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CHRONICLE

## Department of Fruit Plant Acclimatization: history, scientific achievements, and prospects

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### Abstract

The Department of Fruit Plant Acclimatization of the M.M. Gryshko National Botanical Garden of the National Academy of Sciences of Ukraine is a leading scientific unit in the fields of introduction, acclimatization, and breeding of new, non-traditional, neglected, and underutilized (NUS) fruit plants. From 1946 to 2025, the Department has established one of the richest collections of fruit crops in Ukraine, comprising 855 taxa from 39 genera and 20 families, including species with food, medicinal, and ornamental value. The Department's research activities cover the study of adaptive and reproductive abilities of species, biochemical and allelopathic analyses, evaluation of breeding potential and winter hardiness, as well as the development of an adaptive introduction concept that enhances plant viability and stimulates morphogenetic processes under new conditions. Thanks to long-term research, numerous promising fruit plant species from the world flora have been introduced into cultivation, including *Actinidia* spp., *Asimina triloba*, *Schisandra chinensis*, *Cornus mas*, *Ziziphus jujuba*, and others. Additionally, 75 cultivars developed by the Department have been registered in the State Register of Plant Varieties of Ukraine. The practical significance of the Department's work is evident in the introduction of cultivars into industrial, farm, and amateur horticulture, increasing the nutritional and medicinal value of fruits, preserving biodiversity, and developing resilient agroecosystems. The scientific results contribute to a deeper understanding of adaptation mechanisms, assessment of genetic potential, and integration of NUS into breeding programs. The Department actively collaborates with international institutions, participates in global networks and conferences, and contributes to the journal *Agrobiodiversity for Improving Nutrition, Health and Life Quality*, ensuring worldwide utilization of research outcomes and supporting Ukraine's socio-economic programs.

**Keywords:** Department of Fruit Plant Acclimatization, introduction, breeding, neglected and underutilised species, NUS, genetic resources, sustainable fruit production

**Authors' contributions:** Olga Grygorieva and Svitlana Klymenko – conceptualization. Olga Grygorieva, Svitlana Klymenko, Nadiia Skrypchenko, Volodymyr Levon, Volodymyr Kuznetsov, Antonina Ilyinska, Tetyana Venediktova – writing – original draft. Olga Grygorieva, Svitlana Klymenko, Mykhaylo Zhurba – visualization, formal analysis. Olga Grygorieva, Svitlana Klymenko, Nadiia Skrypchenko, Volodymyr Levon, Volodymyr Kuznetsov, Antonina Ilyinska, Inna Goncharovska, Mykhaylo Zhurba, Tetyana Venediktova, Viktoriya Knysh, Iryna Golubkova – writing – review & editing.

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## Introduction

Plant genetic diversity is a fundamental basis for the sustainable development of agriculture, horticulture, and the food industry. In the 21st century, as global climate change, ecosystem degradation, shrinking natural habitats, and increasing food demands become major challenges, the issues of conservation, rational use, and expansion of fruit plant genetic resources are particularly urgent (Frison et al., 2011; Brindza et al., 2016).

One of the most effective ways to address these challenges is through the introduction, acclimatization, and breeding study of new and non-traditional species. This approach allows for the expansion of the cultivated assortment, the development of cultivars with high adaptability, longevity, resistance to biotic and abiotic stresses, and unique economic traits (Klymenko et al., 2005, 2018; Brindza & Grygorieva, 2013; Brindza et al., 2016). Such species include, for example, *Actinidia* spp., *Asimina triloba* (L.) Dunal, *Schisandra chinensis* (Turcz.) Baill., *Ziziphus jujuba* Mill., and other promising fruit plants from the world flora.

Particular importance in this context is given to neglected and underutilized species (NUS) – species that have historically been used in agriculture or possess high potential for modern horticulture, but in recent decades have been overlooked by conventional production (Chivenge et al., 2015; Li et al., 2020). This category includes *Aronia* × *prunifolia* (Marshall) Rehder, *Cornus mas* L., *Cydonia oblonga* Mill., *Sambucus nigra* L., and others.

NUS are characterized by high natural resilience, valuable nutritional and medicinal properties, and the ability to grow effectively across a wide range of soil and climatic conditions, making them a strategic resource for sustainable agroecosystems and food security (Chivenge et al., 2015; Li et al., 2020).

The introduction and reintroduction of new, non-traditional, and NUS species into cultivation requires comprehensive research, encompassing introduction, breeding, biochemical, morpho-physiological, and technological aspects. Since its establishment, the Department of Fruit Plant Acclimatization of the M.M. Gryshko National Botanical Garden of the NAS of Ukraine (NBG) has been implementing these tasks, creating one of the

most complete collections of fruit plants in Ukraine, systematically expanding the gene pool with promising species, and conducting in-depth studies of underutilized crops (Klymenko et al., 2022a, 2022c; Skrypchenko, 2022).

In the current context, with the increasing need for resilient agrobiosystems, the importance of such work continues to grow. The Department of Fruit Plant Acclimatization of the NBG is one of the leading scientific centers for the development of alternative and innovative fruit production in Ukraine, particularly based on neglected and underutilized species. The scientific approaches developed for the introduction, acclimatization, and breeding of underutilized and promising species are the result of long-standing research traditions and systematic work by the Department's team. Their formation relies on the Department's long history, stages of organizational development, and the accumulation of unique experimental material.

## Historical background and formation of the Department

Work on the introduction and breeding of fruit plants in Ukraine, as well as studies of their performance under various cultivation conditions, actively developed in the second half of the 19th century. These efforts were based on the theoretical foundations and practical recommendations of leading Ukrainian scientists such as M.F. Kashchenko, V.V. Pashkevich, L.M. Ro, L.P. Symyrenko, and V.L. Symyrenko (Klymenko et al., 2022b).

The further development of introduction science is associated with the work of Academician M.M. Gryshko, the founder of the NBG, who significantly deepened the scientific foundations of plant introduction. It was on this basis that the future Department of Fruit Plant Acclimatization was later formed.

Before the establishment of the specialized Department, the unit underwent several reorganizations: 1945 – Department of Plant Biology; 1953 – Department of Ornamental and Industrial Crops; 1958 – Department of Cultivated Flora; 1961 – Department of Introduction and Acclimatization of Cultivated Plants (Klymenko et al., 2022a, 2022c).

In 1965, the Department of Fruit Plant Acclimatization was officially established, with I.M. Shaytan appointed as head (Shaytan et al., 1989). With the organization of the Department, breeding work continued in the Acclimatization Garden. Scientists such as I.O. Dryha, H.P. Rudkovskiy, L.L. Kokhanova, O.M. Komarnytska, H.S. Pavlenko, N.I. Ternova, and Y.O. Bryzhalov developed new promising cultivars of apricot, peach, and grape, and selected hybrids of quince, cherry plum, serviceberry, chaenomeles, cornelian cherry, and persimmon for further scientific study.

In 1975, ca. 5 ha of the Acclimatization Garden were allocated for the construction of an educational institution, requiring the rapid relocation of the area. The garden's collection, comprising about 6,000 plants, was transferred to the territory of the NBG (Klymenko & Chuvikina, 2001).

The main work on forming the collection and establishing plots for fruit and berry crops was carried out between 1946 and 1970, with systematic expansion continuing over the following 50 years (Klymenko et al., 2022a, 2022c).

In the post-war period, the foundation for research development was laid by I.O. Dryha (1944–1967), I.M. Shaytan (1946–1996), R.F. Klyeyeva (1946–1986), V.M. Terekh (1947–1965), N.A. Nabok (1948–1995), as well as breeders T.P. Tereshchenko (1957–2016) and L.M. Chupryna (1958–2007). They studied *Actinidia* spp., *Malus* spp., *Morus* spp., *Prunus* spp., *Cerasus tomentosa* (Thunb.) Loisel., *Juglans regia* L., *Schisandra chinensis*, *Viburnum opulus* L., *Vitis vinifera* L., and other species, developed the first cultivars of peach, apricot, and cherry plum, as well as species of *Actinidia* Lindl. and *Schisandra* Michx. that were practically new to Ukraine at that time, and made significant contributions to cultivar evaluation, testing, and promotion of new crops.

In the following decades, their work was continued by P.A. Moroz (1961–2016), O.F. Klymenko (1986–2013), N.V. Skrypchenko, (since 1982), M.I. Kulchytska (1983–2002), V.P. Knysh (since 1999), and O.O. Bezpalko (since 2010), focusing on *Actinidia* spp., *Rubus* spp., *Schisandra* spp., *Viburnum* spp., and *Vitis* spp. Such specialists as I.M. Grykun (1985–2001) and Y.A. Vasiuk (1985–2017) concentrated their

attention on *Crataegus* spp., *Lonicera* spp., *Elaeagnus multiflora* Thunb., *Vaccinium uliginosum* L., and *Ziziphus jujuba*.

Research on stone fruit species (peach, apricot, cherry plum, antipka, cherry) was conducted by O.O. Andriienko (since 1987) and V.M. and N.M. Vasylyshyn (2000–2012). The NBG specialist, I.M. Golubkova (since 2008) added *Prunus spinosa* L. to the research objects, while V.I. Nemynushchyi (2009–2022) and G.V. Mearakishvili (since 2011) also contributed. Doctor of sciences, S.V. Klymenko (since 1960), devoted research to the introduction and breeding of *Chaenomeles* spp., *Cornus* spp., *Crataegus* spp., *Sambucus* spp., *Sorbus* spp., *Asimina triloba*, *Cydonia oblonga*, *Elaeagnus umbellata* Thunb., *Pseudocydonia sinensis* (Dum.Cours.) C.K.Schneid., and *Shepherdia argentea* (Pursh) Nutt.

Since 1998, O.V. Grygorieva studies *Diospyros* spp., as well as *Amelanchier* spp., *Aronia* spp., *Mespilus germanica* (L.) Kuntze, *Ziziphus jujuba*, *Castanea sativa* Mill., and *Elaeagnus multiflora*. The NBG worker, M.G. Tesliuk, researched *Cornus kousa* Bürger ex Hance, *C. florida* L., and *C. capitata* Wall. based on the Department's collection. Species of the genus *Juglans* L. are studied by O.M. Aboimova, while *Akebia* spp., *Decaisnea* spp., *Lycium* spp., *Podophyllum* spp., *Stauntonia* spp., and *Ficus carica* L. are investigated by M.Y. Zhurba.

A separate area of research is devoted to ornamental apple trees, studied by I.V. Goncharovska since 2012. Since 1999, the biochemical properties of fruit species have been investigated by V.F. Levon. Allelopathic studies were carried out by P.A. Moroz, I.M. Grykun, V.P. Grakhov, and I.Y. Osipova.

In 1957, under the guidance of I.M. Shaytan, a unique form-decorative fruit garden was established, which continues to function thanks to the long-term work of T.P. Tereshchenko, D.I. Nevzglad, A.R. Ivanova, H.K. Yaremenko, V.V. Kuznetsov, I.V. Goncharovska, and G.O. Antonyuk.

Over the decades, the established scientific school, accumulated collection funds, and research experience have formed the foundation for the Department's current stage of activity, defining its contemporary research directions today (Klymenko et al., 2022a, 2022c).

## Current research directions and achievements of the Department

Currently, fruit and berry crops occupy an area of 12 ha in the southeastern part of the NBG territory. Plants for the collection were obtained both from numerous expeditions and scientific missions, as well as through delectus – a free seed exchange between botanical institutions worldwide. Professional contacts covered diverse geographical regions, ranging from the Far East to the Carpathians, as well as the USA, Canada, China, Iran, Hungary, Romania, Slovakia, Poland, Serbia, the Czech Republic, and Germany.

Today, the Department of Fruit Plant Acclimatization of the NBG is the only scientific unit in Ukraine with unique gene pools of fruit crops. The collection includes 855 taxa from 39 genera and 20 families (Actinidiaceae Gilg & Werderm., Annonaceae Juss., Berberidaceae Juss., Caprifoliaceae Juss., Cornaceae Bercht. & J.Presl, Ebenaceae Gürke, Elaeagnaceae Adans., Ericaceae Juss., Fagaceae Dumort., Juglandaceae DC. ex Perleb, Lardizabalaceae R.Br., Moraceae Gaudich., Rosaceae Juss., Rhamnaceae Juss., Viburnaceae Raf., Saxifragaceae Juss., Solanaceae Juss., Schizandraceae Blume, and Vitaceae Juss).

Numerous scientific studies have been carried out based on these collections, forming the foundation for Ph.D. dissertations devoted to the biology, reproduction, allelopathy, and adaptation of various fruit species: “Biological characteristics and propagation of Japanese chaenomeles” (O.M. Nedvyha, 1991); “Allelopathic function of phenolic compounds in peach” (V.P. Grakhov, 1991); “Allelopathic functions of phenolic compounds in apple” (I.M. Grykun, 1993); “Introduction of common medlar (*Mespilus germanica* L.) and prospects for its cultivation in Ukraine” (V.V. Oleshko, 1994); “Allelopathic features of new fruit crops” (I.Y. Osipova, 2000); “The family Cornaceae (Dumort.) Dumort. in Ukraine: systematics, biological characteristics, economic importance” (A.V. Kustovska, 2002); “Introduction of *Actinidia* Lindl. species in the Forest-Steppe of Ukraine: growth, development, and reproductive features” (N.V. Skrypchenko, 2002); “Biological characteristics and productivity of pear depending on cultivar-rootstock combinations in the Right-Bank

Forest-Steppe of Ukraine” (O.A. Spryahaylo, 2003); “Bioecological characteristics of North American hawthorn species (*Crataegus* L.) in relation to their use in landscaping in the Forest-Steppe of Ukraine” (V.L. Rubis, 2004); “Cornelian cherry (*Cornus mas* L.) in nature and cultivation in Transcarpathia: biology, ecology, and form diversity” (O.A. Melnychuk, 2008); “*Diospyros* L. species in the Forest-Steppe of Ukraine: introduction, biological characteristics, reproduction” (O.V. Grygorieva, 2009); “Shrub species of the Rosaceae Adans. family in the Left-Bank Polissia: bioecological and morphological features, reproduction, utilization” (S.V. Kyriienko, 2011); “*Sambucus* L. species in the Forest-Steppe of Ukraine: biological and morphological features, introduction, cultivation prospects” (L.M. Kolisnyk, 2011); “*Asimina triloba* (L.) Dunal in the Steppe of Ukraine: introduction, biology, reproduction” (O.A. Grabovetska, 2011); “The genus *Cynoxylon* Raf. (Cornaceae Bercht. & J. Presl) in Ukraine: introduction, biomorphological features, prospects for use” (M.G. Tesliuk, 2016); “*Malus* Mill. species in the Right-Bank Forest-Steppe of Ukraine: biomorphological and decorative features, utilization” (I.V. Goncharovska, 2019); “Biological and ecological features of *Persica* Mill. species utilization in the Right-Bank Forest-Steppe of Ukraine” (I.M. Golubkova, 2019); “The genus *Lycium* L. in Ukraine: introduction, bioecological, morphological, and biochemical features” (M.Y. Zhurba, 2021); “*Juglans* L. species in the Right-Bank Forest-Steppe of Ukraine: bioecological and morphological features, utilization” (O.M. Aboimova, 2021); “Biological features of *Schisandra chinensis* (Turcz.) Baill. under introduction in the Right-Bank Forest-Steppe of Ukraine” (G.V. Slyusar, 2021).

These long-term studies and accumulated experience enable the systematic determination of priority directions in the Department’s scientific activities. The main current research directions of the Department include:

- breeding of southern, new, and underutilized species;
- studies of reproduction and adaptation of introduced species;
- biochemical analysis of plant organs;
- allelopathic studies and investigations of soil fatigue;



**Figure 1.** *Asimina triloba* cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

- Improvement of propagation methods;
- development of the concept of biotic intensification of fruit production;
- assessment of introduction success;
- practical advices for cultivation.

Thanks to this comprehensive activity, the Department has established a strong scientific foundation not only for the applied evaluation of the prospects of new and non-traditional fruit crops but also for fundamental research in the fields of adaptive biology, species ecology, genetics of breeding material, and biochemical characterization of plants. This creates the prerequisites for the development of sustainable and alternative fruit production in Ukraine (Klymenko et al., 2022a, 2022c, 2025).

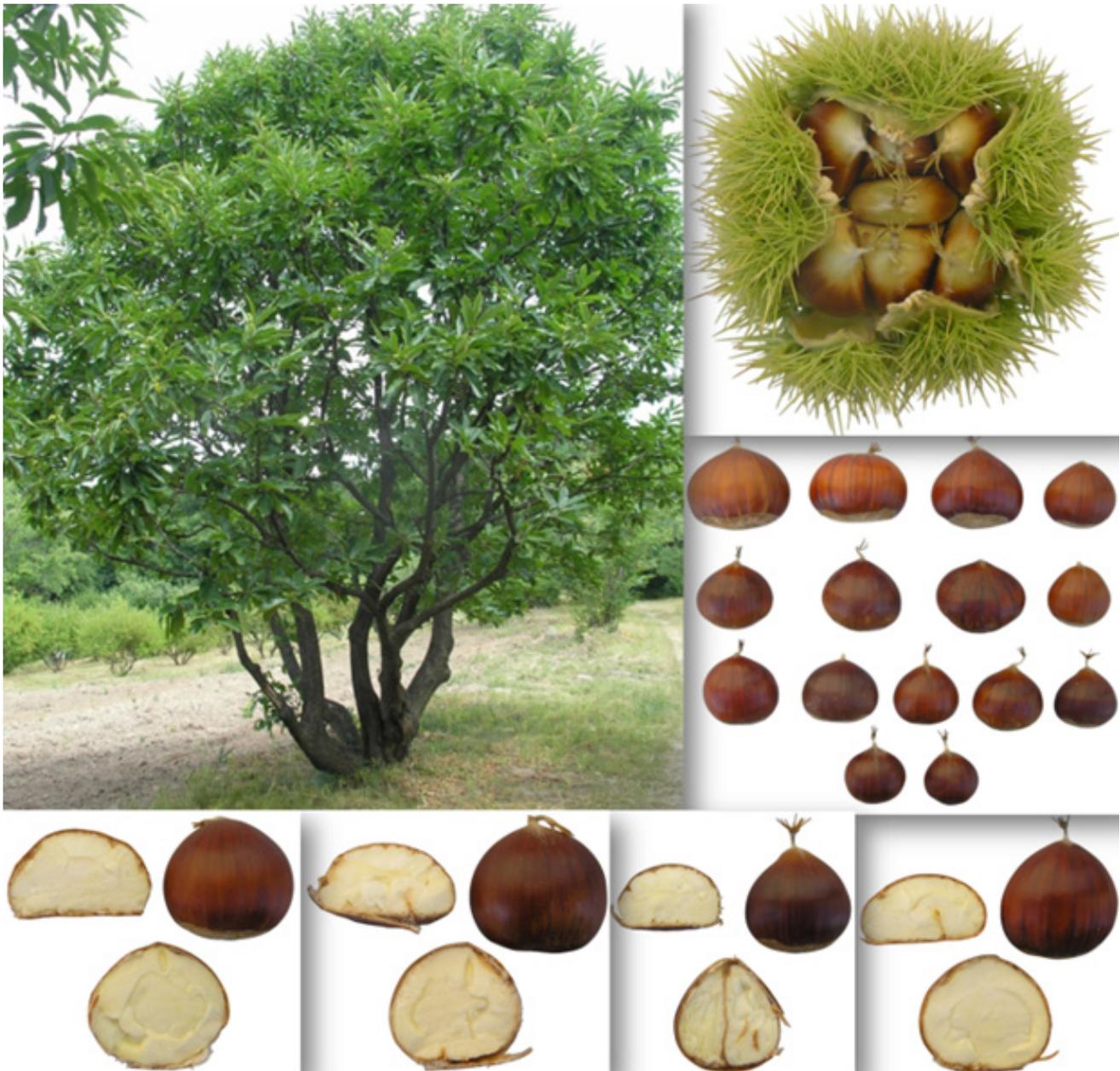
### Key scientific achievements and breeding accomplishments of the Department

From 1946 to 2025, the Department of Fruit Plant Acclimatization has theoretically substantiated and practically developed methods for the adaptation and acclimatization of both native and introduced fruit plant species. The adaptive and reproductive capacities of southern, new, non-traditional, and underutilized species (NUS) of the world flora have been determined,

assessed by indicators such as ecological amplitude, earliness, longevity, ability for self-seeding, and vegetative regeneration. Their breeding potential has been evaluated based on ecological-biological, biochemical, morphological, and economic traits.

The theoretical foundations of species adaptation and acclimatization have been elaborated, and the concept of adaptive introduction has been proposed. According to this concept, seed reproduction combined with natural and artificial selection increases plant adaptability, stimulates morphogenetic processes, and expands the breeding base (Klymenko et al., 2022a, 2022c). It has been demonstrated that a species adaptive capacity is a key factor in forming a cultigenic range beyond its natural distribution.

Research results have shown that the reproductive capacity of new cultivars and varieties obtained through analytical and synthetic breeding is comparable to, and in some cases exceeds, that of local species: under Forest-Steppe conditions in Ukraine, they exhibit annual fruiting and produce viable seeds, indicating a high level of overall adaptation of both species and individual cultivars. The practical essence of introduction has been defined as the selective breeding of the most valuable species and cultivars from a broad spectrum of plants introduced into new conditions. Based on a combination



**Figure 2.** *Castanea sativa* cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

of key and indifferent traits, the concept of the homeostatic ideotype cultivar has been formulated (Klymenko et al., 2022a, 2022c, 2024, 2025).

Thanks to the Department's long-term research on *Cornus mas*, its cultivation has been revived in Ukraine over the past 60 years; the current assortment of this species consists exclusively of NBG-bred cultivars, which are known in many countries across Europe and the USA (Klymenko, 2000; Klymenko et al., 2021b).

As demonstrated by long-term studies (Klymenko, 1993, 2000, 2011; Skrypchenko & Sliusar, 2019; Sun et al., 2020; Klymenko et al.,

2021a, 2022a, 2022c, 2024, 2025; Skrypchenko & Moroz, 2002; Zhurba et al., 2021a, 2021b; Grygorieva et al., 2021, 2022; Venediktova et al., 2024; Skrypchenko et al., 2025), plant adaptation is determined by indicators such as ecological amplitude, earliness, longevity, ability for self-seeding, and vegetative regeneration. The Department's breeding work has focused on winter hardiness as a key factor for successful introduction, and the cultivars obtained have become valuable material for further breeding.

At the same time, some less winter-hardy species – *Asimina triloba*, *Castanea sativa*, *Elaeagnus multiflora*, *Ziziphus jujuba*, *Lonicera*



**Figure 3.** *Chaenomeles* spp. cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

spp., and certain *Cornus* spp. – introduced 30–40 years ago, have shown sufficient winter hardiness and successfully fruit at levels comparable to native species. This is partly explained by changes in climatic conditions, including a reduction in the number of days with low temperatures and an extension of the autumn period with higher positive temperatures.

For each species, there is a minimum set of climatic and ecological factors that limit its distribution. In particular, a certain cumulative temperature above 0°C is required from the beginning of vegetation to a specific developmental phase, rather than the average daily temperature. Plants that complete all developmental phases and produce viable offspring under new conditions are considered acclimatized. Acclimatization is a component of the evolutionary development of plants, during which the genetic potential of the species is expressed: plants activate morphogenetic processes through the realization of adaptive capabilities controlled by the genotype. The genotype's reaction norm is specific and depends on changes in ecological factors (Klymenko et al., 2024).

Based on these principles, gene pools of new, underutilized, and native fruit plants of the world flora, valuable for their content of biologically active compounds, have been

established. The gene pools include species with various uses – nutritional, medicinal, and pharmaceutical (Zhurba et al., 2021c, 2021d; Levon et al., 2022; Goncharovska et al., 2022a, 2022b, 2024, 2025; Grygorieva et al., 2025a, 2025c, 2025d, 2025e). A logical continuation of the processes of introduction, adaptation, and acclimatization is breeding work, during which the most promising cultivars are selected for cultivation (Klymenko et al., 2024).

Through the efforts of several generations of scientists, collections of numerous fruit plant species and cultivars have been established (Figs. 1–9), including: *Actinidia arguta* (Siebold & Zucc.) Planch. ex Miq., *A. kolomikta* (Maxim. & Rupr.) Maxim., *A. polygama* Maxim., *A. chinensis* Planch. var. *deliciosa* (A.Chev.) A.Chev., *Schisandra chinensis* (Turcz.) Baill.; *Akebia quinata* (Houtt.) Decne., *A. trifoliata* (Thunb.) Koidz.; *Amelanchier ovalis* Medik., *A. spicata* (Lam.) K.Koch., *A. canadensis* (L.) Medik., *A. alnifolia* (Nutt.) Nutt. ex M.Roem.; *Aronia* × *prunifolia* (Marshall) Rehder; *Asimina triloba* (L.) Dun.; *Castanea sativa*; *Chaenomeles japonica* (Thunb.) Lindl., *C. cathayensis* (Hemsl.) C.K.Schneid., *C. speciosa* (Sweet) Nakai, *C. × superba* (Frahm) Rehder; *Cornus domestica* (L.) Spach; *Cornus mas*, *C. officinalis* Sieb. & Zucc., *C. sessilis* Torr., *C. kousa*, *C. florida*; *Crataegus monogyna* Jacq., *C. pinnatifida* Bunge, *C.*



**Figure 4.** *Cornus mas* cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

*pojarkovae* Kossyeh; *C. punctata* Jacq.; *Cydonia oblonga*; *Decaisnea fargesii* Franch.; *Diospyros lotus* L., *D. virginiana* L.; *Elaeagnus multiflora*, *E. umbellata*; *Ficus carica*; *Juglans regia*, *J. nigra* L., *J. ailantifolia* Carrière, *J. mandshurica* Maxim.; *Leycesteria formosa* Wall.; *Lonicera edulis* (Turcz. ex Herder) Turcz. ex Freyn, *L. caerulea* L.; *Lycium barbarum* L., *L. chinense* Mill., *L. europaeum* L., *L. truncatum* Y.C.Wang; *Mespilus germanica*; *Morus alba* L.; *Podophyllum peltatum* L., *P. hexandrum* L.; *Prunus avium* (L.) L., *P. brigantina* Vill., *P. cerasifera* Ehrh., *P. cerasus* L., *P. domestica* L., *P. salicina* Lindl., *P. tomentosa* Thunb., *P. davidiana* (Carrière) Franch., *P. persica* (L.) Batsch., *P. armeniaca* L.; *Pseudocydonia sinensis*; *Rubus nigricans* Danthoine, *R. vulgaris* Weihe & Nees; *Sambucus nigra*, *S. racemosa* L., *S. ebulus* L.; *Schisandra chinensis*, *S. rubriflora* (Franch.) Rehd. & Wils; *Shepherdia argentea*; *Sorbus aucuparia* L., *S. koehneana* C.K.Schneid.; *Stauntonia hexaphylla* (Thunb.) Decne., *S. angustifolia* (Wall.) R.Br. ex Wall.; *Viburnum opulus*, *V. lantana* L.; *Vitis vinifera*, *V. labrusca* L.; *Zizyphus jujuba*.

The Department's form-decorative fruit garden houses the largest collection of ornamental apple trees, including *Malus baccata* (L.) Borkh., *M. coronaria* L., *M. fusca* (Raf.) C.K.Schneid., *M. holliana* Koehne, *M. manshurica* (Maxim.) C.K.Schneid., *M. niedzwetzkyana* Dieck, *M. orientalis* Uglitzk., *M. tschonoskii* (Maxim.) C.K.Schneid., *M. microcarpa* (H.Wendl. ex K.Koch), *M. × rudolph* F.L. Skinner, *M. × purpurea* (E.Barbier) Rehder (Goncharovska et al., 2025). The garden is a masterpiece of landscape and park art and a unique area where about 800 plants grow in 50 diverse artificial forms, including vase, wreath, garland, snake, spiral, pyramid, lyre, candelabra palmette, varie palmette, vertical and horizontal cordons, as well as berry plants in standard form.

For decorative purposes, arbours with climbing plants such as *Actinidia*, grapevine, and *Schisandra* have been created. The form-decorative fruit garden serves as a scientific base for research in ornamental horticulture and the acclimatization of fruit crops. It contains collections of local and heritage cultivars – valuable genetic material that has



**Figure 5.** *Cydonia oblonga* cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

preserved resilience and high fruit quality over centuries. The Department maintains approximately 200 apple cultivars and 100 pear cultivars. Preserving ancient and local cultivars, combined with traditional usage in peasant farms, reflects global practices of genetic resource conservation under the terms ‘on-farm’ and ‘in-garden’ (Goncharovska et al., 2020).

Long-term studies and the established collections of the Department have enabled the systematic evaluation of the breeding potential of species and cultivars, assessment of their adaptive and reproductive capacities, and selection of the most valuable material for cultivation. Seventy-five cultivars developed by the Department of Fruit Plant Acclimatization have been included in the State Register of

Plant Varieties of Ukraine, including: *Prunus armeniaca* – two cultivars, *Cydonia oblonga* – five cultivars, *Actinidia arguta* – 17 cultivars, *Prunus cerasifera* – one cultivar, *Vitis vinifera* – one cultivar, *Viburnum opulus* – two cultivars, *Cornus mas* – 14 cultivars, *Schisandra chinensis* – one cultivar, *Prunus persica* – 14 cultivars, *Chaenomeles japonica* – 4 cultivars, and *Malus domestica* – 14 cultivars. These cultivars, developed through analytical and synthetic breeding, have been adapted to multiple regions of Ukraine (Klymenko et al., 2025).

This does not exhaust the diverse pool of fruit plant germplasm from the world flora, which can be used for the successful introduction of promising species and the breeding of new cultivars under Ukrainian conditions.



**Figure 6.** *Elaeagnus multiflora* cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

### Contribution of the Department's scientific research to theory and socio-economic programs in Ukraine

The Department of Fruit Plant Acclimatization at the NBG continues comprehensive fundamental and applied research aimed at assessing the adaptive potential and breeding capabilities of native and introduced fruit plants of the world flora. Special attention is given to neglected and underutilized species (NUS), which can serve as a basis for the development of alternative agroecosystems and enhance the resilience of fruit production under climate change conditions.

The Department's scientific results have a fundamental character, as they contribute to:

- a deeper understanding of the mechanisms of adaptation and reproduction of species under new conditions;
- the development of the concept of adaptive introduction as a tool to enhance the viability and productivity of crops;
- assessment of the genetic and biological potential of new and non-traditional species for breeding programs;

- development of methodologies for integrating NUS into scientifically justified agronomic systems.

The practical significance of the Department's work is reflected in the implementation of the developed cultivars in industrial, smallholder, and amateur horticulture across various natural and climatic regions of Ukraine (Klymenko & Skrypchenko, 2013; Klymenko et al., 2024).

The use of NUS, new, and non-traditional species contributes to expanding the assortment of fruits with high nutritional and medicinal value, increasing the biodiversity of crops, and creating an economic foundation for the development of new directions in fruit production and processing industries (Klymenko et al., 2021b; Zhurba et al., 2021c; Levon et al., 2022; Antoniewska-Krzeska et al., 2023; Grygorieva et al., 2025b, 2025c, 2025d, 2025e).

The results of the Department's research also have significant educational and scientific-theoretical value: they are used in training programs for specialists in horticulture, crop production, biology, and ecology, fostering the integration of fundamental science with its



**Figure 7.** *Lonicera caerulea* cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

practical application. This activity contributes to improving food security, the efficient use of Ukraine's biological resources, and the development of sustainable agroecosystems based on promising, underutilized, and non-traditional fruit plant species..

An important component of the Department's fundamental research is the study of allelopathic interactions and soil fatigue phenomena in perennial fruit plantations, which provides a deeper understanding of plant-soil system functioning under conditions of introduction

and intensive agroecosystem use. The role of allelochemical compounds in regulating plant growth and physiological-biochemical processes, maintaining functional status, and stabilizing the allelopathic regime of the soil (particularly through the application of silicon-containing compounds) has been established. Differences in agrochemical, microbiological, and allelopathic characteristics of soils under non-traditional fruit crop plantations in various soil-climatic conditions have also been demonstrated (Zaimenko et al., 2017, 2020, 2022; Pavliuchenko et al., 2019;



**Figure 8.** *Lycium* spp. cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

Likhanov et al., 2024). These findings have both theoretical and applied significance, as they provide a scientific basis for overcoming soil fatigue, optimizing agrotechnologies, and developing ecologically sustainable agroecosystems. This becomes particularly relevant in the context of soil degradation and increasing anthropogenic pressures, including those resulting from military actions (Grygorieva et al., 2025f).

### Scientific recognition and awards of the Department

The achievements of the scientists of the Department of Fruit Plant Acclimatization at the NBG have received wide recognition at both national and international levels. Over many years, their scientific activity has been honored with numerous prizes and awards, including seven L.P. Symyrenko Prizes, three V.Y. Yuriev Prizes of the Presidium of the NAS of Ukraine, the M.M. Gryshko Prize of the NBG, the Verkhovna Rada of Ukraine Prize for young scientists, and the President of Ukraine Prize for young scientists. Additionally, researchers received the National Academy of Sciences of Ukraine distinction “For Professional Achievements”

and the Jubilee Honorary Diploma of the NAS Presidium “For Achievements and Dedicated Conscientious Work”.

Of particular note is the State Prize of Ukraine in Science and Technology, “Ecological Assessment of the Diversity of Ukraine’s Plant World, Its Conservation, Restoration, and Rational Use for Innovative Development”, which recognizes the Department’s contributions to fundamental and applied research on the genetic resources of fruit plants. International recognition has been confirmed through medals and honors from the Slovak University of Agriculture in Nitra, including awards from the dean of the Faculty of Agrobiology and Food Resources and distinctions from the university rector for active long-term collaboration, implementation of joint international projects, and training of scientific personnel (postgraduate and doctoral internships).

These awards attest not only to the high professional level of the Department’s scientists but also to the significant contribution of the Department to the development of the theoretical foundation of introduction, acclimatization, and breeding of fruit plants, as well as to the implementation of socio-economic programs in Ukraine and international scientific cooperation.



**Figure 9.** *Pseudocydonia sinensis* cultivated at the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

### International scientific cooperation and integration of the Department into global research

The Department of Fruit Plant Acclimatization of the NBG actively integrates into the international scientific community through cooperation agreements with leading foreign institutions: the Slovak University of Agriculture in Nitra, the National Agri-Food Centre – Research Institute of Plant Production (Piešťany, Slovakia), the Coordination and Transfer Center for Applied Research in Eco-Agriculture (Selenča, Serbia), the Dendropark and Institute of Physiography in Bolestrašice (Poland), and the University of Wrocław (Poland). These partnerships involve conducting joint comprehensive scientific research, enhancing educational activities (exchange of researchers, postgraduate and doctoral students, development of methodological guidelines, textbooks, and lectures), and studying non-traditional fruit species for applications in the food, processing, confectionery, and pharmaceutical industries, as well as in agriculture (Grygorieva, 2015, 2024; Grygorieva et al., 2025a, 2025b).

Within the framework of this cooperation, non-traditional plant species are studied in natural and introduced populations in Slovakia, Poland, and Ukraine to compile comprehensive information on their status, collect genetic material, analyze the variability

of bioecological and economic traits, assess their potential for analytical and synthetic breeding, select promising forms, and carry out their subsequent propagation and transfer to variety trials. Special attention is given to the biochemical evaluation of fruits and processed products, the development of information systems for genotype registration, and the creation of classifiers for genotype assessment.

Based on collaboration with the Institute for Biodiversity Conservation and Biological Safety of the Slovak University of Agriculture in Nitra, the creation of the International Network AgroBioNet was initiated, which unites over 250 experts and more than 50 researchers from 21 countries. The network's activities are focused on promoting international scientific cooperation in the study of non-traditional, neglected, and underutilized plant species that are important for food security and the sustainable development of the agricultural sector (Klymenko et al., 2015; Brindza & Grygorieva, 2019; Brindza et al., 2021).

Within the framework of AgroBioNet, international scientific conferences are held dedicated to the conservation and use of non-traditional plant species, including seven conferences in Ukraine, Slovakia, Serbia, and Poland. Since 2010, the International Cornelian Cherry Festivals have been organized annually at the Bolestraszyce Arboretum (Poland) with the participation of scientists, researchers,



**Figure 10.** International scientific journal *Agrobiodiversity for Improving Nutrition, Health and Life Quality*, established in collaboration with the Slovak University of Agriculture in Nitra and the Department of Fruit Plant Acclimatization of the M.M. Gryshko National Botanical Garden of the NAS of Ukraine.

farmers, and enthusiasts from various European countries, where the Department acts as a co-organizer.

Together with the Slovak University of Agriculture in Nitra and the Department of Fruit Plant Acclimatization of the NBG, the International Scientific Journal “*Agrobiodiversity for Improving Nutrition, Health and Life Quality*” (Fig. 10) was established. From 2017 to 2025, 14 issues have been published, promoting the dissemination of high-quality research with international peer review.

Thus, the Department’s international cooperation ensures the integration of Ukrainian scientific research into global programs on the conservation, introduction, and breeding of non-traditional fruit plants, contributing both to the scientific-theoretical development of the field and to the practical use of genetic resources in Ukraine’s socio-economic programs.

## Conclusions

The Department of Fruit Plant Acclimatization of the M.M. Gryshko National Botanical

Garden of the NAS of Ukraine plays a key role in the conservation and study of Ukraine’s fruit crop genetic resources, integrating research on new, non-traditional, and underutilized species. Long-term work on introduction, acclimatization, and breeding has made it possible to determine the adaptive and reproductive traits of various species, develop a scientifically grounded concept of adaptive introduction, and assess their breeding potential. The Department has established unique collections of fruit plants, providing a foundation for further breeding work, scientific research, and the training of highly qualified specialists in horticulture and plant cultivation. The conducted studies facilitate the practical implementation of promising species and cultivars into production, enhance the resilience of agroecosystems, promote alternative and innovative fruit production, and support the utilization of bioresources in Ukraine’s socio-economic programs. The Department’s scientific activities integrate Ukrainian research into the international context, ensure the preservation of genetic heritage, and form the basis for the development of a global research network on non-traditional fruit plants.

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## Відділ акліматизації плодкових рослин: історія, наукові здобутки та перспективи

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Відділ акліматизації плодкових рослин Національного ботанічного саду імені М.М. Гришка НАН України є провідним науковим підрозділом у сфері інтродукції, акліматизації та селекції нових, нетрадиційних і малопоширених (NUS) плодкових рослин. Протягом 1946–2025 рр. відділ створив одну з найбагатших в Україні колекцій плодкових культур, що налічує 855 таксонів із 39 родів і 20 родин, включаючи види харчового, лікарського та декоративного призначення. Наукова діяльність відділу охоплює вивчення адаптаційної та репродуктивної здатності видів, біохімічний та алелопатичний аналіз, оцінку селекційного потенціалу та зимостійкості, а також розробку концепції адаптивної інтродукції, що підвищує життєздатність рослин і стимулює формотворчі процеси в нових умовах. Завдяки багаторічним дослідженням відділу в культуру введено численні перспективні види плодкових рослин світової флори, зокрема *Actinidia* spp., *Asimina triloba*, *Schisandra chinensis*, *Cornus mas*, *Ziziphus jujuba* та інші, а також створено 75 сортів, що внесені до Державного реєстру сортів рослин України. Практичне значення роботи відділу проявляється у впровадженні сортів у промислове, фермерське та аматорське садівництво, підвищенні харчової та лікувальної цінності плодів, збереженні біорізноманіття та розвитку стійких агросистем. Наукові результати сприяють поглибленому розумінню механізмів адаптації, оцінці генетичного потенціалу та інтеграції NUS у селекційні програми. Відділ активно співпрацює з міжнародними установами, бере участь у міжнародних мережах, конференціях і виданні журналу *Agrobiodiversity for Improving Nutrition, Health and Life Quality*, що забезпечує глобальне використання результатів досліджень та підтримує соціально-економічні програми України.

**Ключові слова:** відділ акліматизації плодкових рослин, інтродукція, селекція, знехтувані та недостатньо використовувані види, NUS, генетичні ресурси, стійке плодівництво