https://doi.org/10.46341/PI2026012
UDC 58.006 : 502.7

CHRONICLE

80 years of the Dendropark "Olexandria" within the National Academy of Sciences of Ukraine: Conservation of rare plants in quasi-natural ecosystems of the Dendropark "Olexandria"

Lyudmila Kalashnikova

The "Olexandria" State Dendrological Park, National Academy of Science of Ukraine, Bila Tserkva-13, 09113, Ukraine; kalashnikovaluda@gmail.com

Received: 18.08.2026 | **Accepted**: 04.10.2026 | **Published**: 27.10.2026

Abstract

The results of the research on the conservation and restoration of the rare flora of the Dendropark "Olexandria" are presented across five research themes. In particular, the adaptive potential of introduced and native rare plants was assessed in the park's quasi-natural ecosystems, which are coenotically associated with forest, meadow, meadow-steppe, riparian-aquatic, and aquatic plant communities. The prospects for establishing homeostatic introduced populations, clones, and *ex situ* biogroups of rare species have been demonstrated. According to the inventory, the rare plant component of the dendropark currently comprises 282 species and subspecies, both natural and cultivated. Of these, 92 species are included in the Red Book of Ukraine. In addition, 41 species are protected in the city of Kyiv and the Kyiv Region. 214 species are protected internationally; in particular, 8 species are listed in the appendices to the Bern Convention, and nine are protected under the CITES Convention. Almost 35 % (98 species) are preserved in the collection area "Rare Plants of the Flora of Ukraine". In accordance with the concept of *ex situ* conservation of rare species, the reproductive potential and viability of native and introduced rare flora species were investigated. Monitoring was introduced for the area, abundance, and age structure of populations, clones, and biogroups of rare species in the forest, meadow, meadow-steppe, and riparian-aquatic ecosystems of the dendropark. The research provides substantial evidence that the most promising approach to *ex situ* conservation is the establishment of self-regenerating, stable populations, including introduced populations, which represent fragments of natural phytocoenoses and remain in continuous interaction with their components. Phenological observations identified a set of unfavorable climatic factors that limit the development of 79 introduced dendrosozophytes in the study region under ongoing climate change. Based on the findings, methodological recommendations were developed to optimize the conservation of rare plants in the Dendropark "Olexandria".

Keywords: rare flora, comprehensive research, conservation, introduced populations, monitoring

Funding: The work has been realized within the research themes "Study of the gene pool and introduction into the Dendropark "Olexandria" of rare and endangered species of the flora of Ukraine" (2003–2007), "Conservation, protection, and restoration of rare and endangered plants listed in the Red Book of Ukraine" (2008–2012), "Formation, restoration, and monitoring of natural and introductory populations of rare plant species in the Dendropark "Olexandria"" (2013–2017), "Phytodiversity, natural differentiation, and sozology of the phytobiota of the Dendropark "Olexandria"" (2018–2022), and "Ecological assessment of the stability of local populations of rare herbaceous flora species in the dendropark "Olexandria"" (2023–2026).

Competing Interests: The author declares that they have no conflict of interest.

© The Authors. This content is provided under CC BY 4.0 license.

In the second half of the 20th century, the protection of the gene pool of rare and endangered plant species emerged as one of the most important problems in modern botany and ecology. Therefore, the conservation of rare species under *ex situ* conditions, their rational use, and the restoration and enrichment of biotic and landscape diversity have become the main direction of scientific research work in botanical gardens and arboretums (Shelyag-Sosonko & Ustymenko, 2002). The idea of creating artificial phytocoenoses and models of introductory plant populations in botanical gardens and arboretums dates back to the 19th century, but only since 1996 has the population-based approach become a priority direction in the study of rare species (Antonyuk, 1984).

The research was conducted in the Dendropark "Olexandria", one of the oldest parks in Ukraine, established in 1788. Its territory harmoniously combines natural plant communities with introduced plant compositions, architectural features, and water structures. The park is located in the Right-Bank Forest-Steppe zone, which has a moderately continental climate.

In 2003–2007, purposeful work began on the selection, conservation, and restoration of the gene pool, studying the pathways of adaptation of rare and endangered plants in the conditions of the Right-Bank Forest-Steppe, and introducing them into the quasi-natural ecosystems of the dendrological park. A collection and display area, "Rare Plants of the Flora of Ukraine," covering 0.6 ha, has been established, and 98 species have been identified.

The objects of research were rare plant species of various systematic groups, life forms, range types, and different ecological and coenotic affinities, which are protected by international (IUCN, 2025) and state (Didukh, 2009; MEPNRU, 2021) regulations. Besides this, certain species are listed in the Appendix to the Berne Convention (Council of Europe, 1979), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2025), and regional lists of rare and endangered plant species requiring protection in the Kyiv region (Kyiv Oblast Council, 2012). The biological and ecological characteristics of the growth and development of rare plants were studied using conventional methods, including assessments of their viability and cultivation potential, the development of seed and vegetative propagation techniques, the establishment of new loci, and the monitoring of introduced populations within the dendropark's phytocoenoses (Kalashnikova, 2004, 2007).

Subsequently, studies were continued in 2008–2012. Using the example of rare woody plant species resistant to climatic and physico-geographical environmental conditions, comprehensive studies were conducted on: rhythms of seasonal growth and development, dynamics of shoot growth, characteristics of flowering and fruiting, seed and vegetative reproduction, growth and development rates of seedlings, and the age and spatial structure of clones. Additionally, methods were developed to conserve them in the dendropark's quasi-natural ecosystems by establishing self-sustaining introductory populations.

According to the inventory results, the rare fraction of woody plants amount to 143 species, from them 27 species listed in the Red Book of Ukraine, eight species that are protected in the Kyiv City and Kyiv Region, two species listed in the Appendix to the Bern Convention, one species included in Convension on International Trade in Endangered Species of Wild Fauna and Flora and 137 species on the IUCN Red List (Table 1).

Based on the research results, the adaptive capacities and the success of introducing coenotically associated rare species with forest communities within the transformed phytocoenoses of the dendropark were evaluated, and the prospects for forming homeostatic introductory populations, clones, and biogroups from them were demonstrated. The series of publications (Kalashnikova, 2008, 2009, 2011a, 2011b; Galkin & Kalashnikova, 2013; Kalashnikova & Galkin, 2016) has been published, and a dissertation "Conservation of rare species of woody plants in quasinanural ecosystems of Right-bank Forest-steppe (on example of Dendropark "Olexandria")" was defended based on the results of these studies (Kalashnikova, 2012).

According to the inventory for 2013–2017, the rare fraction of herbaceous plants comprises 139 species, of which 66 were of natural origin, and 73 were introduced. The

Table 1. Taxonomic composition and sozological status of rare species of woody plants of the Dendropark "Olexandria".

No.	Species/infraspecies	IUCN	RBU	K	CITES	BC
1	*Abies alba* Mill.	+	–	–	–	–
2	*Abies balsamea* (L.) Mill.	+	–	–	–	–
3	*Abies cephalonica* Loudon	+	–	–	–	–
4	*Abies concolor* (Gordon & Glend.) Lindl. ex Hildebr.	+	–	–	–	–
5	*Abies koreana* E.H.Wilson	+	–	–	–	–
6	*Abies procera* Rehd.	+	–	–	–	–
7	*Aesculus hippocastanum* L.	+	–	–	–	–
8	*Alnus glutinosa* (L.) Gaerth.	+	–	+	–	–
9	*Berberis vulgaris* L.	+	–	–	–	–
10	*Betula dahurica* Pall.	+	–	–	–	–
11	*Betula ermanii* Cham.	+	–	–	–	–
12	*Betula klokovii* Zaver.	+	+	–	–	–
13	*Betula lenta* L.	+	–	–	–	–
14	*Betula pendula* Roth	+	–	–	–	–
15	*Betula pubescens* Ehrh.	+	–	–	–	–
16	*Betula raddeana* Trautv.	+	–	–	–	–
17	*Betula utilis* D.Don	+	–	–	–	–
18	*Callitropsis nootkatensis* D.Don	+	–	–	–	–
19	*Carpinus betulus* L.	+	–	–	–	–
20	*Cerastium biebersteinii* DC.	+	+	–	–	–
21	*Cerasus klokovii* Sobko	+	+	–	–	–
22	*Cerasus fruticosa* (Pall.) Woron.	+	–	+	–	–
23	*Cercidiphyllum japonicum* Siebold & Zucc. ex J.J.Hoffm. & J.H.Schult.	+	–	–	–	–
24	*Cercis canadensis* L.	+	–	–	–	–
25	*Chamaecyparis lawsoniana* (A.Murray bis) Oerst.	+	–	–	–	–
26	*Chamaecyparis obtusa* (Siebold & Zucc.) Endl.	+	–	–		
27	*Chamaecyparis pisifera* (Siebold & Zucc.) Endl.	+	–	–	–	–
28	*Chamaecytisus albus* (Hacq.) Rothm.	+	+	–	–	–
29	*Chamaecytisus blockianus* (Pawł.) Klásk.	+	+	+	–	–
30	*Chamaecytisus graniticus* (Rehmann) Rothm.	+	+	–	–	–
31	*Chamaecytisus podolicus* (Błocki) Klásk.	+	+	–	–	–
32	*Chamaecytisus rochelii* (Wierzb.) Rothm.	+	+	–	–	–
33	*Cotoneaster lucidus* Schlecht.	+	–	–	–	–
34	*Corylus avellana* L.	+	–	–	–	–
35	*Corylus colurna* L.	+	–	–	–	–
36	*Corylus maxima* Mill.	+	–	–	–	–
37	*Cotinus coggygria* Scop.	+	–	–	–	–
38	*Crataegus helenae* Grinj & Klokov	–	–	+	–	–

Table 1. Continued.

No.	Species/infraspecies	IUCN	RBU	K	CITES	BC
39	*Crataegus laevigata* (Poir.) DC.	+	–	–	–	–
40	*Crataegus monogyna* Jacq.	+	–	–	–	–
41	*Crataegus nigra* Waldst. & Kit.	+	–	–	–	–
42	*Crataegus pojarkovae* Kossych	+	+	–	–	–
43	*Cryptomeria japonica* (L.) D.Don	+	–	–	–	–
44	*Cunninghamia lanceolata* (Lamb.) Hook.	+	–	–	–	–
45	*Daphne cneorum* L.	–	+	–	–	–
46	*Daphne mezereum* L.	+	–	+	–	–
47	*Daphne sophia* Kolenicz.	+	+	–	–	–
48	*Diervilla rivularis* Gatt.	+	–	–	–	–
49	*Eucommia ulmoides* Oliv.	+	–	–	–	–
50	*Euonymus koopmannii* Lauche	+	–	–	–	–
51	*Euonymus nanus* M.Bieb.	–	+	–	–	–
52	*Euonymus verrucosus* Scop.	+	–	–	–	–
53	*Fraxinus excelsior* L.	+	–	–	–	–
54	*Fraxinus ornus* L.	+	+	–	–	–
55	*Genistella sagittalis* (L.) Gams	+	+	–	–	–
56	*Ginkgo biloba* L.	+	–	–	–	–
57	*Juglans regia* L.	+	–	–	–	–
58	*Juniperus chinensis* L.	+	–	–	–	–
59	*Juniperus communis* L.	+	–	+	–	–
60	*Juniperus exelsa* M.Bieb.	+	+	–	–	–
61	*Juniperus foetidissima* Willd.	+	+	–	–	–
62	*Juniperus horizontalis* Moench	+	–	–	–	–
63	*Juniperus procumbens* (Siebold ex Endl.) Miq.	+	–	–	–	–
64	*Juniperus rigida* Siebold & Zucc.	+	–	–	–	–
65	*Juniperus sabina* L.	+	–	–	–	–
66	*Juniperus scopulorum* Sarg.	+	–	–	–	–
67	*Juniperus semiglobosa* Regel	+	–	–	–	–
68	*Juniperus squamata* Buch.-Ham. ex D.Don	+	–	–	–	–
69	*Juniperus virginiana* L.	+	–	–	–	–
70	*Kolkwitzia amabilis* Graebn.	+	–	–	–	–
71	*Larix decidua* Mill.	+	–	–	–	–
72	*Larix kaempferi* (Lamb.) Carr.	+	–	–	–	–
73	*Larix laricina* (Du Roi) K.Koch	+	–	–	–	–
74	*Larix polonica* Racib. ex Wóycicki	+	+	–	–	–
75	*Larix sibirica* Ledeb.	+	–	–	–	–
76	*Liriodendron tulipifera* L.	+	–	–	–	–
77	*Lonicera caerulea* L.	+	+	–	–	–

Table 1. Continued.

No.	Species/infraspecies	IUCN	RBU	K	CITES	BC
78	*Magnolia kobus* DC.	+	–	–	–	–
79	*Malus niedzwetzkyana* Dieck ex Koehne	+	–	–	–	–
80	*Malus orientalis* Uglitzk.	+	–	–	–	–
81	*Malus sylvestris* (L.) Mill.	+	–	–	–	–
82	*Microbiota decussata* Kom.	+	–	–	–	–
83	*Metasequoia glyptostroboides* Hu & Cheng	+	–	–	–	–
84	*Neillia tanakae* (Franch. & Sav.) Franch. & Sav. ex S.H.Oh	+	–	–	–	–
85	*Picea abies* (L.) H.Karst.	+	–	+	–	–
86	*Picea glauca* (Moench.) Voss.	+	–	–	–	–
87	*Picea jezoensis* (Siebold & Zucc.) Carrière subsp. *hondoensis* (Mayr) P.A.Schmidt	+	–	–	–	–
88	*Picea mariana* (Mill.) Britton, Sterns & Poggenb.	+	–	–	–	–
89	*Picea obovata* Ledeb.	+	–	–	–	–
90	*Picea omorica* (Panc.) Purkyne	+	–	–	–	–
91	*Picea orientalis* (L.) Peterm.	+	–	–	–	–
92	*Picea pungens* Engelm.	+	–	–	–	–
93	*Pinus armandii* Franch.	+	–	–	–	–
94	*Pinus bungeana* Zucc. ex Endl.	+	–	–	–	–
95	*Pinus cembra* L.	+	+	–	–	–
96	*Pinus densiflora* Siebold & Zucc.	+	–	–	–	–
97	*Pinus heldreichii* Christ	+	–	–	–	–
98	*Pinus mugo* Turra	+	–	–	–	–
99	*Pinus nigra* J.F.Arnold	+	–	–	–	–
100	*Pinus ponderosa* Dougl. ex Lawson	+	–	–	–	–
101	*Pinus strobus* L.	+	–	–	–	–
102	*Pinus sylvestris* L.	+	–	–	–	–
103	*Pinus tabuliformis* Carr.	+	–	–		+
104	*Pinus uncinata* Ramond ex DC.	+	–	–	–	–
105	*Pinus wallichiana* A.B.Jacks.	+	–	–	–	–
106	*Platycladus orientalis* L.	+	–	–	–	–
107	*Populus nigra* L.	+	–	–	–	–
108	*Prunus avium* (L.) L.	+	–	–	–	–
109	*Prunus cerasifera* Ehrh.	+	–	–	–	–
110	*Prunus mahaleb* L.	+	–	–	–	–
111	*Prunus padus* L.	+	–	–	–	–
112	*Prunus spinosa* L.	+	–	–	–	–
113	*Prunus tenella* Batsch	+	–	–	–	–
114	*Pseudotsuga menziesii* (Mirb.) Franko	+	–	–	–	–
115	*Pterocarya fraxinifolia* (Lam.) Spach	+	–	–	–	–

Table 1. Continued.

No.	Species/infraspecies	IUCN	RBU	K	CITES	BC
116	*Quercus cerris* L.	+	+	–	–	–
117	*Quercus imbricaria* Michx.	+	–	–	–	–
118	*Quercus palustris* Munchh.	+	–	–	–	–
119	*Quercus robur* L.	+	–	–	–	–
120	*Quercus robur* L. subsp. *imeretina* (Steven ex Woronow) Menitsky	+	–		–	–
121	*Rhamnus saxatilis* Jacq. subsp. *tinctoria* Nyman	–	+	–	–	–
122	*Rhododendron luteum* Sweet	+	–	+	–	–
123	*Salix alba* L.	+	–	–	–	–
124	*Salix purpurea* L.	+	–	–	–	–
125	*Syringa josikaea* Jacq. ex Rchb.	+	+	–	–	+
126	*Spiraea polonica* Błocki	–	+	–	–	–
127	*Spiraea tianshanica* Pojark.	+	–	–	–	–
128	*Staphylea pinnata* L.	+	+	–	–	–
129	*Tamarix gracilis* Willd.	–	+	–	–	–
130	*Taxus baccata* L.	+	+	–	–	–
131	*Taxus canadensis* Marsh.	+	–	–	–	–
132	*Taxus cuspidata* Siebold & Zucc.	+	–	–	+	–
133	*Thuja occidentalis* L.	+	–	–	–	–
134	*Thuja koraensis* Nakai	+	–	–	–	–
135	*Thuja plicata* Donn ex D.Don	+	–	–	–	–
136	*Thuja standishii* (Gordon) Carr.	+	–	–	–	–
137	*Thujopsis dolabrata* (L.f.) Siebold & Zucc. 'Variegata'	+	–	–	–	–
138	*Tilia cordata* Mill.	+	–	–	–	–
139	*Tilia* × *euchlora* C.Koch.	+	–	–	–	–
140	*Tilia platyphyllos* Scop.	+	–	–	–	–
141	*Tilia tomentosa* Moench.	+	–	–	–	–
142	*Torminalis glaberrima* (Gand.) Sennikov & Kurtto	–	+	–	–	–
143	*Tsuga canadensis* (L.) Carr.	+	–	–	–	–

Note. **IUCN** – IUCN Red List of Threatened Species; **RBU** – Red Book of Ukraine; **K** – Lists of regionally rare species protected in the city of Kyiv and Kyiv Region; **CITES** – Convention on International Trade in Endangered Species of Wild Fauna and Flora; **BC** – Appendix to the Bern Convention.

collection includes 65 species listed in the Red Book of Ukraine, 33 species that are protected in Kyiv City and Kyiv Region, six species listed in the Annexes of the Bern Convention, eight species included in CITES, and 77 species on the IUCN Red List (Table 2).

Appropriate ecotopes were selected to form introductory populations of rare species within phytocoenoses under the conditions of various ecological niches. Reproductive potential and viability assessment of the sustainability of the introduced rare species in cultivation was provided. Continuous local monitoring has been implemented regarding the area, number of individuals, and age structure of natural and introductory populations, clones, and biogroups of 43 rare plant species: *Abies alba*, *Taxus baccata*, *Cerastium biebersteinii*,

Table 2. Taxonomic composition and sozoological status of rare species of herbaceous plants of the Dendropark "Olexandria".

No.	Species/infraspecies	IUCN	RBU	K	CITES	BC
1	*Acorus calamus* L.	+	–	–	–	–
2	*Adonis vernalis* L.	+	+	+	+	–
3	*Alisma plantago-aquatica* L.	+	–	–	–	–
4	*Allium denudatum* Redoute	–	+	+	–	–
5	*Allium obliquum* L.	+	+	–	–	–
6	*Allium regelianum* Becker ex Iljin	+	+	–	–	–
7	*Allium strictum* Schrad.	–	+	–	–	–
8	*Allium ursinum* L.	+	+	–	–	–
9	*Anemone sylvestris* L.	–	–	+	–	–
10	*Angelica sylvestris* L.	+	–	–	–	–
11	*Aquilegia nigricans* Baumg.	+	+	–	–	–
12	*Aquilegia vulgaris* L.	+	–	+	–	–
13	*Asphodeline lutea* (L.) Rchb.	–	+	–	–	–
14	*Asplenium septentrionale* (L.) Hoffm.	–	–	+	–	–
15	*Aster alpinus* L.	–	+	–	–	–
16	*Astragalus cicer* L.	+	–	–	–	–
17	*Atocion compactum* (Fisch. ex Hornem.) Tzvelev	+	+	–	–	–
18	*Atropa bella-donna* L.	+	+	–	–	–
19	*Bidens cernua* L.	+	–	–	–	–
20	*Biscutella laevigata* L.		+	–	–	–
21	*Bolboschoenus maritimus* (L.) Palla	+	–	–	–	–
22	*Butomus umbellatus* L.	+	–	–	–	–
23	*Campanula carpatica* Jacq.	–	+	–	–	–
24	*Carex acuta* L.	+	–	–	–	–
25	*Carex humilis* Leyss.	–	–	+	–	–
26	*Carex pseudocyperus* L.	+	–	–	–	–
27	*Carex remota* L.	+	–	–	–	–
28	*Carex riparia* Curtis	+	–	–	–	–
29	*Carex rostrata* Stokes	+	–	–	–	–
30	*Carex vesicaria* L.	+	–	–	–	–
31	*Centaurium erythraea* Rafn	+	–	–	–	–
32	*Cerastium arvense* L.	+	–	–	–	–
33	*Colchicum arenarium* Waldst. & Kit. (incl. *C. fominii* Bordz.)	+	+	–		+
34	*Colchicum autumnale* L.	+	+	–	–	–
35	*Colchicum speciosum* Steven	–	–	+	–	–
36	*Convallaria majalis* L.	–	–	+	–	–
37	*Corydalis cava* (L.) Schweigg. & Körte	–	–	+	–	–
38	*Crambe maritima* L.	+	+	–	–	–

Table 2. Continued.

No.	Species/infraspecies	IUCN	RBU	K	CITES	BC
39	*Crocus angustifolius* Weston	–	+	–	–	–
40	*Crocus heuffelianus* Herb.	–	+	–	–	–
41	*Crocus reticulatus* Steven ex Adams	–	+	–	–	–
42	*Crocus speciosus* M.Bieb.	–	+	–	–	–
43	*Cyclamen coum* Mill.	+	+	–	+	+
44	*Cyclamen purpurascens* Mill.	+	–	–	+	–
45	*Delphinium elatum* L.	–	+	–	–	–
46	*Delphinium sergii* Wissjul.	–	+	–	–	–
47	*Dianthus arenarius* L. subsp. *pseudoserotinus* (Błocki) Tutin	–	+	–	–	–
48	*Dianthus gratianopolitanus* Vill.	+	+	–	–	–
49	*Dictamnus albus* L.	+	+	–	–	–
50	*Digitalis grandiflora* Mill.	–	–	+	–	–
51	*Digitalis lanata* Ehrh.	–	–	+	–	–
52	*Dracocephalum ruyschiana* L.	+	+	–	+	–
53	*Echinops exaltatus* Schrad.	–	+	–	–	–
54	*Epipactis helleborine* (L.) Crantz	+	+	–	+	–
55	*Equisetum pretense* Ehrh.	+	–	–	–	–
56	*Eremurus spectabilis* M.Bieb.	–	+	–	–	–
57	*Festuca pallens* Host.	–	+	–	–	–
58	*Festuca rubra* L.	+	–	–	–	–
59	*Festuca ovina* L.	+	–	–	–	–
60	*Fritillaria meleagris* L.	–	+	–	–	–
61	*Gagea pusilla* (F.W.Schmidt) Schult. & Schult.	–	–	+	–	–
62	*Galanthus elwesii* Hook.f.	+	+	–	–	–
63	*Galanthus nivalis* L.	+	+	–	+	–
64	*Galanthus plicatus* M.Bieb.	+	+	–	+	–
65	*Gentiana acaulis* L.	–	+	–	–	–
66	*Gladiolus imbricatus* L.	–	+	+	–	–
67	*Glechoma hirsuta* Waldst. & Kit.	+	–	–	–	–
68	*Glaucium flavum* Crantz	–	+	–	–	–
69	*Hepatica nobilis* Mill.	+	–	+	–	–
70	*Helleborus purpurascens* Waldst. & Kit.	+	–	–	–	–
71	*Helleborus niger* L.	–		+	–	–
72	*Inula helenium* L.	+	–	+	–	–
73	*Iris aphylla* L. (incl. *I. hungarica* Waldst. & Kit.)	–	–	+	–	+
74	*Iris halophila* Pall.	–	–	+	–	–
75	*Iris furcata* M.Bieb.	–	+	–	–	–
76	*Iris pseudacorus* L.	+	–	+	–	–
77	*Iris sibirica* L.	–	+	+	–	–

Table 2. Continued.

No.	Species/infraspecies	IUCN	RBU	K	CITES	BC
78	*Iris versicolor* L.	+	–	–	–	–
79	*Isopyrum thalictroides* L.	–	–	+	–	–
80	*Leucojum vernum* L.	+	+	–	–	–
81	*Lilium martagon* L.	–	+	–	–	–
82	*Lunaria rediviva* L.	–	+	–	–	–
83	*Lysimachia nummularia* L.	+	–	–	–	–
84	*Lysimachia punctata* L.	+	–	–	–	–
85	*Lysimachia vulgaris* L.	+	–	–	–	–
86	*Lytrum salicaria* L.	+	–	–	–	–
87	*Onoclea struthiopteris* Roth (≡ *Matteucia struthiopteris* (L.) Tod)	–	–	+	–	–
88	*Melica transsilvanica* Schur	–	–	+	–	–
89	*Muscari neglectum* Guss. ex Ten.	–	–	+	–	–
90	*Narcissus poeticus* L. (incl. *N. angustifolius* Curtis)	+	+	–	–	–
91	*Neottia nidus-avis* (L.) Rich.	+	+	+	+	–
92	*Nuphar lutea* (L.) Smith	+	–	–	–	–
93	*Nymphaea alba* L.	+	–	+	–	–
94	*Paeonia daurica* Andrews	–	+	–	–	–
95	*Paeonia tenuifolia* L.	+	+	–	–	+
96	*Plantago major* L.	+	–	–	–	–
97	*Phragmites australis* (Cav.) Trin. ex Steud.	+	–	–	–	–
98	*Potamogeton crispus* L.	+	–	–	–	–
99	*Potamogeton natans* L.	+	–	–	–	–
100	*Primula elatior* (L.) Hill	–	–	+	–	–
101	*Primula veris* L.	–	–	+	–	–
102	*Prunella grandiflora* (L.) Turra	–	–	+	–	–
103	*Prunella vulgaris* L.	+	–	–	–	–
104	*Pulmonaria officinalis* L.	+	–	–	–	–
105	*Pulsatilla grandis* Wend.	+	+	–	–	+
106	*Pulsatilla pratensis* (L.) Mill.	–	+	–	–	–
107	*Pulsatilla patens* (L.) Mill. (≡ *Anemone patens* L.)	+	+	+	–	+
108	*Ranunculus repens* L.	+	–	–	–	–
109	*Rhaponticoides taliewii* (Kleopow) M.V.Agab. & Gleuter (≡ *Centaurea taliewii* Kleopow)	+	+	–	–	–
110	*Sagittaria sagittifolia* L.	+	–	–	–	–
111	*Scilla bifolia* L.	–	–	+	–	–
112	*Scilla siberica* Andrews	–	–	+	–	–
113	*Scirpus sylvaticus* L.	+	–	–	–	–
114	*Scrophularia umbrosa* Dumort.	+	–	–	–	–
115	*Scopolia carniolica* Jacq.	+	+	–	–	–

Table 2. Continued.

No.	Species/infraspecies	IUCN	RBU	K	CITES	BC
116	*Scutellaria galericulata* L.	+	–	–	–	–
117	*Sempervivum globiferum* L. (incl. *Jovibarba sobolifera* (Sims) Opiz)	–	+	–	–	–
118	*Sempervivum ruthenicum* Schnit. & Lehm.	–	–	+	–	–
119	*Silene zawadzkii* Herbich (≡ *Silenanthe zawadzkii* (Herbich) Griseb. & Schrenk)	–	+	–	–	–
120	*Silene vulgaris* (Moench.) Garcke	+	–	–	–	–
121	*Stipa capillata* L.	–	+	–	–	–
122	*Stipa lessingiana* Trin. & Rupr.	–	+	–	–	–
123	*Stipa pennata* L.	–	+	–	–	–
124	*Stipa pulcherrima* C.Koch	–	+	–	–	–
125	*Stipa tirsa* L.	–	+	–	–	–
126	*Stipa ucrainica* Smirn.	–	+	–	–	–
127	*Thalictrum foetidum* L.	–	+	–	–	–
128	*Teucrium chamaedris* L.	+				
129	*Trifolium alpestre* L.	+	–	–	–	–
130	*Trifolium arvense* L.	+	–	–	–	–
131	*Trifolium pratense* L.	+	–	–	–	–
132	*Trifolium repens* L.	+	–	–	–	–
133	*Trifolium rubens* L.	–	+	–	–	–
134	*Tulipa biflora* Pall.	–	+	–	–	–
135	*Tulipa sylvestris* L. subsp. *australis* (Link) Pamp (incl. *T. quercetorum* Klokov & Zoz., *T. biebersteiniana* Schult.)	–	+	–	–	–
136	*Typha angustifolia* L.	+	–	–	–	–
137	*Typha latifolia* L.	+	–	–	–	–
138	*Vicia sepium* L.	+	–	–	–	–
139	*Viola alba* Bess.	–	+	–	–	–

Note. **IUCN** – IUCN Red List of Threatened Species; **RBU** – Red Book of Ukraine; **K** – Lists of regionally rare species protected in the city of Kyiv and Kyiv Region; **CITES** – Convention on International Trade in Endangered Species of Wild Fauna and Flora; **BC** – Appendix to the Bern Convention.

Cerasus klokovii, *Chamaecytisus podolicus*, *C. rochelii*, *Euonymus nanus*, *Fraxinus ornus*, *Onoclea struthiopteris*, *Syringa josikaea*, *Spiraea polonica*, *Staphylea pinnata*, *Allium ursinum*, *Asphodeline lutea*, *Convallaria majalis*, *Corydalis cava*, *Dictamnus albus*, *Galanthus nivalis*, *Festuca pallens*, *Isopyrum thalictroides*, *Melica transsilvanica*, *Primula veris*, *Pulsatilla pratensis* and others, which formed homeostatic populations or stable biogroups in the forest, meadow, meadow-steppe, and riparian-aquatic ecosystems of the dendropark (Galkin & Kalashnikova, 2014; Grevtsova & Kalashnikova, 2014; Kalashnikova, 2016; Kalashnikova & Galkin, 2017).

In 2018–2022, based on new methodological approaches to the assessment of rare species proposed by Popovych (Popovych, 2010, 2011; Popovych et al., 2013, 2016), and later developed by Stepanenko & Popovych (2015) and Klymenko & Kuznetsov (2014), the life forms' formulas for 187 rare species were established. These formulas reflect the share of participation of each biomorphological

group in the dendropark's phytocoenoses. An analysis was conducted by height classes and phytocoenotypic structure. The age status (ratio of mature, middle-aged, and young plants) and vital status (ratio of healthy, damaged, heavily damaged, dying, and deadwood) of the plants under the conditions of further climate xerophytization were established. Based on meteorological indicators in the research region and phenological observations of 79 rare species, a complex of unfavorable climatic factors limiting their development was identified. Based on the research results, methodological recommendations were provided for optimizing the conservation of phytorarities in the dendropark "Olexandria" (Kalashnikova & Galkin, 2018; Kalashnikova, 2019; Kalashnikova & Doroshenko, 2020, 2021).

Studies conducted in 2023–2026 aim to characterize ecotopes and the growing conditions of rare-species populations, their distribution and spatial patterns, and to determine their frequency of occurrence and population development based on projected cover abundance. The species composition of five seasonal aspects of the herbaceous layer in natural and artificial biotopes was analyzed. These biotopes correspond to categories C, D, G, E, and G:14.21 (Didukh et al., 2011; Didukh, 2020). The distribution and quantitative species ratios of herbaceous plant fluctuations were established. In the forest biotope, the spatial structure of tree stands was analyzed, and the status of coenopopulations of 13 ephemeroid and 30 rare herbaceous plant species influenced by this structure was assessed. In meadow, meadow-steppe, riparian-aquatic, and aquatic biotopes, the frequency of occurrence of 84 species with varying conservation statuses was analyzed (Kalashnikova et al., 2024; Kalashnikova & Doroshenko, 2025). Based on the results of the overall comprehensive work, 247 scientific publications have been published.

References

Antonyuk, N.E. (1984). The phytocenotic principle of creating collections in the Central Republican Botanical Garden of the Academy of Sciences of the Ukrainian SSR. *Bulletin of the Main Botanical Garden, 133,* 3–5. (In Russian)

CITES. (2025). Convention on international trade in endangered species of wild fauna and flora. CITES species checklist. https://checklist.cites.org

Council of Europe. (1979). Convention on the conservation of European wildlife and natural habitats. Appendix I: strictly protected flora species (ETS No. 104). https://coe.int

Didukh, Y.P. (2020, March 25–26). Methodological foundations of assessing the differentiation of biotopes. In Y.P. Didukh (Ed.), *Proceedings of the Scientific Conference "Classification of vegetation and biotopes of Ukraine"* (pp. 6–13). Kyiv. (In Ukrainian). http://www.botany.kiev.ua/doc/conf_klas_rosl_2020.pdf

Didukh, Y.P. (Ed.). (2009). *Red book of Ukraine. Plant world.* Globalconsulting, Kyiv. (In Ukrainian)

Didukh, Y.P., Fitsaylo, T.V., Korotchenko, I.A., Yakushenko, D.M., & Pashkevych, N.A. (2011). *Biotopes of the forest and forest-steppe zones of Ukraine.* Macros, Kyiv. (In Ukrainian)

Galkin, S.I., & Kalashnikova, L.V. (2013). Current questions of conservation of rare plant species in the Dendropark Olexandria. *Plant Introduction, 53,* 12–17. (In Ukrainian). https://doi.org/10.5281/zenodo.1492295

Galkin, S.I., & Kalashnikova, L.V. (2014). The problems of protection and conservation of rare plants of the state dendropark "Olexandria" of the National Academy of Sciences of Ukraine. *Journal of Botany. Chisinau, 6*(8), 53–61.

Grevtsova, G.T., & Kalashnikova, L.V. (2014). The morphological features of fruits and seeds of rare species of woody plants in the conditions of the dendropark "Olexandria" of the NAS of Ukraine. *Bulletin of the V.N. Karazin Kharkiv National University. Ser. Biology, 1100*(20), 29–35. (In Ukrainian)

IUCN. (2025). The IUCN red list of treatened species. https://www.iucnredlist.org/

Kalashnikova, L.V. (2004). Assessment of the prospects for the introduction of rare woody plants of Ukraine in the cultural coenoses of the Dendropark "Olexandria" of the NAS of Ukraine. *Biological Journal. Kharkiv, 8*(1), 71–73. (In Russian)

Kalashnikova, L.V. (2007). Main features of development and age structure of artificial population of *Staphylea pinnata* L. in cultural phytocenoses of the Dendropark "Olexandria". *Scientific Notes. Ser. Biology, 4*(34), 38–41. (In Ukrainian)

Kalashnikova, L.V. (2008). Peculiarities of growth and development of rare plants in the introduced populations of the Dendropark "Olexandria" of the National Academy of Sciences of Ukraine. *Bulletin of the Bila Tserkva National Agrarian University, 54*, 82–86. (In Ukrainian)

Kalashnikova, L.V. (2009). Growth of annual shoots of rare woody plants in the ecological conditions of the Right-Bank Forest-Steppe (Dendropark "Olexandria"). *Ecology. Biological Sciences, 1,* 101–108. (In Ukrainian)

Kalashnikova, L.V. (2011a). Structure of introduced populations of rare woody species in Dendrological Park Olexandria. *Plant Introduction, 51,* 43–48. (In Russian). https://doi.org/10.5281/zenodo.2544471

Kalashnikova, L.V. (2011b). Growth and development of seedlings and saplings of rare tree species in the conditions of the Right-Bank Forest-Steppe. *Scientific Bulletin,164,* 239–243. Kyiv. (In Ukrainian)

Kalashnikova, L.V. (2012). Consrevation of rare species of woody plants in quasinatural ecosystems of the Right-bank Forest-Steppe (on example of the dendropark "Olexandria") [Abstract of the dissertation for the degree of Candidate of Biological Sciences, Taras Shevchenko National University of Kyiv]. (In Ukrainian)

Kalashnikova, L.V. (2016). The monitoring studies of the introduced population of *Staphylea pinnata* L. in the phytocenotic conditions of the dendropark "Olexandria". *Scientific Bulletin of the National Technical University of Ukraine, 26*(3), 81–87. (In Ukrainian)

Kalashnikova, L.V. (2019). The conservation of relict species *ex situ* conditions. *Ecological Sciences, 1*(24), 112–116. (In Ukrainian). https://doi.org/10.32846/2306-9716-2019-1-24-2-22

Kalashnikova, L.V., & Doroshenko, Y.V. (2020). The comprehensive assessment of rare species of the Magnoliophyta of the collection of the Dendropark "Olexandria". *Ecological Sciences, 3*(30), 176–181. (In Ukrainian). https://doi.org/10.32846/2306-9716/2020.eco.3-30.29

Kalashnikova, L.V., & Doroshenko, Y.V. (2021). The biomorphological analysis of rare dendroflora of the Dendropark "Olexandria" of the NAS of Ukraine. *Ecological Sciences, 7*(34), 91–96. (In Ukrainian). https://doi.org/10.32846/2306-9716/2021.eco.7-34.15

Kalashnikova, L.V., & Doroshenko, Y.V. (2025, September 9–10). The ecological assessment of the growth conditions of rare species of herbaceous plants in the forest biotope of the Dendropark "Olexandria" of the NAS of Ukraine. In *Proceedings of the International Scientific and Practical Conference "Current issues of ecology, botany, beekeeping and economics of balanced nature management"* (pp. 91–94). Kyiv. (In Ukrainian). https://doi.org/10.32782/978-617-8598-72-3

Kalashnikova, L.V., & Galkin, S.I. (2016). Sozological analysis of dendroexotics of Dendrological Park Olexandria of the NAS of Ukraine. *Plant Introduction, 72,* 28–38. (In Ukrainian). https://doi.org/10.5281/zenodo.2457385

Kalashnikova, L.V., & Galkin, S.I. (2017). Taxonomic, sozological and biological characteristics of rare species of herbaceous plants from collection of Dendrological Park Olexandria of the NAS of Ukraine. *Plant Introduction, 76,* 19–24. (In Ukrainian). https://doi.org/10.5281/zenodo.2327454

Kalashnikova, L.V., & Galkin, S.I. (2018). The analysis of the rare gymnosperm component (Pinophyta) of the collection of the Dendropark "Olexandria" of the NAS of Ukraine according to the latest reports of official red lists. In S.M. Nikolayenko (Ed.), *Floristic and cenotic diversity in recovering, protection and preservation of the plant world.* Lira-K, Kyiv. (In Ukrainian). https://nubip.edu.ua/sites/default/files/u260/kolektivna_monografiya_2018.pdf

Kalashnikova, L.V., Boyko, N.S., Sylenko, O.V., Soloshenko, V.S., & Doroshenko, Y.V. (2024). The influence of climatic conditions on the seasonal development of rare species of woody plants of the Dendropark "Olexandria" at the beginning of the 21st century. *Ecological Sciences, 1*(52), 211–221. (In Ukrainian). https://doi.org/10.32846/2306-9716/2024.eco.1-52.1.33

Klymenko, Y.O., & Kuznetsov, S.I. (2014). *The comprehensive assessment of park plantings: methodological approaches and recommendations*. Kyiv. (In Ukrainian)

Kyiv Oblast Council. (2012). *Official lists of regionally rare plants of administrative territories of Ukraine. Excerpt from Appendix I to the decision of the Kyiv Regional Council No. 285-15-VI on 07.02.2012.* Kyiv. (In Ukrainian)

MEPNRU. (2021). *On approval of lists of plant and fungal species included in the Red Data Book of Ukraine (plant kingdom), and plant and fungal species excluded from the Red Data Book of Ukraine (plant kingdom). Order No. 111 on 15.02.2021.* Ministry of Environmental Protection and Natural Resources of Ukraine. (In Ukrainian). https://zakon.rada.gov.ua/laws/show/z0370-21

Popovych, S.Y. (2010). *Reserve dendrosozoflora of the Forest-Steppe of Ukraine.* Agrar Media Group, Kyiv. (In Ukrainian)

Popovych, S.Y. (2011). *Dendrosozological catalog of the nature reserve fund of the Forest-Steppe of Ukraine*. Agrar Media Group, Kyiv. (In Ukrainian)

Popovych, S.Y., Vlasenko, A.S., & Bereguta, E.I. (2013). *Reserve dendrosozoflora of the Steppe of Ukraine.* Komprint, Kyiv. (In Ukrainian)

Popovych, S.Y., Vlasenko, A.S., & Kryvenko, O.G. (2016). *Checklist of dendroexotics of Ukraine*. Komprint, Kyiv. (In Ukrainian)

Shelyag-Sosonko, Y.R., & Ustymenko, P.S. (2002). Rare gene pool of Ukrainian forests: analysis and categorization. *Ukrainian Botanical Journal, 59*(4), 365–372. (In Ukrainian)

Stepanenko, N.P., & Popovych, S.Y. (2015). *Reserve dendrozophytes of the Forest-Steppe of Ukraine.* Agrar Media Group, Kyiv. (In Ukrainian)

80 років дендропарку “Олександрія” у складі Національної академії наук України: Збереження раритетних видів рослин у квазіприродних екосистемах дендропарку “Олександрія”

Людмила Калашнікова

Державний дендрологічний парк “Олександрія” НАН України, Біла Церква-13, Київська обл., 09113, Україна; kalashnikovaluda@gmail.com

Висвітлено результати досліджень щодо збереження та відновлення раритетного флорофонду дендропарку “Олександрія” за п’ятьма науковими темами. Зокрема, оцінено адаптаційні можливості інтродукованих та природних раритетних рослин в квазіприродних екосистемах дендропарку, які ценотично пов’язані з лісовими, лучними, лучно-степовими, прибережно-водними та водними угрупуваннями. Доведено перспективність формування з раритетних видів гомеостатичних інтродукційних популяцій, клонів та біогруп *ex situ*. За результатами інвентаризації з’ясовано, що на теперішній час раритетна складова дендропарку налічує 282 види та підвиди природного й культурного походження. З них до Червоної книги України залучено 92 види. Окрім того, 41 вид охороняється у місті Києві та Київській області. Під міжнародною охороною перебувають 214 видів; зокрема, 8 видів охороняються Додатком Бернської конвенції і дев’ять – Конвенцією CITES. Майже 35 % (98 видів) зберігаються на створеній колекційній ділянці “Рідкісні рослини флори України”. За концепцією збереження раритетних видів в умовах *ex situ* вивчено репродуктивний потенціал та рівень життєздатності природних та інтродукованих видів раритетного флорофонду та запроваджено моніторинг за площею, чисельністю та віковою структурою популяцій, клонів та біогруп раритетних видів у лісових, лучних, лучно-степових та прибережно-водних екосистемах дендропарку. Проведені дослідження надають вагомі докази того, що найперспективнішим методом збереження раритетних видів *ex situ* є самовідновлювані стійкі популяції, зокрема інтродукційні, які є фрагментами природних фітоценозів і перебувають у постійній взаємодії з їхніми компонентами. За фенологічними спостереженнями з’ясовано комплекс несприятливих кліматичних факторів, які обмежують розвиток 79 інтродукованих дендросозофітів в умовах кліматичних змін у регіоні досліджень. За результатами досліджень надано методичні рекомендації щодо оптимізації збереження фітораритетів дендропарку “Олександрія”.

Ключові слова: раритетний флорофонд, комплексні дослідження, збереження, інтродукційні популяції, моніторинг