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CHRONICLE

The role of scientific seed exchange in the formation of collections of the M.M. Gryshko National Botanical Garden of the NAS of Ukraine

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Abstract

The paper deals with the role of the Seed Laboratory in developing and maintaining the plant collections of the M.M. Gryshko National Botanical Garden of the National Academy of Sciences of Ukraine. The paper summarizes the results of 80 years of work related to the scientific exchange of seeds and planting material. The contributions made by different departments of the Botanical Garden to this process are analyzed. As a result of continuous documentation activities, the register of incoming plant material currently comprises 98 accession journals. Over the entire period of its activity, the Seed Laboratory has maintained scientific contacts with more than 600 botanical institutions in Ukraine and abroad. At present, active exchange of plant material is carried out with 165 botanical gardens and research centers that regularly submit seed requests. Most collaborations involve European institutions. While exchanges with botanical organizations in Asia, North America, and Africa occur less frequently. The Index Seminum issued by the Botanical Garden is published electronically every two years. Nearly all departments of the Botanical Garden participate in the seed exchange network. Since 2004, within the framework of the research program of the Department of Natural Flora, work has been conducted on establishing a specialized seed collection of rare and endangered plant species of the flora of Ukraine. This collection includes seeds gathered during field expeditions as well as seeds obtained from *ex situ* cultivations maintained by various departments, including Natural Flora, Dendrology and Park Science, Cultural Flora, Flowering-Ornamental Plants, Tropical and Subtropical Plants, and the Laboratory of Medical Botany. Currently, the collection comprises 472 species belonging to 82 families. The paper also presents photographs of plants cultivated from seeds obtained through scientific exchange. It demonstrates the practical outcomes of the Seed Laboratory's activities. Information is also provided about the carpological collection developed within the laboratory. Today, the carpological collection contains 17827 samples belonging to 1630 genera, 7266 species, and 218 families. Possible directions for further expansion and improvement of the carpological collection are proposed.

Keywords: international seed exchange, plant collections, carpological collection

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Competing Interests: The authors declare no conflict of interest.

6/7-472	12564	Paeonia	Linne	
"	12565	"	Livingstone	
"	12566	"	Madame de Verneville	
"	12567	"	Mad. René Tessier	
"	12568	"	Mons. Charles Leveque	
"	12569	"	Madeste Guerin	
"	12570	"	Niobe	
"	12571	"	Pres. Taft.	
"	12572	"	Rane Hortense	
"	12573	"	Rubra Trioumphans	
"	12574	"	Suzette	
"	12575	"	Loe Calot.	
"	12576	"	Festiva maxima	

Figure 1. Fragment of a page from Registration Journal No. 3 with a list of peony cultivars.

Every botanical garden has a unit responsible for the scientific exchange of plant material. This mechanism plays a significant role in replenishing the expositions and collections in botanical gardens. The tradition is nearly 200 years old. International agreements strictly regulate the exchange of plant material for scientific purposes. Ukraine has acceded to the Florence Agreement on the Importation of Educational, Scientific and Cultural Materials (UNESCO, 1950), the Convention on Biological Diversity (CBD, 1992), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973).

The Seed Laboratory was initiated to mobilize and inventory plant material in the second half of 1944. It was established shortly after the botanical garden gained the status of an independent scientific institution within the Academy of Sciences of Ukraine system. Today, the Seed Laboratory is a part of the Department of Natural Flora (Vakulenko & Chuvikina, 2005; Chuvikina, 2016).

The laboratory staff initiated a scientific exchange of seeds and planting materials and began the registration process. The first specialized seed journal, titled "Registration of Seeds and Planting Material Received by the Botanical Garden of the Academy of Sciences of the Ukrainian SSR", was established in 1944. The first portion of the seeds was registered on 3 August 1944. The seeds were obtained from the Botanical Garden of Ashgabat, Turkmenistan (Loya et al., 2025).

According to archival data, seed exchange occurred even before the introduction of

registration journals. For example, as early as 1936, nearly 2,500 samples of fruits and seeds from various woody plants were received from different botanical institutions worldwide. All the seeds were immediately sown (Chuvikina, 2016).

Today, the register of incoming plant material consists of 98 journals. The journals provide detailed information on the creation of collections and the places of mobilization of planting material, including the date of receipt, Latin name, sender, and the curator to whom the material was assigned.

The list of registered seeds enables us to trace the approaches used in the formation of the botanical garden's collections and expositions. In particular, plants grown from seeds obtained from various geographical regions later formed exposition plots modeled according to the botanical-geographical principle (Department of Natural Flora). Seeds of plants with decorative features served as the basis for replenishing the collections of the Departments of Flower-Ornamental Plants, Dendrology and Park Science, as well as the Landscape Construction. Seeds of plants with medicinal properties or economic value were directed to the collections of the Laboratory of Medical Plants, the Department of Cultural Flora, and the Department of Acclimatization of Fruit Plants.

The informational significance of the registration journals is difficult to overestimate. For example, entry No. 2709 in Journal No. 1 indicates that the portion of *Atropa caucasica* Kreyer seeds, received from the Botanical Garden of the USSR Academy of Sciences (Leningrad), was transferred in May 1945 for sowing to the prominent botanist M.G. Popov (Loya et al., 2025).

Journal No. 3 dated 06.01.1947 records peony cultivars (Fig. 1). The peonies were received as seedlings from the Langerhausen nursery (Dresden, Germany).

Notably, the 'remarks' column shows that the planting material was received as reparations from Germany (certificate No. 9 from 03.09.1946). These cultivars remain in the collection under their respective numbers and are used in breeding work in the Department of Flower-Ornamental Plants' peony plot. For example, we have observed the flowering of several peony cultivars:



Figure 2. Flowering of peony cultivars received from Germany in 1947 (Department of Flower-Ornamental Plants, curator V.F. Horobets): A - 'Zoe Calot'; B - 'Linne'; C - 'Livingstone'; D - 'Louis van Houtte'; E - 'President Taft'; F - 'Albrecht Dürer'.

'Linne' No. 12564, 'Livingstone' No. 12565, 'Zoe Calot' No. 12575, 'Albrecht Dürer' No. 12578, 'Louis van Houtte' No. 12580, and 'President Taft' No. 12571 (Fig. 2).

Scientific exchange of plant material was conducted for both the needs of the botanical garden and for other institutions, including institutes of genetics and breeding, botany, plant physiology, and municipal landscaping services.

During its 80-year history, the staff of the seed laboratory conducted extensive work in exchanging seeds with Ukrainian and foreign botanical institutions. Over this period, scientific contacts were maintained with more than 600 botanical institutions worldwide.

Today, active exchange occurs with 165 institutions that send seed requests. Most exchanges occur with European botanical institutions, with fewer exchanges taking place with institutions in Asia, North America, and Africa.

In addition to the botanical gardens, seed exchange is conducted with research institutions, arboreta, higher educational establishments, forestry enterprises, nurseries, as well as with private domestic and foreign collectors.

The assortment of seeds offered for scientific exchange is reflected in seed exchange lists of botanical institutions. In Ukraine and abroad, such documents are



Figure 3. Collection of poppies (Department of Flower-Ornamental Plants, curator H.O. Gorai): **A** – *Dicranostigma erectum* K.-F.Günther; **B** – *Papaver atlanticum* (Ball) Coss.; **C** – *P. bracteatum* Lindl.; **D** – *P. commutatum* Fisch., C.A.Mey & Trautv. ‘Ladybird’; **E** – *Glaucium squamigerum* Kar. & Kir.; **F** – *Hunnemannia fumariifolia* Sweet.

issued under various titles, including “Seed Catalogue”, “Seed List”, “Delectus”, and “Index seminum”.

Since 1947, initially annually and later every two years, a seed exchange list “Index seminum” has been published. It listed 400 to 1,836 plant names in different years (Fig. 2).

Currently, the seed list proposed by the botanical garden for scientific exchange is published electronically every two years. It is compiled and standardized in accordance with recommendations adopted by the International Association of Botanical Gardens in Nancy, France, in 1984 (Larsen & Maudsley, 1984):

- title page indicates the year of publication and institution identification;
- families arranged alphabetically within taxonomic groups;
- genera and species listed alphabetically;
- only verified taxa included;
- origin of each sample provided;
- each sample is assigned an accession number, which is also its order number.

The basis for Index seminum is the collections of living plants in open ground and in greenhouse conditions. Almost all departments of the botanical garden



Figure 4. Collection of spice plants replenishment (Department of Cultural Flora, curator M.O. Gaznyuk): **A** – *Achillea asplenifolia* Vent.; **B** – *A. pannonica* Scheele; **C** – *Cistus creticus* L.; **D** – *Elsholtzia stauntonii* Benth.; **E** – *Phonus lanatus* (L.) Hill; **F** – *Satureja subspicata* Bart. ex Vis. subsp. *liburnica* Silic.

participate in scientific seed exchange (Table 1).

During the existence of the seed laboratory, its staff sent about 200,000 seed samples to related institutions. More than 390,000 samples of seeds and planting material were ordered and received, sown, and planted in the plots of the botanical garden. Seed exchange enabled collections to be enriched with unique species of world flora. It demonstrates the diversity, beauty, and richness of the plant kingdom. These include rare and endangered species of natural flora, extensive collections of dendrology and ornamental plants, collections of aromatic

and fodder plants, exotics from greenhouses, and others. For example, the poppy collection of the Flower-Ornamental Plants Department was almost entirely formed from plants grown from seeds ordered from Delectus. Plants from seeds obtained through international scientific exchange are now represented in the collections of every department. Only a small portion of these plants is shown in Figs. 3–7. Data on their origin are presented in Table 2.

It is worth noting that plants grown from seeds obtained through international scientific exchange are widely used in breeding programs. In particular, scientists from

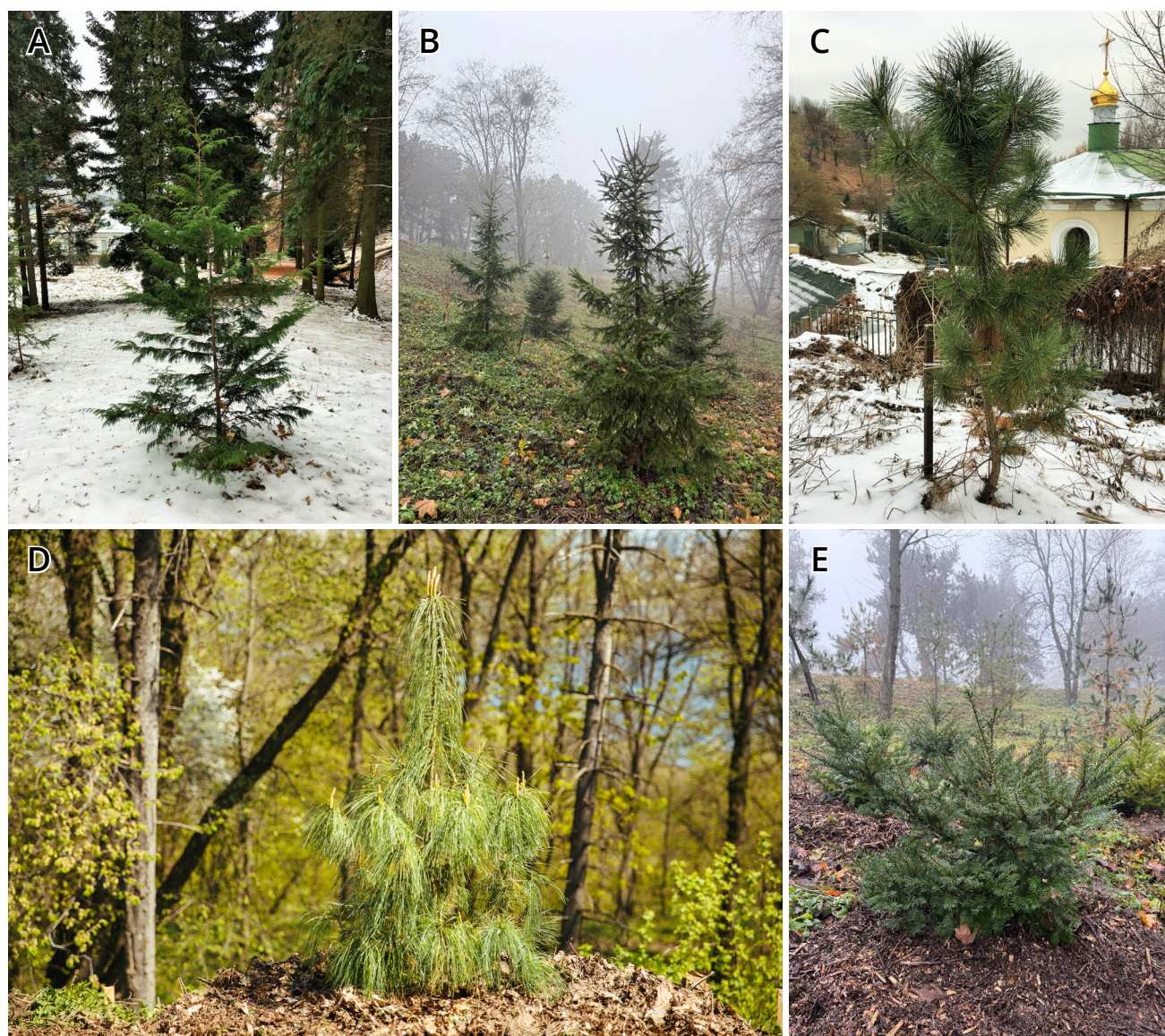


Figure 5. Conifer collection replenishment (Department of Dendrology and Park Science, curator O.P. Pokhylchenko): **A** – *Chamaecyparis obtusa* (Siebold & Zucc.) Endl.; **B** – *Picea koyamae* Shiras.; **C** – *Pinus thunbergii* Parl.; **D** – *P. armandi* Franch.; **E** – *Taxus canadensis* Marshall.

Table 1. Number of seed samples provided by curators for exchange (2015–2025).

Departments and laboratory names	Number of seed samples
Cultural Flora	2268
Flower-Ornamental Plants	1554
Natural Flora	847
Dendrology and Park Science	410
Accimatization Fruit Plants	404
Laboratory of Medical Botany	276
Tropical and subtropical plants	185
Landscape Construction	131

Table 2. Data on collection enrichment via scientific seed exchange.

Species, infraspecies	Year of introduction	Origin of the seeds
<i>Achillea aspleniifolia</i> Vent.	2018	Linz Botanical Garden, Austria
<i>Achillea pannonica</i> Scheele	2018	Schlossgarten Botanical Garden, Erlangen, Germany
<i>Carex bohémica</i> Schreb.	2022	Geneva Botanical Garden, Switzerland
<i>Chamaecyparis obtusa</i> (Siebold & Zucc.) Endl.	2009	Hiroshima Botanical Garden, Japan
<i>Cistus creticus</i> L.	2018	University Botanical Garden, Bern, Switzerland
<i>Dicranostigma erectum</i> K.-F.Günther	2009	Botanical Garden of the University of Technology, Dresden, Germany
<i>Draba aizoides</i> L.	2017	Botanical Garden, Porrentruy, Switzerland
<i>Elsholtzia stauntonii</i> Benth.	2021	University Botanical Garden, Besancon, France
<i>Festuca heterophylla</i> Lam.	2016	University Botanical Garden, Poznan, Poland
<i>Glaucium squamigerum</i> Kar.&Kir.	2001	Botanical Garden of the University of Technology, Dresden, Germany
<i>Hunnemannia fumariifolia</i> Sweet	2004	University Botanical Garden, Toronto, Canada
<i>Papaver atlanticum</i> (Ball) Cosson	2003	Botanical Garden, Gothenburg, Sweden
<i>Papaver bracteatum</i> Lindl.	2007	University Botanical Garden, Leipzig, Germany
<i>Papaver commutatum</i> Fisch., C.A.Mey. & Trautv. 'Ladybird'	2002	University Botanical Garden, Bayreuth, Germany
<i>Phonus lanatus</i> (L.) Hill.	2011	University Botanical Garden, Leipzig, Germany
<i>Picea koyamae</i> Shiras.	2011	Groningen Botanical Garden, Switzerland
<i>Pinus armandi</i> Franch.	2011	Botanical Garden of the University of Technology, Dresden, Germany
<i>Pinus thunbergii</i> Parl.	2004	Botanical Garden Okamoto, Japan
<i>Rosa gallica</i> L.	2003	University Botanical Garden, Brno, Czech Republic
<i>Rosa glauca</i> Pourr.	1955	Rose Nursery Langerhausen, Dresden, Germany
<i>Rosa roxburghii</i> Tratt.	2013	Kyoto Botanical Garden, Japan
<i>Rosa rubiginosa</i> L.	2000	Nikitsky Botanical Garden, Yalta, Ukraine
<i>Rosa rugosa</i> Thunb.	2009	University Botanical Garden, Poznań, Poland
<i>Satureja subspicata</i> Bart.ex Vis. subsp. <i>liburnica</i> Silic	2023	University Botanical Garden, Ljubljana, Slovenia
<i>Silene zawadzki</i> Herbich	2013	University Botanical Garden, Konstanz, Germany
<i>Taxus canadensis</i> Marshall	2014	Arboretum Dubrava, Kaunas, Lithuania
<i>Trifolium rubens</i> L.	2016	University Botanical Garden, Poznan, Poland

the Department of Cultural Flora obtained a patent for a new variety of Staunton's *elmsholtzia* 'Veresneva Krasunya' (authors of the cultivar: Korableva O.A., Gaznyuk M.O., Rakhmetov D.B.), in the breeding of which plants grown from seeds obtained from France were used (Fig. 4D; Table 2).

Immediately after the laboratory's establishment, the collection of seed samples

for further morphological study began. Most of the obtained planting material was used directly for sowing or planting. In contrast, a smaller portion of seeds was retained for the laboratory's collections. This essentially marked the beginning of the carpological collection and one of the most important research activities of the laboratory (Fig. 8). Systematized seed collections form the basis



Figure 6. Replenishment of the collection of rare plants of the flora of Ukraine (Department of Natural Flora, curator A.M. Hnatiuk): **A** – *Carex bohemica* Schreb.; **B** – *Draba aizoides* L.; **C** – *Festuca heterophylla* Lam.; **D** – *Silene zawadskii* Herbich; **E** – *Trifolium rubens* L.

for morphological, anatomical, and systematic study of plants. Currently, the carpological collection contains 17827 samples belonging to 1630 genera, 7266 species, and 218 families.

A significant contribution to the seed collection was made by the well-known Ukrainian carpologist Dr. Nina Dudik. She headed the laboratory for many years. The order Fabales of the world flora is most fully represented in the carpological collection (about 2000 samples), as well as seeds

of Ukrainian flora (over 3000 samples). A collection received from German botanical gardens in 1947, comprising fruits and seeds of approximately 1,000 plant species from 65 families, holds considerable historical and scientific interest. Seed material more than 70 years old has been well-preserved in glass stoppered tubes and can still be used as reference specimens.

Since 2004, within the framework of research activities of the Department of



Figure 7. Replenishment of the *Rosa* species to Rosarium (Department of Landscape Construction, curator O.L. Rubtsova): **A** – *Rosa gallica* L.; **B** – *R. glauca* Pourr.; **C** – *R. roxburghii* Tratt.; **D** – *R. rubiginosa* L.; **E** – *R. rugosa* Thunb.

Natural Flora, a collection of seeds from rare and endangered species of Ukrainian flora has been established. Its basis consists of seeds collected in nature during expeditions. Additionally, samples are collected in plots managed by the Departments of Natural Flora, Dendrology and Park Science, as well as the Flower-Ornamental Plants, Tropical and Subtropical Plants, and Cultural Flora. Samples are also obtained via Delectus from other botanical gardens. Currently, the

collection of rare and endangered species of Ukrainian flora comprises 472 species, belonging to 82 families. It includes species listed in the Bern Convention, the IUCN Red List, the Red Book of Ukraine, and regional red lists.

The M.M. Gryshko National Botanical Garden today serves as a center for *ex situ* conservation of rare plants. Therefore, establishing a Seed Bank (a type of genetic bank) of rare and endangered species of the



Figure 8. Staff of the Seed Laboratory reviewing the carpological collection: **A** – research scientist, Vlasta Loya; **B** – chief engineer, Tetyana Kayutkina.

flora of Ukraine at the Seed Laboratory is a highly urgent task. Despite the absence of specialized storage conditions required for long-term preservation of genetic material, such collections remain of considerable scientific value. They are used in training future biologists as visual material illustrating the diversity of plant adaptations for seed protection and dispersal.

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Роль наукового обміну насінням у формуванні колекцій Національного ботанічного саду імені М.М. Гришка НАН України

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У статті показано роль насінневої лабораторії у створенні колекцій рослин Національного ботанічного саду імені М.М. Гришка Національної академії наук України. Підбито підсумки 80-річної діяльності лабораторії у науковому обміні посадковим матеріалом та насінням, проаналізовано участь у цьому різних відділів ботанічного саду. В результаті багаторічного документування реєстр надходження насіння та посадкового матеріалу наразі складається з 98 журналів. Протягом всього часу діяльності наукові контакти підтримувались з понад 600 зарубіжними та вітчизняними ботанічними установами. Активний обмін рослинним матеріалом відбувається з 165 ботанічними установами, звідки надходять заявки на насіння. Більшість наукового обміну насінням здійснюється за участю європейських установ, менше – з ботанічними установами Азії, Північної Америки та Африки. "Index Seminum", що видається Ботанічним садом, публікується в електронному вигляді кожні два роки. Майже всі відділи Ботанічного саду беруть участь у науковому обміні насінням. З 2004 року в межах наукової тематики відділу природної флори розпочата робота по створенню колекції насіння рідкісних та зникаючих видів флори України. Ця колекція включає насіння, зібране у природі під час експедиційних відряджень співробітниками відділу природної флори, а також відібране на ділянках відділів природної флори, дендрології та паркознавства, квітничково-декоративних рослин, тропічних та субтропічних рослин, нових культур, лабораторії медичної ботаніки. Наразі колекція налічує 472 види, що належать до 82 родин. Представлено фотографії рослин, що вирощені кураторами ділянок з отриманого за науковим обміном насіння. Наведено дані про карпологічну колекцію, що зібрана в насінневій лабораторії, та намічено шляхи її подальшого розвитку та вдосконалення. Карпологічна колекція налічує 17827 зразків, що належать до 1630 родів, 7266 видів та 218 родин.

Ключові слова: міжнародний обмін насінням, колекції рослин, карпологічна колекція