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Plant Collections of the E. Gareev Botanical Garden: Diversity and Characteristics

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Abstract

The article presents the results of long-term research on plant introduction and the establishment of plant collections at the E. Gareev Botanical Garden of the National Academy of Sciences of the Kyrgyz Republic. The aim of the research was to preserve, expand, and comprehensively investigate the living plant collection of the E. Gareev Botanical Garden. Phenological, ontogenetic, and biological characteristics were examined, along with plant adaptation to the soil and climatic conditions of the Chui Valley. The living collection comprises 495 woody and shrub taxa (48 families, 121 genera), including 80 coniferous and 415 deciduous species. Notably, 63 native Kyrgyz taxa were identified, comprising 5 coniferous and 58 deciduous tree species, with 30 subendemics and 2 endemics. The herbaceous collection includes 57 native Kyrgyzstan species, of which 5 are endemic, 37 are subendemic, and 14 are listed in the Red Book of the Kyrgyz Republic. Additionally, 117 medicinal species and varieties were documented, with 48 species (41 genera, 15 families) representing the native flora. Species from the low-mountain valleys, foothills, and lower mountain belts exhibited the highest adaptation success, whereas high-mountain species showed comparatively lower establishment rates. These findings provide a scientific basis for optimizing ex situ conservation strategies and expanding the botanical garden's collection through targeted introduction programs.

Keywords: natural flora; endemics; adaptation; conservation; Kyrgyzstan

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1. Introduction

Botanical gardens are institutions that maintain documented collections of living plants for the purposes of scientific research, biodiversity conservation, public demonstration, and education [1]. Globally, botanical gardens play an increasingly important role in mitigating plant biodiversity loss and supporting conservation efforts. According to data from Botanic Gardens Conservation International (BGCI), there are approximately 3000 botanical gardens worldwide, cultivating over 80,000 species of higher plants—accounting for one-third of all currently described species (International Agenda, 2000) [2]. These living collections serve

as crucial ex situ conservation reservoirs, particularly for rare, endemic, and threatened taxa, and contribute significantly to international conservation strategies and sustainable development goals. The conservation of plant diversity in cultivated conditions represents a complementary approach to in situ protection, especially in regions facing rapid habitat loss, climate change, and anthropogenic pressure. Ex situ collections not only safeguard genetic material but also provide opportunities for research on plant adaptation, reproductive biology, and potential reintroduction programs. In this context, botanical gardens function as living gene banks, preserving the evolutionary potential of species that may otherwise face extinction in their natural habitats.

Since its establishment in 1938, the E. Gareev Botanical Garden of the National Academy of Sciences of the Kyrgyz Republic has conducted systematic research on the introduction and acclimatization of both local and foreign plant species. As a leading botanical institution in Central Asia, the garden plays a key role in documenting, preserving, and studying the region's unique and diverse flora. The geographical position of Kyrgyzstan, characterized by dramatic altitudinal gradients from lowland deserts to high-mountain ecosystems, contributes to exceptional plant diversity, including numerous endemic and relict species of significant scientific and conservation value. Living collections form the core of botanical gardens, serving as essential resources for conserving genetic diversity under cultivated conditions, particularly with respect to native flora. The E. Gareev Botanical Garden has prioritized the collection and study of local plant species, recognizing their fundamental importance for understanding regional biodiversity patterns and for developing evidence-based conservation strategies. Through the collective efforts of multiple generations of botanists, the garden has amassed a substantial collection that includes trees and shrubs, ornamental flowering plants, medicinal plants, groundcover species, and fruit-bearing plants, many of which are of considerable ecological and economic importance. The conservation significance of these collections is underscored by national and regional biodiversity assessments. The Red Book of the Kyrgyz Republic lists 83 species of wild plants requiring protection [3], reflecting the growing conservation needs within the country. According to Popova, Malosieva, and Kenjebaeva [4], the E. Gareev Botanical Garden currently maintains 170 species of native flora in its native flora collection, among which 37 are classified as rare and protected, and 16 are included in the Red Book. Of these Red Book species, 3 are endemic, and 13 are subendemic to the region. These figures underscore the garden's significance as a refuge for threatened plant species and as a center for research on the biology and ecology of rare taxa.

The arboretum collection, representing the woody component of the garden's living collections, comprises 495 taxa representing 48 families and 121 genera. This includes 80 coniferous taxa and 415 deciduous trees and shrubs. This rich dendrological diversity not only supports comparative studies on growth, adaptation, and reproductive biology but also provides a valuable resource for landscape restoration, urban greening, and educational outreach. The collection includes representatives of major temperate forest genera, as well as introduced species from other regions, facilitating research on plant performance under local climatic conditions. Beyond the arboretum, the garden maintains specialized collections of herbaceous perennials, annual flowering plants, medicinal herbs, and economically valuable species. These collections serve multiple purposes: they preserve genetic diversity, support educational programs for students and the public, provide plant material for research projects, and contribute to the aesthetic and recreational value of the garden as an urban green space. Many accessions have been carefully documented with respect to their provenance, cultivation requirements, and phenotypic characteristics, creating a valuable dataset for future research.

Despite extensive efforts in collection development and research on introduction, a comprehensive characterization of the garden's plant collections remains incomplete. Detailed documentation of taxonomic composition, geographical origin, conservation status, and morphological diversity is essential for maximizing the scientific and conservation value of these living collections. This study provides a comprehensive overview of the plant collections maintained at the E. Gareev Botanical Garden, with particular emphasis on taxonomic diversity, conservation importance, and structural characteristics. We analyze the composition of the arboretum and native flora collections, examine the representation of rare and protected species, and discuss the significance of these collections for research, conservation, and education. By documenting the current state of the collections, we aim to establish a baseline for future monitoring, identify priorities for collection enhancement, and highlight the garden's contribution to plant conservation in Kyrgyzstan and Central Asia.

2. Materials and Methods

2.1. Study Area

The research was conducted at three laboratories of the Research Institute of the E. Gareev Botanical Garden, the National Academy of Sciences of the Kyrgyz Republic: experimental botany, the woody and shrub plants laboratory, and the floral and ornamental plants laboratory.

The E. Gareev Botanical Garden is situated in the foothills of the Chui Valley, near Bishkek, on the alluvial fans of the Alamedin and Ala-Archa Rivers, at an elevation of approximately 800 m a.s.l. The Chui Valley, located in northern Kyrgyzstan, spans an elevation range from 550 to 1 300 m a.s.l.

The study area exhibits a pronounced continental climate. July is the warmest month, and January is the coldest. Winters are cold, with frequent thaws and unstable snow cover. Snow cover persists for 75–90 days, typically accumulating in November–December and melting in February–March. Annual precipitation averages 400–600 mm, no more than 40% of which falls during the growing season. Mean annual relative humidity is 61%.

Mean January temperatures range from −5 to −7 °C. Daytime temperatures typically vary from 0 to −4 °C, whereas nighttime temperatures can drop to −10 to −15 °C. Spring is marked by late frosts; autumn is generally dry and warm but with early frosts. Summers are hot and dry, characterized by intense solar radiation and very low relative humidity (25–30%). The mean annual temperature is +10.5 °C. Mean daily temperatures in summer reach +21.9 °C in June, +24.1 °C in July, and +22.7 °C in August. Absolute maximum temperatures occur in the second half of summer (July–August), reaching +40.4 °C [5]. The soils are classified as sierozems.

2.2. Data Collection

The findings presented in this study are derived from long-term research on the introduction and acclimatization of plants, encompassing both introduced and native species of Kyrgyzstan's flora. The E. Gareev Botanical Garden began collecting and studying native Kyrgyz plants in the 1950s, and targeted investigations of these species under cultivated conditions have continued to the present. The study and expansion of introduced plant collections were facilitated through the exchange of seeds, cuttings, and live plants with 140 botanical gardens and arboreta across 37 countries. The propagation, cultivation, study, and conservation of these plant resources enabled the development of living plant collections, which constitute the primary asset of botanical gardens. During the preparation of this article, a comprehensive review of the scientific literature was also conducted, drawing upon the published studies by the botanical garden staff as well as the authors' previous research.

2.3. Research Methods

The introduction process was sequential and consisted of several stages, including field-based plant inventory and data collection, mobilization of source material, and primary and secondary introduction trials. To identify and mobilize source materials from other regions, an exchange of seeds (Index Seminum), cuttings, and live plants with other botanical gardens was used. Plants and seeds of native flora were collected during expeditions to their natural habitats and specially protected natural areas. Primary introduction trials included assessments of drought tolerance, winter hardiness, phenology, growth, development, seed production, vegetative propagation, and collection creation.

Winter hardiness was assessed through long-term observation of plant survival under natural conditions over multiple winters. Evaluations were conducted following overwintering, as plant health is fully manifested only after the onset of vegetation and bud break. The extent of damage was quantified by determining the proportion of affected tissues. Growth parameters were measured monthly from May to November, including plant height, lateral shoot length, number of newly formed shoots, and root collar diameter. Phenological observations followed standard ground-based protocols. These included monitoring of shoot development, beginning with bud swelling (onset of growth); foliage formation; flowering; and concluding with autumn leaf (needle) senescence, fruit and seed maturation, or abscission. Drought tolerance was assessed using field methods under natural conditions. Visual and anatomical evaluations were employed to identify adaptive traits, including cuticle thickness, waxy coating, leaf pubescence, and root depth. Propagation was conducted through both sexual and asexual methods. Seed propagation was performed via winter and spring sowing, whereas vegetative propagation was carried out in a breeding greenhouse. Secondary introduction trials were conducted to test the use of plants in landscape design, cultivar selection, nursery production, and other applications.

3. Results and Discussion

3.1. Collection of Coniferous Plants

Coniferous forests cover approximately 280,000–284,000 hectares, accounting for almost 68% of the republic's total forested area. The main forest areas are concentrated in the Tien Shan and Pamir-Alai Mountain ranges. In the natural flora of Kyrgyzstan, conifers are represented by *Picea schrenkiana* subsp. *tianschanica* (Rupr.) Bykov, *Abies sibirica* subsp. *semenovii* (B. Fedtsch.) Farjon, and junipers. According to G.A. Lazkov [6], six species of juniper grow in Kyrgyzstan: *Juniperus sibirica* Burgsd., *Juniperus turkestanica* Kom., *Juniperus semiglobosa* Regel., *Juniperus sabina* L., *Juniperus pseudosabina* Fisch. & C. A. Mey., and *Juniperus zeravschanica* Kom.

The collection of coniferous plants includes the following number of species: *Chamaecyparis* Spach.—9, *Juniperus* L.—17, *Platycladus orientalis* (L.) Franco—2, *Thujopsis dolabrata* (L.f.) Siebold & Zucc., *Thuja occidentalis* L.—25, *Abies* Mill.—6, *Larix* Mill.—2, *Picea* A. Dietr.—8, *Pinus* L.—8, *Pseudotsuga menziesii* (Mirb.) Franco, and *Tsuga canadensis* (L.) Carrière.

Of the eight conifer species native to the country, five are maintained in the collection (Table 1). Population sizes within the collection are adequate for *Juniperus sabina* L. (20 individuals) and *Picea schrenkiana* subsp. *tianschanica* (Rupr.) Bykov (11 individuals). In contrast, *Abies sibirica* subsp. *semenovii* (B. Fedtsch.) Farjon, *Juniperus semiglobosa* Regel., and *Juniperus sibirica* Burgsd. are represented by only one or two specimens each, which is explained by their poor reproductive success under the conditions in the E. Gareev Botanical Garden.

Table 1. Collection of coniferous plants of the natural flora in the E. Gareev Botanical Garden of Kyrgyzstan.

Family	Genus	Species	No. of Specimens or Individuals
Cupressaceae Gray	*Juniperus* L.	*Juniperus semiglobosa* Regel.	2
		Juniperus sibiria Burgsd.	1
		Juniperus sabina L.	20
Pinaceae Spreng. ex F. Rudolphi	*Abies* Mill.	*Abies sibirica* subsp. *semenovii (B. Fedtsch.) Farjon*	1
	Picea A. Dietr.	*Picea schrenkiana* subsp. *tianschanica (Rupr.) Bykov*	11

The introduction of native mountain flora to the Chui Valley—where the E. Gareev Botanical Garden of the National Academy of Sciences is located—is hindered by difficulties in acclimatization and adaptation to the lowland's natural, climatic, and edaphic conditions. Consequently, introductions often fail. Given this context, the addition of a single specimen of *Abies sibirica* subsp. *semenovii* (B. Fedtsch.) Farjon to the collection is particularly noteworthy. This endemic, relict, boreal fir subspecies grows exclusively in the Western Tien Shan of Kyrgyzstan, specifically in the Aksy and Toktogul districts and partially in the Talas region. The general inventory of this species was recorded in the Red Book of the Kyrgyz Republic [3]. The species has been under trial at the botanical garden since 1962. Despite the challenges of acclimatization in the Chui Valley, the garden is undertaking measures to preserve this species in its collection.

Currently, conifers are actively used in both private and urban landscaping in the Chui Valley. However, the available selection remains limited, comprising *Picea schrenkiana* subsp. *tianschanica* (Rupr.) Bykov, *Picea pungens* Engelm., *Picea pungens* f. *glauca* (Regel) Beissn., *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, *Thuja occidentalis* f. *fastigiata* (H. Jaeger) Beissn., *T. occidentalis* 'Golden', *T. occidentalis* 'Smaragd', *Juniperus sabina* L., *J. virginiana* L., *J. communis* L., and *Platycladus orientalis* (L.) Franco. In particular, *Thuja occidentalis* f. *fastigiata* (H. Jaeger) Beissn. is ubiquitously planted in large quantities. Although there is considerable conifer biodiversity in the collection, these species have not become widespread in landscaping practice. Therefore, a key goal is to expand the range of conifers for landscaping, which can be achieved through a comprehensive assessment of the adaptive, ornamental, and economically valuable traits of introduced species.

The introduction of new conifer species and forms into landscaping and landscape architecture often occurs spontaneously. There is a clear need to study their biological characteristics in order to enrich the collection and to develop a scientifically based modern assortment for implementation in green building practices in the Chui Valley.

The demand for conifer planting material is not fully satisfied, owing to imperfections in propagation and cultivation technologies [7,8]. Seed propagation of many conifers is constrained by poor seed quality, slow germination, and prolonged seedling growth. Moreover, many ornamental conifers fail to produce seeds, and when they do, the offspring often do not inherit the desired ornamental traits [9].

Vegetative propagation can be used for conifers that are poorly productive and difficult to propagate by cuttings. However, rooting ability varies among species: some root easily, while others are incapable of vegetative propagation by cuttings. Furthermore, the rooting process for conifer cuttings is generally very slow [10]. Plynskaya et al. [11] developed a micropropagation technology for more than 25 conifer species, using vegetative plant organs as explants for clonal micropropagation. The feasibility of using such explants for regeneration in pine, larch, Norway spruce, Siberian juniper, and single-seeded conifers was demonstrated.

Thus, the limited use of conifers in landscaping is attributable not only to climatic conditions but also to propagation difficulties and slow growth. Consequently, the present research focuses on improving conifer propagation technologies. The identification, collection, and mobilization of source material, primary and secondary introduction trials, and the propagation and cultivation of plant material are fundamental requirements of experimental botany. Accordingly, the botanical garden's Laboratory of Experimental Botany conducts research on the biological characteristics (phenology and growth), winter hardiness, drought tolerance, and propagation and cultivation of introduced species.

An assessment of the success of introducing *Cupressaceae* species in the Chuy Valley was conducted. The scales developed by P. I. Lapin and S. V. Sidneva were used to assess the prospects of introduction. Highly promising: plants that complete their full developmental cycle, suffer no frost damage, and produce viable offspring. Promising: species that flower and bear fruit but occasionally require minimal protection against extreme weather conditions. Of limited promise: plants that can grow and even flower but struggle with the climate, rarely bear fruit, and do not regenerate naturally without constant care. Unpromising: species that suffer severe frost damage in winter or die shortly after planting [12]. According to our data, highly promising garden forms of *Thuja occidentalis* L. are considered to be 'Ellwangeriana', 'Globosa nana', 'Alba', 'Brabant', 'Dimosa', and 'Spiralis'. Among junipers, highly promising are *Juniperus sabina* 'Tamariscifolia', *Juniperus sabina* 'Aurea', *Juniperus horizontalis* 'Blue Chip', *Juniperus squamata* 'Blue Carpet', *Juniperus scopulorum* 'Blue Arrow', *Juniperus horizontalis* 'Andorra Compacta', and *Juniperus communis* var. depressa 'Aurea'. All these taxa are recommended for landscaping in the Chui Valley. *Thuja occidentalis* 'Hoveyi' and *Chamaecyparis pisifera* 'Filifera' are considered of limited promise, whereas *Cryptomeria japonica* 'Globosa' and *C. japonica* 'Elegans' are completely unsuitable and cannot be used for landscaping in this region. The range of conifers suitable for urban landscaping in the Chui Valley has thus been expanded and updated. Assessing their potential is crucial for their widespread distribution and introduction into cultivation in other regions of the Kyrgyz Republic [13].

Nurmanbetova and Akhmatov [14,15] conducted studies on the vegetative and seed propagation characteristics of spruce, pine, and fir. The most effective concentrations and combinations of synthetic growth stimulants for inducing rooting in *Picea pungens* f. *glauca* (Regel) Beissn. cuttings were 0.3 g NAA + 0.9 g IBA (43% rooting) and 0.15 g NA + 0.6 g NAA + 0.9 g IBA (30% rooting). Among biostimulants, honey (14 g/L) and honey (14 g/L) combined with aloe (18 g/L) were the most effective, yielding a maximum rooting percentage of 10–13% for *Picea pungens* f. *glauca* (Regel) Beissn. Spring was identified as the optimal time for cuttings. For seed propagation under the introduction conditions of the Chui Valley, pre-winter sowing is necessary to obtain uniform seedlings with high soil emergence. Using this method, seed germination rates were 42% for *Picea schrenkiana* subsp. *tianschanica* (Rupr.) Bykov and 64% for *Pinus nigra* subsp. *pallasiana* (Lamb.) Holmboe, while *Abies alba* Mill. seeds did not germinate. To preserve seedlings, treatment of the soil and seedlings with fungicides is required. The growth stimulants Clonex and VitroClon Rooting Complex positively affected the rooting of *Picea pungens* f. *glauca* (Regel) Beissn. cuttings. Cuttings treated with VitroClon Rooting Complex achieved up to 31% rooting, whereas those treated with Clonex reached up to 10%.

Despite substantial progress in introduction biology, acclimatization research, and propagation studies, the practical utilization of conifer diversity remains limited. This gap indicates that scientific achievements have not yet been fully translated into large-scale production and landscape implementation. One limiting factor is the insufficient development of advanced propagation infrastructure, particularly for modern biotechnological approaches such as micropropagation and tissue culture. Establishing specialized nurseries

and integrating biotechnological propagation methods could increase the availability of planting material and facilitate broader utilization of valuable conifer taxa.

3.2. Collection of Deciduous Woody Plants

The deciduous woody plants occurring in the natural flora of Kyrgyzstan and growing in the E. Gareev Botanical Garden encompass 13 families, 25 genera, 58 taxa, and 451 specimens (Table 2). Among these, 30 are subendemic, and two are endemic, while the remaining species are widely distributed. The following plants were propagated and preserved: *Betula pendula* Roth, *Juglans regia* L., *Clematis orientalis* L., *Armeniaca vulgaris* Lam., *Cotoneaster multiflorus* Bunge, *Malus sieversii* (Ledeb.) M. Roem., *Padus racemosa* C.K.Schneid., *Populus bolleana* Lauche, *Prunus sogdiana* Vassilcz. f. *fructo-lutea*, *Pyrus korshynskyi* Litv., *Salix rosmarinifolia* Laest. ex Andersson and *Celtis caucasica* Willd.

Table 2. Deciduous woody plants collected from the natural flora of Kyrgyzstan and grown in E. Gareev Botanical Garden.

Family	Taxon	No. of Specimens or Individuals,	Note, Bloom
Berberidaceae Juss.	*Berberis* L.		
	Berberis integerrima Bunge	2	subendemic
	Berberis nummularia Bunge	1	subendemic
	Berberis oblonga (Regel) C. K. Schneid.	1	subendemic
	Berberis sphaerocarpa Kar. & Kir.	1	subendemic
Betulaceae Gray	*Betula* L.		
	Betula pendula Roth	11	
	Betula procurva Litv.	6	subendemic
	Betula tianschanica Rupr.	1	subendemic
	Betula turkestanica Litv.	5	subendemic
Caprifoliaceae Juss.	*Lonicera* L.		
	Lonicera altmannii Regel & Schmalh.	1	subendemic
	Lonicera karelini Bunge ex P.Kirillov	2	subendemic
	Lonicera korolkovii Stapf	5	subendemic
	Lonicera microphylla Willd. ex Schult.	6	
	Lonicera stenantha Pojark.	3	
	Lonicera tatarica L.	3	
	Lonicera tatarica f. rosea (Regel) Rehder	2	
Elaeagnaceae Juss.	*Elaeagnus* Tourn. ex L.		
	Elaeagnus angustifolia L.	4	
	Elaeagnus orientalis L.	1	
Fabaceae Lindl.	*Caragana* Fabr.		
	Caragana aurantiaca Koehne	3	subendemic
	Caragana turkestanica Kom.	2	subendemic
Grossulariaceae DC.	*Ribes* L.		
	Ribes janczewskii Pojark.	1	subendemic

Table 2. *Cont.*

Family	Taxon	No. of Specimens or Individuals,	Note, Bloom
Juglandaceae DC. ex Perleb.	*Juglans* L.		
	Juglans regia L.	14	
Oleaceae Hoffmanns. & Link	*Fraxinus* Tourn. ex L.		
	Fraxinus sogdiana Bunge	8	subendemic
Polygonaceae Juss.	*Atraphaxis* L.		
	Atraphaxis pyrifolia Bunge	2	subendemic
Ranunculaceae Juss.	*Clematis* L.		
	Clematis orientalis L.	23	
Rosaceae Juss.	*Armeniaca* Scop.		
	Armeniaca vulgaris Lam.	18	subendemic
	Cerasus Mill.		
	Cerasus mahaleb (L.) Mill.	2	
	Cotoneaster Medik.		
	Cotoneaster melanocarpus (Bunge) Fisch. ex Loudon	4	
	Cotoneaster multiflorus Bunge	12	
	Crataegus L.		
	Crataegus almaatensis Pojark.	4	subendemic
	Crataegus korolkovii L.Henry.	1	
	Crataegus songorica K. Koch	5	subendemic
	Exochorda Lindl.		
	Exochorda tianschanica Gontsch.	3	subendemic
	Malus Mill.		
	Malus niedzwetskya na Dieck	5	subendemic, EN [3]. in mid- to late April or early May
	Malus sieversii (Ledeb.) M. Roem.	88	subendemic, VU [3]. in the second or third ten-day period of April
	Padus Mill.		
	Padus racemosa C. K. Schneid.	64	
	Dasiphora Raf.		
	Dasiphora fruticosa (L.) Rydb.	5	
	Prunus L.		
	Prunus divaricata Ledeb. f. *atropurpurea* Jacq.	4	
	Prunus sogdiana Vassilcz. f. *fructo-lutea*	10	
	Prunus sogdiana Vassilcz. f. *fructo-rubra*	6	
	Prunus sogdiana Vassilcz. f. *melanocarpa* Vass.	9	

Table 2. *Cont.*

Family	Taxon	No. of Specimens or Individuals,	Note, Bloom
Rosaceae Juss.	*Pyrus* L.		
	Pyrus asiae-mediae (Popov) Maleev	1	subendemic, DD [3]. in April and lasts 10–14 days
	Pyrus korshynskyi Litv.	10	subendemic, CR [3]. in the second half of April and lasts two weeks
	Pyrus regelii Rehder	8	subendemic
	Pyrus tadshikistanica Zaprjagaeva sp. *nova*	4	subendemic
	Rosa L.		
	Rosa albertii Regel	3	
	Rosa beggeriana Schrenk ex Fisch. & C. A. Mey.	7	
	Rosa corymbifera Borkh.	2	
	Rosa fedtschenkoana Regel	1	subendemic
	Rosa kokanica (Regel) Regel ex Juz.	1	subendemic
	Rosa webbiana Wall. ex Royle	1	
	Rubus L.		
	Rubus idaeus L.	5	
Salicaceae Mirb., nom. cons.	*Populus* L.		
	Populus alba L.	8	
	Populus bolleana Lauche	25	subendemic
	Populus densa Kom.	2	subendemic
	Populus thalassica Kom.	2	endemic
	Populus tianschanica Tkatsch.	3	endemic
	Salix L.		
	Salix rosmarinifolia L.	10	
Ulmaceae Mirb., nom. cons.	*Celtis* L.		
	Celtis caucasica Willd.	10	
	Total: 13 families, 25 genera, 58 taxa	451	

Four species of deciduous woody plants are listed in the Red Data Book of the Kyrgyz Republic (2007). The following species accounts draw on data from the monograph by V.I. Tkachenko [16] and the article by G.V. Malosieva et al. [17].

Malus niedzwetzkyana Dieck—EN (Endangered)

A subendemic small tree, reaching 6–8 m in height (Figure 1a). In Kyrgyzstan, it occurs in the Chatkal, Fergana, and Uzun-Akhmat ranges. Its declining distribution is attributed to agricultural expansion, overgrazing, poor seed reproduction, and hybridization with other species and varieties. In the botanical garden, this species is cultivated from seeds collected in the Chatkal, Uzun-Akhmat, and Talas ranges in 1952–1953. The growing season typically begins in the second half of March or in early April during colder years. Depending on

spring conditions, flowering occurs in mid- to late April or early May, lasting approximately two weeks. Fruits ripen in July–August (Figure 1b). Leaf fall commences after the first cold period in late October; in some years, early frost may cause remaining leaves to freeze. Shoots become fully lignified by winter. The trees exhibit good winter hardiness and relative drought tolerance. Seed propagation is successful. The Arboretum Reserve currently maintains five specimens. This species is widely utilized in breeding programs.

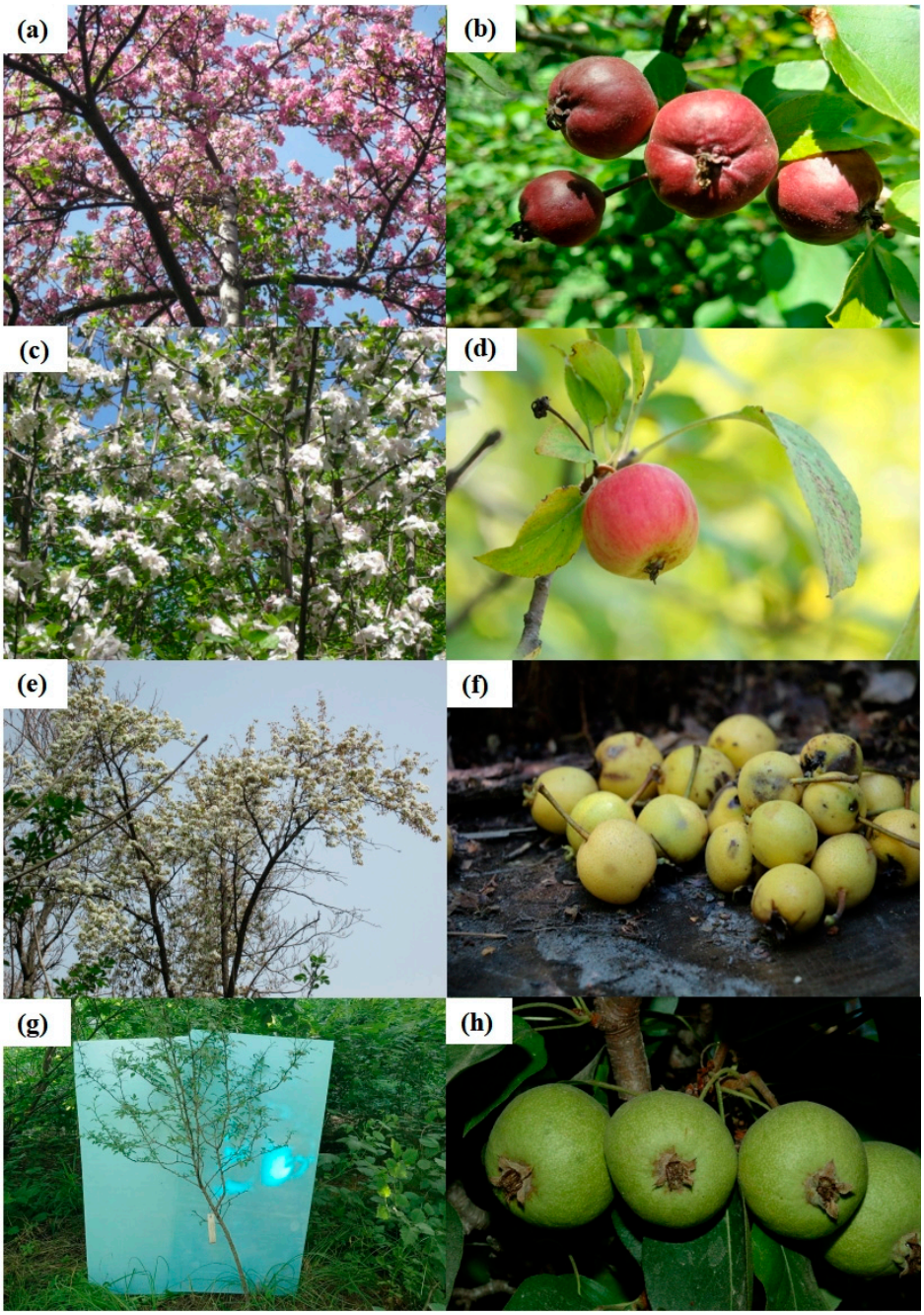


Figure 1. Photos of the research collections: (**a**) tree of *Malus niedzwetzkyana* Dieck, (**b**) fruits of *M. niedzwetzkyana* Dieck, (**c**) tree of *M. sieversii* (Ledeb.) M. Roem., (**d**) fruits of *M. sieversii* (Ledeb.) M. Roem., (**e**) tree of *Pyrus asiae-mediae* (Popov) Maleev, (**f**) fruits of *P. asiae-mediae* (Popov) Maleev, (**g**) tree of *P. korshinskyi* Litv., and (**h**) fruits of *P. korshinskyi* Litv.

Malus sieversii (Ledeb.) M. Roem.—VU (Vulnerable)

A subendemic tree, up to 10 m in height (Figure 1c). In Kyrgyzstan, it is distributed across the Chatkal, Fergana, Uzun-Akhmat, Atoynok, Kyrgyz, and Talas ranges. Wild

populations are declining due to agricultural expansion, increased grazing pressure, and hybridization with other species and varieties. Cultivated in the garden from seeds collected in natural habitats in 1953–1954. The growing season begins in mid-March or early April, depending on spring conditions. Flowering occurs in the second or third ten-day period of April and lasts about two weeks. Fruits ripen in July–August (Figure 1d). Leaf fall typically begins after the first light frosts in late October and often concludes with the freezing of remaining leaves. Shoots become fully lignified by winter. The trees are winter-hardy and drought-tolerant. The species propagates well by seed and is used in breeding. The Arboretum Reserve currently houses 88 mature specimens.

Pyrus asiae-mediae (Popov) Maleev—DD (Data Deficient)

The taxonomic status of this species remains unclear. It is a subendemic tree, 12–16 m in height, with a spreading crown (Figure 1e). In Kyrgyzstan, it is found in the Chatkal, Pskem, and Uzun-Akhmat ranges. This species has been cultivated in the botanical garden since 1961, with seeds originating from the Tegene tract. Under local conditions, growth begins in late March. Flowering occurs in April and lasts 10–14 days; in years with late spring frosts, slight freezing of pistils in open flowers has been observed. Fruits ripen in late August to early September (Figure 1f). Shoot growth ceases in July, allowing sufficient lignification by winter. Leaf fall typically begins in late October, with remaining leaves freezing after November frosts. The species overwinters without damage, exhibits relative drought tolerance, and reproduces well by seed. It shows resistance to fungal diseases and codling moth damage. It is used in breeding. The Arboretum Reserve contains one mature specimen.

Pyrus korshinskyi Litv.—CR (Critically Endangered)

A subendemic tree, 8–12 m in height, with a spreading, conical crown (Figure 1g). In Kyrgyzstan, it occurs in the Chatkal and Fergana ranges. The critical status of this species is attributed to uncontrolled fruit harvesting, collection of seedlings for rootstock use, uprooting of young plants, and livestock grazing. Cultivated in the garden since 1954 from seeds collected in the Shaitan-Sai Gorge, Fergana Range. In the botanical garden, growth begins in late March to early April. Flowering occurs in the second half of April and lasts two weeks. Fruits ripen in August (Figure 1h). The tree exhibits winter hardiness and relative drought tolerance. It reproduces well by seed and is utilized in breeding. The Arboretum Reserve currently has 10 specimens.

3.3. Collections of Herbaceous Plants

The collection of herbaceous plants for open and greenhouse cultivation comprises 1500 varieties, species, and forms, representing 150 genera across 40 families. The most abundantly represented families are *Iridaceae* Juss., *Liliaceae* Juss., and *Asteraceae* Bercht. & J. Presl, while the most species-rich genera include *Tulipa* L., *Iris* L., *Eremurus* M. Bieb., and *Allium* L.

Particular emphasis is placed on the collection of herbaceous species from the natural flora of Kyrgyzstan, which includes 14 species of *Eremurus* M. Bieb., 16 species of *Tulipa* L., 12 species of *Allium* L., and 13 species of *Iris* L., as well as representatives of *Fritillaria* Tourn. ex L. and *Eriodyctiol* Rodion. Among these, five are endemic, and 37 are subendemic, with 14 species listed in the Red Data Book of the Kyrgyz Republic [3]. Table 3 presents the results of our research on the collection of herbaceous plants from the native flora of Kyrgyzstan at the botanical garden. Most species are represented by sufficient numbers of specimens; however, 26 species (49%) are represented by only 2 to 8 specimens each, primarily due to poor propagation and cultivation difficulties.

Table 3. Collection of herbaceous plants of the natural flora in the E. Gareev Botanical Garden of Kyrgyzstan.

Family	Taxon	No. of Specimens or Individuals	Note, Bloom
Amaryllidaceae J.St.-Hil.	*Allium* L.		
	Allium aflatunense B.Fedtsch.	20	subendemic, in May
	Allium altissimum Regel	200	subendemic
	Allium caesium Schrenk	3	subendemic
	Allium caeruleum Pall.	3	subendemic
	Allium karataviense Regel	2	subendemic
	Allium obliquum L.	2	
	Allium oschaninii O. Fedtsch.	20	subendemic
	Allium pallasii Murray	2	subendemic
	Allium pskemense B. Fedtsch.	5	subendemic, EN [3]. in May–June
	Ixiolirion Fisch. ex Herb.		
	Ixiolirion tataricum (Pall.) Schult. & Schult. f.	5	
	Ungernia Bunge		
	Ungernia sewerzowii (Regel) B. Fedtsch.	2	subendemic
Araceae Juss.	*Arum* L.		
	Arum korolkowii Regel	50	subendemic
Asphodelaceae Juss.	*Eremurus* M. Bieb.		
	Eremurus alberti Regel	3	subendemic
	Eremurus altaicus (Pall.) Steven	5	
	Eremurus comosus O. Fedtsch.	2	subendemic
	Eremurus cristatus Vved.	5	subendemic
	Eremurus fuscus (O. Fedtsch.) Vved.	50	subendemic
	Eremurus inderiensis (M. Bieb.) Regel	2	subendemic
	Eremurus lactiflorus O. Fedtsch.	5	subendemic
	Eremurus regelii Vved.	10	subendemic
	Eremurus robustus (Regel) Regel	50	subendemic
	Eremurus stenophyllus (Boiss. & Buhse) Baker	50	subendemic
	Eremurus tianschanicus Pazij & Vved. ex Pavlov	40	subendemic
	Eremurus tianschanicus Pazij et Vved. ex Golosk.	7	subendemic
Asteraceae Bercht. & J.Presl	*Achillea* L.		
	Achillea filipendulina Lam.	10	
	Achillea millefolium L.	1	

Table 3. *Cont.*

Family	Taxon	No. of Specimens or Individuals	Note, Bloom
Iridaceae Juss.	*Crocus* L.		
	Crocus alatavicus Regel & Semen.	10	subendemic
	Iris L.		
	Iris kuschakewiczii B. Fedtsch.	20	subendemic
	Iris orchioides (Carrière) Vved.	25	subendemic, VU [3]. in mid-April for two weeks
	Iris graeberiana Sealy	5	endemic
	Iris alberti Regel	3	subendemic
	Iris bludovii Ledeb.	2	
	Iris halophila Pall. (*I. sogdiana* Bunge)	5	
	Iris lactea Pall. (*I. oxypetala* Bunge)	10	
	Iris loczyi Kanitz (*I. tianshanica* (Maxim.) Vved. ex. Woronov)	1	subendemic
	Iris ruthenica Ker-Gawl. (*I. brevituba* (Maxim) Vved. ex Nikitina)	1	
	Iridodictyum Rodion		
	Iridodictyum kolpakowskianum (Regel) Rodion	10	subendemic, VU [3]. in mid-March
Liliaceae Juss.	*Colchicum* L.		
	Colchium luteum Baker		
	Korolkowia Regel		
	Korolkovia sewerzowii (Regel) Regel	3	subendemic
	Petilium Ludw.		
	Petilium eduardii (Regel) Vved.	35	subendemic, EN [3]. in late March–early April
	Tulipa L.		
	Tulipa affinis Botschantz.	8	endemic, VU [3]. in the second half of April
	Tulipa × *anadroma* Botschantz.	60	endemic, VU [3]. in mid-April
	Tulipa bifloriformis Vved.	5	subendemic
	Tulipa binutans Vved.	10	subendemic
	Tulipa dasystemon (Regel) Regel	7	subendemic
	Tulipa dasystemonoides Vved.	5	subendemic
	Tulipa ferganica Vved.	15	subendemic

Table 3. *Cont.*

Family	Taxon	No. of Specimens or Individuals	Note, Bloom
Liliaceae Juss.	*Tulipa greigii* Regel	70	subendemic, EN [3]. in late April
	Tulipa heterophylla (Regel) Baker	4	subendemic
	Tulipa kaufmanniana Regel	90	endemic, VU [3]. in March
	Tulipa kolpakowskiana Regel	10	endemic, VU [3]. in April
	Tulipa korolkowii Regel	10	subendemic, VU [3]. in April
	Tulipa ostrowskiana Regel	12	endemic, VU [3]. in late April
	Tulipa platystemon Vved.	10	endemic, VU [3]. in mid-April
	Tulipa rosea Vved.	10	subendemic, EN [3]. in April
	Tulipa subbiflora Vved.	7	endemic
	Tulipa thalassica Lazkov	7	endemic
	Tulipa tarda Stapf	200	subendemic
	Tulipa tetraphylla Regel	15	endemic, VU [3]. in mid-April
	Tulipa zenaidae Vved.	10	endemic, VU [3]. in late April
Melanthiaceae Batsch ex Borkh.	*Veratrum* L.		
	Veratrum lobelianum Bernh.	3	
Papaveraceae Juss.	*Corydalis* DC		
	Corydalis ledebouriana Kar. & Kir	5	
Poaceae Barnhart	*Erianthus* Michx.		
	Erianthus ravennae (L.) P. Beauv.	10	
Scrophulariaceae Juss.	*Linaria* Mill.		
	Linaria vulgaris Mill.	10	
	Total: 9 families, 18 genera, 63 taxa	1243	

Separately, it is worth mentioning the collection of the *Iridaceae* Juss. family, which includes 24 species and 264 varieties belonging to 3 genera: *Crocus* L., *Iris* L., and *Iridodictyum* Rodion. The plant collection was established in 1952. In the natural flora of Kyrgyzstan, there are 21 species from the *Iridaceae* family, belonging to 4 genera: *Crocus* L.—2 species, *Iris* L.—17 species, and *Iridodictyum* Rodion—2 species. Of these, 11 species have been introduced. Six species are subendemic, and two species are endemic to Kyrgyzstan. *Iridodictyum kolpakowskianum* (Regel) Rodion and *Juno zenaidae* Vved. (*Iris graeberiana* Sealy) are listed in the Red Book of the Kyrgyz Republic.

Below is a description of plants listed in the Red Book of the Kyrgyz Republic [3].

Petilium eduardii (Regel) Vved.—Bulbous perennial. Brought from the Turkestan Range in 1980 and 2010. Currently, there are 5 mature bulbs and 30 small bulbs, 6 years old, grown

from seed. Blooms in late March–early April; the seeds ripen in June. Reproduced by seed, blooming 7–10 years after sowing; very rarely, the bulbs can divide after flowering. The bulbs do not tolerate excess moisture in the soil and can die from Fusarium, so it is recommended to grow them in raised areas with the addition of sand to the soil. A highly ornamental plant, it is recommended for use for landscaping and breeding. Subendemic. Due to intense anthropogenic pressure on the territory, flower picking, digging up bulbs, and grazing, populations in the natural environment are declining.

Iris (Juno) orchioides (Carrière) Vved.—A bulbous perennial, repeatedly brought from the Kyrgyz Mountains since 1970. The collection includes 25 mature bulbs. It blooms in mid-April for two weeks and bears fruit in June. It reproduces well both by seed and vegetatively and self-seeds. Three forms have been selected for flower color. The plant is decorative and resistant in cultivation. It can be used in landscaping for alpine slides, rock gardens, and selection. It is subendemic.

Iridodictyum kolpakowskianum (Regel) Rodion—A bulbous perennial. Repeatedly collected on the Kyrgyz Ridge from 1970 to 2016. The collection includes 10 specimens. It blooms in mid-March, the seeds ripen in May–June, and it reproduces poorly vegetatively. It can be used in breeding and in landscaping for alpine gardens. It is a subendemic.

Allium pskemense B. Fedtsch.—A bulbous perennial. Brought from the Chatkal Range in 1968 and 2015 (Figure 2a). The collection includes five specimens. It blooms in May–June and bears fruit in August. It reproduces by seed and has slow vegetative growth. It is ornamental, edible, and used in breeding. It is a subendemic plant.

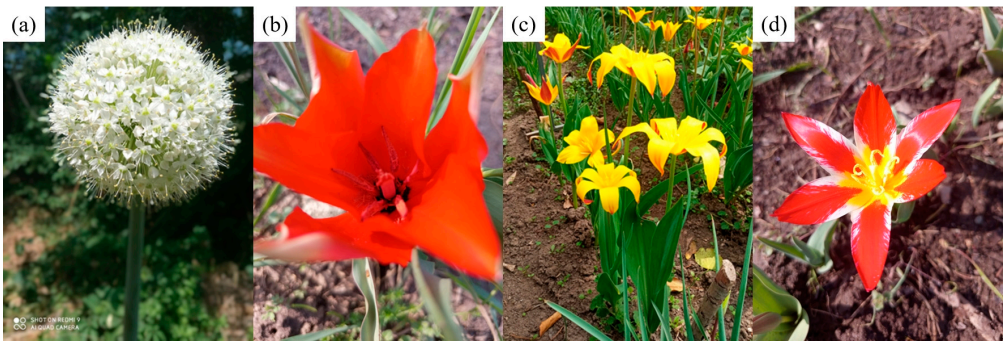


Figure 2. Photos of the research collections. (**a**) *Allium pskemense* B. Fedtsch., (**b**) *Tulipa affinis* Botschantz., (**c**) *Tulipa* × *anadroma* Botschantz. and (**d**) *Tulipa kaufmanniana* Regel.

Tulipa affinis Botschantz—Brought from the Turkestan Range in 1997 and 2019 (Figure 2b). The collection includes 8 bulbs. Blooms in the second half of April and bears fruit in June. Propagated by seeds. A very decorative and rare species. It can be used for breeding and landscaping. It is subendemic.

Tulipa × *anadroma* Botschantz—The bulbs were brought in 1970 and 2017 from the Chatkal Range (Figure 2c). The collection includes 10 mature bulbs and 50 bulbs obtained from seed sowing in 2019–2022. It blooms in mid-April and bears fruit in early summer. It reproduces by seed; if the bulbs reach a large size, they form daughter bulbs. Two forms have been selected based on flower stalk height. This highly decorative, rare, and hardy species can be used for landscaping and breeding. It is endemic.

Tulipa greigii Regel—Has been repeatedly brought from the foothills of the Kyrgyz Range since 1970. The collection includes 10 mature bulbs and 60 small bulbs obtained from seed sowing in 2019–2022. It blooms in late April and bears fruit in May–June. It reproduces by seeds, rarely vegetatively. Six forms have been described based on perianth color. Highly ornamental, it is used in breeding for new varieties. It is a subendemic plant.

Tulipa kaufmanniana (Regel) Rodion—Has been cultivated in the botanical garden since 1970, having been repeatedly brought from the Chatkal Range (Figure 2d). One of the earliest-blooming tulip species blooms in March and bears fruit in May. It is hardy in cultivation, propagating by seeds, self-seeding, and vegetatively. The collection contains 40 mature bulbs. In addition, 50 bulbs were obtained from seed sowing in 2019–2022. Highly ornamental, it boasts a wide variety of perianth color forms; eight forms have been selected and described in the collection. It is widely used in breeding for new varieties. It is a subendemic species.

Tulipa kolpakowskiana Regel—Cultivated in the botanical garden since 1970. It has been brought several times from the Kyrgyz Mountains. It blooms in April and bears fruit in May. It reproduces by seeds, self-sows, and very rarely produces daughter bulbs. Two forms have been selected for their perianth color (red and yellow). The collection contains 10 mature bulbs. It can be used in landscaping and breeding. It is a subendemic plant.

Tulipa korolkowii Regel—Brought from the Chatkal Range in 2012 and 2020. Blooms in April and bears fruit in May. Propagated by seed. Ten bulbs are grown in the collection. It is unstable in cultivation, as the soil composition of its natural habitat differs from that of its introduction. A rare ornamental plant. It is subendemic.

Tulipa ostrowskiana Regel—Brought repeatedly from the Kyrgyz Mountains from 1970 to 2019. Blooms in late April and bears fruit in May–June. Propagated by seed. The collection includes 12 bulbs. Ornamental. It can be used in breeding and landscaping. It is subendemic.

Tulipa platystemon Vved.—Brought in 2020 from the Alay Range. Blooms in mid-April, seeds ripen in May–June. The collection includes 10 bulbs. Ornamental. Endemic.

Tulipa rosea Vved.—Brought repeatedly from the Turkestan Range from 1980 to 2020. Blooms in April and bears fruit in May–June. Like *T. korolkowii*, it is unstable in cultivation, dropping off 3–4 years after planting. Propagated by seed. The collection includes 10 bulbs. An ornamental, rare species. It is subendemic.

Tulipa tetraphylla Regel—Imported several times between 1980 and 2019. Collected in the Issyk-Kul Basin. Blooms in mid-April and ripens in May–June. Propagated by seed. Interesting for breeding because it exhibits polyploidy (tetraploid forms). Highly ornamental and resistant in cultivation. The collection includes 15 bulbs. It can be used in landscaping. It is subendemic.

Tulipa zenaidae Vved.—Brought repeatedly from the foothills of the Kyrgyz Range from 1970 to 2020. Blooms in late April and bears fruit in May–June. Propagated by seed. Ten specimens are grown in the collection. Three ornamental forms have been selected based on perianth color. It can be used for breeding and landscaping. It is endemic.

Species such as *Tulipa greigii* Regel, *Tulipa kaufmanniana* Regel, *Iris Alberti* Regel, *Crocus alatavicus* Regel & Semen., *Juno kuschakewiczii* (B. Fedtsch.) Poljakov, *Juno orchioides* (Carrière) Vved., *Iris zenaidae* Vved., *Iridodictyum kolpakowskianum* (Regel) Rodion, and *Eremurus stenophyllus* (Boiss. & Buhse) Baker are already being used in breeding to develop new cultivars. Other ornamental and resistant species have the potential to be used both for landscaping and in breeding (*Tulipa tarda* Stapf, *Tulipa* × *anadroma* Botschantz., *Tulipa kolpakowskiana* Regel, *Tulipa affinis* Botschantz., and *Petilium eduardii* (Regel) Vved.). *Allium pskemense* B. Fedtsch. is consumed by locals, and *Iris lactea* Pall. is used medicinally.

3.4. Collections of Medicinal Plants

The medicinal plant collection consists of 117 species and varieties of native and indigenous flora of Kyrgyzstan. The native flora comprises 48 species from 41 genera,

belonging to 15 families. Below is a basic list of medicinal plants from the native flora that were systematically arranged based on species and supraspecific categories [18].

Liliaceae Juss.

Allium aflatunense B. Fedtsch. Perennial. Cultivated since 1970–1980. Blooms in May; seeds ripen in June. Propagated by seeds and vegetatively. Resilient in cultivation, it does not require regular watering.

Caryophyllaceae Juss.

Saponaria officinalis L. Perennial and adventive. Introduced in the 1970s–1980s. Blooms in June–July; seeds ripen in August–September. Propagation by seeds and vegetative means. Stable in culture.

Ranunculaceae Juss.

Thalictrum foetidum L. Perennial. It has been cultivated in the garden since 1970–1980. Blooms in June and July, and the seeds ripen in August and September. Propagated by seeds and vegetatively. Resistant in cultivation.

Papaveraceae Juss.

Chelidonium majus L. Perennial and adventive. Cultivated since 2009. Blooms in May; bears fruit in June. Propagated by seeds. Not resistant in cultivation.

Brassicaceae Burnett

Isatis tinctoria L. Biennial. Introduced in 2016. Blooms in May, seeds ripen in early June. Propagated by seeds. Resistant in cultivation.

Eruca sativa Mill. Annual. Cultivated since 1970–1980. Blooms in May; seeds ripen in June. Propagated by seeds. Not very stable in cultivation, often dropped from collections; seed reproduction is poor.

Rosaceae Juss.

Fragaria vesca L. Perennial. Cultivated in the garden since 2014. Blooms from May to August; seeds ripen from June to September. Propagated vegetatively and by seeds. Resistant in cultivation.

Geum urbanum L. Perennial. Introduced in 2013. Blooms from May to June; seeds ripen in July to September. Propagated by seeds. Resistant in cultivation.

Filipendula vulgaris Moench. Perennial. Cultivated since 1970–1980. Blooms from the second half of May to the first half of June, bearing fruit in July. Propagated by seeds and vegetatively. Drought-resistant. Resistant in cultivation.

Alchemilla retropilosa Juz. Perennial. Cultivated in gardens since 1965. Blooms in April–May. Bears fruits in June. Propagated vegetatively and by seeds. Resistant in cultivation.

Sanguisorba officinalis L. Perennial. Introduced in the 1970s–1980s. Blooms in July and August; seeds ripen in September. Reproduced by seeds and vegetatively. Resistant in cultivation.

Zygophyllaceae R.Br.

Peganum harmala L. Perennial. Introduced in 2010. Blooms in May–June. Bears fruits in July–August. Not stable in cultivation. Propagated by seed.

Malvaceae Juss.

Malva sylvestris L. Biennial. Cultivated since 2011. Blooms in July; bears fruit in September. Propagated by seed. Not stable in cultivation.

Lavatera thuringiaca L. Perennial. Cultivated in the garden since 2013. Blooms in June–July; bears fruit in August–September. Propagated by seeds and division. Resistant in cultivation.

Alcea nudiflora (Lindl.) Boiss. Perennial. Cultivated since 2009. Blooms in June–August; seeds ripen in August–September. Propagated by seed. Not resistant in cultivation.

Althaea armeniaca Ten. Perennial. Introduced in the 1970s and 1980s. Blooms in July–August and bears fruit in August–September. Propagated by seed and division. Resistant in cultivation.

Althaea officinalis L. Perennial. Cultivated since 2012. Blooms in July–September; bears fruit in August–October. Propagated by seeds and division. Resistant in cultivation.

Onagraceae Juss.

Epilobium hirsutum L. Perennial. Introduced in the 1970s and 1980s. Blooms in July and August; seeds ripen in September. Propagated by seed and vegetatively. Resistant in cultivation. Moisture-demanding.

Oenothera biennis L. Biennial and adventive. In cultivation since 2010. Flowering in June–September, seeds ripen in September–October. Propagation by seeds. Self-sowing. Resistant in cultivation.

Umbelliferae Juss.

Conium maculatum L. Biennial. Introduced in the 1970s and 1980s. Flowering in July, seeds ripen in August. Propagation by seeds. Not resistant in cultivation.

Carum carvi L. Biennial. Cultivated since 2015. Blooms in May; seeds ripen in June. Propagated by seeds. Resistant in cultivation.

Apium graveolens Cham. Biennial and adventive. Cultivated in the garden since 2016. Blooms in June; fruits ripen in August. Propagated by seed. Resistant in cultivation.

Pastinaca sativa L. Biennial and adventive. Introduced in the 1970s–1980s. Blooms in July–August; bears fruit in September–October. Propagated by seed; it self-sows. Resistant in cultivation.

Boraginaceae Juss.

Lithospermum officinale L. Perennial. Cultivated since 2013. Blooms in May; seeds ripen in July. Propagated by seed. Resistant in cultivation.

Borago officinalis L. Annual and adventive. Cultivated in the garden since 2010. Blooms in June–August; seeds ripen in July–September. Propagated by seed; it self-sows. Resistant in cultivation.

Labiatae Juss.

Nepeta bucharica Lipsky. Perennial. Introduced in the 1970s and 1980s. Blooms in May; seeds ripen in July. Propagated by seed and division. Resistant in cultivation.

Nepeta cataria L. Perennial. Cultivated since the 1970s and 1980s. Blooms in June and July; bears fruit in August and September. Propagated by seed and division. Resistant in collections.

Phlomoides tuberosa (L.) Moench. Perennial. Introduced in the 1970s and 1980s. Blooms in May; seeds ripen in July. Propagation by seeds and vegetative means. Resistant in cultivation.

Salvia sclarea L. Biennial. Cultivated in gardens since the 1970s and 1980s. Blooms in May and June; seeds ripen in July and August. Propagated by seed. Resistant in cultivation.

Salvia verticillata L. Perennial and adventive. Introduced in the 1970s–1980s. Flowering in July, seeds ripen in September, self-sowing. Propagation by seeds. Resistant in cultivation.

Melissa officinalis L. Perennial. Has been in the collection since 1962. It blooms from June to August and bears fruit in September to October. It is easily propagated by seeds and division. It is hardy in cultivation and requires regular watering.

Origanum vulgare L. Perennial. Introduced in the 1970s–1980s. Blooms in June–August and bears fruit in August–September. Propagated by seeds and vegetatively. Resistant in cultivation.

Thymus martallianus Willd. Subshrub. Has been in the collection since 1965. Blooms in May–June. Seeds ripen in July. Propagated vegetatively and by seeds. Drought-resistant, winter-hardy plant. Resistant in cultivation.

Thymus seravschanicus Klokov. Subshrub. Introduced in the 1970s–1980s. Blooms in May and June; bears fruit in July. Propagated by seeds and vegetatively. Resistant in cultivation.

Lycopus europaeus L. Perennial. Introduced in the 1970s–1980s. Blooms in July; seeds ripen in September. Propagated vegetatively and by seeds. Resistant in cultivation.

Rubiaceae Juss.

Galium turkestanicum Pobed. Perennial. Cultivated in gardens since the 1970s and 1980s. Flowering in May and June, fruiting in July. Propagated vegetatively and by seeds. Resistant in cultivation.

Galium verum L. Perennial. Introduced in the 1970s–1980s. Blooms in June and July; bears fruit in August. Propagated by seeds and vegetatively. Resistant in cultivation.

Rubia tinctorum L. Perennial. Introduced to the botanical garden in 1964. Plant growth begins in the first half of April, flowering in July, and seeds ripen in late August and September. Resistant in cultivation, it requires regular watering.

Campanulaceae Juss.

Campanula rapunculoides L. Perennial. Introduced in the 1970s–1980s. Blooms in June–August; seeds ripen in August–September. Propagated by seeds and vegetative means. Resistant in cultivation.

Compositae Giseke

Inula helenium L. Perennial. Introduced in the 1970s–1980s. Flowering in June–August, fruiting in August–September. Propagated vegetatively and by seeds, self-sowing. Resistant in cultivation.

Anthemis subtinctoria Dobrocz. Perennial. Has been growing in the collection since 2010. Blooms in June–August; seeds ripen in August–October. Propagated by seeds. Resistant in cultivation.

Achillea arabica Kotschy. Perennial. Has been in the collection since 2016. Blooms in May–June and bears fruit in July. Propagated by seeds and division. Drought-tolerant. Not resistant in cultivation.

Achillea filipendulina Lam. Perennial. Cultivated in the garden since 2016. Blooms in June–August; seeds ripen in August–September. Propagation by seeds and division. Resistant in cultivation.

Achillea millefolium L. Perennial. Introduced in 2016. Blooms in June–August. Bears fruits in August–September. Propagated by seeds and division. Resistant in cultivation.

Tanacetum vulgare L. Perennial. Introduced in the 1970s–1980s. Blooms from July to September. Fruit ripens in August–October. Propagated vegetatively and by seeds. Resistant in cultivation. Undemanding in soil. Forms vigorous bushes.

Artemisia dracunculus L. Perennial. Cultivated in gardens since the 1970s and 1980s. Blooms from the second half of July through August. The fruits ripen in September. Propagated vegetatively and by seeds. Resistant in cultivation.

Tussilago farfara L. Perennial. Cultivated since 2013. Blooms in April; seeds ripen in early May. Propagation by seeds and vegetative means. Moisture-demanding. Not resistant in cultivation.

Centaurea cyanus L. Annual. Introduced in the 1970s–1980s. Blooms in May; bears fruit in June. Not stable in cultivation. Propagated by seeds.

The collection is most abundantly represented by species from the families *Labiatae* Juss., *Compositae* Giseke, *Malvaceae* Juss., *Rosaceae* Juss., and *Apiaceae* Lindl. The majority of

life forms are perennials (36 species), biennials (7), subshrubs (2), and annuals (3). A total of 39 species are well adapted to cultivation, whereas 9 species are not resistant in cultivation.

4. Conclusions and Recommendations

Through decades of research on plant introduction and acclimatization, the E. Gareev Botanical Garden of the National Academy of Sciences of the Kyrgyz Republic has assembled and preserved unique collections of trees, shrubs, ornamental and herbaceous plants, and medicinal species, encompassing both non-native and indigenous flora. Of particular significance are introduction studies and the development of scientific foundations for the ex situ conservation of Kyrgyzstan's plant genetic resources. Native species have adapted to the botanical garden's conditions to varying degrees. Introduction efforts have proven most successful for species originating from low-mountain valleys, foothills, and the lower mountain belt, whereas species from high-mountain ecosystems have shown comparatively lower success rates. The following collections of plants have been assembled and preserved: tree-bush flora, comprising 48 families, 121 genera and 495 species and forms, of which the natural flora of the Kyrgyz Republic includes 5 species of coniferous and 58 deciduous trees, including 30 subendemic and two endemic species; grassy local flora, comprising 57 species, including five endemic species and 37 subendemic species, 14 of which are listed in the Red Book of the Kyrgyz Republic; and medicinal plants, comprising 117 species and forms, 48 of which occur in natural flora. In summary, the collections of Kyrgyzstan's native flora at the E. Gareev Botanical Garden of the National Academy of Sciences of the Kyrgyz Republic represent a unique genetic repository that serves as a foundation for the conservation of endangered species. These collections include 170 native plant species, comprising 67 subendemic species, 19 endemic species, and 19 species listed in the Red Data Book of the Kyrgyz Republic. For future efforts, it is recommended to: (1) strengthen the practical application of introduced species in landscape design, ecological restoration, and conservation programs; and (2) prioritize specimen-collecting expeditions targeting endemic, subendemic, and endangered taxa to enhance the comprehensiveness of the collections.

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