

CONSERVATION OF WOODY PLANTS BIODIVERSITY IN THE O.V.FOMIN BOTANICAL GARDEN

Z.G. Bonyuk, O.O. Tkachuk, A.I.Girin, A.T. Grevtsova

O. V. Fomin Botanical Garden

of Taras Shevchenko National University of Kyiv;

1 Symon Petlyura Str., Kyiv, 01032 Ukraine, botsad_fomin@ukr.net.

Abstract. The article presents the results of studies of introduction of woody plants collection in the O. V. Fomin Botanical Garden, which has 1091 species and 1035 intraspecific taxa belonging to 217 genera, 69 families, 33 orders, 5 classes and 2 sections. The most widely are represented the generic complexes: *Cotoneaster* Medik., *Crataegus* L., *Rhododendron* L., *Spiraea* L., *Magnolia* L., *Rosa* L. etc.

INTRODUCTION

In modern conditions of the negative anthropogenic impact on the environment, climatic changes in the world, quick conversion of natural vegetation, disappearance of many species, the problem of conservation of plant diversity becomes especially urgent one. The botanical gardens play an important role in solving this problem with their rich collections of living plants all over the world. They are the sources of the gene pool of local and world flora and perform an important task of replenishment of plant resources. The O. V. Fomin Botanical Garden of Taras Shevchenko National University of Kyiv, founded in 1839, is one of the centers of conservation and enrichment of plant diversity in Ukraine. It occupies 22.5 hectares in the center of Kyiv. Low subzero temperatures in winter period in the absence of snow cover and frequent thaws are essential obstacles of successful acclimatization of plants in this region. The researches of phenotypic diversity of woody plants, their resistance in new conditions of growth for a long period of time are both a theoretical and practical interest.

MATERIALS AND METHODS

The object of research is the collection fund of woody plants of outdoor ground, numbering 2126 species and intraspecific taxa of which 1091 species, 10 subspecies, 871 cultivars, 33 forms, 62 variations, 59 hybrids that belong to 217 genera, 69 families, 33 orders, 5 classes and two sections [1]. The conventional methods [8–10],

archive documents, publications, materials of inventor are used in the researches with the dendrological fund.

RESULTS AND DISCUSSIONS

In the Botanical Garden Arboretum such genera are the most widely represented: *Cotoneaster* Medik. – about 200 taxa, *Crataegus* L. – 59, *Rhododendron* L. – 170, *Spiraea* L. – 127, *Pinus* L. – 51, *Magnolia* L. – 61, *Chamaecyparis* Spach – 28, *Juniperus* L. – 56, *Rosa* L. – 174 etc. [2–7]. More than a half of the taxa collection (54%) comes from Asia, 23% – from the North America, 17% – from Europe and the rest are widely distributed in Eurasia and North America. The trees make up 43%, including evergreen – 18%; shrubs – 52%, 11% of them are evergreen; subshrubs – about 2% and vines – 3% of the collection fund. As a result of the research of introduction perspective, from 70 to 98% of the tested species are estimated as promising for use in the forest-steppe and woodland of Ukraine.

The particular attention is paid to the conservation of the collection plants which age is hundred years or more, namely: *Carya glabra* (Mill.) Sweet., *C. ovata* (Mill.) K. Koch, *Cladrastis lutea* K. Koch, *Juglans nigra* L., *Pinus strobus* L., *Pseudotsuga menziesii* (Mirb.) Franco, *Quercus bicolor* Willd., *Q. rubra* L., *Tsuga canadensis* (L.) Carr. from the North America; *Fraxinus syriaca* Boiss. from the Asia Minor and the Central Asia; *Phellodendron amurense* Rupr. from the Far East; *Ginkgo biloba* L. from China; *Quercus macranthera* Fisch. et C. A. Mey. ex Hohen from the Caucasus; *Pinus pallasiana* D. Don - from countries of the Asia Minor and Crimea, *P. nigra* Arn. from the Balkans; powerful specimens of *Quercus robur* L. of local flora and *Larix decidua* Mill. from the mountains of Europe.

The arboretum plant collection has been formed by generations of botanists for over 170 years. Through the efforts of the scientific staff of the Botanical Garden in Ukraine such exotic plants are widespread: *Ailanthus altissima* (Mill.) Swingle, *Cercis canadensis* L., *Celtis occidentalis* L., *Gleditsia triacanthos* L., *Gymnocladus dioica* (L.) K. Koch, *Juglans nigra* L., *Morus alba* L., *Phellodendron amurense* Rupr., *Pinus strobus* L., *Robinia pseudoacacia* L., *Thuja occidentalis* L. and others.

Due to the large polymorphism, hybridization and apomixis of the representatives of the genus *Cotoneaster*, their source material is collected as far as possible in natural habitats. Some species dominate in the collection by geographical origin: *Cotoneasters* from the Southeast (18%) and Southwest (17%) China, then Himalayan (14%) and Chinese species (8%) of the mountainous areas of the Pamir-Alai and Tien-Shan and the Central Kopet Dagh – 10%; Europe – 9%; Iran, Afghanistan, Pakistan – 7%; Caucasus – 7%; Altai, Eastern Siberia – 5%; Mongolia – 2%; Crimea – 2%; North Africa – 1%. The collection of *Cotoneaster* Medik. in the O. V. Fomin Botanical Garden is replenished with 9 species, new for botanical science, which are named in honor of scientists: *C. bilokonii* Grevtsova, *C. daralagesicus* Grevtsova,

C. grevtsovae Bonyuk, *C. kazankinii* Grevtsova, *C. kirgizicus* Grevtsova, *C. logginovii* Grevtsova, *C. rusanovii* Grevtsova, *C. tkatschenkoi* Grevtsova, *C. uzbekicus* Grevtsova [3].

According to the duration of the vegetation period, the studied species are distributed in groups: 171–180, 181–190, 191–200, 201–210, 211–220, 221–230, 231–240 days. It is found that there is a dependence between the duration of the growing season and winter hardiness of *Cotoneaster*. In the group with the duration of the growing season 171–180 days, a number of winter-hardy species makes up 100%. With an increase in the growing season, the number of winter-hardy species decreases from 94% (181–190 days) to 33% (221–230 days). In the group of species with the duration of the growing season 231–240 days the winter-hardy species are absent. According to the results of the overwintering of representatives of the genus *Cotoneaster* the extreme winters of 2005–2006 years in Kyiv, 65% of taxa are persistent and can be recommended for introduction in ornamental gardening, 25% – are subject to acclimatization, 10% – for the valuable collection of the Botanical Garden as a priority in Ukraine and neighboring countries. As a result of the long-term researches, the representatives of the genus *Cotoneaster* 160 perspective taxa are determined and recommended to use: in ornamental horticulture – 140, to secure the eroded slopes, ravines – 80; landscaping for suburban recreation areas, trails, local roads – 60; plantations – 50; interior phytodesign – 40; apiculture – 70; horticulture – 15, as medicinal plants with high adaptogenic properties – 88.

Since 1983, in the Botanical Garden, more than 100 species and intraspecific taxa of *Spiraea* have been studied. Most of the species of *Spiraea* are from 10–30 years or more and they are presented with 340 samples, more than 3 thousand specimens. The plants are represented in different landscape compositions: in borders, flowerbeds, stone hills, clumps of 5–7, 20–30 and more specimens, solitaires, as ground cover, in accordance with the environmental requirements of the species. The polymorphic genus *Spiraea* is represented in the Botanical Garden both as arrow local endemics and species of widespread habitat, extended in conditions of tropical, subtropical to temperate climate (eg, *S. japonica* L. fil.), which is a manifestation of stability or variability of morphological characteristics of plants in conditions of introduction. There were the most variable features in conditions of the Botanical Garden: size of leaves, pubescence, color of leaves and flowers. We carried out the identification of the species diversity of the collection of *Spiraea* by chemotaxonomy method. We investigated more than 300 samples of *Spiraea* and analyzed spectra of peroxidases. Each species of *Spiraea* has the characteristic spectrum of isoperoxidase. A form and two new cultivars are identified and described: *S. trilobata* L. f. *crataegifolia* hort., f. nova, *S. nipponica* Maxim. f. *tosaensis* (Vatabe) Mak. 'Nana', cv. nov., *S. fritschiana* Schneid. 'Rosea' cv. nov. [2].

The present collection of the genus *Rosa* L. in the Botanical Garden consists of

52 species and taxa of subspecies rank belonging to 9 sections, as well as 122 varieties of roses of 10 garden groups. Some sections are the most widely represented in the collection: *Caninae* Crép., *Cinnamomeae* DC., *Pimpinellifoliae* DC., *Rugosae* Chrshan. and *Synstylae* DC. There are majority of varieties in the expositions of the Botanical Garden: tea-hybrid, floribunda and winding garden roses groups. The most part of the present collection fund of wild roses in the Botanical Garden is introduced in the 1970-s from the Central Asia, Baltic States and Western Europe through the exchange of seeds by delectus. About 20% of species are collected in their natural habitats.

The investigations of introduction in the conditions of the Botanical Garden were done using more than 80 species of wild rose and 320 varieties of 10 garden roses groups. As a result of the researches, 35 species of wild rose and 50 varieties of roses were selected from the collection for wide use in gardening design in the conditions of the north-west of Ukraine. The study of environmental sustainability of introduced plants allowed to select 25 tolerant varieties that can successfully grow and develop, blossom abundantly and continuously in the conditions of high gas content of the air.

According to the results of breeding work currently being undertaken with a collection of *Rosa*, the author O. O. Tkachuk created two new high-decorative, winter-hardy and resistant to fungal disease pathogens of the grade tea-hybrid groups – ‘Pervistok’ and ‘Kelych Aromatu’. The last one has a deep tea aroma inherent in some representatives of the ancient tea roses [11, 12].

The hawthorn *Crataegus* L., growing in the Botanical Garden of the University of Kyiv, is first mentioned in the list of seed exchange in 1842. On the summary list of inventory for 1884 the collection consisted of 9 species. Currently, the collection numbers 59 species and forms, 56 of them entered into the generative phase. The greatest number of species of the genus *Crataegus* researched in the Botanical Garden makes up the North American hawthorns (87%). The introduced hawthorns by systematic basis belong to 15 sections. The most part of species are grown from seed samples obtained in the botanical gardens of Tashkent, Frunze and Minsk. The native species are grown from seeds collected in the areas of natural habitat. The collection of *Crataegus* is located on the separate plot. The plants are in clumps of 3–5 (7) specimens. In addition, a part of the collection plants is located on lighted spots across the Botanical Garden. All investigated species are winter-hardy, blossom and fruit.

CONCLUSIONS

The collection of trees and shrubs in the Botanical Garden has more than 2000 species and intraspecific taxa and serves as a source of enrichment of the Ukrainian flora with new species and cultivars as well as a base for researches on the biology of plants, and is used for the educational process of students of biological faculties and specialists of green building, for educational activity.

The phenotypic diversity of forms of polymorphic genera *Cotoneaster*, *Crataegus*, *Magnolia*, *Spiraea*, *Rhododendron*, *Rosa* and many others allows conserving the vegetable biodiversity and serves as a basis for the further studies of their genetic potential and microevolutionary processes.

REFERENCES

1. APG III. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants : APG III // Bot. J. Linnean Soc. – 2009. – 161. – P. 105–121.
2. Бонюк З. Г. Таволги (*Spiraea* L.) : монографія / З. Г. Бонюк. – К. : ВПЦ “Київський університет”, 2008. – 248 с.
3. Гревцова Г. Т. Атлас – Кизильники *Cotoneaster* (Medic.) Bauhin. / Г. Т. Гревцова. – К.: Дім, сад, город, 1999. – 372 с. ISBN 966-95428-4-7.
4. Зарубенко А. У. Культура рододендронів в Україні : Монографія / А.У. Зарубенко – К.: ВПЦ “Київський університет”, 2006. – 175 с.
5. Інтродукція деревних рослин у Ботанічному саду ім. акад. О. В. Фоміна (1839-2009) : монографія / О. М. Колісниченко, З. Г. Бонюк, Г. Т. Гревцова та ін.; за ред. Г. Т. Гревцової. – К.: ВПЦ «Київський університет», 2011. – 175 с. ISBN 978-966-439-465-6.
6. Колісниченко О.М. Сезонні біоритми та зимостійкість деревних рослин. – Київ: Фітосоціоцентр, 2004. – 178 с.
7. Коршук Т. П., Палагеча Р. М. Магнолії (*Magnolia* L.): Монографія / Т. П. Коршук, Р. М. Палагеча – К.: ВПЦ “Київський університет”, 2007. – 207 с.
8. Лапин П.И., Сиднева С.В. Оценка перспективности интродукции древесных растений по данным визуальных наблюдений // Опыт интродукции древесных растений. – М.: Наука. – 1973. С. 7–67.
9. Русанов Ф.Н. Метод родовых комплексов в интродукции растений и его дальнейшее развитие // Бюл. ГБС АН СССР. – 1971. – Вып. 81. – С. 15–20.
10. Соколов С. Я. Современное состояние теории интродукции и акклиматизации растений. – М.-Л., 1953. – С. 10–18.
11. Ткачук О.О. Свідоцтво №10365 про авторство на сорт троянди ‘Первісток’. Заявка №09246004 // Державний реєстр сортів рослин придатних для поширення в Україні у 2011 р. – К., 2011. – С. 270.
12. Ткачук О.О. Свідоцтво №10366 про авторство на сорт троянди ‘Келих аромату’. Заявка №09246003 // Державний реєстр сортів рослин придатних для поширення в Україні у 2011 р. – К., 2011. – С. 269.