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**HISTORICAL ASPECTS OF PLANT COMPOSITION
AND THE MAIN RESULTS OF INTRODUCTION OF DECORATIVE PLANTS
IN THE PARTERRE PART OF BSTU BOTANICAL GARDENS**

Historical aspects of creation of the compositions and the results of the introduction of ornamental plants in the parterre part of the BSTU Botanical Gardens in 1991–2015 years are considered. The number of compositions in regular and landscape styles were created, in which territory the collectible and demonstration plantings of ornamental trees and shrubs and herbaceous plants were placed. With the use of modern techniques of landscape architecture and design the compositions of the modular garden, garden of shady plants, rockeries, collections plantations of types, forms and varieties of junipers, peonies, daylilies, grasses and other plants, that are perspective for use in the garden and park construction, are created. In 2015 the collection includes 59 species and 107 ornamental varieties of flowering woody plants, 36 species and 46 ornamental forms of trees and shrubs with decorative leaves, 25 species and 92 ornamental forms of conifers, 30 species and varieties of annual, 17 – of biennial and 289 – of perennial herbaceous plants of open spaces. The main criteria of the selection of species, their decorative forms and varieties is a combination of high decorative qualities with resistance to adverse environmental effects, which makes it possible to test and introduce them in the green building in the Republic of Belarus.

Key words: composition, botanical gardens, ornamental plants collection, assortment, introduction.

Introduction. The Botanical Garden of the educational establishment “Belarusian State Technological University” (BSTU) with its area of 14.8 hectares is located on the territory of Negorelsky Experimental Forestry and is a training base that provides educational process on a broad block of disciplines – botany, dendrology, decorative dendrology, gardening, construction and operation of landscape architecture, and others [1].

The largest part of the BSTU Botanical Garden is the arboretum, founded in 1954 on the initiative of Professor B. D. Zhilkin and famous dendrologist S. D. Georgievsky. The arboretum collections are presented in seven sectors, they were created in accordance with the phyto-geographical principle (dendroflora of China, Japan, Far East, Siberia, Central Asia, the Crimea and the Caucasus, Europe and North America).

The forming of a parterre part of the BSTU Botanical Garden began in the middle of 90s XX century on the initiative of the rector of Belarusian State Technological University Professor I. M. Zharsky on an area of 2.9 hectares, adjacent to the arboretum from the dormitories and the academic building of BSTU.

Main part. The main stages of the formation of the compositions of the parterre of BSTU Botanical Garden were:

- the setting up of two stylistically different parts – regular and landscape – to demonstrate the basic techniques of landscape art and form the spaces for decorative plants exhibitions, which find wide application in landscape construction (1995–2001);

- holding of the first replanting of decorative woody plants in the most valuable crops of stored on the territory (2002–2005);

- reorganization of the collection of flower-decorative cultures planted in 1991–1992 and the creation on its base of the system of modular gardens, round rockeries and decorative pond, formed in accordance with modern trends in landscape design (2005–2008);

- development and implementation of the project of recreation area in the entrance zone of the BSTU Botanical Garden, creation of a maze garden by planting of *Thuja occidentalis*, reconstruction of decorative pond with the creation of the adjoining second rockery (2009–2015).

In the process of transformation of the territory the siringary and the collection of *Philadelphus*, the orchard, ordinary landings of mother conifers and deciduous, as well as some valuable specimens of trees and shrubs have been preserved (Fig. 1).

The sources of income of the new planting material for forming compositions were the garden centers in Minsk and Minsk region, the nursery of ornamental plants “Red Maple” (Minsk), collection plantings of SSI “Central Botanical Garden of NAS of Belarus”, RUE “Institute for Fruit Growing”, the basic forest nursery of Negorelsky Experimental Forestry, private collections.

The work on the introduction of woody and herbaceous plants was aimed at the creation of collections of the following groups:

- ornamental flowering shrubs, their varieties and garden forms;

- ornamental trees and shrubs with decorative leaves, their decorative forms;

- conifers and their garden forms;

- perennial flower cultures, their varieties;

- annual and biennial flower cultures, their varieties and hybrids.

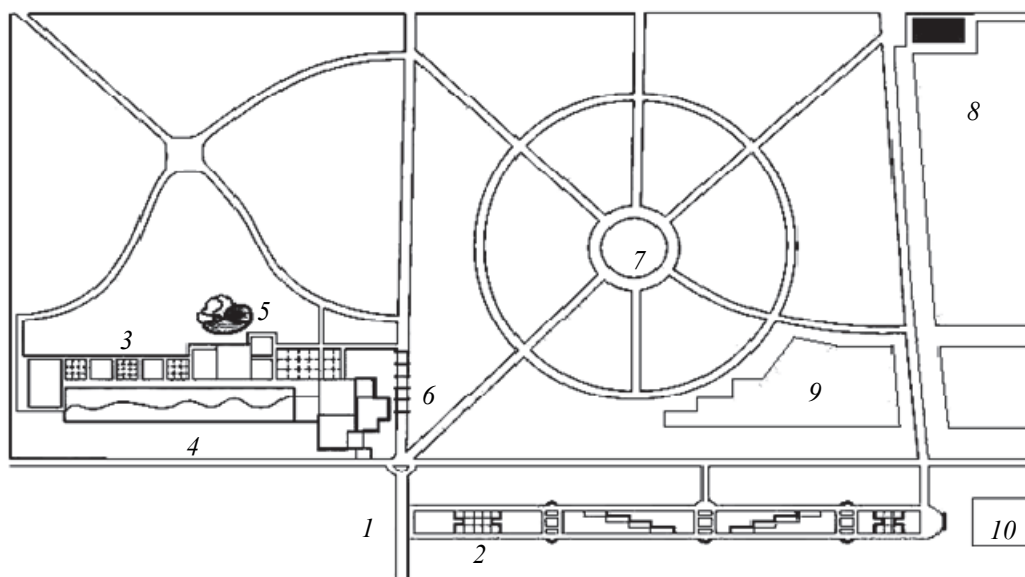


Fig. 1. Layout of the parterre of the BSTU Botanical Garden:

- 1 – entrance zone; 2 – recreation zone; 3 – modular garden; 4 – garden of shadow plants;
5 – pond with the rockery; 6 – garden of creeping plants; 7 – round rockery; 8 – orchard garden;
9 – collection of *Syringa* and *Philadelphus*; 10 – *Thuja occidentalis* maze garden

The formation of the collection of flowering shrubs was started with the plantings of 2002–2006. (*Weigela*, *Deutzia*, *Hydrangea*, *Lonicera*, *Potentilla*, *Spiraea* and others) and continued in 2007–2008 with the creation of linear circular planting of *Syringa*, with the setting up of a rose garden (98 m²) and the “Garden of shadow plants” composition (150 m²), where a collection of rhododendrons was planted.

The work on the introduction of roses (28 varieties), rhododendrons (16 species in 2008 and 11 species and ornamental forms in 2015), *Spiraea* (11 species and ornamental forms), *Potentilla* (10 species and varieties), *Syringa* (4 species, 10 varieties) was consistently carried out. In 2015 a collection of flowering woody plants includes 59 species and 107 decorative forms and varieties. Rosary gathered representatives of various groups of garden roses (climbers – 22.2%, park – 13.3%, floribunda – 57.8%, large flowered – 6.7%), characterized by a variety of colors – 35.6% range were red, 26.7% – pink, 13.3% – orange, 20% – yellow, 4.4% – white roses. The plantings of rhododendrons are dominated by evergreen species (56.9%); species with pink flowers (47.1%) prevail, a plant with yellow flowers make up 17.6%, with lilac – 11.9%, with a white, red and orange colored flowers – 7.8% each.

Among the representatives of the genus *Spirea* the varieties with pink flower color (47.1%), less often white (37.6%) and red color (15.3%) form a great part. In addition to the traditional garden forms with yellow color of flowers (42.9%) there are also forms with white (33.3%), pink (19.0%) and red-orange (4.8%) colors of flowers in the collection of *Potentilla*. A separate collection of the

planting of seven species of decorative forms and varieties of apple trees, viable for using at the objects of landscape construction – *Malus prunifolia*, *Malus angustifolia*, *Malus pumila*, *Malus sieversii*, *Malus niedzwetzkyana*, etc. – was created in 2011.

The condition of flowering plants in the plantings for 2011 is reflected in Fig. 2.

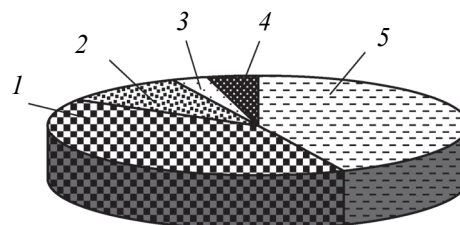


Fig. 2. The results of the assessment of condition of flowering shrubs (2011):

- 1 – good condition (40.4%);
2 – satisfactory condition (9.6%);
3 – unsatisfactory condition of (2.9%);
4 – dead specimens (3.8%);
5 – excellent condition (43.3%)

The major work on the introduction of ornamental woody plants with decorative leaves in the collection plantings of the parterre of the BSTU Botanical Garden was carried out in 2003–2010. As a result of inventory in 2012 139 samples of 35 species and 45 decorative plant forms of this group belonging to 20 genera and 14 families grow in the collection. The collection includes species and garden forms of *Acer*, *Berberis*, *Betula*, *Caragana*, *Carpinus*, *Cornus*, *Corylus*, *Cotoneaster*, *Cytisus*, *Euonymus*, *Lonicera*, *Morus*, *Physocarpus*, *Salix*, *Sambucus*, *Sorbus*, *Tilia*, *Ulmus* and others.

For 2012 the loss of plants of this group in the collection were 31 samples, or 18.2%. They are caused by the weakened state of seedlings, resulted from the lack of adaptation to local conditions of growth of imported planting material, mechanical damage, the development of disease and exposure to pests. Distribution of decorative deciduous plants into categories according to their state (2012) is the following: excellent – 45.0%, good – 38.0%, satisfactory – 14.0%, unsatisfactory – 3.0% [2].

The most resistant and having the most decorative character in plantings are *Berberis thunbergii* 'Erecta', *Euonymus fortunei* 'Canadale Gold', 'Emerald Gaiety', 'Emerald'n Gold', *Lonicera pileata* and *Lonicera japonica* 'Aureoreticulata', *Caragana arborescens* 'Lorbergii', *Cotoneaster dammeri* 'Eichholz' and *Cotoneaster adpressa* 'Little Gem', *Acer platanoides* 'Drummondii' and 'Faassen's Black', *Acer negundo* 'Flamingo', *Corylus avellana* 'Purpurea', decorative forms of *Physocarpus opulifolius* 'Diabolo', 'Luteus', 'Nugget' and 'Red Baron', *Cytisus decumbens*, *Sorbus cashmiriana*. Quickly fell out from the collection plantings because of the instability the following plants – *Betula pendula* 'Purpurea' and 'Laciniata', *Berberis thunbergii* 'Aurea' and 'Red Pillar', *Corylus avellana* 'Contorta', *Morus alba* 'Tortuosa' and some others. *Salix reptans* 'Argentea', *Salix caprea* 'Kilmarnock', *Salix babylonica* 'Tortuosa' are gradually losing the decorative features. The plantings of *Sambucus nigra* 'Aurea' are inhomogeneous in habitus and leaf color.

In the process of creation of the collection of ornamental woody plants with decorative leaves attention was paid to the involvement in its composition of decorative forms with discolored leaves and crown shape. According to the color characteristics of the leaves decorative forms with yellow-variegated and yellow color of leaves (28%), in the form of the crown – the weeping and the spherical (17%) dominate. In 2015, the collection was replenished with *Fagus sylvatica* 'Atropunicea'.

The introduction of conifers was most actively carried out in 2005–2010 and in 2015. In the first period 25 species of conifers belonging to 10 genera and represented by 70 decorative shapes (*Pinus* – 7, *Picea* – 10, *Larix* – 2, *Tsuga* – 1, *Thuja* – 5, *Juniperus* – 32, *Chamaecyparis* – 9, *Taxus* – 4) were planted. Also the collections were replenished with *Ginkgo biloba* and *Thujopsis dolabrata*. For 2013, the total number of coniferous plants in the collections was 139 samples. In addition to this, in autumn 2015 44 samples of 22 decorative forms were planted (*Chamaecyparis* – 2, *Juniperus* – 12, *Pinus* – 2, *Thuja* – 5, *Tsuga* – 1 form). As a result, in 2015 the collection includes 25 species and 92 decorative forms of conifers. The largest collection of conifers is presented by junipers and it includes 44 decorative forms of 9 species (Fig. 3).

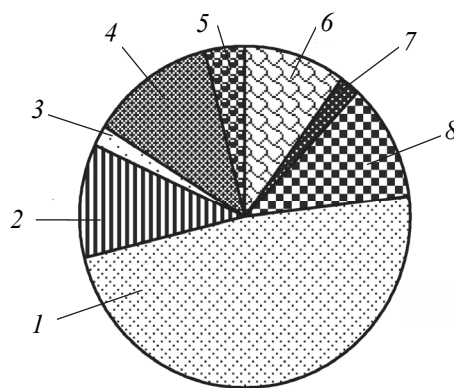


Fig. 3. The proportion of decorative forms of coniferous plants in the collection, 2015:

- 1 – Juniper (48%); 2 – Picea (11%);
 3 – Tsuga (2%); 4 – Chamaecyparis (12%);
 5 – Taxus (4%); 6 – Pinus (10%);
 7 – Larix (2%); 8 – Thuja (11%)

The most decorative are *Picea glauca* 'Daisy's White', *Picea pungens* 'Glauc Globosa', *Picea abies* 'Nidiformis' and 'Acrocona', *Chamaecyparis pisifera* 'Sungold' and *Chamaecyparis lawsoniana* 'Ivone', *Larix kaempferi* 'Diana' and 'Stiff Weeping', *Juniperus communis* 'Horstmann' and *Juniperus media* 'Old Gold', *Pinus mugo* 'Winter Gold', *Thuja occidentalis* 'Yellow Ribbon' and 'Danica'.

The results of the inventory of conifer plantations (2013) showed that 70% of the plants are in excellent condition, 15% – in good, 12% – satisfactory and 3% (*Juniperus communis* 'Hibernica' is damaged with pine-twig blight) – unsatisfactory [3].

The process of creation of the collection of plantings of flower cultures included the following steps:

- the setting up of the collection in the orchard of the BSTU Botanical Garden (1991–1992);
- the transfer of the collection from the orchard to the exposition area of the Botanical Garden (1995–1996);
- the forming of a circular rockery composition (2006–2007);
- large-scale plantings in areas of the “Garden of shadow plants” and “Modular Garden” compositions (*Astilbe*, *Iris*, *Hemerocallis*, *Phlox*, *Hosta* and others, 2008);
- the arrangement of flower beds in a recreation area (2009–2010);
- the plantings around the decorative pond and the adjacent rockery (2013–2014);
- the creation of the collection of decorative grasses and the replenishment of the collections of other perennial cultures (2014–2015).

The collection of decorative flower plants in the parterre of the BSTU Botanical Garden in 2015 includes 30 species and varieties of annual (*Amaranthus*, *Aster*, *Tagetes*, *Centaurea*, *Kochia*,

Zinnia, etc.), 17 – biennial (*Malva*, *Bellis*, *Myosotis*, *Digitalis*, etc.) and 289 – perennial (*Astilbe*, *Iris*, *Hemerocallis*, *Narcissus*, *Paeonia*, *Rosa*, *Tulipa*, *Hosta*, etc.) flower cultures.

Main perennial flower cultures are the varieties of *Paeonia lactiflora* (30), *Iris* (23), *Hemerocallis* (52), *Hosta* (15), as well as ornamental grasses and sedges (9 species) and others. Bulbous (*Tulipa*, *Narcissus*, *Lilium*) and some small bulbous (*Crocus*, *Scilla*, *Muscari*) plants are planted in the exposition in a mixture of varieties [4].

The results of evaluation of the state of herbaceous decorative plants in the compositions are presented in Fig. 4. Varieties of *Phlox* has dropped out to a large extent because of its strong damaging by powdery mildew.

Conclusion. As a result of almost twenty-five years period of introduction in the parterre of the BSTU Botanical Garden collectible plantings of ornamental trees and herbaceous plants were created, on the basis of which the research work on the study of the characteristics of growth and development of species, new decorative forms and varieties of decorative herbaceous and woody plants with a long-range of use in

landscaping of localities, evaluation of their decoration, state, stability and security in the compositions are carried out.

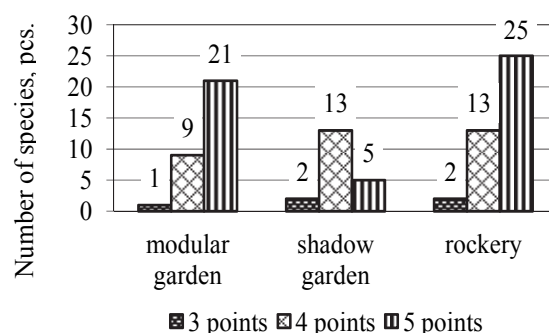


Fig. 4. The condition of the perennial flower cultures in the compositions (2014)

A long-term plan of introduction of trees and decorative plants, which include 79 species of decorative forms and varieties of flowering trees, shrubs and vines, 34 species and forms of ornamental deciduous trees and shrubs, 47 species and forms of conifers, more than 200 species and varieties of an open ground flower cultures is prepared.

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