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Erzsébet Kohut, Anita Szikura, Zoltán Kopor, István Kolozsvári

JÓZSEF SZIKURA BOTANICAL GARDEN



Ержибет Когут, Аніта Сікура, Злотан Копор, Іштван Коложварі

БОТАНІЧНИЙ САД ІМЕНІ ЙОСИПА СІКУРИ

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ABSTRACT

Objective is to study and analyse the history of the creation of the József Szikura Botanical Garden, the results of its scientific, educational and environmental work.

Materials and methods of the study. The collections of the natural flora plants established by Professor József Szikura in 2011 in the village of Velyki Berehy, located 8 km northeast of the city of Berehove, Zakarpattia region were studied.

The main criteria for assessing the plants diversity in the botanical garden were the following: the qualitative and quantitative composition of the collections, their condition, the results of plant propagation, the possibility of repatriating them to natural ecosystems, the effects of research work, and educational activities.

The plant compositions were analyzed, and the species composition of the plots was studied. The role of the botanical garden in preserving the gene pool of flora was also assessed by the qualitative and quantitative composition of the long-lived seed bank. The results of the cultivation and acclimatisation of species of the world flora and the Carpathians have been evaluated since 2012. The evaluation of the results, cultivation and acclimatization of species of the world flora and the Carpathians has been carried out since 2012.

Scientific novelty. For the first time, the compositional and systematic composition of the József Szikura Botanical Garden was analysed in the context of successful solution of problems related to the conservation of plant diversity in artificially created phytocoenoses of Transcarpathia.

Based on the results of the study, an electronic catalogue (EC) of the Bank of long-lived seeds was created for the first time.

Conclusions. According to the results of the inventory analysis, it was determined that the area of 0,82 ha is represented by plants of different natural flora, the taxonomic composition of the collection of which includes 89 families, 468 species, 149 varieties and cultivars.

The most numerous families in the collection are *Amaryllidaceae* J.St.-Hil., *Iridaceae* Juss., *Poaceae* Barnhart, *Caryophyllaceae* Juss., *Lamiaceae* Martinov, *Asteraceae* Giseke, *Cupressaceae* Gray. Three *Allium* L. species and two *Iris* L. species are listed in the Red Data Book of Ukraine. The collection contains plants listed in the IUCN Red List (*Allium* – 5 species, *Iris* – 2 species) and the relict *Syringa josikaea* J.Jacq. ex Rchb.

The analysis of the composition of the Seed Bank showed the following distribution between taxa – 249 species belonging to 47 families.

The József Szikura Botanical Garden effectively combines research work on the study and protection of biodiversity, introduction and acclimatisation, reproduction and efficient use of plants, and functioning as an educational regional centre for the dissemination of ecological and ethnographic knowledge, education and upbringing of the population in the traditions of caring for nature and preserving the cultural heritage of the region.

Key words: biodiversity conservation, introduction, collection of natural flora species, biotechnology, seed bank

АНОТАЦІЯ

Мета роботи. Прослідкувати та проаналізувати історію створення Ботанічного саду імені Йосипа Сікури, результати наукової, просвітницької та природоохоронної роботи.

Матеріали та методи дослідження. Досліджувалися колекції рослин природної флори, закладені професором Йосипом Сікурою у 2011 році на території села Великі Береги, розташованому за 8 км на північний схід від міста Берегове Закарпатської області.

Основними критеріями оцінки різноманітності рослин у ботанічному саду були такі: якісний і кількісний склад колекцій, їх стан, результати розмноження рослин, можливості репатріації їх у природні екосистеми, наслідки виконання науково-дослідних робіт, заходи освітньо-виховного характеру.

Аналізувалися композиції рослин та видовий склад ділянок. Роль ботанічного саду для збереження генофонду рослинного світу оцінена також за якісним та кількісним складом банку насіння з довготривалим терміном зберігання. Проводилася оцінка результатів, культивування й акліматизації видів світової флори та Карпат з 2012 року.

Наукова новизна. Вперше проаналізовано композиційний та систематичний склад ботанічного саду імені Йосипа Сікури у контексті успішного вирішення задач, пов'язаних зі збереженням різноманітності рослин у штучно створених фітоценозах Закарпаття.

На основі результатів дослідження вперше сформовано електронний каталог (ЕК) Банку насіння з тривалим терміном зберігання.

Висновки. За результатами інвентаризаційного аналізу визначено, що на площі 0,82 га представлено рослини різних природних флор, таксономічний склад колекції яких нараховує 89 родин, 468 видів, 149 сортів і культиварів.

Найчисленнішими родинами в колекції є *Amaryllidaceae* J.St.-Hil., *Iridaceae* Juss., *Poaceae* Barnhart, *Caryophyllaceae* Juss., *Lamiaceae* Martinov, *Asteraceae* Giseke, *Cupressaceae* Gray. Три види *Allium* L. та два види *Iris* L. занесені до Червоної книги України. У колекції є рослини, занесені до Червоної книги МСОП (*Allium* – 5 видів, *Iris* – 2 види), та релікт *Syringa josikaea* J.Jacq. ex Rchb.

Аналіз складу Банку насіння показав такий розподіл між таксонами – 249 видів, що належать до 47 родин.

Ботанічний сад імені Йосифа Сікури ефективно поєднує науково-дослідну роботу з вивчення та охорони біорізноманіття, інтродукції та акліматизації, розмноження та ефективного використання рослин та функціонування як освітній регіональний центр поширення екологічних та етнографічних знань, освіти та виховання населення в традиціях дбайливого ставлення до природи та збереження культурної спадщини краю.

Ключові слова: збереження біорізноманіття, інтродукція, колекція видів природної флори, біотехнологія, насінневий банк

Statement of the problem

The conservation of biodiversity is perhaps the most important task facing biological science today. The plant world is an invaluable treasure trove of natural resources that requires careful and respectful treatment. Moreover, among plants, there are some that have survived to the present day from historical times in an unchanged state (relicts); there are others that are found only in a certain limited area and nowhere else on the entire planet (endemics). Some combine these features, i.e. are both relicts and endemics. Certain plants have repeatedly saved people from serious illnesses, and now mankind has identified them as a separate group of medicinal plants. There are groups of ornamental, food, fodder, oilseed, and spinning plants, etc. The list goes on and on, but the task before us is to emphasise once again the responsible and professional approach to preserving and increasing such unique plant resources. These are the tasks of plant introduction (Szikura & Kapustian, 2003).

Each territory on any continent has certain climatic, edaphic, orographic, hydrological and other characteristics. The flora of each region also has individual characteristics. Therefore, the broad task of introduction is to

find out in detail the natural conditions in which the plants of interest to researchers usually grow. It is necessary to have information about the ecological, biological, phenological, biochemical, and other features of these plants. It is also necessary to know all the characteristics of the region where the plants will be transferred. Then researchers can expect a positive outcome of the introduction experiment. Likewise, succeeding in taking effective steps towards the conservation of biological diversity (Komendar, 1988; Szikura & Kapustian, 2001).

In 2011, the Research Centre, named after the world-renowned botanist, ecologist, and doctor of biological sciences István Fodor, was established to conduct a comprehensive monitoring study of the natural resources of Transcarpathia.

On the initiative and direct involvement of Professor József Szikura, a garden with a collection of plants was established in the village of Velyki Berehy, located 8 km north-east of Berehove, Zakarpattia region, in an old rural manor (1898), which now belongs to the Ferenc Rákóczi II Transcarpathian Hungarian College of Higher Education. The botanical garden is located among private estates, but it successfully fits the landscape view without

disturbing the overall architectural and landscape ensemble. It is a structural unit of the College and operates as part of the István Fodor Research Centre.

The 21 varieties of cockerels received as a gift from Dr. Milan Blazek, a Czech botanist, marked the beginning of the plant collection, which now includes 468 species. It was assumed that in the future this collection could be used in the educational process, in complex scientific research, for ex situ conservation and reproduction of representatives of both other flora and characteristic species of the Transcarpathian flora (Komendar, 1988; Szikura & Kapustian, 2001).

Over time, new plants and seed samples of representatives of the flora of our region from the slopes of the Róna valley, the Pliska and Fekete mountains, the passes of the Ukrainian Carpathians, and plain species appeared. The collection was substantially replenished in 2014, when Dr. József Szikura†, the former

rector of our College, brought a large number of live plants from the National Botanical Garden of Vácrátót (Hungary), the Botanical Garden of the Eötvös Loránd University of Science (Hungary), the Botanical Garden of the University of the Carpathians (Poland), Eötvös Loránd Scientific University (Budapest, Hungary), the M.M. Hryshko National Botanical Garden of the National Academy of Sciences of Ukraine (Kyiv), and the O.V. Fomin Botanical Garden of the Taras Shevchenko National University (Kyiv). As a result, we began to work on generative plant propagation. Plots of monocotyledonous and dicotyledonous plants (Fig. 1-2), spicy-aromatic and medicinal plants, memorial trees donated by alumni were established, as well as an arboretum, and a rock garden designed. The number of plants gradually increased in parallel with the gradual expansion of the botanical garden.



Fig. 1. Plots with plants planted (2011-2012)



Fig. 2. Fragments of the collection plots (2023)

The Council of Botanical Gardens and Dendroparks of Ukraine included the collection garden in the RBSDU (2014).

In 2018, by the decision of the Academic Council of the Ferenc Rákóczi II Transcarpathian Hungarian College of Higher Education, the garden was renamed the Botanical Garden and named after its founder, József Szikura (Fig. 3).

Materials and methods of the study

The collections of the natural flora plants established by Professor József Szikura in 2011 in the village of Velyki Berehy, located 8 km northeast of the city of Berehove, Zakarpattia region were studied.

The main criteria for assessing the plants diversity in the botanical garden were the following: the qualitative and quantitative composition of the collections, their condition, the results of plant propagation, the possibility of repatriating them to natural ecosystems, the effects of research work, and educational activities. Systematic analysis of flora collec-

tions was carried out based on proven approaches (Kuzmishina & Kotsun, 2011).

A compositional and landscape analysis of the territory of the botanic garden based on developments for the M. M. Hryshka National Botanical Garden of the National Academy of Sciences of Ukraine (Zibnytska et al., 2013). The plant compositions were analyzed, and the species composition of the plots was studied. The role of the botanical garden in preserving the gene pool of flora was also assessed by the qualitative and quantitative composition of the long-lived seed bank. The results of the cultivation and acclimatisation of species of the world flora and the Carpathians have been evaluated since 2012. The evaluation of the results, cultivation and acclimatization of species of the world flora and the Carpathians has been carried out since 2012.

Research results

The current area of the garden is almost four times larger than the original one. Figure 4 shows a modern plan of the Botanical Garden and the location of the plant collections.



Fig. 3. Botanical Garden named after its founder József Szikura

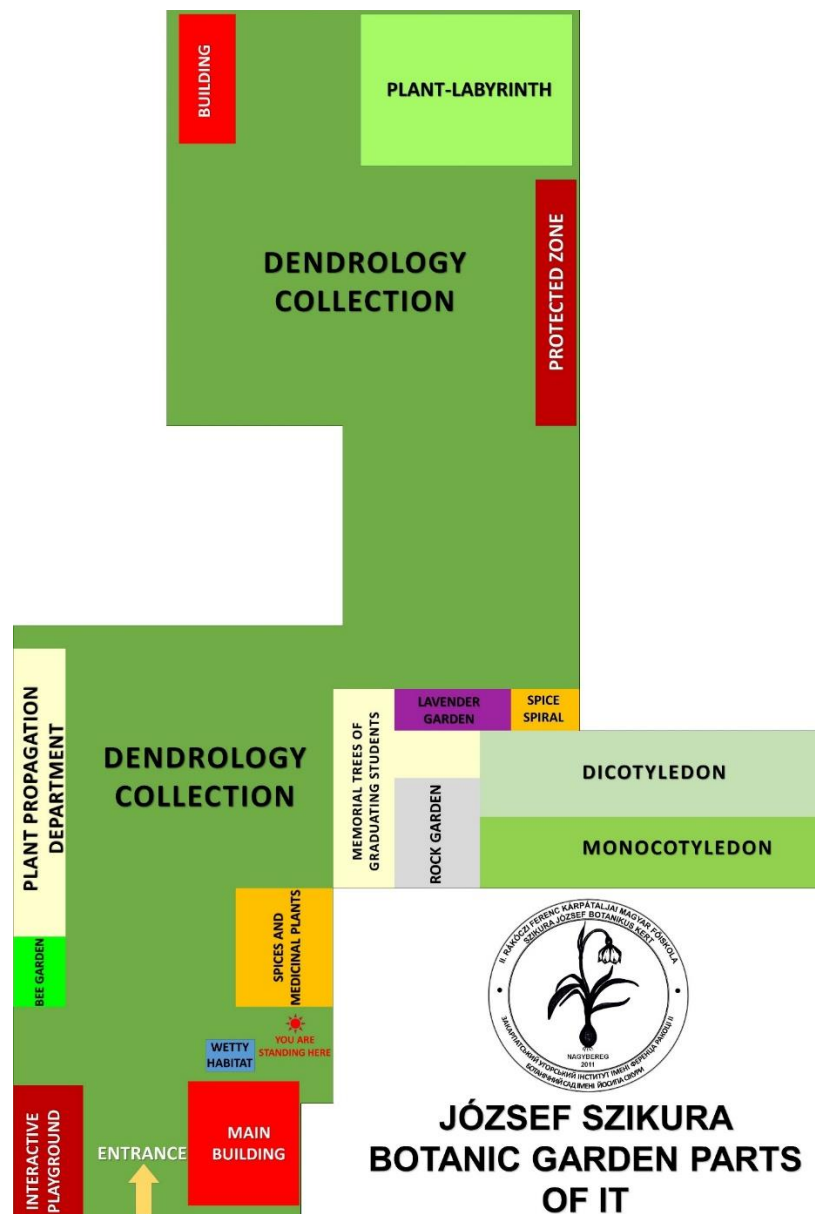


Fig. 4. Territory plan and emblem of the botanical garden

The collection is gradually growing and, accordingly, the tasks are being detailed. Thus, the main tasks of the Botanical Garden include: * preservation and replenishment of collections of the gene pool of living plants of local and world flora in artificial conditions, with a focus on rare and endangered species; * conducting research on the study and protection of biodiversity, introduction and acclimatisation, reproduction and efficient use of plants; * conducting educational and training work on botany, ecology, nature conservation, breeding, plant growing, ornamental gardening and landscape architecture; * creation of a computerised database on the plant collection fund, rare plants of the region, their ecological

and biological features; * ensuring the operation of the regional educational centre for dissemination of ecological and ethnographic knowledge, education and upbringing of the population in the traditions of careful attitude to nature and preservation of the cultural heritage of the region.

The renovated central building of the Botanical Garden officially received the emblem and signboard «Szikura József Botanikus Kert» and «Ботанічний сад імені Йозефа Сікури» in a solemn atmosphere in the presence of the institute's management, many invited honoured guests, colleagues and students (2021) (Fig. 5).



Fig. 5. The main building of the Botanical Garden

The building is designed and equipped with the necessary modern technology to make it convenient to hold both local and international conferences. A spacious conference hall with a permanent exhibition (life and work of famous scientists Lajos Wágner, Antal Margittai, István Fodor, József Szikura) is provided for events.

The office area is a place for meetings, negotiations and scientific discussions. We cooperate with more than twenty partner institutions in Ukraine, Hungary, the Czech Republic and Kazakhstan.

We have a laboratory with special equipment for conducting state-of-the-art

research, including biotechnological experiments with aseptic tissue culture and in vitro plant propagation. Under the leadership of Dr. Kohut E. over the past ten years, we have participated in several international programmes, one of which is «Research on the impact of climate change on snowdrops in the period 2015-2020» (Kezdőlap, 2023) (Fig. 6-7). The programme had a dual purpose: a scientific one, which investigated climate change using plants of the genus *Galanthus* L., and a study of green spots on snowdrop petals to investigate the genus' genetic diversity.

Fig. 6. *Galanthus* colony

Fig. 7. Experiments on seed germination

The educational goal of such programmes is to improve the level of knowledge of secondary school students and develop their long-term strategic thinking. At the same time, a didactic module of inquiry-based learning (IBL) was introduced.

The Seed Bank stores a collection of seeds of plants of the world flora under special conditions (Fig. 8).



Fig. 8. Long-term storage of seeds

The creation of the Seed Bank was initiated by Dr. József Szikura at the time of the opening of the Botanical Garden. The taxonomic analysis of the seed collection showed that today there are 249 species belonging to 47 families. Among them there are rare and endangered species, one relict species – *Syringa josikaea* J.Jacq. Based on the results of the study, an electronic catalogue (EC) of the Bank of Long-Lived Seeds was created for the first time.

According to the results of the inventory analysis, it was determined that the area of 0,82 ha contains plants of different natural flora, the taxonomic composition of the collection of which includes 89 families, 468 species,

149 varieties and cultivars. The most numerous families are: *Amaryllidaceae* J.St.-Hil., *Iridaceae* Juss., *Poaceae* Barnhart, *Caryophyllaceae* Juss., *Lamiaceae* Martinov, *Asteraceae* Giseke, *Cupressaceae* Gray.

The collection, for example, includes 60 taxa of *Allium* L. and 51 taxa of *Iris* L. including 42 species of *Allium* and 30 species of *Iris*. Of these, three *Allium* species (*Allium lineare* L., *A. obliquum* L., *A. ursinum* L.) and two *Iris* species (*Iris graminea* L., *I. sibirica* L.) (Fig. 9) are listed in the Red Data Book of Ukraine (Didukh, 2009).



Allium lineare L.



Allium obliquum L.



Allium ursinum L.



Iris graminea L.



Iris sibirica L.

Fig. 9. *Allium* and *Iris* species listed in the Red Data Book of Ukraine



Iris missouriensis Nutt.



Iris prismatica Pursh.



Allium altynolicum N. Friesen



Allium altaicum Pall.

Fig. 10. *Allium* L. and *Iris* L. species from the IUCN Red List

The taxonomic composition and condition of the coniferous plant collection was analysed in detail. It is located in the Dendrological Collection area (see the plan diagram in Fig. 4). The Conifers collection was established in 2017.

Today we have 22 species belonging to 4 families and 34 cultivars. The latest addition is *Cunninghamia lanceolata* (Lamb.) Hook., which appeared in our collection in 2022 (Fig. 11).



Fig. 11. *Cunninghamia lanceolata* (Lamb.) Hook.

In addition to its scientific activities, the Botanical Garden successfully performs an important function of environmental education, especially for schoolchildren and students. We attract visitors and keep their attention with special themed programmes. For example, we hold a Botanical Garden Day every spring. We have prepared an interesting and informative tour along the dendrological trail. A plant labyrinth and an open interactive zone were created.

A small Ethnographic Museum with authentic local exhibits (in the aforementioned old manor) and the active work of the «Tulipán Tanoda» children's school of arts and creativity of the hungarian people play a significant role in this. In general, this combination of diverse scientific research and the support and preservation of folk traditions, including those related to plant motifs, is a unique experience for a botanical institution.

Conclusions

According to the results of the inventory analysis, it was determined that the area of 0,82 ha contains plants of different natural flora, the taxonomic composition of the collection of

which includes 89 families, 468 species, 149 varieties and cultivars.

The most numerous families in the collection are *Amaryllidaceae*, *Iridaceae*, *Poaceae*, *Caryophyllaceae*, *Lamiaceae*, *Asteraceae* and *Cupressaceae*. Three *Allium* species and two *Iris* species are listed in the Red Book of Ukraine. The collection includes plants listed in the IUCN Red List (*Allium* – 5 species, *Iris* – 2 species) and the relict *Syringa josikaea* J.Jacq.

The analysis of the composition of the Seed Bank showed the following distribution between taxa – 249 species belonging to 47 families.

In conclusion, the József Szikura Botanical Garden effectively combines research work on the study and protection of biodiversity, introduction and acclimatisation, reproduction and efficient use of plants, and functioning as an educational regional centre for the dissemination of environmental and ethnographic knowledge, education and upbringing of the population in the traditions of caring for nature and preserving the cultural heritage of the region.

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Information about the authors:

Kohut E. [in Ukrainian: **Корут Е.**] ¹, Ph.D., Assoc. Prof., email: kohut.erszsebet@kmf.org.ua

ORCID: 0000-0002-7614-1606

Department of Biology and Chemistry, Ferenc Rákóczi II Transcarpathian Hungarian College of Higher Education
6 Kossuth square, Beregszász, Transcarpathia, 90200, Ukraine

Szikura A. [in Ukrainian: **Сікура А.**] ², Ph.D., Prof., email: szikura.anita@kmf.org.ua

ORCID: 0000-0002-6474-4821

Fodor István Research Centre, Department of Biology and Chemistry, Ferenc Rákóczi II Transcarpathian
Hungarian College of Higher Education
6 Kossuth square, Beregszász, Transcarpathia, 90200, Ukraine

Kopor Z. [in Ukrainian: **Копор З.**] ³, MSc, email: kopor.zoltan@kmf.org.ua

ORCID: 0000-0002-4330-8465

Fodor István Research Centre, Department of Biology and Chemistry, Ferenc Rákóczi II Transcarpathian
Hungarian College of Higher Education
6 Kossuth square, Beregszász, Transcarpathia, 90200, Ukraine

Kolozsvári I. [in Ukrainian: **Коложварі І.**] ⁴, Ph.D., Assoc. Prof., email: kolozsvari.istvan@kmf.org.ua

ORCID: 0000-0002-4527-7762

Fodor István Research Centre, Ferenc Rákóczi II Transcarpathian Hungarian College of Higher Education
6 Kossuth square, Beregszász, Transcarpathia, 90200, Ukraine

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³ Study design, data collection, manuscript preparation, funds collection

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