alleys of 9 streets of Nitra town were evaluated from the phytopatology point of view (TKÁČOVÁ, 2003). The cities are characterised as spaces with expressive environmental changes, which limits selection of trees for street alleys. For this reason a lot of authors and research projects have aimed in issue solution and definition of criterions on advisable tree selection for urban environment (QUIGLEY, 2004; SAEBO et al., 2005; SUPUKA, 2005; VREŠTIAK, 1994 and others).

The aim of the paper is to assess framework development in establishment and changes of streets in Nitra town, to evaluate current state of selected street spaces from point of species composition, ecological importance, environmental adaptability and cultural-aesthetic values. The specific street's tree assessment method was defined and applied in Nitra town conditions.

## Material and methods

Historical development of street tree alleys establishment in relation to urban structure reconstruction at Nitra town was assessed by using of published historical documents (FUSEK and ZEMENE, 1998) and as a result of own field study. Current state of selected 26 most inter-

ested street alleys were assessed complexly by using of published particular criterions (BENČAĎ, 1982; MACHOVEC et al., 2000; JUHÁSOVÁ et al., 1991; SUPUKA, 2005; VEREŠOVÁ, 1999; VREŠTIAK, 1994; ZLÍNSKA, 1996). Throughout syntheses particular marks and characteristics we have defined following categories and assessing criteria for street trees alleys in Nitra town:

- a) Characteristic dates
  - aa) Locality, street, square
  - ab) Name of woody plant and cultivar
  - ac) Average tree alley high
  - ad) Average tree alley age
  - ae) Average landscape gardening value
- b) Potential of environmental adaptability to
  - ba) Urban soils
  - bb) Urban climate
  - bc) Soil salinity
  - bd) Complex of immission impact
- c) Potential of biology-ecological values
  - ca) Potential for ecological networks and ways
  - cb) Topical and trophical potential for biodiversity support
  - cc) Potential of phytoncidity activity and microbiology regulation
  - cd) Potential of pest and disease impact
  - ce) Potential of tree pruning tolerance and regeneration ability
- d) Potential of culture values
  - da) Potential of aesthetic effect and perception
  - db) Potential of species rareness and gene-pool value
- e) Potential of negative influences
  - ea) Potential of phyto-allergy
  - eb) Potential of invasive demonstration
  - ec) Potential of litter fall contamination.

Each potential within particular categories might be valued in three degrees: (1) low, (2) medium, (3) high.

## Results and discussion

The graphic vedutes from 1<sup>st</sup> half of 19 century shows Nitra as romantic town surrounded by gardens with domain of sacral and governance buildings and churches. To the town leaded road bridged over Nitrička (second branch of the Nitra river to the south of castle hill), lined by both side tree alleys. In that time street trees were rather ambition that reality, the trees were most often as river bank side tree line, in domain of poplars, willows, ashes and alders. Effective planting of street tree alleys and park areas was started after revolution years 1848–1849s, which was closely associated with reconstruction of urban structure of settlements. The contribution is coursed only at those new buildings and reconstruction which relates to new tree planting. In 1870–1873s there were made terraced modifications of the square in

front of Piaristic church and placed 12 apostles' sculptures and throughout circumference were 100 pieces of horse chestnuts tree planted, which are found there at present time. In period of 1878–1885, the 14 chapels of cross-route were built-up at Mariansky hill associated with linden and horse chestnuts tree plantings. Construction of region theatre on contemporary Svätopluk square in 1885 was accompanied by tree planting of *Acer platanoides* 'Globosum' at square circumstance. In 1905 was reconstructed the New Elisabeth road from town barracks to gasworks, 8 m in width, paved surface and tree alleys planted on both sides. Road from Nitra's capitol till Taufel garden at Chmelova valley, constructed in 1888 was lined by tree alleys plantings.

After the Nitra river regulation on the turn out of 19<sup>th</sup> and 20<sup>th</sup> century there was established city park Sihot' and embankment of new canal was planted up by tree alleys (linden, horse chestnut, and poplar). Tree alley was planted along with road from down town to rail way station, at Palanok street under castle were planted coniferous trees. High merit at tree alley planting has had Nitra's decorative association established in 1888 at Chmelova valley town zone that was renamed to Zobor's decorative association in 1889 and on 24 October 1897 to Town's decorative association (first chair MUDr. K. Tarnóci). At tree alley plantations, parks establishment and a forestation of Mariansky and Šibeničný hill there was very active forester Marcel Boroš. In 1917 association has expired because of the 1<sup>st</sup> world war. The historical documents and photos of Nitra town from period of 1920ies show tree alleys from the Kralik restaurant as far as theatre. The new dwelling zones of Nitra town have been built up after 2<sup>nd</sup> world war and parallely there were planted street alleys and new park was established. In sixties of the 20<sup>th</sup> century there was appointed town's enterprise of gardening and technical service, which has had solicitude at street trees and green areas. Since 1990 all activities related to city greenery have been under profession auspices of city authority Department of main architect, section of urbanism and architecture. Reconstruction, new plantings and maintenance of street trees, park trees and green areas are served by profession private enterprises.

Establishment of street tree alleys is directly associated to urban development of the town. Constitution of the 1<sup>st</sup> Czechoslovak republic creates extensive opportunity for social-economy development of new state human society including Nitra town. There were established new dwelling zones such as Čineš, under Calvary, Post colony, under Zobor. In the new built up streets were planted new streets alleys, especially linden, maple, ash, locust-tree, in natural tree shape or as cultivars mostly in globes or column ones. After the 2<sup>nd</sup> world war additional dwelling town zones were built up, e.g. Chrenová, Párovce, Čermáň, Klokočina, Diely, Zobor (further intensification). Those zones were es-

tablished on area of original villages or on new areas at former agriculture land and vineyards. Along with transport lines, small squares and public spaces were planted new tree alleys. Besides traditional trees, a new woody species and cultivars were planted, such as *Acer platanoides* 'Globosa', *Acer dasycarpum*, *Carpinus betulus* 'Columnare', *Fraxinus excelsior* 'Globosa', *Prunus cerasifera* 'Atropurpurea', *P.c.* 'Nigra', *Ribinia pseudoacacia* 'Umbraculifera', *R. p.* 'Bessoniana', and others. To the newest planted woody species and cultivars in the streets belongs e.g. *Acer platanoides* 'Columnare', *Koelreuteria paniculata*, *Gingko biloba*, *Liquidambar styraciflua*, *Prunus fruticosa* 'Globosa', *Sorbus aria* 'Lutescens' and others. Those new tree forms and cultivars were successively planted to alleys during reconstruction of Svätoplukovo square and Štefánikova street at present time as pedestrian zone. Those two public spaces have representative and culture aesthetic dominant functions therefore they are designed in high architectural level with applying of modern trees in alleys. New woody plant species and attractive cultivars were also planted as a part of reconstruction of old tree alleys or within process of humanisation of the down town and housing estates.

Very important and high effective was change of tree alleys in Naperville street, where original older trees of *Populus × canadensis* were replaced by *Celtis occidentalis* street trees, mainly for reason of human body allergy elimination. Smaller poplar's alley (*P. × canadensis*) is planted at the Nitra river embankment in neighbouring of birch Grove Park and also throughout circumference of football and hockey stadium as protection green barriers. Particular survey of species composition of contemporary tree alleys at selected street spaces and squares of Nitra town is presented in Table 1, including the tree assessment according to described methods.

At the Nitra territory there have been mapped 26 most important street tree alleys where 22 species and cultivars were identified and assessed. To the most traditional street trees belongs linden, which represents the oldest alley at Nábřežie mládeže embankment. To the latest tree elements belong e.g. *Gingko biloba* L. 'Fastigiata' and *Liquidambar styraciflua* L. Originally, perspective of *Prunus fruticosa* 'Globosa' species shows its weak point because attack by *Erwinia amylovora* fungus has been identified at older trees in Sládkovičova street. At assessment method of the street tree alleys we paid attention to the marks, which have been used very rare till now in the research and practical mapping. Most often valuation marks up to the present time were pest and diseases occurrence at the vegetation organs, tree vitality characteristics, tree stability and social values of trees as well. Those assessment characteristics and methodical approaches according to individual authors are described in complex publication of group authors (HRUBÍK et al., 2011).



Achieved results of our research activity have showed positive trends in tree alley reconstruction on the one hand. On the other hand many tree alleys in Nitra town are destroyed, trees are too old, and unseemly that would be reason for more effective decision to remove them from street soon. In some streets we may see alleys with different tree species, which looks very diversified and out of composition rules, e.g. Štefánikova street, Župné square. Every year tree branches cutting at *Acer saccharinum* L. in J. Král' street creates compacted and unified street alley. Species of *Populus* genus, with regards to fast growing character and big tree crown should be useful to the future also as elements for protection barriers, as shade tree and also for wind-breaks around large sport centres, but selected male gender trees only (VARGA, 1994).

In conclusion, our research results show positive and negative feedback. In our opinion Nitra town needs to elaborate complex master plan for reconstruction and quality improving of main and the most attractive streets regarding tree alleys.

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