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The article focuses on the results of species composition research and diversity of the decorative coniferous plants collection of the botanical garden parterre of Belarusian State Technological University, introduced in 2004–2010. The classification of decorative forms of coniferous species has been specified, the qualitative and quantitative features of plants have been evaluated determining their decorative features, growth and conditions in the plantation. The paper gives some data on the study of increment parameters of some decorative junipers by their height and crown diameter. Some conclusions have been made as to the efficiency of using decorative forms of coniferous species in the composition plantations of the parterre of BSTU botanical garden and their prospects for landscaping of Minsk urban area.

Introduction. In the Republic of Belarus the use of evergreen coniferous species for decorative gardening is of absolute practical interest. At the same time the number of coniferous plants which are appropriate for these purposes and have long-term ornamental qualities is quite limited. Therefore their numerous ornamental forms are becoming more and more widespread. Such plants are characterized by a distinctive shape of their crown, branching system, diverse shape and colour of the leaves [1, 2].

On the whole, the ornamental forms of coniferous plants are applied universally and suited for creating landscape designs of different styles, front doors and parterres, backyards, making rockeries as well as for unconventional landscaping, e.g. roof gardens and container landscaping. Ornamental conifers and their garden varieties can be used as solitaires, groups, for terrace decoration, on slopes and around ponds. Complex compositions containing several conifers and their ornamental forms are to be paid special attention.

Object-matters and methods of research.

The parterre part of the BSTU botanical garden (Negoreloye forestry experimental station) has a collection of ornamental coniferous plants created in the period from 2004 to 2010. The trees were planted as standard ball-rooted seedlings acquired in the garden centres of Minsk. The aim of this research was to specify the composition and to assess the health of the garden varieties of conifers in the parterre collection of the BSTU botanical garden (hereinafter referred to as BSTU botanical garden).

The object-matters of research were ornamental forms of coniferous trees of the BSTU botanical garden collection. In the course of research we specified the classification of the trees, their height, crown diameter, increment and health. For some trees of Juniper genus the data of 2013 were compared with those of 2009 and the data available in literary sources [1, 3].

Main part. The inventory results of 2013 showed that the BSTU botanical garden collection is composed of 25 coniferous species and 70 coniferous ornamental forms of 10 genera of 4 families. The collection includes species and ornamental forms of pine, spruce, larch, hemlock, thuja, false arborvitae, juniper, false cypress, yew and ginkgo. The total number of the trees in the study group accounts for 139 individuals.

Most ornamental forms of the collection are of Juniper genus (32 ornamental forms). The ornamental forms of spruce (10 forms) and false cypress (9 forms) have an approximately equal number of forms. The garden disposes of 7 ornamental forms of Pine genus, 5 forms of Thuja genus, 4 forms of Yew genus. There are also 2 ornamental forms of Japanese larch and 1 ornamental form of Canada hemlock (Figure).

The coniferous trees of the collection are mostly characterized by excellent (70% of individuals) or good (15%) health; annual increment, have leaves and shoots without visible damage and develop a crown typical of their species or garden variety.

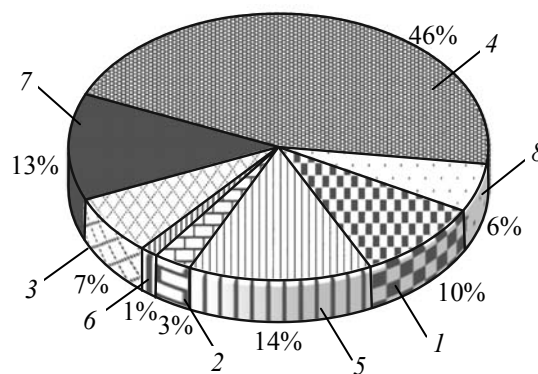


Figure – Genus distribution of garden varieties of conifers in the collection of BSTU botanical garden:
1 – pine; 2 – larch; 3 – thuja; 4 – juniper; 5 – spruce;
6 – hemlock; 7 – false cypress; 8 – yew

12% of conifers are in a satisfactory condition, i.e. they demonstrate poor increment, local damage by fungi, slight drying of leaves (e.g., some garden varieties of Canadian spruce), etc. Three trees (3%) of common juniper are considerably damaged by pine-leaf cast (*Lophodermium juniperium* de Not.) and their health can be categorized as unsatisfactory. The collection of junipers is the richest one consisting of 32 ornamental forms of 8 species. Various ornamental compositions include 73 juniper trees. The table below shows some data on morphometric characteristics of junipers as of different years of experimental observations (2009 and 2013) and compared to the data of literary sources.

These data make it possible to get an insight into their growth characteristics in Negoreloye forestry experimental station.

The study showed that mall ornamental forms of juniper had had both diameter and crown increments over the period from 2009 to 2013. It should also be noted that the annual increment of juniper plants was considerable over their first years, decreasing in the subsequent years. Thus, the flaky juniper ornamental forms ('*Blue Carpet*' and '*Meyerii*') planted in 2005 showed the annual in-

crement of 2013 twice as little as that of 2009. The same tendency can be observed with several other ornamental junipers planted in 2008. For instance, red juniper ('*Burkii*'), shore juniper ('*Shlager*'), Chinese pyramid juniper ('*Kuriwao Gold*') planted in 2008 showed their annual increment of 2013 being 1.7-3.6 times as little as that of 2009.

The study has showed that the growth form of ornamental junipers is largely determined by their crown shape. The plants of a pyramid, column-like crown shape reveal a more intensive height growth, whereas their crown diameter increases only inconsiderably. The height of common juniper ('*Hibernica*') increased by 0.5 m (30%) over the period from 2009 to 2013, its crown diameter growing by only 0.04 m (15%). Creeping plants are characterized by an expressed crown increment. For instance, the crown diameter of Chinese pyramid juniper ('*Expansa Variegata*') grew by 0.7 m (47%), its height increasing by 0.02 m (6%). Ornamental forms with oval-shaped and branchy crowns (common juniper ('*Horstmann*'), Chinese pyramid juniper ('*Kuriwao Gold*'), flaky juniper ('*Meyerii*')) reveal almost equal increments in height and crown diameter averaging 0.7-0.9 m (50-57%) and 0.8-1.7 m (50-54%) respectively.

Morphometric characteristics of some plants of Juniper genus in the parterre of BSTU botanical garden

Ornamental form	Year of planting	Average characteristics of BSTU botanical garden collections						Average characteristics acc. to literary sources [1, 3]	
		height, m		crown diameter, m		annual increment, cm		height, m	crown diameter, m
		2009	2013	2009	2013	2009	2013		
Red juniper (' <i>Burkii</i> ')	2008	1.9	4.0	0.8	1.2	27.0	7.5	3.0	–
Creeping juniper (' <i>Blue Ship</i> ')	2005	0.3	0.4	0.9	1.3	21.5	1.0	0.3	1.2
Creeping juniper (' <i>Douglasii</i> ')	2005	0.2	0.3	0.9	1.3	17.0	1.5	4.0–5.0	–
Creeping juniper (' <i>Prince of Wales</i> ')	2005	0.2	0.4	0.9	1.4	13.0	3.6	0.3	2.5
Creeping juniper (' <i>Wiltonii</i> ')	2005	0.1	0.2	0.6	1.0	11.0	4.1	0.1	–
Chinese pyramid juniper (' <i>Blaauw</i> ')	2008	0.9	2.1	0.7	2.0	13.0	5.6	2.0	–
Chinese pyramid juniper (' <i>Kuriwao Gold</i> ')	2008	0.5	1.2	0.7	1.5	16.0	9.2	0.4–0.5	–
Chinese pyramid juniper (' <i>Expansa Variegata</i> ')	2005	0.3	0.4	0.8	1.5	14.0	1.5	0.3	1.2
Common juniper (' <i>Depressa Aurea</i> ')	2008	0.3	0.5	0.9	1.2	12.0	4.0	0.3	1.5–2.0
Common juniper (<i>Hibernica</i>)	2005	1.2	1.7	0.2	0.3	8.3	2.5	3.0–5.0	–
Common juniper (<i>Horstmann</i>)	2005	0.8	1.7	1.4	3.1	14.5	9.8	1.5	1.5
Common juniper (<i>Repanda</i>)	2005	0.2	0.3	0.7	1.8	7.9	8.7	0.3	1.5
Common juniper (<i>Sterling Silver</i>)	2005	0.3	0.4	0.7	1.1	10.5	11.4	–	–
Shore juniper (' <i>Shlager</i> ')	2008	0.2	0.4	0.7	2.0	17.7	7.9	0.2	0.8–1.0
Rocky mountain juniper (' <i>Blue Arrow</i> ')	2008	1.3	2.4	0.4	0.9	25.5	12.0	2.0–3.0	–
<i>Juniperus media</i> (' <i>Old Gold</i> ')	2005	0.4	0.5	1.4	1.8	15.0	2.7	2.0	–
Flaky juniper (' <i>Blue Carpet</i> ')	2005	0.2	0.3	1.3	2.5	19.0	8.9	0.3–0.5	1.5–2.5
Flaky juniper (' <i>Meyerii</i> ')	2005	0.8	1.6	1.0	2.0	11.0	3.4	5.0	1.0

It should be noted that by 2013 most ornamental junipers of the BSTU botanical garden parterre (planted in 2005 and 2008) had reached the characteristics of height and crown diameter that are typical of adult plants and are cited by literary sources (Table).

Conclusion. In the course of research we studied the composition of ornamental coniferous forms of the BSTU botanical garden, specified the classification of the trees and shrubs planted in 2004-2010, determined the quality characteristics and the number of trees and shrubs, their health and growth characteristics. It has been stated that the ornamental forms of several Juniper species show the most active growth in their first years and decreases in the subsequent years. The rate of increment in height and

crown diameter is directly dependent on the crown shape of conifers.

The obtained data on basic growth and health characteristics of ornamental plants enable us to recommend most of them to be used as decoration of expository areas of botanical gardens as well as for landscaping purposes in Minsk.

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