Baltic Botanic Gardens in 2024-2025

Estonia Latvia Lithuania



Baltic Botanic Gardens in 2024-2025

Estonia Latvia Lithuania

The periodical issue of Baltic Botanic Gardens includes information about the main events in the botanical gardens of Estonia, Latvia and Lithuania. It contains statistical information about the gardens and articles about collections, conducted research and public activities. The authors themselves are responsible for the contents of the published papers.

Baltic Botanic Gardens

LATVIJAS VALSTS MEŽI
ARBORĒTUMS

KOPŠ 1975
50

Latvia's State Forest arboretum in Kalsnava
"Ogu īves", Kalsnava parish, Madona municipality, LV-4860, Latvia

© Latvia's State Forest arboretum in Kalsnava ISBN (to be issued)

Riga, Latvia
2026

Table of contents

6 Introduction

8 Report of development

10 Latvia's State Forest arboretum in Kalsnava

14 University of Latvia Botanical garden

24 National Botanic garden of Latvia

30 Tallinn Botanic garden

42 University of Tartu Botanical garden

46 Vilnius University Botanical Garden

58 Vytautas Magnus University Botanical garden

68 Klaipeda University Botanical garden

74 Vilnius university Šiauliai Academy Botanical Garden

80 Articles

82 Collection of ornamental Norway spruce Picea abies forms of wild local origin in the Latvia's State Forest arboretum in Kalsnava

88 The Botanic Garden as a Space for Curriculum Based Informal Education

98 New ornamental cultivars of Deschampsia cespitosa from the Vytautas Magnus University Botanical Garden

108 Modernization of the Palm House for Subtropical Plant Collections at the University of Latvia Botanical Garden

114 The use of phenological observations in VU Šiauliai Academy Botanical Garden

120 Vilnius University Botanical Garden: from its origins to the present day

136 Rosarium of the Tallinn Botanic Garden

152 Astilbes in Tallinn Botanic Garden

162 Integrating Plant Crafts into Learning

170 Overview of Estonian spring bulb cultivars and their conservation at the University of Tartu Botanical Garden

180 Structural Differentiation of Root Endophytic Communities in Festuca Tourn. ex L., Lolium L. and Hybrid Grasses

196 Ericaceae Family Collection in Vilnius University Botanical Garden

206 Conference

Introduction

The Baltic Association of Botanical Gardens has served as a symbol of cooperation, professional friendship and shared passion for more than thirty years. Since 1992, this publication has reflected the development, achievements and most significant events of the botanical gardens of the Baltic States, affirming our common commitment to caring for the preservation of plant diversity, the development of science and research, environmental education and inspiring society.

This publication summarizes the achievements of the Baltic botanical gardens in 2024–2025 – a time that has brought changes, challenges and, at the same time, new opportunities to many institutions. Our gardens have repeatedly demonstrated their ability to grow, develop and maintain high standards of quality even in conditions that require flexibility, strategic thinking and professional resilience.

For the Latvia's State Forest arboretum in Kalsnava, 2025 has also been a time of significant changes and new professional challenges. As a result of the company's reorganization, the arboretum's activities were included in the structure of Forest Information Centre dendrological parks, a subdivision of the "LVM Recreation and Environment" department, while simultaneously expanding management responsibility for 13 more dendrological plantations throughout Latvia. Such development allows for the creation of a unified and professionally managed network of dendrological parks, ensuring the preservation and sustainable development of the Latvia's state dendrological gene pool, serving scientific research, environmental education and promoting public awareness.

It was a special honour for the Latvia's State Forest Arboretum in Kalsnava in 2025 to host colleagues from the Baltic botanical gardens in the year of the arboretum's 50th anniversary. This meeting once again confirmed how strong, open and inspiring the Baltic botanical garden community is, which is based on mutual trust, exchange of experience and shared responsibility for the preservation of natural heritage.

This publication collects not only statistical information and reports on the activities of the gardens, but also scientific and professional articles that reveal the diversity, knowledge and development directions of our gardens. These are stories about everyday work, long-term processes and values that unite botanical gardens in the Baltic region.

I would like to express my sincere gratitude to all authors, cooperation partners and colleagues for their contribution to the creation of this publication. May it serve as a source of inspiration, strengthen our mutual cooperation and become an important testimony to the joint work of the Baltic botanical gardens.

Liene Opincāne
Head of the Latvia's State Forest dendrological parks
Kalsnava, 2026

Report of development

10 Latvia's State Forest arboretum in Kalsnava

14 University of Latvia Botanical garden

24 National Botanic garden of Latvia

30 Tallinn Botanic garden

42 University of Tartu Botanical garden

46 Vilnius University Botanical Garden

58 Vytautas Magnus University Botanical garden

68 Klaipeda University Botanical garden

74 Vilnius university Šiauliai Academy Botanical Garden

Latvia's State Forest arboretum in Kalsnava

Address	**"Ogu īves", Jaunkalsnava, Kalsnava parish, Madona district, LV-4860, Latvia**
Phone	**+371 27841099**
E-mail	**arboretums@lvm.lv**
www	**atputa.lvm.lv/en/mammadaba-nature-objects/latvias-state-forests-arboretum-in-kalsnava**
Director	**Liene Opincāne**
Territory area	**130 ha**

Living plant collections

Total No. of taxa in 2025: 2860

Main taxa	No. of taxa
Trees and shrubs, including:	2530
Conifer species and alien cultivars	760
Conifer forms of Latvian origin	66
Rhododendrons	200
Hydrangeas	140
Herbaceous plants, including:	330
Paeonia cultivars	330

Scientific activities

2024

Scientific publications

- Strode L., Opincāne L. *Spruce Picea* A.Dietr. collection in the Latvia's State Forests Kalsnava Arboretum. Baltic Botanic Gardens in 2021-2023. Vilnius, 2024. p. 158.–167.
- Roze D., Strode L., Lazdāne M. The hazelnut *Corylus* L. species and ornamental cultivars in the scientific collections in Latvia: inventory results and recommendations for the creation and maintenance of the collection. Latvijas veģetācija, 2025, 35, p. 28.–74.

Conferences

- Strode L. Development of recommendations and criteria for the assessment of dendrological values and uniqueness of the specially protected dendrological plantations of Latvia. Biennal meeting of the Nordic Arboretum Comitee at the Latvia's State Forests Kalsnava Arboretum. 26.-30.08.2024.
- Strode L. Spruce *Picea* A.Dietr. collection in the Latvia's State Forests Kalsnava Arboretum. Baltic Botanic Gardens meeting at the Vilnius University Botanical Garden. 03.-4.10.2024.

Other activities

- In August 2024, the biennial meeting of the Nordic Arboretum Committee was held at the Latvia's State Forest arboretum in Kalsnava.

- The arboretum participates in the annual Latvia's Forest Days organized by JSC "Latvia's State Forests", introducing pupils and families to forest ecosystems and biological diversity in Latvia and worldwide. The event attracted more than 15000 visitors in 2024 and over 16500 in 2025, offering activities related to forest restoration, sustainable management, and career opportunities in the forestry sector.

- In September 2025, arboretum hosted the annual meeting of Baltic Botanic Gardens. In conjunction with the arboretum's 50th anniversary, an exhibition on its history was created in cooperation with the Madona History Museum. The same year, the trail network in compartment C2 was completed, improving access to the collections and initiating the establishment of a Philadelphus garden.

- The arboretum actively contributes in implementation of environmental education by participating in various events of regional and national scale, such as Environmental Days in Latgale, conversation festival "LAMPA" in Cēsis, and the annual Green Class initiative, which engaged up to 2000 pupils in 2025.

- Educational programmes are offered for school and preschool groups, with participation increasing from over 500 pupils in 2024 to more than 1400 children in 2025. In addition, the arboretum supports teacher professional development through national forums and by hosting the conference "The Green Schoolyard: How to Teach and Learn in Nature." Guided excursions led by arboretum specialists or professional guides are available to visitors.

Visitors per year

	2024	2025
Number of visitors	12242	14080

Structure and staff

	2024	2025
Administration	2	2
Dept. of Environmental Education	2	2
Dept. of Outdoor Collections	2	2
Technical staff	2	2
Seasonal field staff	11	11
TOTAL including:		
PhD	-	-
Msc	4	4

Finances (in EUR)

	2024	2025
Income		
TOTAL	786 048	791 396
Expenses		
TOTAL	73539	73000

University of Latvia Botanical garden

University of Latvia Botanical Garden

Address	**Jāņa Šteinhauera iela 2, Riga, LV-1083, Latvia (main area)**
Phone	**+371 26422065**
E-mail	**botaniskais.darzs@lu.lv**
www	**www.botanika.lu.lv**
Director	**Renāte Lagzdiņa**
Territory area	**14.8 ha**

Rhododendron Breeding and Testing Nursery “Babīte”

Address	**“Rododendri”, Spilve, Babītes pagasts, Mārupes novads, LV-2101, Latvia**
Phone	**+371 67913127**
E-mail	**rodod@lu.lv**
www	**www.rododendri.lu.lv**
Director	**Renāte Lagzdiņa**
Territory area	**11.8 ha**

Living plant collections at the Botanical Garden (main area)

Total No. of taxa (2025): 5765

Main taxa	No. of taxa
Indoor plants, including:	1299
Succulent plants	608
Tropical plants	332
Subtropical plants	359
Azaleas	141
Trees and shrubs, including:	906
Rhododendrons	125
Magnolias	20
Herbaceous ornamental plants, including:	1800
Herbaceous perennial plants	1538
Lilies	42
Dahlias	220
Plant beds	346
Biological and morphological groups of plants, including:	1185
Medicinal plants	295
Poisonous plants	38
Mire plants	28
Grasslands and meadows	60

Living plant collections at the Rhododendron Breeding and Testing Nursery “Babīte”

Total No. of taxa (2025): 529

Main taxa	No. of taxa
Rhododendron species	119
Rhododendron cultivars	410

Scientific activities

2024–2025

Projects

- The University of Latvia project "The study of plant diversity *ex situ*".
- Lead partner in LIFE project "Peatland restoration for greenhouse gas emission reduction and carbon sequestration in the Baltic Sea region", LIFE21 - CCM - LV - LIFE – PeatCarbon, 2022-2027.
- Partner in the LIFE project "Optimising the Governance and Management of the Natura 2000 Protected Areas Network in Latvia" (LIFE-IP LatViaNature), LIFE19 IPE/LV/000010, 2020–2027.
- Participation in COST Action CA21157 - European Network for Innovative Woody Plant Cloning (COPYTREE), 2022-2026

2024

Conferences

- Ķeire L., Strazdiņa L., Rūsiņa S. Enhancing plant diversity in urban lawns. 66th IAVS Annual Symposium, 32nd Conference of the IAVS Working Group European Vegetation Survey, 16.-20.09.2024, Funchal, Madeira. Book of Abstracts, p. 130.
- Nāburga I. Introduction of ornamental grasses from family *Poaceae* in Latvia. In: Book of abstract of European Horticulture Congress In Bucharest, Romania, 13.-16.05.2024, p. 26.
- Tomsone S., Lazdane M., Kalnina J. *In vitro* propagation of lingonberry *Vaccinium vitis-idaea* L. The 2nd conference of Cost Action CA21157 COPYTREE. In vitro culture of woody crops: problem solving by new approaches, 22.-24.04.2024, Bulduri Technical School, Jūrmala, Latvia. Book of Abstracts, p. 69.
- Kunrads K., Gudrupa I., Ķeire L., Akmane I., Berga R. K. and Tomsone S. Promoting the use of plant resources through horticultural knowledge communication. 8th Global Botanic Gardens Congress, 06.-09.08.2024, Singapore. https://www.8gbgc.sbg.org.sg/Storage/PDFs/AbstractPDF/ABS-00221.pdf
- Berga R.K. et al. Extinction risk assessment of vascular plant species in Latvia: first results. XX International Botanical Congress IBC 2024, 21.–27.07.2024, Madrid, Spain. Book of Abstracts. Posters, p. 695. https://ibcmadrid2024.com/docs/secciones/24.pdf
- Berga R.K. et al. Results of the extinction risk assessment of nationally protected vascular plant species in Latvia. LIFE for Species International conference: Safeguarding Biodiversity: Red Lists and Beyond, 18.–20.09.2024, Rīga.
- Berga R.K., Dauškane I., Miķelsone A. New insights into the growth conditions and distribution of the protected intermediate wintergreen Pyrola media Sw. in Latvia. LIFE for Species International conference: Safeguarding Biodiversity: Red Lists and Beyond, 18.-20.09.2024, Rīga.
- Breeding (Rhododendron Breeding and Testing Nursery "Babīte")
- The Royal Horticultural Society Certificate of International Registration for seven rhododendron cultivars: 'Ārija', 'Dārza elpa', 'Lapsaste', 'Ābeļzieds', 'Lettonia's Roberts Rūsis', 'Mežtaka' and 'Zigis'.

2025

Publications

- Cano A., (...), Nāburga I. et al. Insights from a century of data reveal global trends in *ex situ* living plant collections. Nature Ecology and Evolution, 2025, 9, p. 214-224 DOI:10.1038/s41559-024-02633-z
- Nāburga I. Introduction of perennial ornamental grasses from the family Poaceae in Latvia. EHC2024: International Symposium on the History of Horticulture in Europe. Acta Horticulturae, 2025, September, pp. 411-418. DOI:10.17660/ActaHortic.2025.1438.49

- Roze D., Strode L., Lazdāne M. The hazelnut *Corylus* L. species and ornamental cultivars in the scientific collections in Latvia: inventory results and recommendations for the creation and maintenance of the collection. Latvijas veģetācija, 2025, 35, p. 28.-74.

Conferences

- Ķeire L., Akmane I., Rūsiņa S. From concept to reality: three urban meadow initiatives at the University of Latvia Botanical Garden. 10th European Botanic Gardens Congress EUROGARD, Botanic Gardens in the UN Decade of Ecosystem Restoration, 22.-26.09.2025, Rome, Italy. Book of Abstracts, p. 149.

- Ķeire L., Rūsiņa S., Tomsone S. Early results in grassland restoration experiment in the University of Latvia Botanical Garden. International conference Together for Nature: Merging Public and Private Efforts. Organized by LIFE-IP LatViaNature project. 25.-26.09.2025. Rīga, Latvia. Book of Abstracts, p. 6.

- Tomsone S., Ķeire L., Langenfelde I. Creation of the expositions for biodiversity demonstration on the University of Latvia Botanical Garden. International conference Together for Nature: Merging Public and Private Efforts. Organized by LIFE-IP LatViaNature project. 25.-26.09.2025., Rīga, Latvia. Book of Abstracts, p. 17.

- Ķeire L. Public evaluation of grassland management techniques: a long-term study at the University of Latvia Botanical Garden. The Global Strategy for Plant Conservation - International Plant Conservation Conference 12.-14.03.2025., Missouri, USA, Conference Programme, p. 19. https://www.missouribotanicalgarden.org/Portals/0/Science%20and%20Conservation/PDFs/Conferences/Global%20Partnership%20for%20Plant%20Conservation%20Programme.pdf

- Nāburga I. Herbaceous ornamental garden escapers – a path from the urban environment to the forest. Abstract Proceedings of the 5th International Scientific Conference Society. Technology. Solutions. Valmiera, Latvija, 16.10.2025, p. 16. DOI: https://doi.org/10.35363/ViA.sts.2025.113

- Breeding (Rhododendron Breeding and Testing Nursery "Babīte")

- The Royal Horticultural Society Certificate of International Registration for five rhododendron cultivars: 'Gundega', 'Kalsnavas arborētums', 'Mana Madona', 'Zanda' and 'Ingmārs'.

Other activities

2024

Rhododendron Breeding and Testing Nursery "Babīte"

- Nursery has joined the Global Conservation Consortium for Rhododendron.

- Expedition to the Romanian Carpathians to collect *Rhododendron kotschyi* material for *ex situ* propagation for species conservation purposes and to conduct molecular analyses to assess genetic diversity. (19.-25.10.2024, R. K. Berga, K. Kunrads).

- Opening of Japanese Garden.

2025

Botanical Garden (main area)

- Following the completion of reconstruction works, the Palm House was reopened to the public.

- Completion of the reconstruction of the Bog Exhibition.

- A temporary modular building for staff has been constructed.

- Commemorative event and exhibition marking the birthday of the first Director of the Botanical Garden of the University of Latvia, Professor Nikolajs Malta (1890–1944).

Rhododendron Breeding and Testing Nursery "Babīte"

- Expedition to Bulgaria within the framework of the project "New Trees for the Arboretum". During the expedition, five protected natural areas were visited. In total, seeds and cuttings from 12 taxa were collected, as well as leaves of *Rhododendron kotschyi* for genetic analyses (17.-29.09.2025, R. K. Berga).

- An exhibition dedicated to European wild rhododendron species was opened.

Visitors per year at the Botanical Garden (main area)

	2024	2025
Number of visitors	36809	39846

Visitors per year at the Rhododendron Breeding and Testing Nursery "Babīte"

	2024	2025
Number of visitors	22853	28746

Structure and staff of the Botanical Garden

Main area (*sum of workloads, except project staff, whose number of employees varies from 17 to 24 per year*)

	2024	2025
Administration	2.03	1.53
Academic staff	0.95	0
Field staff	14.45	15.33
Technical staff	8.66	12.06
Technical staff*	2.00	2.00
TOTAL, including:	**26.09**	**28.92**
PhD (employees)	4	4
MSc (employees)	4	5

*number of employees with other type of contract

Structure and staff of the Rhododendron Breeding and Testing Nursery "Babīte" *(sum of workloads)*

	2024	2025
Administration	2.50	2.00
Academic staff	1.08	1.73
Field staff	9.45	8.70
Technical staff	5.00	5.00
TOTAL, including:	**18.03**	**17.43**
PhD (employees)	1	1
MSc (employees)	5	5

Finances of the Botanical Garden main area *(in EUR)*

	2024	2025
Income		
Financing granted by the University of Latvia	555 707	563 069
Self-generated income	250 867	306 507
External grants (EU LIFE)	591 518	1 697 654
TOTAL	**1 398 092**	**2 567 230**
Expenses*		
Salaries with taxes	816 896	856 425
Other expenses	216 923	1 252 293
TOTAL	**1 033 819**	**2 108 718**

*does not include external project expenses (EU LIFE)

Finances of the Rhododendron Breeding and Testing Nursery "Babīte" *(in EUR)*

	2024	2025
Income		
Financing granted by the University of Latvia	146 000	140 000
Self-generated income (tickets, plant sales, etc.)	187 448	278 334
TOTAL	**333 448**	**418 334**
Expenses		
Salaries with taxes	259 274	270 015
Goods and services	76 017	40 372
Contribution to the University's budget	15 427	23 358
TOTAL	**350 718**	**333 745**



National Botanic garden of Latvia

Address	**Miera Street 1, Salaspils, LV-2169, Latvia**
Phone	**+371 67945460**
E-mail	**nbd@daba.gov.lv**
www	**www.nbd.gov.lv; www.botania.lv**
Director	**Artis Vītiņš**
Territory area	**129 ha**

Living plant collections

Total No. of taxa (2025): 13698

Main taxa	No. of taxa
Indoor plants, including:	**2620**
Greenhouse flowers (gerberas, chrysanthemums, alstroemerias, pelargonium, cyclamen a.o. species and cultivars)	520
Orangery plants	2100
Trees and shrubs, including:	**4430**
Conifers (incl. new forms)	830
Rhododendrons	250
Crataegus	200
Rosa cv.	430
Other woody plants	2720
Herbaceous plants, including:	**5392**
Bulbous plants species collections	1800
Dahlia cv.	295
Astilbe cv.	157
Phlox paniculata cv.	120
Hosta cv.	97
Paeonia cv.	302
Hemerocallis	476
Iris	265
Tulips	274
Narcissus, Hyacinths	121
Lilium sp.+ cv	302
Rock garden plants	696
Other perennials	367
Annual flowers	120
Utility plants (berry, medicinal, spice etc.)	**1113**
Rare and endangered plants of Latvia	**143** (incl. 73 *in vitro*)

Herbarium

50 000 specimens

Scientific activities

2024

Scientific conferences

- 82nd International Scientific Conference of the University of Latvia. Riga, Latvia, 08.02.2024.:

– Apine I., Megre D. 2024. Use of root cuttings in Rhododendron propagation (in Latvian).

- International conference "Safeguarding Biodiversity: Red Lists and Beyond". Riga, Latvia, 18.–20.09.2024.:

– Auniņa L., Baroniņa V., Berga R.K., Bojāre A., Evarte-Bundere G., Evarts-Bunders P., Dauškane I., Gritāne Dz., Grīnberga L., Ikauniece S., Kabucis I., Kluša J., Kļaviņa D., Krasnopoļska D., Kukāre I., Laime B., Opermanis O., Opmanis A., Priede A., Putna S., Roze I., Rustanoviča N., Suško U., Svilāne I., Svirževska L., Uzule L., Čekstere-Muižniece G. 2024. Results of the extinction risk assessment of nationally protected vascular plant species in Latvia.

– Grauda D., Priede A., Butkauskas D., Muceniece P.M., Kļaviņa D., 2024. Genetic diversity of yellow lady's-slipper (*Cypripedium calceolus* L.) populations in Latvia and Estonia.

– Kļaviņa D., Zviedre E., Jakobsone G., Osvalde A., Tabors G., Priede G., Dubova I., 2024. Inventory of Eastern pasqueflower (*Pulsatilla patens* (L.) Mill.) populations in Latvia and prospects for conservation of this rare species.

2025

Scientific conferences

- 83rd International Scientific Conference of the University of Latvia. Riga, Latvia, 29.01.2025.:

– Osvalde A., Kļaviņa D. Soil nutrient availability and its potential relationship with the population size and demographic indicators of the forest pasqueflower (Pulsatilla patens) in Latvia (in Latvian).

– Megre D., Apine I. Anatomical structure of evergreen rhododendrons' root cuttings and formation of adventitious buds in them (in Latvian).

– European Botanic Garden Congress EuroGard 10, Rome, 19-26th September:

– L. Višņevska, L. Līdaka. Environmental Education Center "Botania" – first reviews and conclusions

Scientific publications

- Kļaviņa, D., Osvalde, A.; Tabors, G.; Jakobsone, G. Current Status of *Pulsatilla patens* in Latvia—Population Size, Demographic and Seed Viability Indicators, Soil Parameters and Their Relationships. Plants 2025, 14, 375. https://doi.org/10.3390/plants14030375

Other activities

2024

Guided excursions - 180; workshops for school children – 70; thematic plant fairs – 5; exhibitions in NBG – 12; participation in exhibitions outside NBG – 5; other public events – 30; scientific popular lessons – 20; TV – 25; radio – 19; publications in press – 32, including 2 books: Z. Purne "Telpaugi" (Houseplants), and "Mājas augi veselībai" (Houseplants for health) – Rīga, Latvijas Mediji, 2024.

2025

Guided excursions - 175; workshops for school children – 81; thematic plant fairs – 5; exhibitions in NBG – 18; participation in exhibitions outside NBG – 3; other public events – 32; scientific popular lessons – 5; TV – 8; radio – 6; publications in press – 23.

Visitors per year

	2024	2025
Number of visitors	92731	74122

Structure and staff

	2024	2025
Administration	10.2	10.2
Department of Education and Information	16	16
Department of Ecophysiology	5	5
Dendroflora Department	8.5	7.2
Department of Food, Aromatic and Medicinal Plants	4	4
Department of Herbaceous plants	8.3	9
Department of Houseplants of Latvian Breeding	7.8	7
Orangery Department	4	4
Technical Department	11	9
Plantation Maintenance Department	8.4	8.4
TOTAL including:	**83.2**	**79.8**
PhD (persons/workloads)	6/5.8	4/3.8
Msc (persons/workloads)	11/9.6	9/8.2

Finances *(in EUR)*

	2024	2025
Income, including:	**2 381 331**	**2 231 333**
State financing	1 902 098	1 800 684
Own income (tickets, plant sell a.o.)	479 233	430 649
Expenses, including:	2 646 708	2 231 333
Salaries (incl. taxes)	1 419 823	1 456 434
Maintenance expenses	850 864	523 805
Capital expenditures	376 021	251 094



In accordance with State Administration Structure Law, the State Scientific Institute – the Derived Public Entity "National Botanic Garden of Latvia" – has been liquidated by December 31, 2024, and a direct administrative institution subordinate to the Minister of Smart Administration and Regional Development "National Botanic Garden of Latvia" has been established as of January 1, 2025.

In order to improve the institutional systems of public administration and ensure the efficiency, optimization and reduction of bureaucracy of their operations, the National Botanic Garden of Latvia was liquidated as of January 1, 2026, by attaching it to the Nature Conservation Board.

Tallinn Botanic garden

Address	**Kloostrimetsa tee 52, 1193, Tallinn, Estonia**
Phone	**+372 606 2679**
E-mail	**aed@botaanikaaed.ee**
www	**www.botaanikaaed.ee**
Director	**Urve Sinijärv**
Territory area	**42 ha**

Living plant collections

Total No. of taxa in 2025: 9454

Main taxa	No. of taxa
Indoor plants, including:	**1913**
Tropical plants	440
Subtropical plants	397
Orchid species	296
Cultivars of Cymbidium	170
Succulents	604
Carnivorous	24
Trees and shrubs, including:	**2624**
Trees and shrubs in arboretum	1890
Roses	734
Herbaceous plants, including:	**3871**
Lilies	157
Hyacinths	53
Dwarf bulbous	361
Crocuses	67
Daffodils	52
Tulips	183
Alliums	105
Ornamental grasses	94
Useful plants	420
Mountain plants	746
Estonian plants	339
Tall perennials	310
Irises	200
Peonies	294
Phloxes	126
Astilbes	97
Daylilies	141
Ornamental perennials around the Palm House	61

Herbarium

No. of specimens: 74426 in 2023; 79033 in 2024; 82493 in 2025

Herbarium collection	2023	2024	2025
Herbaceous plants	12439	12501	12641
Woody plants	11236	11304	11337
Wood collections	464	464	464
Carpological collection	794	810	811
Fungi	9092	9186	9253
Mosses	27978	29086	29946
Lichens	12423	15682	18041

Scientific activities

2024

- In 2024, a long-term research plan for the Tallinn Botanical Garden was completed.
  - The main goal of research in Tallinn Botanical Garden is to study the diversity of the plant kingdom and the distribution of plant species as well as biology and ecology.

Research topics in 2025–2029

Reproduction biology and ecology of the restoration of populations of endangered plant species

The study covers research into the ecology of the restoration of populations, reproduction biology, and ecology of the plant species endangered in Estonia and internationally in and beyond their natural habitats.

Biodiversity of urban environment

The study focuses on various aspects of the biodiversity of urban environment. The purpose of the study lies in researching biodiversity in Tallinn and developing novel solutions for preserving and increasing biodiversity in Tallinn.

In 2024, international cooperation started on the Baltic lichen list: As a result of work led by the University of Tartu, the list of Estonian lichens, together with data on distribution and ecology of species, was almost complete by the end of the year.

A framework agreement for a doctoral research fellowship was signed with the University of Tartu. As the first science transfer doctoral student at TBG, species conservation specialist Iti Jürjendal will start her PhD studies at the University of Tartu on a topic related to the botanical garden's work. The topic of her PhD thesis is "Growth and cultivation of bryophytes in anthropogenic environments".

Projects

2024

In 2024, applied research and projects were carried out with a total of 17 participations, including:

- Vegetation survey of meadows under restoration. Tallinn Environment and Public Works Department
- Survey of the distribution of woolly buttercup (*Ranunculus lanuginosus*), including the provision of conservation management recommendations and the development of a methodology for reinforcement planting and result monitoring at the Mustanina site. Environmental Board.
- Assessment of the effectiveness of restoration activities for *Saxifraga adscendens* and *Cerastium alpinum*. Environmental Board.
- Inventory of Protection Category I fern species at selected locations. Environmental Board.
- Vegetation survey of the large coastal pasture in Paljassaare. Tallinn Environment and Public Works Department.
- Survey of woolly buttercup at selected sites, including the provision of conservation management recommendations and the development of a methodology for reinforcement planting and monitoring at the Mustanina site. Environmental Board.
- Mosses and lichens in the proposed Astangu-Mäeküla protected area and the proposed Kakumäe Forest protected area in Tallinn. Tallinn Urban Environment and Public Works Department.

2025

In 2025, applied research and projects were carried out with a total of 11 participations, including:

- Survey of mosses and lichens in the forests south of Lake Ülemiste. Tallinn Urban Environment and Public Works Department.
- Inventory of endangered and near threatened macrolichens at Paekalda Street 4a, Tallinn. Visioon Haljastus OÜ.
- Study of species richness dynamics and management effectiveness of grassland plant communities under restoration in Tallinn. Tallinn Environment and Public Works Department.
- Botanical survey in Kakumäe and along Lake Ülemiste. Tallinn Environment and Public Works Department.

Publications

2024

- Ots, Katri; Tullus, Tea; Sild, Mari; Tullus, Arvo; Lutter, Reimo; Kaivapalu, Marju; Sopp, Reeno; Täll, Kristjan; Tullus, Hardi (2024). Ash Treatment Promotes the Revegetation of Abandoned Extracted Peatlands. Land, 13 (10), 1623. DOI: 10.3390/land13101623.
- Rattur, Maris; Aguraiuja, Ruth; Kull, Tiiu; Sild, Mari (2024). Effects of Local Weather Conditions on the Population Dynamics of the Rock Fern Asplenium septentrionale in Estonia. American Fern Journal, 114 (2), 159–171. DOI: 10.1640/0002-8444-114.2.159.
- Randlane, Tiina; Jüriado, Inga; Mark, Kristiina; Marmor-Ohtla, Liis; Oja, Ede; Saag, Andres; Savchenko, Anton; Degtjarenko, Polina (2024). Steep increase in red-listed lichens of Estonia. The Lichenologist, 56 (6), 329–343. DOI: 10.1017/S0024282924000203.
- Suija, Ave; Degtjarenko, Polina; Jüriado, Inga; Martin, Ljudmilla; Oja, Ede; Randlane, Tiina (2024). Updates to the list of Estonian lichenized, lichenicolous and allied fungi. Folia Cryptogamica Estonica, 61, 91–97. DOI: 10.12697/fce.2024.61.11.
- Paal, J., Juerjendal, I., Suija, A., Kull, A. 2024. Impact of drainage on raised bogs in Estonia. Mires and Peat, 31, ARTN 7. DOI: 10.19189/MaP.2022.OMB. Sc.2330065.
- Runnel, Kadri; Lõhmus, Piret; Küngas, Kati; Marmor-Ohtla, Liis; Palo, Anneli; Pütsepp, Geili; Tamm, Heidi; Tammekänd, Indrek; Lõhmus, Asko (2024). Aerial eDNA contributes vital information for fungal biodiversity assessment. Journal of Applied Ecology, 61 (10), 2418–2429. DOI: 10.1111/1365-2664.14691.
- Kupper, T., Vellak, K., Ehrlich, L., Kannukene, L., Leis, M., Ingerpuu, N. 2024. Updates to the species list of Estonian bryophytes. Folia Cryptogamica Estonica, 61, 35–38. DOI: 10.12697/fce.2024.61.04.
- Prangel, E., Reitalu, T., Neuenkamp, L., Kasari-Toussaint, L., Karise, R., Tiitsaar, A., Soon, V., Kupper, T., Meriste, M., Ingerpuu, N., Helm, A. 2024. Restoration of semi-natural grasslands boosts biodiversity and re-creates hotspots for ecosystem services. Agriculture Ecosystems & Environment, 374. DOI: 10.1016/j.agee.2024.109139.
- Tallinn Botanic Garden. The Beauty and Diversity of the Plant World. Tallinn, 2024, 64 p.

2025

- Randlane, Tiina; Degtjarenko, Polina; Jüriado, Inga; Marmor-Ohtla, Liis; Oja, Ede; Saag, Andres (2025). Distribution and Frequency of Estonian Lichens – Revisited After 25 Years. *Acta Botanica Hungarica*, 67 (1-3), 161–172.
- Marmor-Ohtla, Liis; Jüriado, Inga; Liiv, Siiri; Martin, Ljudmilla; Oja, Ede; Suija, Ave; Randlane, Tiina (2025). New and noteworthy records of lichenized, lichenicolous and allied fungi from Estonia. *Folia Cryptogamica Estonica*, 62, 51–58.

- Prangel, Elisabeth; Reitalu, Triin; Kasari-Toussaint, Liis; Marja, Riho; Jüriado, Inga; Kupper, Tiiu; Ingerpuu, Nele; Oja, Ede; Tiitsaar, Anu; Karise, Reet; Soon, Villu; Takkis, Krista; Keerberg, Liis; Meriste, Mart; Helm, Aveliina (2025). Grassland restoration drives strong multitrophic biodiversity recovery, but climate extremes jeopardize drought-sensitive species. *Global Change Biology*, 31 (9), e70496. DOI: 10.1111/gcb.70496.

- Godefroid, Sandrine; Lacquaye, Sam; Ensslin, Andreas; Dalrymple, Sarah; Abeli, Thomas; Branwood, Hannah; Ferrando Pardo, Inmaculada; Ferrer Gallego, P. Pablo; Zippel, Elke; Gouveia, Luísa; Lobo, Carlos Alberto; Fernandes, Francisco; Rasp, Marion; Daco, Laura; Séleck, Maxime; Frankard, Philippe; Fischer, Leonie K.; Koutsovoulou, Katerina; Finger, Aline; Valkó, Orsolya; Garfi, Giuseppe; Španiček, Branka; Bürli, Sarah; Dickenmann, Regula; Jones, Johanna; Guyonneau, Julien; Papuga, Guillaume; De Vitis, Marcello; Fenu, Giuseppe; Van Rossum, Fabienne; Cogoni, Donatella; Foster, Gail; Julien, Margaux; Piqueray, Julien; Vít, Petr; Bonnet, Véronique; Carta, Angelino; Descombes, Patrice; Lazarević, Maja; Müller, Norbert; Orsenigo, Simone; Ravera, Sonia; Sild, Mari; Smyth, Sarah; Wagner, Thomas C.; Walisch, Tania; Ballian, Dalibor; Cambria, Vito Emanuele; Colas, Bruno; Dixon, Lara; Draper, David; Froidevaux, Viviane; Pagitz, Konrad; Pánková, Hana; Pankhurst, Tim; Preston, Jamie; Prunier, Patrice; Saura-Mas, Sandra; Sartori, Karin; Socher, Stephanie A.; Stanik, Nils; Wunderli, Anna; Nikowitz, Tanja; White, Fiona Jane. Current state of plant conservation translocations across Europe: motivations, challenges and outcomes. //Biodiversity and Conservation, 2025, 34: 769–792.

Conferences

2024

- Joint conference between the Institute of Forestry and Engineering at the Estonian University of Life Sciences and Tallinn Botanic Garden "Common oak – an evergreen and beloved Estonian forest tree". held at the Tallinn Botanic Garden, 11.04.2024.

- Conference dedicated to the 150th anniversary of Konstantin Päts' birth, held at the Tallinn Botanic Garden, 13.09.2024.

2025

- Kalamees, Rein; Sild, Mari. Restoring species-rich grasslands in Tallinn. Should we remove shredded grass or not? EUROGARD 10, Rooma. 20.-26.09.2025. Poster presentation.

- Sild, Mari; Kalamees, Rein. Mitigation translocations in Estonia: assessing the outcomes. EUROGARD 10, Rooma. 20.-26.09.2025. Poster presentation.

- Hermann, Pille. "Integrating plant crafts into learning". EUROGARD 10, Rooma. 20.-26.09.2025. Poster presentation.

- Poola, Arnet. The Rosarium at Tallinn Botanic Garden and it´s collection. Baltic Botanic Gardens meeting, 11.–12.08.2025 at the LVM arboretum in Kalsnava.

- Joint conference between the Institute of Forestry and Engineering at the Estonian University of Life Sciences and Tallinn Botanic Garden " Common juniper – more than an evergreen shrub" held at the Tallinn Botanic Garden, 10.04.2025.

- Joint conference between the Institute of Ecology and Earth Sciences, University of Tartu "Plants and pollinators – who can separate them?", held at the Tallinn Botanic Garden, 29.05.2025.

Educational activities

2024

- A total of 157 various nature education exhibitions, theme days, workshops, theme excursions and curator tours were organised, the biggest and most popular of which were Orchid Exhibition, Saintpaulias Exhibition, Peony Days, Apple Party and the exciting Fruit and Seed Exhibition.

- As a new initiative, the curator started to organise tours to introduce the Botanic Garden's collection, with 14 curator tours in 2024. As the workshops have proved to be popular with visitors, the programme continued in 2024, with 52 workshops for various age and interest groups.

- A total of 276 excursions were carried out, with a total of 5375 participants. A new initiative in TBG's educational work was to introduce flowering plants every month. In addition to the monthly list of flowering plants illustrated with photos on the website, theme excursions were organised, during which TBG botanist Urmas Laansoo, popular with visitors, introduced the plants flowering in the TBG exhibit that month.

- Within the framework of the curriculum, 94 study days were conducted, setting an all-time record for the number of study days carried out since records began in 2006, when curriculum-based studies began at TBG.

2025

- A total of 136 various nature education exhibitions, theme days, workshops, theme excursions, curator tours and conferences were organised. The traditional Orchid Exhibition, Peony Exhibition and Rose Exhibition continued to be the most popular, as well as exhibitions of chili peppers and tomatoes, indoor plants and world flavours.

- The collection curator continued to organise tours to showcase TBG's collection, with 9 curator tours. Throughout the year, 45 special workshops and 262 excursions were organised.

- The "Child of Nature" hobby group has been reorganised into a monthly Children's Saturday.

- In 2025, 103 days of curriculum-based study days were carried out, setting an all-time record for the number of study days carried out since records began. They involved 1096 students. Satisfaction among participants in curriculum-based programmes has been consistently high, at 95% in 2025.

Other activities

2024

- In terms of the development of the visitor environment, the most important events were the opening of the Visitor Centre, together with the opening of Café Herba and a shop. A new entrance area with self-service checkouts was completed.

- The reconstructed Rose Garden was completed. Reconstruction work was carried out on the exhibition of ornamental grasses, and several collections were renewed and added to. The construction of roads and irrigation systems for the new plant nursery area was completed.

- The exterior lighting on the site was upgraded; the old ones were completely removed and replaced with new stylish LED lights that blend in with the natural surroundings.

- In 2024, a total of 78911 people visited Tallinn Botanical Garden.

2025

- The big event of the year was the official opening of the reconstructed Rose Garden on July 18th with the mayor. An important event was the selection of the Rock Garden as a nominee for the Estonian Landscape Architecture of the Year Award.

- The biggest investment project was the construction of a new visitors' car park.

- New signs and maps were installed on the territory, based on the visual identity of the Botanic Garden. A reconstructed ornamental grass exposition with a new road network was completed. New landscaped high-rises of blueberry and heath were built. Work began on extending the liana exhibit to a new area, for which attractive liana support structures were ordered. New landscaped areas for flower bulbs were created.

- In 2025, a total of 88586 people visited Tallinn Botanical Garden, an all-time record.

Visitors per year

	2024	2025
Number of visitors	78 911	88 586

Structure and staff *(sum of workloads)*

	2024	2025
Administration	10	10
Department of Environmental Education	15	14
Department of Outdoor Collections	18	14
Department of Tropical and Subtropical Collections	7	7
Technical Department	9	8
TOTAL including:	**56.5**	**51.5**
PhD	6	6
MSc	22	20

Finances *(in EUR)*

	2024	2025
Income		
TOTAL	**382.3**	**459.5**
Expenses		
Operation expenditure	1044.8	1180.4
Salaries	1205.1	1599.5
Investments	1361.5	1077.0
TOTAL	**3611.4**	**3.856.9**



University of Tartu Botanical garden

Address	**Lai 38, Tartu, 51005, Estonia**
Phone	**+372 737 6180**
E-mail	**botaed@ut.ee**
www	**www.natmuseum.ut.ee**
Director	**Sergei Põlme**
Territory area	**3.5 ha**

Living plant collections

Total No. of taxa in 2025: 15570

Main taxa	No. of taxa
Indoor plants, including:	**2204**
Palm house	565
Tropical house + succulents	1643
Trees and shrubs	**1078**
Herbaceous plants, including:	**9504**
Alpine plants	2108
Native species	736
Medicinal plants	771

Scientific activities

- National programme "Collection and Conservation of Plant Genetic Resources in 2021-2027".

Other activities

- GIS-based documentation and mapping of collections.
- Development of Moss Garden.
- Improving the department of Estonian native species.
- Annual exhibitions (Orchids, Garden Day).

Visitors per year

	2024	2025
Number of visitors	121 000	126 000

Structure and staff

	2024	2025
Administration	1	1
Gardener	10	10
Administrators	2	2
Technician	1	1
Other	3	3
TOTAL including:	**17**	**17**
PhD	1	1
MSc	4	4

Finances *(in EUR)*

	2024	2025
Income		
Tartu University	300 000	300 000
Other	120 000	120 000
TOTAL	**420 000**	**420 000**
Expenses		
Staff	220 000	220 000
Economic cost, materials	220 000	220 000
TOTAL	**420 000**	**420 000**



Vilnius University Botanical Garden

Address	**Kairėnų 43, LT-10239 Vilnius, Lithuania**
Phone	**(+370-5) 219 3133**
E-mail	**hbu@bs.vu.lt**
www	**www.botanikos-sodas.vu.lt**
Director	**Audrius Skridaila**
Territory area	**198,9 ha**

Living plant collections

Total No. of accessions – 11926; No of taxa – 10095* (as of 31.12.2025)

Major collections by Family	No. of taxa
Asparagaceae Juss.	429
Asphodelaceae Juss.	420
Asteraceae	722
Cupressaceae	281
Cactaceae Juss.	184
Caprifoliaceae	197
Crassulaceae DC.	226
Ericaceae Juss.	886
Grossulariaceae	417
Iridaceae	500
Lamiaceae	433
Liliaceae	616
Oleaceae Hoff. et Link.	284
Paeoniaceae	358
Poaceae	1012
Rosaceae	1538
Other families	1403
Native Species growing in Natural Habitats	**534**

*actual information of the VU BG plant collections is available online here: http://botsodas.lt/indexplantarum

Herbarium

The Vilnius University Herbarium is managed by the Centre of Life Sciences; the Botanical Garden does not oversee this collection.

Scientific activities and research

The Garden's research focuses on plant genetics, taxonomy, biotechnology (including in vitro micropropagation and mycorrhiza), plant cultivation, and the preservation of genetic resources. The current research program (2021–2025), "Biological and molecular research of plant genetic resources and natural ecosystems, in vitro technologies," is led by Prof. Habil. Ph.D. I.

VU BG is the Centre of Coordination of Research of Ornamental Plants Genetic Resources in Lithuania (since 2002).

Key Projects

2024-2025

Endophytic Fungal Inoculants: Investigating the effects of fungal inoculants on spring barley growth and secondary metabolite distribution. Supervisor: Ph.D. Habil. I. Pašakinskienė; Funding: €4,800.

Volatile Organic Compounds: Researching the impact of fungal-emitted volatile compounds on root growth using a specialized "dish-in-dish" *in vitro* method. Supervisor: Ph.D. Habil. I. Pašakinskienė; Funding: €4,800.

National Genetic Resources: Since 2002, the VU Botanical Garden has served as the coordination centre for ornamental plant genetic resources in Lithuania. In 2025, it maintained 557 samples of national genetic importance. This program is funded by the Ministry of Environment, with a 2024–2025 budget of €12116.

Articles

2024

- Z. Sinkevičienė, D. Naugžemys, J. Butkuvienė. Molecular evidence for the origin of the little-known hybrid Potamogeton ×vilnensis //Aquatic Botany, Volume 195, November 2024,103808. https://doi.org/10.1016/j.aquabot.2024.103808

- J. Prakofjewa, M. Sartori, R. Kalle, Ł. Łuczaj, M. Karbarz, G. Mattalia, P. Šarka, et al. (2024). "But how true that is, I do not know": The influence of written sources on the medicinal use of fungi across the western borderlands of the former Soviet Union. *IMA Fungus*, 15(1), Article 22. https://doi.org/10.1186/s43008-024-00156-7

- J. Prakofjewa, M. Sartori, P. Šarka, R. Kalle, A. Pieroni, & R. Sõukand (2024). Knowledge in motion: Temporal dynamics of wild food plant use in the Polish-Lithuanian-Belarusian border region. *Journal of Ethnobiology and Ethnomedicine*, 20(1), Article 65. https://doi.org/10.1186/s13002-024-00706-8

- I. Pašakinskienė, V. Stakelienė, S. Matijošiūtė and J. Martūnas. Diversity of Endophytic Fungi and Bacteria Inhabiting the Roots of the Woodland Grass, *Festuca gigantea* (*Poaceae*) // Diversity 2024, 16, 453. https://doi.org/10.3390/d16080453

- D. Ryliškis. Assessment of the quality of plant collections of Vilnius University Botanical Garden // Baltic Botanic gardens in 2021-2023 Estonia, Latvia, Lithuania, Vilnius, Lithuania, 2024, p. 149-157.

- S. Žilinskaitė. Vilnius University Botanical Garden in Kairėnai – five decades of development and activities // Baltic Botanic gardens in 2021-2023 Estonia, Latvia, Lithuania, Vilnius, Lithuania, 2024, p. 168-183.

- F.M. Dagnino, V. Benigno, E. Dalla Mutta, L. Ferlino, E.M. Vercelli, R. Cangini, G. Skujienė, R. Ryliškienė. Gamifying a platform for natural sciences education in primary school // ICERI 2024, the 17th annual International Conference of Education, Research and Innovation, Seville, Spain on and November 11th, 12th 13th, 2024. ICERI2024 Proceedings – pages 5951-5960. https://library.iated.org/view/DAGNINO2024GAM

Conference abstracts

- S. Matijošiūtė, V. Stakelienė, J. Martūnas, I. Pašakinskienė. Identification of endophytic fungi in *Festuca gigantea* and *Lolium perenne* species and their hybrids // International Conference of Life Sciences "The COINS 2024", April 15th-17th. Book of Abstracts, 2024, p. 87.

- V. Stakelienė, J. Martūnas, S. Matijošiūtė, I. Pašakinskienė. Endophytic fungi in the roots of *Festuca* and *Lolium* species and their hybrids // International Conference of Life Sciences "The COINS 2024", April 15th-17th. Book of Abstracts, 2024, p. 88.

- S. Matijošiūtė. Spring barley as a model for studying the effect of endophytic fungal inoculums: changes in plant growth and distribution of secondary metabolites // LMT student conference "Student Research 2023 | 2024", May 16th-17th. Books of Abstracts, 2024, p. 5.

- S. Matijošiūtė. Study of the effect of volatile organic compounds released by endophytic fungi on root growth using the plate-plate method // LMT student summer scientific practice final conference "SUMMER OF SCIENCE", August 28. Books of Abstracts, 2024, p. 13.

- R. Ryliškienė, D. Ryliškis, G.Jurkevičienė, I.Raubaitė. Experiential outdoor informal learning activities in Vilnius University Botanical Garden, Lithuania // INTED2024 Proceedings – page 3650. 18th annual International Technology, Education and Development, Conference, Valencia (Spain). March 4th - 6th, 2024. https://library.iated.org/publications/INTED2024/start/575

- S. Žilinskaitė. Vilniaus universiteto vaistiniai augalai istorijos vingiuose // SCIENTIA ET HISTORIA. Lietuvos mokslo istorikų ir filosofų bendrijos konferencijos programa ir pranešimų tezės, Vilnius – Kaunas 2024 m. balandžio 4–5 d., p. 43. http://www.moksloistorija.lt/wp-content/uploads/2024/03/Scientia-et-historia-2024-knygele_v8.pdf

- P. Evarts-Bunders, G. Evarte-Bundere, D. Ryliškis. Old manor parks and dendrological plantations – the main source of the spread of invasive woody plants in the Baltic states // NEOBIOTA 2024 – 13th International Conference on Biological Invasions, September 3rd-6th, Lisbon, Portugal. Book of Abstracts, 2024, p. 414. https://www.neobiota2024.org/_files/ugd/6ecb9d_d4dcc8f7f07f408da40ffa65ae669051.pdf

Other publications

- "Baltic Botanic Gardens in 2021-2023 Estonia, Latvia, Lithuania". VUL, 2024, 190 p.

- R. Juodkaitė, A. V. Dobkevičiūtė, A. Skridaila, S. Žilinskaitė. "Vilnius University Botanical Garden in Vingis". VUL, 2024, 66 p.

- G. Jurkevičienė. "*Botaniniai galvosūkiai. Pažinkime Vilniaus universiteto botanikos sodą*" (Botanical puzzles. Let's get to know the Vilnius University Botanical Garden). VUL, 2024, 24 p.

- S. Žilinskaitė. "Jono Frideriko Volfgango gyvenimas ir darbai Vilniuje ir Paluknyje" (The life and works of Jan Friderik Volfgang in Vilnius and Paluknys) pages 6-45. Book section // Gloriae Pharmaciae Lituaniae since 2017. Lithuanian Museum of Medicine and Pharmacy, p. 6-45, Kaunas, 2024, 59 p.

PhD thesis summary

2025

Violeta Stakelienė. Characteristics of Festuca gigantea (L.) Vill.: phylogenetic origin and relationships with endophytes. Natural Sciences, Biology (N 010).

- https://doi.org/10.15388/vu.thesis.833
- https://orcid.org/0009-0005-8351-3710

Doctoral dissertation defended on October 10th, 2025.

Articles

- M. Rudawska, A. Aučina, D. Naugžemys, A. Skridaila, L. Karlinski, M. Pietras, T. Leski. Does topography affect the ectomycorrhizal fungal community structure of Scots Pine (*Pinus sylvestris* L.) grown on the sand coastal dunes in Poland and Lithuania // Forest Ecology and Management, 589 (2025) 122786. https://doi.org/10.1016/j.foreco.2025.122786

- I. Pašakinskienė, V. Stakelienė, S. Matijošiūtė, J. Martūnas, M. Rimkevičius, J. Būdienė, A. Aučina, A. Skridaila. Growth-Promoting Effects of Grass Root-Derived Fungi *Cadophora fastigiata*, *Paraphoma fimeti* and *Plectosphaerella cucumerina* on Spring Barley (*Hordeum vulgare*) and Italian Ryegrass (*Lolium multiflorum*) // Microorganisms, 2025, 13, 25. https://doi.org/10.3390/microorganisms13010025

- V. Stakelienė, I. Pašakinskienė, S. Matijošiūtė, J. Martūnas, G. Štukėnienė. Identifying Root-Associated Endophytic Fungi and Bacteria in *Festuca* and *Lolium* Grasses from a Site in Lithuania // Microorganisms 2025, 13,799. https://doi.org/10.3390/microorganisms13040799

- J.Butkuviene, D. Naugzemys, D. Zvingila. The Complete Chloroplast Genome of Water Crowfoot of *Ranunculus* cf. *penicillatus* and Phylogenetic Insight into the Genus *Ranunculus* (sect. *Batrachium*). // Int. J. Mol. Sci.2025, *26*(14), 6953; https://doi.org/10.3390/ijms26146953

- L. Kamaitytė-Bukelskienė, Z. Sinkevičienė, D. Naugžemys, J. Butkuvienė. Phenotypic and genetic variation of *Najas marina* and *Najas major* in the south-eastern Baltic region // Aquat. Bot., 2025, 203, 103971. https://doi.org/10.1016/j.aquabot.2025.103971

- G. Štukėnienė, A. Skridaila. Conservation of Plant Genetic Resources in Lithuania. XIV International Symposium on Flower Bulbs and Herbaceous Perennials, 2025 // ISHS Acta Horticulturae 2025, No 1435, p. 165-171. ISSN 0567-7572 (print), 2406-6168 (electronic); ISBN 978 94 6261 434 5.

Conference abstracts

- G. Štukėnienė, A. Skridaila, V. Stakelienė. Conservation of Lithuanian National Plant Genetic Resources on Vilnius University Botanical Garden // EUROGARD10 2025 - 10˚ European Botanic Gardens Congress – Botanic Gardens in the UN decade of ecosystem restoration. 22.-26.09.2025 Roma, Italija, p. 26.

- I. Pašakinskienė, V. Stakelienė,S. Matijošiūtė. Diversity and Growth-Promoting Potential of Root. Associated Endophytes in *Festuca* and *Lolium* Grasses from Grassland and Forest Ecosystems // International conference "Rhizosphere 6: Rooting for Earth". Edinburgh, UK, 15.-19.06.2025. Abstract book, 2025, p. 85.

- V. Stakelienė, I. Pašakinskienė. Growth-promoting effects of three endophytic fungi on Italian Ryegrass (*Lolium multiflorum*) // International Conference of Life Sciences The COINS 2025. Vilnius (Lietuva), 17.-20.03.2025. Book of Abstracts, 2025, p. 29.

- I. Malinauskaitė, I. Pašakinskienė, V. Stakelienė. Features of centromeric Fesreba sequences across *Poaceae* species // International Conference of Life Sciences The COINS 2025. Vilnius (Lietuva), 17.-20.03.2025. Book of Abstracts, 2025, p. 187.

- D. Naugžemys, J. Butkuvienė, Z. Sinkevičienė, C. Lambertini, R. Bolpagni, F. Buldrini, J. Patamsytė. Aquatic plant communities: what can we expect as temperatures change? // 17 International Symposium on Aquatic Plant: Back to the Future of Aquatic Plants and the Way Forward, Lisabona, 15.-19.09.2025., Lisbon, p. 126.

- J. Butkuvienė, L. Grīnberga, J. Jėkabsone. Growing distribution of *Hydrilla verticillata* in Latvia and lithuania–good news? // 17th International Symposium on Aquatic Plant: Back to the Future of Aquatic Plants and the Way Forward, Lisabona, 2025, p. 96.

- M. Saliamoras, D. Ryliškis, M. Liaudanskas, V. Janulis. Determination of the quantitative composition of triterpenic compounds and antiradical activity *in vitro* of decorative apple fruit samples // PLANTA+. Science, practice and education, 28.-29.01.2025., Kyiv, Ukraine, Tom 1, Volume 1, p. 59.

- S. Petrauskaitė, D. Ryliškis, M. Liaudanskas, V. Janulis. Determination of qualitative and quantitative composition of flavan-3-ols and evaluation of antiradical activity *in vitro* of decorative apple fruit extracts // PLANTA+. Science, practice and education, 28.-29.01.2025., Kyiv, Ukraine, Tom 1, Volume 1, p. 61.

- S. Petrauskaitė, D. Ryliškis, M. Liaudanskas, V. Janulis. Dekoratyvinių obelų vaisių ėminių kvercetino glikozidų kokybinės ir kiekybinės sudėties varijavimas // Nacionalinės mokslinės konferencijos Farmacijos tyrimai ir technologijos 2025 Abstraktų knyga, Kaunas, p. 25.

- M. Saliamoras, D. Ryliškis, M. Liaudanskas, V. Janulis. Determination of extraction conditions for triterpenic compounds of decorative apple fruit samples // International conference Contemporary pharmacy: issues, challenges and expectations 10.04.2025., Kaunas, Lithuania, p. 34.

- D. Ryliškis. Vilnius University Botanic Garden: Harnessing Technology for Interactive Learning and Engagement // The 11th International Congress on Education in Botanic Gardens. Abstract Book. 09.-13.06.2025., Seul COEX, p. 243.

- A.V. Dobkevičiūtė. Botanic Garden as a Meeting Point for Different Communities with Nature // The 11th International Congress on Education in Botanic Gardens. Abstract Book. 09.-13.06.2025., Seul COEX, p. 273.

Conferences, seminars, workshops

2024

International conference of Baltic Botanic Garden association: "Botanical Gardens: Legacy, Achievements, Mission and Chalenges in the first Decades of the 21st Century". Vilnius university Botanical in Kairėnai; 03-04.10.2024.

International conference: "European Arboristic Experiences and Trends". Vilnius University Botanical Garden in Kairėnai 11.10.2024.

2025

International conference: "Greeneries in Urbanized Territories and Their Management. Vilnius University Botanical Garden in Kairėnai 17.10.2025.

Public engagement and events

The Garden remains a vibrant hub for public education and culture, hosting hundreds of events annually.

2024

VU BG has organized 188 educational and cultural events for the public. Employees of the Garden published 4 books or parts of books, 14 scientific, 15 popular publications (papers), and 10 publications online; 7 presentations for conferences, seminars, workshops, etc.; 4 public lectures; provided educational services for 280 registered groups (educational lectures, guided excursions, workshops, etc.). The biggest events organized in the Garden: event on occasion of 50-th anniversary of VU BG in Vilnius suburb Kairėnai (10.06.2024.), plant fairs (18.-19.05.2024; 13.-19.09.2024); exhibition of summer flowers – "Lilium for the crown of Mindaugas" (05-07/07/2024); fiesta of herbs – "Žolinėk 2024" (Pick herbs 2024); content of floristics – "Celebrating Christmas in the Garden" (13.12.2024.) etc.

2025

178 educational and cultural events were organised for visitors in the Garden. Employees of the Garden published 6 scientific, 18 popular publications (papers and online); prepared 12 presentations for conferences, seminars, workshops; provided educational services for 232 registered groups (educational lectures, guided excursions, workshops, etc.). The biggest events organized in the Garden: 2 plant fairs (27.-29.05.2025; 12.-14.09.2025); "Picnic of Lilacs" – popular feast during the blossoming of biggest lilac collection in Lithuania in VU BG in Kairėnai; exhibition of peonies featuring the new cultivar – `M.K. Čiurlionis` dedicated to the occasion of 150 years anniversary of the birthday of famous Lithuanian painter and composer, an event for popularisation of medicinal herbs - "Žolinėk 2025" (15.08.2025) etc.

Infrastructure and development

2024-2025

Significant investments were made to enhance visitor experience and garden maintenance.

- Kairėnai Site: Expanded the walkway system by 2000 m^2 pedestrian paths and 6,970 m^2 paved roads, enlarged the peony collection area by 2500 m^2.

- Vingis Department: Finished renovation of the entire 7,000 m^2 pedestrian path system, started reconstruction of perenial plant collections.

- Equipment: Over €80,000 was invested in new machinery and maintenance equipment.

Visitors per year

	2024	2025
Number of visitors (thousands)	124.3	116.3

Structure and staff *(sum of workloads)*

	2024	2025
Administration	1	1
Department of Plant Collections	35.5 (+1)*	38 (+1)*
Department of Science Programs	7.25	7.25
Department of Communication and Services	13 (+4)*	14 (+3)*
Department of Administration and Maintenance	**35.5 (+6)***	**36.5 (+6)***
Department of Vingis	8	8
TOTAL including:	**100.25 (+10)**	**104.75 (+10)**
PhD (+PhD students)	10 (+2)	11 (+1)
MSc	9	8

the table provides the number of permanent working staff in the Garden during the years, but the number of staff positions within a year has fluctuated (not significantly). In the summer, an additional 10-11 temporary workers are employed (per season)

Volunteers per year

	2024	2025
Number of volunteers / working hours	1200 / 3760	1232 / 3752

Finances *(in EUR)*

	2024	2025
Income		
VU University Grant	2 878 675	3 055 942
VU BG self-generated revenue	315 670	328 590
Vilnius municipality financial support	40 000	40 000
Other Projects and Grants	65 730	9 541
TOTAL	**3 255 235**	**3 434 073**
Expenses		
Salaries (including taxes)	2 218 904	2 577 750
Other expenses	966 747	724 682
TOTAL	**3 185 651**	**3 302 432**

International Recognition

In 2024, the Vilnius University Botanical Garden received official accreditation from Botanic Gardens Conservation International (BGCI), recognizing its adherence to the highest international standards in plant conservation.

Vytautas Magnus University Botanical garden

Address	**Ž. E. Žilibero str. 4, Kaunas, 46324 Lithuania**
Phone	**+370 37 390033**
E-mail	**info.botanika@vdu.lt**
www	**botanika.vdu.lt**
Director	**Dr. Nerijus Jurkonis**
Territory area	**62.5 ha**

Living plant collections (as of 31.12.2025)

Total No. of collection examples – 19 995

Collections	No. of taxa*
Outdoor plants, including:	**16 554**
Rosa	2739
Paeonia	921
Hemerocallis	747
Dahlia	711
Tulipa	478
Iris	410
Vaccinium	356
Astilbe	322
Hosta	319
Rhododendron	283
Heuchera	281
Aster, s.l.	232
Clematis	136
Hydrangea	120
Lilium	115
Rare and protected plants of Lithuania	**93**
Greenhouse, including:	**1190**
Ficus	44
Agave	32
Mammillaria	30
Aloe	26
Euphorbia	21
Begonia	20
Opuntia	20
Peperomia	16
Echinopsis	16
Gasteria	16

*species, intraspecific taxa, cultivars

Herbarium

No. of specimens ~10000

Scientific activities

Scientific projects 2024-2025

Development of an innovative oral gel made from natural plant-based ingredients to reduce the symptoms of xerostomia (prof. Ona Ragažinskienė). Project duration 2024–2026.

Breeding

- The American Paeony Society has registered a new peony variety '*Latvian Rain*' (bred by Dr. Arūnas Balsevičius) and added it to the International Peony Registry.

- The American Rose Society has registered a new rose variety '*Ugnis*' (bred by Dr. Arūnas Balsevičius) and added it to the International Rose Registry.

Defended dissertations

- Viktorija Januškevičė defended PhD thesis 'Modeling and optimization of fermentation process for plant raw materials' in 2024.

- Vesta Vančugovienė defended PhD thesis 'Exploring and Enhancing Conceptual Change in Biology Education: Within and Beyond the Classroom' in 2025.

List of scientific publications

2024

- Deveikienė V., Jurkonis N., Daubaras R., Deveikis S. The connection between botanical science and landscape art: aspects of the development of botanical gardens. Landscape architecture – the theoretical and practical aspects = L'architecture de paysage – les aspects théoriques et pratiques, 2024, vol. 1(9), p. 45-60.

- Česonienė L., Januškevičė V., Saunoriūtė S., Liaudanskas M., Žvikas V., Krikštolaitis R., Viškelis P., Zych M., Martusevičė P., Urbonavičienė D., Daubaras R., Balčiūnaitienė A., Viškelis J. Phenolic compounds in berries of winter-resistant *Actinidia arguta* Miq. and *Actinidia kolomikta* Maxim.: evidence of antioxidative activity. Antioxidants, 2024, vol. 13, no. 3, p. 1-15. https://doi.org/10.3390/antiox13030372

- Jovaišaitė J., Jūrienė L., Pukalskas A., Baranauskienė R., Ragažinskienė O., Venskutonis P. R. Recovery of lipophilic compounds of Vincetoxicum species by supercritical carbon dioxide extraction. Journal of supercritical fluids, 2024, vol. 206, p. 1-8. https://doi.org/10.1016/j.supflu.2023.106159

- Mingaila J., Vilimas V., Viškelis P., Marozas V., Bobinas Č., Viškelis J. Qualitative changes in birch sap after freezing and thawing. Forests, 2024, vol. 15, no. 5, p. 1-14.

- Januškevičė V., Gomes A. M., Sousa S., Barbosa, J. C., Vedor R., Martusevičė P., Liaudanskas M., Zvikas V., Viškelis P., Česonienė L., Balčiūnaitienė A., Viškelis J., Szonn S., Urbonavičienė D. Phytochemical and functional diversity of enzyme-assisted extracts from *Hippophae rhamnoides* L., *Aralia cordata* Thunb., and *Cannabis sativa* L. Antioxidants, 2024, vol. 13, no. 8, p. 1-19. https://doi.org/10.3390/antiox13080950

- Drevinskas T., Ihara H., Maruška, A.S., Takafuji M., Jonušauskas L., Armonavičius D., Stankevičius, M. Bimbiraitė-Survilienė K., Skryzdlewska E., Ragažinskienė O., Kuwahara Y., Nagaoka S., Kaškonienė V., Kubilienė L. A spectroscopy solution for contactless conductivity detection in capillary electrophoresis. Micromachines, 2024, vol. 15, no. 12, p. 1-11. https://doi.org/10.3390/mi15121430

- Maruška A. S., Mickienė R., Kaškonienė V., Grigiškis S., Stankevičius M., Drevinskas T., Kornyšova O., Donati E., Zacchini M., Mikašauskaitė-Tiso J., Tiso N., Levišauskas D., Ragažinskienė O., Bimbiraitė-Survilienė K., Kanopka A., Dūda G. Searching for chemical agents suppressing substrate microbiota in white-rot fungi large-scale cultivation. Microorganisms, 2024, vol. 12, no. 6, p. 1-15. https://doi.org/10.3390/microorganisms12061242

- Balčiūnaitienė A., Januškevičė V., Saunoriūtė S., Raubytė U., Viškelis J., Memvanga P.B., Viškelis, P. Antimicrobial antioxidant polymer films with green silver nanoparticles from *Symphyti radix*. Polymers, 2024, vol. 16, no. 3, p. 1-14. https://doi.org/10.3390/polym16030317

- Vančugovienė V., Södervik I., Lehtinen E., Mcmullen J. Individual differences in secondary school students' conceptual knowledge: Latent profile analysis of biology concepts. Learning and individual differences, 2024, vol. 111, p. 1-17. https://doi.org/10.1016/j.lindif.2024.102436

2025

- Saunoriūtė S., Zymonė K., Marksa, M., Raudonė L. Comparative analysis of phenolic profiles and antioxidant activity in the leaves of invasive *Amelanchier* × *spicata* (Lam.) K. Koch in Lithuania. Plants, 2025, vol. 14, no. 2, p. 1-23. https://doi.org/10.3390/plants14020221

- Armonavičius D., Maruška A.S., Jakštys B., Stankevičius M., Drevinskas T., Bimbiraitė-Survilienė K., Čaplikaitė M., Ihara H., Takafuji M., Skrzydlewska E., Ragažinskienė O., Kuwahara Y., Nagaoka S., Kaškonienė V., Šatkauskas S., Kanopka A. Evaluation of the anticancer activity of medicinal plants predominantly accumulating ellagic acid compounds. Antioxidants, 2025, vol. 14, no. 11, p. 1-30. https://doi.org/10.3390/antiox14111339

- Januškevičė V., Saunoriūtė S., Ondrášek I., Petrikaitė V., Štreimikytė P., Liaudanskas M., Žvikas V., Daubaras R., Viškelis P., Viškelis J., Zych M., Petruškevičius A., Česonienė L. Biochemical diversity and anticancer potential of phenolic compounds in *Sambucus nigra* L. cultivars. Applied Food Research, 2025, vol. 5, no. 2, p. 1-11. https://doi.org/10.1016/j.afres.2025.101404

- Balčiūnaitienė A., Zehra S. H., Liaudanskas M., Viškelis J., Trumbeckaitė S., Kubilienė L., Saunoriūtė S., Memvanga P. B., Ive D. K., Kyana J., Viškelis P. Microwave-assisted synthesis of antimicrobial silver nanoparticles using propolis extracts. Processes, 2025, vol. 13, no. 9, p. 1-17. https://doi.org/10.3390/pr13092861

- Raudonė L., Zymone K., Marksa M., Česonienė L. Phenolic diversity in *Viburnum* L. Inflorescences: A comparative study of *V. opulus*, *V. trilobum*, and *V. sargentii*. Scientia Horticulturae, 2025, vol. 350, p. 1-12. https://doi.org/10.1016/j.scienta.2025.114327

- Saunoriūtė S., Sukackas J., Raudonė L. *Amelanchier* Medik. species: An underutilized source of bioactive compounds with potential for pharmacological and nutraceutical applications. Molecules, 2025, vol. 30, no. 17, p. 1-24. https://doi.org/10.3390/molecules30173562

- Vančugovienė V., McMullen J., Lehtinen E., Södervik I. Exploring individual differences in photosynthesis and respiration knowledge in the context of green plants. Journal of biological education, 2025, vol. 59, no. 1, p. 104-123. https://doi.org/10.1080/00219266.2023.2293762

- Vančugovienė V., Lehtinen E., Södervik I. The impact of inquiry-based learning in a botanical garden on conceptual change in biology. International journal of science education, 2025, vol. 47, no. 7, p. 1-25. https://doi.org/10.1080/09500693.2024.2354542

Organised conferences

2024

- 30th International Scientific-practice Conference 'The Human and Nature Safety', May 8th-10th, 2024, VMU Botanical Garden and VMU Agriculture Academy. Conference dedicated to the 100th Anniversary of the Department of Medicinal Plants of the Botanical Garden.

- European Heritage Days 2024 Practical Workshop "From herbal medicine tradition to the Council of Europe's Cultural Route". 06.09.2024. VMU BG.

2025

- 31st International Scientific-Practical Conference 'Human and Nature Safety 2025', May 7th-9th, 2022, VMU Botanical Garden and VMU Agriculture Academy.
- Workshop dedicated to Medicinal (Aromatic) Plants (MAP's) Research Traditions, Contemporary Trends, Innovations and their Rational Use. 07.05.2025. VMU BG.

Awards and recognition

- In 2024, the VMU Botanical Garden became a full member of the Council of Europe Cultural Route of Historic Pharmacies and Medicinal Gardens, *Aromas Itinerarium Salutis* (AIS).
- The VMU Botanical Garden was nominated by the Ministry of Social Security and Labour of the Republic of Lithuania for the ICEBREAKER 2025 award, which recognizes the Garden's contribution to the development of the Family Card programme.
- Dr. Vesta Vančugovienė, an educator at VMU Botanical Garden, was awarded the prestigious 2025 Marsh Award for Education in Botanic Gardens.

Other activities

2024

- VMU Botanical Garden organized over 90 events, the most notable of which include the President Valdas Adamkus Prize for Environmental Merit award ceremony, the International Dahlia Festival, Fascination of Plants Day (as national coordinator), the summer festival Night of Scents, community events such as the Aleksotas Festival and Shrovetide Carnival, an exhibition of exotic butterflies, Botanical Nights 2024, and the Pažaislis Music Festival.
- On the occasion of the 100th anniversary of the Department of Medicinal Plants at the VMU Botanical Garden, an open-air photo exhibition titled "The Development of the Creative, Research, Study, and Practical Activities of the Department of Medicinal Plants of VMU Botanical Garden (1924–2024)" was organized, along with other events dedicated to the history of medicinal plant use in Lithuania.
- An exhibition of Lithuanian dahlia varieties was established at the Botanical Garden of the University of Wrocław (Poland).
- Eighteen VMU Botanical Garden staff members participated in Erasmus+ training visits to botanical gardens in various EU countries. Dr. N. Jurkonis represented VMU BG at the 8th Global Botanic Gardens Congress in Singapore.
- In 2024, 239 educational activities took place at the VMU Botanical Garden, attended by 3664 children. During the summer holidays, two summer camps were organized, with 46 school students participating. In total, 6374 participants took part in educational activities at VMU BG.

2025

- VMU Botanical Garden organized over 80 events, the most notable of which include the President Valdas Adamkus Prize for Environmental Merit award ceremony, the International Dahlia Festival, Fascination of Plants Day (as national coordinator), the summer festival Night of Scents, the Day of Fruits, community events such as the Aleksotas Festival and Shrovetide Carnival, an exhibition of exotic butterflies, the experimental theatre festival House No. 5, an open-air photo exhibition, the exhibition Materia Medica (in cooperation with the Lithuanian Museum of Pharmacy), and Italian Days (in cooperation with Kaunas City Municipality).
- Dr. Vesta Vančugovienė, together with co-authors, published an article in the BGCI education review for botanic gardens Roots titled "The Impact of Learning in a Botanical Garden on Conceptual Change" (2025), Roots, 22(2), 19–21.
- Nineteen VMU Botanical Garden staff members participated in Erasmus+ training visits to botanical gardens in various EU countries. Dr. N. Jurkonis, K. Mulevičienė, and Dr. V. Vančugovienė represented VMU BG at the 11th International Congress on Education in Botanic Gardens in Seoul (Korea), while Dr. N. Jurkonis also represented VMU BG at the 10th European Botanic Gardens Congress (Eurogard10) in Rome (Italy).
- In 2025, 185 educational activities took place at the VMU Botanical Garden, attended by 3523 children. During the summer holidays, four summer camps were organized, with 70 school students participating. In total, 6196 participants took part in educational activities at VMU BG.

Visitors per year

	2024	2025
Number of visitors	114 856	104 323

Structure and staff *(sum of workloads)*

	2024	2025
Administration	3	3
Department of Expositions and Collections including:	17.5	17.5
Collections and database management	2	2
Flora Systematics Group	2	2
Sector of Floriculture	10.5	10.5
Greenhouse	3	3
Department of Science including:	13.5	13.6
Sector of Pomology	6	6.4
Sector of Medicinal and Spice Plants	5.5	5.7
Sector of Dendrology and Phytopathology	2	2
Department of Service and Education	8.5	8
Nursery	2.5	2.5
Technical staff	6	6
Seasonal staff	16	16
TOTAL including:	**67**	**66.6**
PhD	10	9
MSc	13	13

* VMU BG structure according to the 18.03.2019. VMU Rector's order

Finances *(in EUR)*

	2024	2025
Income		
University subsidy	1 395 350	1 510 600
Grants	134 526	44 256
Other income (tickets, services, plant sales, etc.)	418 564	406 039
TOTAL	**1 948 440**	**1 960 895**
Expenses		
Salaries (including taxes)	1 468 324	1 565 682
Other	445 885	378 677
TOTAL	**1 914 209**	**1 944 359**

Klaipeda University Botanical garden

Address	**Kretingos str. 92, Klaipeda**
Phone	**+370 46 398833**
E-mail	**Botanikos.sodas@ku.lt**
www	**botanikossodas.ku.lt**
Director	**Asta Klimienė**
Territory area	**9.3 ha**

Living plant collections

Total No. of taxa in 2025: 4100

Main taxa	No. of taxa
Indoor plants, including:	
Indoor plants	32
Trees and shrubs, including:	
Deciduous	920
Conifers	470
Naturally growing plants	**270**
Herbaceous plants, including:	
Medicinal and spice plants	510
Herbaceous ornamental plants	300
Seaside dunes plants in the collection	43

Herbarium

No. of specimens ~

Scientific activities

- Main scientific projects, list of scientific publications, conferences, expeditions etc.

- Klimienė A., Klimas R., Pilkaitytė. Observation of climatic parameters and plant phenology in the International Phenological Garden of Klaipėda university Botanical Garden, Lithuania. International Journal of meteorology. International Journal of Biometeorology 70(2) DOI:10.1007/s00484-025-03067-3.

- Klimiene A., Klimas R., Narvilas G. Promotion of Aquaponics Development in Lithuania // Marine and Coastal Research 2024: Scienti—Practical Conference Proceedings. ISSN 2669-2147. Klaipeda University, April 19-21, 2023. p. 84-88. (Online, PDF. Article in a peer-reviewed scientific publication not indexed in international databases).

- Grecevičius, P. (2024). Vilniaus kultūrinis kraštovaizdis. Vingrių šaltinių skvero projekto sprendiniai ir jų realizavimas..“ Kraštovaizdžio architektūra“ 5 nr. 44-50 p. Print: ISSN 2783-6304.

- Grecevičius, P. (2024). Gyvenu įdomiai. Reinoldui Liaudanskui -70. “Kraštovaizdžio architektūra“ 5 nr. 56-59 p. Print: ISSN 2783-6304.

- Klimienė A. The content of bioactive substances in peppermint (Mentha piperita) depending on growing conditions”.

- J. Ignotienė.”Naujokai želdynuose- anksti žydintys krūmai” “Namie ir sode” Nr. 8.

- J. Ignotienė .”Išskirtinio grožio lapuočiai-nauji sodybų akcentai” “Namie ir sode” Nr. 8.

- A. Klimienė, E. Kaškelienė, L. Normantė. The influence of growth conditions on the amount of active substances in *Mentha x piperita* L Klaipėda University, H. Manto 84, 92294 Klaipėda. In: International Congress on Natural products research.

- A. Klimiene, J. Ignotiene. Fraxinus species in Klaipėda university Botanical Garden. Klaipeda University, H. Manto 84, 92294 Klaipeda, Lithuania; In: Issue ESTONIA LATVIA LITHUANIA.

- A. Klimiene, L. Normante, E. Kaškeliene. Dependence of the concentration bioactive compounds in Origanum vulgare on agrochemical properties of the soil. Klaipeda University, H. Manto 84, 92294 Klaipeda, Lithuania.

Other activities

Articles in magazines

- J. Ignotienė. “Distinctively Beautiful Deciduous Trees – New Accents for Homesteads”. *Namie ir sode* (No. 8) 2025.

- “Newcomers in Green Spaces – Early-Flowering Shrubs”. *Namie ir sode* (No. 8) 2025.

- “Evergreen Plants in the Garden”. *Namie ir sode* (No. 2) 2024.

- “Decorative Fruits – Signs of Autumn Elegance” (No. 10) 2024.

- Baltic Botanic Gardens. Estonia, Latvia Lithuania. Asta Klimienė, Jurgita Ignotienė. Fraxinus species in Klaipėda University Botanical Garden 2024.

Projects

- EU projects (Commercialization of R&D in spin-off companies. The aim of the measure is to promote the transfer of scientific knowledge and the development of innovative products based on research and experimental development (R&D) results created in higher education and research institutions (HEIs/RIs) within spin-off companies). Two licensing agreements have been prepared: MB “Kuriu idėją“, MB Edidev.

- International Plant Sentinel Network (IPSN); BGCI project: Emerald Ash Borer (EAB) monitoring activities.

Conferences

- Baltic Botanic Gardens Conference. Kalsnava, 11-12.09.2025.

- Congress on Natural products research. 2025 09 06 – 10. The influence of growth conditions on the amount of active substances in Mentha x piperita L.

- Biennial Meeting of the Nordic Arboretum Committee. KU Botanical Garden".
- BGCI. "Botanical gardens: legacy, achievements, mission, and challenges in the first decades of the 21st century ". Presentation: Dependence of the concentration bioactive compounds in Origanum vulgare on agrochemical properties of the soil.
- BGCI. "Botanical gardens: legacy, achievements, mission, and challenges in the first decades of the 21st century ". Presentation: "Fraxinus species in KU Botanical Garden".

Visitors per year

	2024	2025
Number of visitors	12 501	12 647

Structure and staff

	2024	2025
Administration	3	4
Scientists	1	1
Specialists (collections curators, educator)	3	4
Field workers	8	8
Security	4	4
TOTAL including:	**19**	**21**
PhD		
MSc		

Finances *(in EUR)*

	2024	2025
Income		
Revenue from services	41 038.43	52 437.05
TOTAL	**41 038.43**	**52 437.05**
Expenses		
Salary (paid Klaipeda University)	166 198.75	258 339.13
Operating and maintenance costs	186 250.03	217 316.17
TOTAL	**352 448.78**	**475 655.50**

Vilnius university Šiauliai Academy Botanical Garden

Address	**Paitaičių str. 4, Šiauliai, Lithuania**
Phone	**+370 65993748**
E-mail	**subotanika@sa.vu.lt**
www	**www.sa.vu.lt/bs**
Director	**Martynas Kazlauskas (manager)**
Territory area	**6.5 ha**

Living plant collections

Total No. of taxa (year): 2024 – 4650, 2025 – 4785

Main taxa	No. of taxa
Indoor plants, including:	**280**
Succulents	170
Pelargonium	40
Others	70
Trees and shrubs, including:	**925**
Coniferous	270
Deciduous	655
Herbaceous plants, including:	**3380**
Native flora species	100
Introduced species	1900
Ornamental	1380

Herbarium

No. of specimens (2025): 11400 accessions

Scientific activities

The scientific research carried out in the botanical garden is related to the introduction and acclimatisation of ornamental plants, plant biodiversity conservation *ex-situ* and *in-situ* as well as phenological observations under programme of Phenological Gardens of Europe (IPG). Botanical garden served as experimental place for some species of pharmaceutical interest. However, since 2021 garden no longer has academic staff, but is still open for researchers and students of Šiauliai Academy.

List of scientific publications (without garden's affiliation, but made using its infrastructure or by persons working in it):

Effect of the Phenological Stage on the Phenolic Composition, and Antioxidant and Antimicrobial Properties of Cirsium vulgare (Savi) Ten. Extracts. Griskeviciene, Urte; Dambrauskiene, Justina; Marksa, Mindaugas; Mazeliene, Zaneta; Vainoriene, Rimanta; Ivanauskas, Liudas. ISSN: 2075-1729; EISSN: 2075-1729; DOI: 10.3390/life14091191; PMID: 39337972 Life (Basel, Switzerland), 09.2024, Vol.14 (9), p. 1191.

Other activities

2024

- In 2024, the Botanical Garden carried out following projects funded by the Šiauliai City Municipality: "Nature Laboratory in Šiauliai," "Feast of the Assumption in Botanical garden" "I Hear Nature in the City," STEAM program "The Fascinating World of Botany" and the STEAM JUNIOR program "To Explore, Plant, and Grow – Mission Possible!". As a member of the Association of Botanical Gardens of Lithuanian Universities, together with the Nordic Genetic Resource Center NordGen and the Nordic Council of Ministers Office in Lithuania, implemented the project "See, Sow, and Taste!".

- In 2024, the Botanical Garden organized events that have become traditional for the public – "Forty Birds Day," "Ode to the Joy of Spring," "Feast of the Assumption," and "Wind Day" – as well as new events "Festive Creativity Backstage" and the "Harvest Festival."

- For teachers and the city community, the Botanical Garden prepared and implemented three professional development events based on the programs "Understanding and Creatively Using Plant Material in Science Education" and "Planting and Maintenance of Woody Plants." The Botanical Garden contributed its space and work to the Šiauliai Cultural Centre's program dedicated to the International Day of Older Persons – inviting the public to "Senior Day" – and to one of the largest events in the city, "Šiauliai Nights," during which the Speaker of the Parliament of the Republic of Lithuania visited the garden. Educational institutions operating in Šiauliai organized eight events of various sizes in the Botanical Garden in 2024, the largest of which were graduation ceremonies.

2025

- In 2025, expeditions for collecting wild plant seeds in Šilalė district were conducted.

- The botanical garden in 2025 organized events that have become traditional for the public: "Forty Birds Day," "Ode to the Joy of Spring," "Feast of the Assumption," "Wind Day," and "Harvest Festival."

- For teachers and the city community prepared and implemented three professional development events based on the programs "New Generation: Pedagogical Narrative," "Plant Pruning and Shaping," and "Planting, Pruning, and Grafting Woody Plants." It also conducted training on creating spiral and artistic-style bouquets titled "Racing Against Frost," and organized "Zero Waste" gift-wrapping workshops for city residents.

- The Botanical Garden contributed its space and work to the implementation of the Šiauliai Cultural Centre's event program dedicated to the International Day of Older Persons – inviting the public to the "Senior Day" celebration – as well as one of the city's largest events, "Šiauliai Nights."

Visitors per year

	2024	2025
Number of visitors	23 000	20 500

Structure and staff

	2024	2025
Administration	2.5	2.5
Scientists	0	0
Specialists (collections curators, educator)	5 [1]	5 [1]
Field workers	2.5 [4]	2.5 [4]
Security	0	0
TOTAL including:	**10 [5]**	**10 [5]**
PhD	1	1
MSc	3	3

*[additional seasonal employees, up to -]

Finances *(in EUR)*

	2024	2025
Income		
Subsidies from VU Šiauliai Academy	68 000	95 000
Other income (tickets, educations, etc.)	35 000	45 000
Projects	120 000	170 000
TOTAL	**220 000**	**310 000**
Expenses		
Salaries	175 000	235 000
Infrastructure	12 000	15 000
Other expenses	36 000	60 000
TOTAL	**223 000**	**310 000**

*numbers are preliminary, due to common accounting with parent division of Šiauliai Academy



Articles

82 Collection of ornamental Norway spruce Picea abies forms of wild local origin in the Latvia's State Forest arboretum in Kalsnava

88 The Botanic Garden as a Space for Curriculum-Based Informal Education

98 New ornamental cultivars of Deschampsia cespitosa from the Vytautas Magnus University Botanical Garden

108 Modernization of the Palm House for Subtropical Plant Collections at the University of Latvia Botanical Garden

114 The use of phenological observations in VU Šiauliai Academy Botanical Garden

120 Vilnius University Botanical Garden: from its origins to the present day

136 Rosarium of the Tallinn Botanic Garden

152 Astilbes in Tallinn Botanic Garden

162 Integrating Plant Crafts into Learning

170 Overview of Estonian spring bulb cultivars and their conservation at the University of Tartu Botanical Garden

180 Structural Differentiation of Root Endophytic Communities in Festuca Tourn. ex L., Lolium L. and Hybrid Grasses

196 Ericaceae Family Collection in Vilnius University Botanical Garden

Collection of ornamental Norway spruce *Picea abies* forms of wild local origin in the Latvia's State Forest arboretum in Kalsnava

Linda Strode
Latvia's State Forests Arboretum in Kalsnava
"Ogu īves", Jaunkalsnava, Kalsnava parish,
Madona district, LV-4860, Latvia,
+371 29436027,
l.strode@lvm.lv



Fig. 1. 'Baldone'



Fig. 2. 'Dundanga'



Fig. 3. 'Irbe'



Fig. 4. 'V. Mitlers'



Fig. 5. 'Putns'



Fig. 6. 'Mērdzene'

Table 1.
Characteristics of vegetatively propagated Norway spruce ornamental forms of wild local origin in the Latvia's State Forests Arboretum in Kalsnava.

ABSTRACT

Spruces are one of the most important woody plant genera and the most diverse conifer genus in the Arboretum with the Norway spruce *Picea abies* being the most widely represented through its numerous cultivars and forms. This article provides an insight into the history and development of the Arboretum's collection of locally bred ornamental Norway spruce forms. Over the years, a total of approximately 70 spruce forms have been collected and evaluated at the Arboretum, the majority of which were derived from witches' brooms found in the wild. Currently, the collection includes approximately 40 distinct spruce forms. Descriptions of 22 vegetatively propagated forms are provided.



Fig. 7. 'Anna'



Fig. 8. 'Kuģenieki'



Fig. 9. 'Pope'



Fig. 10. 'Strautiņi'



Fig. 11. 'Pededze'



Fig. 12. 'Velēna'

KEY WORDS

New ornamental forms of woody plants, witches' brooms, plant collection, selection, arboretum

INTRODUCTION

The selection of locally sourced ornamental woody plants and the development of their collections is one of the core research areas of the Arboretum. The collection of ornamental Norway spruce forms has been developed since the establishment of the Arboretum. Most of the ornamental forms originate from witches' brooms found within natural forest stands throughout the different regions of Latvia while several others were selected from nurseries. The plants have been propagated vegetatively, either by cuttings or by grafting onto Norway spruce rootstocks. In total, approximately 70 spruce forms have been collected and evaluated over the years. To date, 40 different forms are maintained in the collection. Detailed descriptions are provided for 22 of these forms.

MATERIAL AND METHODS

The forms were measured and described at the end of the growing season in 2024. Each form in the collection is represented by one to several specimens. For forms represented by more than one plant, the measurement table shows the minimum and maximum dimensions.

RESULTS

Names, origins and descriptions of Norway spruce ornamental forms in the collection of Latvia's State Forest arboretum in Kalsnava are given in Table 1. In the table, the ornamental forms are listed according to their year of accession into the collection.

Latvijas valsts mežu arborētums Kalsnavā – unikāla kokaugu kolekcija

50 gadu garumā zinātnisko novērojumu reģistrācija un datu analīze par augiem un to piemērotību Latvijas apstākļiem.

LATVIJAS VALSTS MEŽI
ARBORĒTUMS
KOPŠ 1975
50

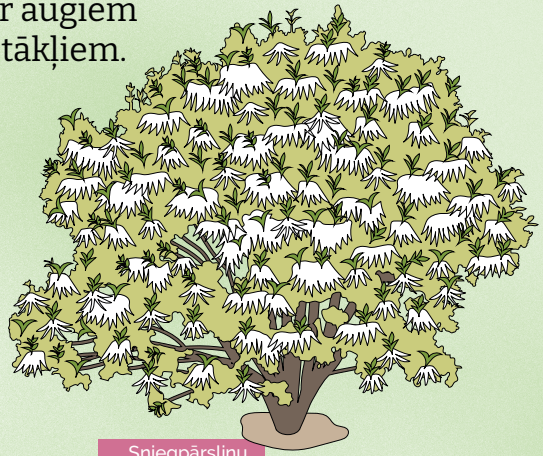
Arborētuma uzdevumi

- Augu pavairojamā materiāla ieguve mežsaimniecībai un apzaļumošanai
- Introducēto kokaugu genofonda krātuve
- Zinātniskās pētniecības bāze kokaugu bioloģijā
- Mācību vieta augstskolu studentiem

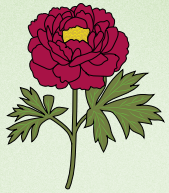
1975. gadā arborētumā iestādīti pirmie kokaugi

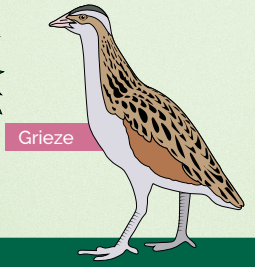
Sadarbība ar **100** dendroloģiskajiem parkiem visā pasaulē

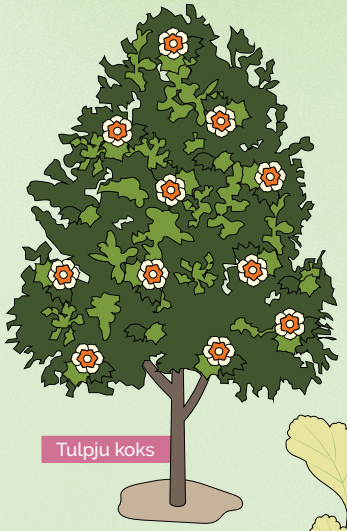
Arborētuma lepnums – **peoniju dārzs ar vairāk nekā 300 šķirnēm**

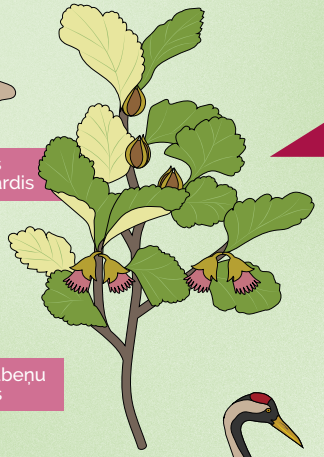

Sniegpārsliņu koks






Grieze

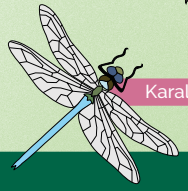

Tulpju koks


Ugunszemes dienvidskabārdis


Zirgskābeņu zilenītis


Zaļziedu naktsvijole


Dzērve


Karaliskā dižspāre

Īpaši dabas retumi:

- Tulpju koks
- Sniegpārsliņu koks
- Ugunszemes dienvidskabārdis un citi

Viena no Latvijas bagātākajām kokaugu kolekcijām **130 ha platībā**

Kopš 2001. gada arborētumu apsaimnieko AS "Latvijas valsts meži"

20 000 dažādi koki, krūmi un liānas no visas pasaules

Mājvieta **23** īpaši aizsargājamām putnu, kukaiņu un augu sugām

Kopš 2001. gada
VALSTS NOZĪMES AIZSARGĀJAMS DABAS PIEMINEKLIS – ĪPAŠI AIZSARGĀJAMI DENDROLOĢISKIE STĀDĪJUMI

Iecienīts tūrisma objekts ar plašu kultūras un izziņas programmu

100 pasākumi gadā = **20 000** apmeklētāji

Vides izglītības programmas dažāda vecuma bērniem

The Botanic Garden as a Space for Curriculum-Based Informal Education

Živilė Bilotaitė-Jokubauskienė
Vytautas Magnus University Botanical Garden, Ž. E. Žilibero str. 4, Kaunas, 46324, Lithuania, +370 37 390 033
zivile.bilotaite-jokubauskiene@vdu.lt

ABSTRACT

This article analyses the educational role of the Vytautas Magnus University Botanical Garden (VMU Botanical Garden), combining an overview of its educational activities with a case study of its long-term partnership with Kaunas "Varpelis" primary school. The study is based on institutional data analysis and a description of educational practices, enabling an evaluation of the scope of activities, organisational principles, and pedagogical approaches.

The article highlights the model of curriculum-based informal education, in which the botanic garden becomes a regular learning environment aligned with the school curriculum. The long-term partnership with "Varpelis" primary school is presented as a transferable model demonstrating how cyclically organised educational sessions and integrated projects contribute to early environmental and sustainability education.

The results indicate that structured and sustained partnerships between botanic gardens and schools strengthen the impact of informal education and enable the development of a systematic, experience-based learning process.

INTRODUCTION

Botanic gardens have traditionally been associated with plant collections and conservation. However, for several decades their role has also been clearly defined within the educational context. As Willison (1994) emphasises, plant conservation cannot succeed without education – as it ensures long-term public understanding and engagement. Thus, botanic gardens are no longer perceived solely as repositories of plant collections or "living libraries"; they are increasingly regarded as active catalysts for change, capable of transforming global environmental challenges into locally understandable and experience-based knowledge.

Educational activities in botanic gardens encompass both formal and informal learning. In many European countries, botanic gardens provide curriculum-linked educational programmes ranging from preschool to university level, organise outdoor lessons, and offer practical activities in botany, ecology, and environmental





Fig. 1-2.
The Botanic Garden as a space for informal education.

protection, often in cooperation with schools and higher education institutions (European Commission, 2006). In the field of informal education, botanic gardens provide opportunities for self-directed learning through interpretation panels, exhibitions, guided tours, and community projects, contributing to environmental awareness and the formation of long-term value systems.

One of the key advantages of botanic garden education compared to traditional classroom learning is experiential and multisensory engagement. While classroom learning often relies on text, diagrams, and verbal explanation, learning in a botanic garden occurs through direct contact with living organisms – observing, touching, smelling, and moving within space. Such environments foster inductive learning, where understanding emerges from observation and experience rather than from predefined definitions, allowing for deeper comprehension (Louv, 2008).

These practices are supported by constructivist learning theory, which states that learning occurs when learners actively construct understanding based on prior knowledge and new experiences (Jaramillo et al., 2025). Botanic gardens also provide favourable conditions for social learning, as educational activities often take place in groups, through dialogue, collaborative tasks, and shared experiences, promoting both knowledge acquisition and the development of transversal competences.

The educational role of botanic gardens is particularly significant in primary education. Research indicates that regular learning in natural environments positively affects children's executive functions – including attention, working memory, cognitive flexibility, and self-regulation – as well as problem-solving skills (Nazirova, 2022). Experiential outdoor learning is also associated with greater intrinsic motivation and improved long-term knowledge retention compared to classroom-based instruction alone (Louv, 2008).

These general findings are reinforced by empirical research conducted at the VMU Botanical Garden. A study led by Dr. Vesta Vančugovienė, in collaboration with international partners, demonstrated that biology teaching in a botanic garden using an inquiry-based approach helps students overcome persistent biological misconceptions and develop a deeper understanding of complex processes such as photosynthesis and respiration (Vančugovienė et al., 2024). The research also revealed a long-term effect: knowledge acquired in the botanic garden remained more substantial several months after the learning activity compared to traditional classroom-based teaching.

In contemporary European practice, botanic garden education is increasingly linked to sustainability education and long-term partnerships between schools, botanic gardens, and other educational institutions (European Commission, 2006). Such partnerships enable the development of coherent, experience-based educational content, more effective use of educational resources, and sustained educational impact.





EDUCATIONAL ACTIVITIES AT THE VMU BOTANICAL GARDEN

The VMU Botanical Garden considers education an integral part of its mission, closely connected to science communication, public engagement, and education for sustainable development. Data from recent years show that educational activities are characterised by both significant scope and structural continuity.

Between 2022 and 2025, the garden organised approximately 300 educational sessions annually, involving 5000–6000 participants each year, primarily children and school students. These figures indicate that education is one of the main forms of the garden's interaction with society. The strong participation of children and youth reflects the garden's role in early education and scientific literacy development.

Most programmes focus on plant knowledge, botanical fundamentals, plant diversity, and human–nature interactions. Themes are often connected to seasonality, plant life cycles, biodiversity, and everyday experiences such as food, growth, and environmental change.

Fig. 3-4.
Educational activities at the VMU Botanical Garden.

Educational activities take place in outdoor collections, the greenhouse, and educational classrooms, depending on the season and topic. This spatial diversity enables the use of varied learning methods and highlights the garden's potential as a "living laboratory." The format directly reflects experiential and multisensory learning principles discussed earlier.

A defining feature of the garden's educational activity is continuous content adaptation. Each year, new activities are developed or existing formats are revised, taking into account students' age, previous experiences, seasonal factors, and current issues.

In recent years, STEAM elements have increasingly been integrated, combining botany with technology, mathematics, and creative tasks. This approach fosters interdisciplinary thinking, recognised as a key competence in contemporary education.

Within this context, the long-term partnership with Kaunas "Varpelis" primary school has gained particular importance, evolving from regular participation to co-creation of a structured and cyclic educational model.

CASE STUDY: KAUNAS "VARPELIS" PRIMARY SCHOOL

Cooperation with Kaunas "Varpelis" Primary School has continued for more than a decade and is characterised by remarkable regularity. Educational sessions take place weekly, typically on Fridays, with three classes attending each week. One cycle spans over six consecutive Fridays, ensuring that all school classes – approximately 18 in total – participate during each cycle.

This continuity has enabled the garden to become a stable component of the school's learning environment. The partnership gradually evolved from standard visits to a structured, cyclic model involving the entire school community.

An important aspect of this model is the avoidance of repetition for the same classes. Each cycle is newly planned, considering students' age, previous participation, and current educational priorities. As a result, returning students experience new learning activities rather than repeated content. Although the programmes do not always directly replicate the formal curriculum, they organically complement topics explored in school. Activities emphasise observation, inquiry, questioning, and creative thinking. Seasonal adaptation allows students to observe plant changes over time and understand cyclic and process-oriented aspects of nature that often remain abstract in classroom settings.



Key factors underlying the success of the partnership include:

- continuity,
- trust-based dialogue,
- flexible content planning,
- and child-centred experiential learning.



Fig. 5-6.
Long-term partnership with "Varpelis" primary school for curriculum-based informal education.

A notable outcome of the partnership is the integrated educational project "See, Sow and Taste!", implemented in cooperation with the Nordic Genetic Resource Center (NordGen). The project follows the pathway of a plant "from seed to harvest," enabling students to experience the entire growth process as a coherent educational sequence. It integrates biological, environmental, and social dimensions while fostering responsible attitudes toward nature and consumption.

Regular meetings with teachers ensure systematic feedback and continuous improvement. Teachers report that activities in the botanic garden increase students' curiosity, stimulate questioning, and frequently serve as a starting point for further classroom activities.

The broader impact of the partnership is visible in students returning to the garden with their families, indicating that learning extends beyond the school context. Ongoing research aims to evaluate more comprehensively the long-term effects of these activities on students' attitudes toward nature and learning.

Unlike nonregular visits, this sustained cooperation enables the development of a coherent educational process whose impact becomes visible over time.

This case may serve as a transferable model for other botanic gardens seeking to strengthen their educational role and establish long-term partnerships aligned with both local needs and broader European sustainability and education priorities.

CONCLUSIONS

The educational activities of the VMU Botanical Garden confirm that contemporary botanic gardens can play a significant role in the education system, particularly at the primary level. Education in the garden is not an additional activity but a strategically developed component of the institution's mission, encompassing large-scale, structured programmes tailored to defined audiences.

The long-term partnership with Kaunas "Varpelis" primary school demonstrates that curriculum-based informal education can create a systematic and continuous learning process. Cyclic organisation, content renewal, and integrated projects contribute to early environmental and sustainability education. The use of diverse garden spaces, seasonality, and interdisciplinary approaches enables children to understand natural processes as dynamic and interconnected systems.

In summary, the cooperation between the VMU Botanical Garden and Kaunas "Varpelis" primary school represents a transferable model relevant to other botanic gardens in the Baltic region and beyond. Long-term, structured partnerships with educational institutions strengthen the educational potential of botanic gardens and contribute to the development of sustainable, experience-based learning practices.

REFERENCES

Willison, J. 1994, Environmental education in botanic gardens; guidelines for developing individual strategies, *Botanical Garden Conservation International*, Descanso House, UK.

European Commission. 2006. *Plant Science Gardens: Plant Science education for primary schools in European Botanic Gardens*. Final Report. FP6 Science and Society Programme.

Louv R. 2008. Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder. *Algonquin Books*, Chapel Hill. P. 390.

Nazirova G.M. 2022. The effects of outdoor education on cognitive development in preschool children. *International Journal of Early Childhood Education*, 28(2): 145–156.

Vančugovienė V., Lehtinen E., Södervik I. 2024. The impact of inquiry-based learning in a botanical garden on conceptual change in biology. *International Journal of Science Education*, 47(2): 1–25. https://doi.org/10.1080/09500693.2024.2354542.

Jaramillo M.A., Jimenez P., Frediani K. 2025. The educational garden: Exploring the multifaceted roles of university botanic gardens through history. *Botanical Journal of the Linnean Society*. (First published online).

New ornamental cultivars of *Deschampsia cespitosa* from the Vytautas Magnus University Botanical Garden

Arūnas Balsevičius
Vytautas Magnus University Botanical Garden,
Ž. E. Žilibero St 4, Kaunas, LT-46324, Lithuania
arunas.balsevicius@vdu.lt

ABSTRACT

Founded in 1923, the Vytautas Magnus University Botanical Garden is an important research and conservation centre in the Baltic region, maintaining extensive plant collections and conducting active breeding programmes. Initially, the Garden focused on the collection and display of wild and economically important plants, while ornamental species were introduced later; for example, the first roses were acquired in 1925. There is no reliable evidence that ornamental plant breeding was conducted during the interwar period, and no cultivars from that time have been preserved. Systematic breeding activities began in 1947, when Dr Ona Skeivienė developed the first peony cultivars (19 in total), marking the beginning of ornamental plant breeding at the Garden.

Three new cultivars of *Deschampsia cespitosa*, 'Bambena', 'Prana', and 'Rudė', were selected from open-pollinated material under field conditions and evaluated for their ornamental traits. The selected cultivars are characterised by distinct growth habits, decorative inflorescences, and good adaptation to local climatic conditions. These cultivars represent valuable additions to ornamental grass assortments suitable for temperate regions. The results highlight the potential of *Deschampsia cespitosa* as a resilient ornamental species and confirm the importance of long-term selection under natural conditions for the development of adapted cultivars.

INTRODUCTION

According to POWO (2025), the genus *Deschampsia* P. Beauv. is distributed mainly in temperate and cold regions of both hemispheres, particularly in the Holarctic (Europe, Asia, and North America). Some species exhibit an almost circumpolar distribution. A high diversity is found in the Andes and Patagonia of South America, and the genus is also present in subantarctic regions and New Zealand. Isolated species occur in Arctic and Antarctic regions as well as in tropical high mountains.

In Lithuania, only one species of the genus is recorded, *Deschampsia cespitosa* (L.) P. Beauv. (Gudžinskas, 1999). The species is widely distributed throughout the country (Lekavičius, 1989), where it forms abundant populations, most commonly in communities of the class *Molinio-Arrhenatheretea* Tx. 1937 (pastures, meadows,

and tall-herb fringes on fertile soils), particularly within the orders *Molinietalia caeruleae* Koch 1926 and *Filipendulo ulmariae-Lotetalia uliginosi* Passarge 1975. It also occurs in fens and other wetland habitats, along ditches, in forests, forest margins, and shrublands.

The distribution range of *Deschampsia cespitosa* extends from Morocco and Portugal in the west to the Caspian Sea and the European part of Russia in the east, and from Turkey and Greece in the south to Iceland and the Svalbard archipelago in the north (Valdés et Scholz, 2009).

Deschampsia cespitosa, is a perennial tuft-forming grass widely distributed in temperate regions and well adapted to a broad range of ecological conditions. Owing to its ornamental value, particularly its fine-textured foliage and airy inflorescences, the species has been widely introduced into cultivation, resulting in numerous horticultural cultivars. The living collection of *Deschampsia cespitosa* at the Vytautas Magnus University Botanical Garden comprises both commercially available cultivars and locally selected genotypes. Introduced cultivars include 'Bronzeschleier' (syn. 'Bronze Veil'), 'Goldschleier' (syn. 'Golden Veil'), 'Goldtau' (syn. 'Golden Dew'), 'Palava', 'Pixie Fountain', 'Schottland', 'Tardiflora', 'Tauträger', and 'Waldschatt'. These accessions were obtained from Lithuanian nurseries and commercial growers and are maintained in ornamental grass and mixed planting displays.

In addition to introduced material, the Botanical Garden maintains several locally selected cultivars derived from open-pollinated wild-collected plants. These include 'Bambena', 'Prana', 'Rudė', 'Rusnė', and 'Šyša'. These selections are grown under field conditions and evaluated for their ornamental traits and adaptation to local climatic conditions.

The collection is maintained across several *ex situ* displays, including ornamental grass collections, thematic flower beds, and breeding plots, providing a basis for long-term evaluation, selection, and conservation of genetic diversity within the species.

MATERIALS AND METHODS

The breeding programme of *Deschampsia cespitosa* was initiated in 2019 through field expeditions aimed at collecting genetic material. During these expeditions, individual plants were selected from wild populations based on distinctive morphological traits. Selection was primarily focused on ornamental characteristics, with the aim of propagating selected individuals for use in ornamental plantings. Selected plants were propagated vegetatively by clump division. The resulting clones were cultivated under field conditions and evaluated annually over five years for their ornamental traits and adaptation to local environmental conditions. Nomenclature for cultivars conforms to the International Code of Nomenclature for Cultivated Plants (ICNCP) (Brickell et al., 2016).

RESULTS AND DISCUSSION

Three new cultivars of *Deschamps cespitosa*, namely 'Bambena', 'Prana', and 'Rudė', were selected from open-pollinated seedlings originating from wild populations in Lithuania and subsequently evaluated under field conditions. The cultivars exhibited stable morphological traits over five years of vegetative propagation, indicating good clonal stability and adaptation to local environmental conditions.



DESCHAMPSIA CESPITOSA ‘BAMBENA’

Author:
Dr A. Balsevičius (Vytautas Magnus University Botanical Garden).

Original seedling number:
No. 2/2019. Open-pollinated seedling selected from a wild population (Lithuania, Alytus district, Ąžuoliniai village). The seedling was selected in 2019.

Diagnosis:

Differs from typical *Deschampsia cespitosa* by its more graceful habit, finer foliage, and loosely arranged, nodding inflorescences.

Description:

Perennial tuft-forming grass forming medium-sized, slightly spreading clumps. Clump height up to 90 cm, width about 50 cm. Leaves narrow, arching, up to 50 cm long and about 0.7 cm wide, green (RHS Green Group N137A). Culms are slender. Inflorescences a loose panicle with drooping branches, creating a soft, flowing structure; panicles up to 40 cm long and 30–40 cm wide. Inflorescences greyed yellow at anthesis (RHS Greyed-Yellow Group 195B), light and airy. Flowering from mid-July to early August.

Ornamental use:

The cultivar ‘Bambena’ is particularly suitable for naturalistic and meadow-style plantings, where its loose habit and nodding, airy inflorescences create a soft and dynamic visual effect. The arching foliage and lightweight panicles enhance movement in wind, contributing to a relaxed and informal composition.

Etymology:

The cultivar name ‘Bambena’ is derived from the name of the Bambena River.



DESCHAMPSIA CESPITOSA ‘PRANA’

Author:
Dr A. Balsevičius (Vytautas Magnus University Botanical Garden)

Original seedling number:
No. 3/2019. Open-pollinated seedling selected from a wild population (Lithuania, Alytus district, Ąžuoliniai village). The seedling was selected in 2019.

Diagnosis:

Differs from typical *Deschampsia cespitosa* by its vigorous growth and large, highly branched, diffuse inflorescences forming a pronounced cloud-like effect.

Description:

Perennial tuft-forming grass forming moderately large, dense clumps. Clump height up to 110 cm, width about 40 cm. Leaves narrow, up to 40 cm long and about 0.5 cm wide, yellow-green (RHS Yellow-Green Group 147A). Culms erect. Inflorescences a large, highly branched panicle forming a broad, diffuse structure; panicles up to 30 cm long and 30–40 cm wide. Inflorescences greyed yellow at anthesis (RHS Greyed-Yellow Group 160B), very light and airy. Flowering from mid-July to early August, representing the latest-flowering cultivar among those studied.

Ornamental use:

The cultivar ‘Prana’ is well suited for large-scale and naturalistic plantings, where its vigorous growth and diffuse, cloud-like inflorescences create a strong yet visually light effect. It combines effectively with tall perennials and grasses, enhancing structural diversity and movement in plant compositions. The cultivar is also suitable for cut flower production. Its long, airy inflorescences are appropriate for fresh and dried arrangements, where they provide volume and a delicate texture.

Etymology:

The cultivar name ‘Prana’ honours the renowned Lithuanian ornithologist Arūnas Pranaitis (Žuvintas Biosphere Reserve).



DESCHAMPSIA CESPITOSA ‘RUDĖ’

Author:
Dr A. Balsevičius (Vytautas Magnus University Botanical Garden)

Original seedling number:
No. 1/2019. Open-pollinated seedling selected from a wild population (Lithuania, Alytus district, Ąžuoliniai village). The seedling was selected in 2019.

Diagnosis:

Differs from typical forms of ***Deschampsia cespitosa*** by its more compact and robust habit and relatively dense, well-structured inflorescences.

Description:

Perennial tuft-forming grass forming dense, upright clumps. Clump height up to 100 cm, width about 50 cm. Leaves narrow, up to 30 cm long and about 0.5 cm wide, green (RHS Green Group N137D). Culms erect. Inflorescences a well-developed panicle, relatively dense and structured; panicles up to 30 cm long and about 30 cm wide. Inflorescences greyed yellow at anthesis (RHS Greyed-Yellow Group 160C). Flowering from early June to early July, representing the earliest-flowering cultivar among those studied.

Ornamental use:

This cultivar is suitable for use in perennial plantings, naturalistic compositions, and as a cut ornamental grass. Owing to its compact habit and structured inflorescences, it is particularly effective as a textural and vertical element in mixed plantings, especially in combination with broad-leaved perennials.

Etymology:

The cultivar name ‘Rudė’ refers to the name of a stream near which the original seedling was collected

COMPARATIVE ANALYSIS

The selected cultivars represent three distinct ornamental types within *Deschampsia cespitosa*, differing in growth habit, inflorescence architecture, phenology, and overall visual effect.

The cultivar ‘Rudė’ is characterised by a compact and robust habit with relatively dense, well-structured panicles, resulting in a strong architectural presence. In contrast, ‘Bambena’ exhibits a more relaxed and graceful habit, with arching foliage and loosely arranged, nodding inflorescences that create a softer and more dynamic appearance. The cultivar ‘Prana’ represents a third type, distinguished by its vigorous growth and large, highly branched, diffuse inflorescences forming a pronounced cloud-like effect.

The cultivars also differ in flowering phenology, forming a clear seasonal sequence. ‘Rudė’ is the earliest-flowering cultivar, blooming from early June to early July. ‘Bambena’ flowers later, from mid-July to early August, while ‘Prana’ is the latest, extending flowering into the second half of summer. This sequential flowering pattern enhances their combined ornamental value in designed plantings.

Differences in inflorescence colour further contribute to their ornamental distinctiveness. ‘Rudė’ displays greyed-yellow tones, while ‘Bambena’ and ‘Prana’ exhibit lighter, pale yellowish inflorescences, resulting in a more luminous and airy visual effect.

Overall, the observed variation among the cultivars reflects the considerable phenotypic diversity present in wild populations of *Deschampsia cespitosa* and demonstrates their potential as a valuable source for the selection of ornamental forms adapted to temperate climates.

CONCLUSIONS

The study demonstrates that wild populations of *Deschampsia cespitosa* represent a valuable source of genetic diversity for the selection of new ornamental cultivars. Three distinct cultivars, 'Rudė', 'Bambena', and 'Prana', were selected and characterised, each exhibiting stable morphological traits and good adaptation to local climatic conditions under field cultivation.

The cultivars differ markedly in growth habit, inflorescence architecture, and flowering phenology, forming clearly distinguishable ornamental types within the species. 'Rudė' represents an early-flowering, structurally compact type with relatively dense inflorescences, whereas 'Bambena' is characterised by a more relaxed habit and softer, nodding inflorescences. 'Prana' constitutes a vigorous, late-flowering type with large, diffuse panicles producing a pronounced cloud-like effect.

The observed variation among the cultivars reflects the considerable phenotypic diversity present in natural populations of *Deschampsia cespitosa*. The results confirm that targeted selection from wild material, combined with long-term evaluation under natural conditions, is an effective approach for developing ornamental cultivars adapted to temperate climates.

The selected cultivars have significant potential for use in a wide range of planting designs, including naturalistic and large-scale compositions, as well as in cut flower production.

REFERENCES

Brickell C. D., Alexander C., David J. C., Hetterscheid W. L. A., Leslie A. C., Malécot V., Xiaobai Jin, Cubey J. J. 2016. International Code of Nomenclature for Cultivated Plants (ICNCP), 9th edition. Scripta Horticulturae 18. International Society for Horticultural Science, Leuven.

Gudžinskas Z. 1999. Lietuvos induočiai augalai. Vilnius: Botanikos instituto leidykla.

Lekavičius A. 1989. Vadovas Lietuvos augalams pažinti. Vilnius: Mokslas.

POWO 2025. *Deschampsia*. Plants of the World Online. Royal Botanic Gardens, Kew. Published on internet: https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:325390-2 (accessed: 20.03.2026).

Valdés B., Scholz H.; with contributions from Raab-Straube E. Von, Parolly G. 2009+. *Poaceae* (pro parte majore). Euro+Med PlantBase – the information resource for Euro-Mediterranean plant diversity. Published on internet: https://europlusmed.org/ (accessed: 20.03.2026).



Fig. 3.
Renovated Palm house (2026).
Photo by L. Ķeire.

Modernization of the Palm House for Subtropical Plant Collections at the University of Latvia Botanical Garden

Signe Tomsone, Ingūna Gudrupa, Kristaps Kunrads, Lauma Ķeire

Botanical Garden, University of Latvia,
Jāņa Šteinhauera str. 2, Riga, LV-1083, Latvia,
+371 26390753,
signe.tomsone@lu.lv

ABSTRACT

The University of Latvia Botanical Garden maintains subtropical plant collection comprising 343 taxa from 71 families. Most taxa are displayed in the Palm house – the garden's largest public greenhouse. Aging infrastructure reduced energy efficiency and hindered the stable environmental conditions required for cultivation. A major renovation and technical upgrade were therefore implemented in 2024–2025. Key improvements included structural reinforcement and corrosion protection, polycarbonate wall cladding, a glass roof to facilitate snow melting, rain and meltwater harvesting for irrigation, automated thermal/shading screens, full modernization of the heating-system, expanded ventilation area, vertical airflow turbines, humidity maintenance system, and improved walkways and lighting. The modernized Palm house now provides more stable, automated microclimate control and improved energy saving, while improving conditions for daily plant maintenance and visitors.

KEYWORDS

Subtropical plants, plant collection, greenhouse, renovation energy efficiency.



Fig. 1.
The Palm house at different times:

1 – 1930s

2 – 1960s

3 – 1970s.

Photos from the University of Latvia Botanical Garden archive; photo collage by L. Ķeire.

Subtropical plant collection of the University of Latvia Botanical Garden comprises plant diversity from the Mediterranean Basin and other subtropical regions worldwide, including Southeast Asia and parts of Africa, Australia, and the Americas. The collection supports university-level teaching in botany and ecology, contributes to the garden's participation in plant-exchange networks, and enhances public understanding of global vegetation beyond temperate regions. The collection started in the 1930s, when the greenhouses were built. For nearly 100 years, the Palm house has served as the main location for subtropical plants and as the largest greenhouse in the garden, it is also open to the public. Over time it has undergone multiple reconstructions to maintain conditions suitable for plant cultivation. The most recent renovation, completed in late 2025 after two years of work, aimed to modernize the structure and engineering systems. This article provides an overview of the subtropical plant collection and presents the outcomes of the Palm House technical upgrade.

The subtropical plant collection includes 343 taxa from 71 families. Most taxa are displayed in the Palm house (Table 1): 24 palm species (Arecaceae) and 20 taxa of conifers (Araucariaceae, Casuarinaceae, Cupressaceae, Pinaceae, Podocarpaceae etc.) as well as representatives from Fabaceae, Lythraceae, Malvaceae, Myrtaceae, Oleaceae, and other families representing typical and rare species. Nineteen species in the collection are listed in the IUCN Red List of Threatened Species, with conservation status ranging from Near Threatened to Critically Endangered. Notable examples include the Vulnerable palm *Howea forsteriana* (Lord Howe Island, Tasman Sea), the Endangered *Sabal bermudana* (Bermuda), the Critically Endangered *Wollemia nobilis* (Australia), and the Vulnerable *Podocarpus salignus* (Chile). The collection also contains economically important edible plants, including *Ficus carica*, *Musa* species, *Olea europaea*, *Laurus nobilis* and *Punica granatum*. Among the oldest specimens in the Palm house are a more than 90-year-old *Ficus macrophylla* and a nearly 90-year-old *Phoenix canariensis*.

Initially, the Palm house was considerably smaller, with a height of 9 meters. As the plants expanded, the space soon proved insufficient, leading to the roof being raised by three meters in 1953. The Palm house acquired its present dimensions in 1972, measuring 550 m2 with a height of 24 meters (Fig. 1). Although the glazing was replaced with polycarbonate in 2011, the structure and engineering systems continued to deteriorate. Aging foundation, metal load-bearing structures, heating system, polycarbonate walls and roof, ventilation and other engineering elements reduced the greenhouse's efficiency and made it increasingly difficult to maintain stable environmental conditions for subtropical plants. At the same time, the aging infrastructure failed to provide appropriate working conditions for staff and no longer met visitors' expectations. For these reasons, renovation and technical modernization began in 2024.

The construction company was tasked with building a modern greenhouse that provides several requirements: energy efficiency, prevention of snow accumulation on the roof during winter, and automated microclimate control for plant cultivation. Prior to construction works, all the potted plants were relocated to other greenhouses. However, the renovation posed significant technical difficulties, as the work had to be done while preserving around 50 inground plants, including large palms and conifers.

During reconstruction, the foundations were strengthened, metal load-bearing structures were reinforced and treated against corrosion (Fig. 2.). The walls were clad with polycarbonate, while the roof was glazed with glass, which provides higher heat transmission and thus supports snow melting in winter. The roof was equipped with a system to collect meltwater and rainwater, which is used to water the plants. To improve energy performance, automated thermal and shading screens were installed on the walls and roof to reduce heat loss in winter and provide shading on sunny days, as well as the heating system was fully modernized. The ventilation efficiency was enhanced by extending the total hatches area to 115 m2 in the walls, but to equalize the temperature in the greenhouse from ground level to the roof, eight vertical airflow turbines were installed. Relative humidity is now maintained via an irrigation network. Plant display infrastructure was also improved by replacing old shelving with new units.

Visitor comfort and accessibility were enhanced through wider walkways and the installation of benches (Fig. 3). In addition to the lighting designed to stimulate flowering, new visitor lighting was introduced, making the Palm house more attractive during the lowlight autumn and winter period and providing opportunities for evening events.



Fig. 2.
Palm house during reconstruction (2024). Photo by L. Ķeire.

Following the 2024–2025 modernization, the Palm house is now far better equipped to meet both the cultivation requirements of subtropical plants and the functional needs of a contemporary public exhibition greenhouse. The integrated structural and engineering upgrades, including automated microclimate control, improved environmental regulation, and energyefficiency measures, provide significantly enhanced conditions for maintaining and further expanding the collection. Looking ahead, these improvements create a strong foundation for the Palm house's longterm development. It will allow the introduction of new and botanically valuable taxa, while the improved visitor infrastructure opens opportunities for educational programs, and yearround events. Combined, these advancements position the Palm house as a solid basis for a living plant collection area and a centre for public engagement, enhancing its role in promoting awareness of subtropical plant diversity and the importance of plant conservation.

Category	Total in the collection number)	Located in Palm House (number)
Families	71	60
Genera	158	115
Species	263	163
Cultivars	80	42
IUCN Red List species	119	91
CITES species	4	3

Table 1. Subtropical plant collection.

The use of phenological observations in VU Šiauliai Academy Botanical Garden

Martynas Kazlauskas[1], Rimanta Vainorienė[2]

[1] Vilnius University Šiauliai Academy Botanical Garden, Paitaičių str. 4, LT-77175, Šiauliai, Lithuania
martynas.kazlauskas@sa.vu.lt

[2] Vilnius University Šiauliai Academy Institute of Regional Development, Vytauto str. 84, LT-76352, Šiauliai, Lithuania.

ABSTRACT

Botanic gardens have finally changed since they were specialized gardens. Today, they have to combine plant collecting with various other needs – public recreational and educational; scientific – they conduct research themselves or serve as a base for conducting research; conservationists - plant protection and public education on this topic; comply with the media's right to know. Phenological collections help combine many of the above needs in one place and require relatively few resources to maintain. A phenological garden was established in Šiauliai Academy's botanical garden in 2005, after joining the International Network of Phenological Gardens. In almost 20 years of operation, it has demonstrated its multiple benefits, and it, like all data sets, continues to grow over the years.

KEYWORDS

Phenology, Phenophases, Garden, Šiauliai.

INTRODUCTION

Botanic gardens have finally changed since they were specialized gardens. Today, they have to combine plant collecting with various other needs - public recreational and educational; scientific – they conduct research themselves or serve as a base for conducting research; conservationists - plant protection and public education on this topic; comply with the media's right to know. Phenological collections help combine many of the above needs in one place and require relatively few resources to maintain.

SHORT BACKGROUND

Phenological networks have several scientific goals, including monitoring environmental changes, detecting climate impacts, developing phenological models/maps, or comparing with remote sensing data. This is related to understanding how ecosystems respond to environmental change, which can have important implications for management decisions and policy making (Catholic ..., 2024). In Lithuania, the first phenological studies were started in the 18th century, but for one reason or another, their activities were interrupted. Currently, only the Lithuanian Hydrometeorological Service conducts phenological observations covering a wide geography, but the lists of observed species differ from those used by the International Network of Phenological Gardens (IPG), and the observed individuals are not genetically uniform. The IPG began to function in Europe in 1959 (Renner et Chmielewski, 2022). The main idea behind this program was to standardize large-scale phenological research by establishing gardens across Europe that would grow only identical, cloned species of trees and shrubs, in order to eliminate inherited genetic diversity. There are two phenological gardens in Lithuania cities Šiauliai and Klaipėda, that have joined in the International Network of Phenological Gardens (IPG).

DESCRIPTION

VU Šiauliai Academy Botanical Garden joined the monitoring network in 2005 (23.267° E, 55.917°, alt. 117 m). 18 plants were obtained from IPG: *Larix decidua* Mill., *Picea abies* (L.) H. Karst. f. Early, *Picea abies* (L.) H. Karst. f. Late, *Pinus sylvestris* L., *Betula pubescens* Ehrh., *Fagus sylvatica* L., *Populus tremula* L., *Robinia pseudoacacia*, *Sorbus aucuparia* L., *Tilia cordata* Mill., *Ribes alpinum* L., *Salix acutifolia* Willd., *Salix* × *smithiana* Willd., *Salix viminalis* L., *Sambucus nigra* L., *Corylus avellana* L., *Forsythia suspensa* (Thunb.) Vahl 'Fortunei', *Syringa* × *chinensis*, 'Red Rothomagensis'. Observations began in 2007, after the plants were moved to their permanent place of growth. By the IPG requirements, the following 8 phenological phases are observed: Leaf/needle unfolding (UL), may shoot (MS), St. John's shoot (JS), beginning of flowering (BF), full flowering (FF), first ripe fruits (RF), autumn colouring (CL), leaf fall (LF). All observation data is entered into a common database and is available to all members of the network.

The data of phenological observations are important for scholars in studying the influence of geographical factors, the dynamics of seasonality on the development of one or another plant species. For more global research, phenological data are used to study the impact of climate change on plants, predict future climate change trends, create phenological maps, etc.

Observation data in the botanical garden of the Šiauliai Academy have already been published before (Klimienė et al., 2017). According to recent dataset (2017-2023) it was found, vegetation in general ends at the same time, but begins earlier, and therefore the seasons are getting longer. For most of the species observed, the data shows trends, but they are statistically unreliable, however, some indicate the following, statistically reliable changes over the observation period. In *Corylus avellana* case, the length of the season in second period increases by an average of 25 days, the beginning of the season (flowering) occurs earlier by an average of 22 days, the unfolding of the leaves and ripening the fruit occurs earlier. Half of our observed *Salix* species shows finish of vegetation season earlier: *Salix* × *smithiana* by 7 days and *Salix viminalis* by 8 days on average. The start of the season of *Sorbus aucuparia* L. was brought forward by 8 days, the plant blooms earlier, but the fruit ripens later. According to our results *Larix decidua* unfolds its leaves also latter. We came to conclusion, five plants out of 18 observed under the IPG program in the VUŠA Botanical Garden respond to changing climatic conditions in the duration of the vegetation season and changes in the time of manifestation of phenophases. Such data bring benefits in a scientific sense, but at the same time, they also help in the wider activities of botanical gardens. As is well known, one of the most popular topics that botanic garden workers are interviewed by the media is "too early" flowering of plants, "too long autumn" or the like. Knowing that meteorological data is not recorded by botanists, but by meteorologists, phenological data collected in botanical gardens helps to provide the media with information that does not duplicate, but complements meteorological data, thus helping botanists-interviewers to disseminate more detailed information and with greater confidence.

The phenological garden is perfect for those visitors to the botanical gardens, for whom it is more important to hear than to walk as far as possible, such as seniors, students, guided tours ordered by blind and partially sighted societies. In the phenology garden in Šiauliai, the topics that have attracted interest and are therefore considered to be successful are: individual differences between representatives of the same species, cloning, which many have heard of, but practical examples of its use are less heard and known, climate change and its causes.

As citizen science becomes more popular in the world, academics are increasingly recognizing its benefits which were underestimated before. In Lithuania, it is worth renewing a good idea, when according to D. Romanovskaja and E. Bakšienė (2009), since 1959 the established network relied on volunteer observers who recorded phenophases in various areas of Lithuania. People interested in citizen science, for example, three popular monitoring apps for phones alone have been downloaded as many as 12 million times (Klinger et al., 2023). Volunteers collect reasonably good data, but remaining barriers to the quality of observations would benefit from training in some aspects (Fuccillo et al., 2015). Botanic gardens, with a compatible operational goal, infrastructure, knowledge and experience, could be useful in this activity - to instruct and advise volunteers who want to or are already involved in phenological observations.

CONCLUSIONS

The phenology garden in the VUŠA Botanic Garden is useful because its maintenance is relatively cheap, but it brings multiple benefits - scientific, educational and helps to popularize garden. Botanic gardens have the resources to be consultative centres supporting citizen science initiatives at least when they are about plant phenology.

REFERENCES

Catholic University of Eichstätt-Ingolstadt. The International Phenological Gardens: https://ipg.ku.de/en/ (viewed 30.05.2024)

Klimienė A., Vainorienė R., Klimas R., 2017. Phenological research of climate changes in the north part of Lithuania by the phenological garden of Šiauliai University. Int J Biometeorol, p. 1–9.

Fuccillo K. K., Crimmins T. M., de Rivera C.E., Elder T. S. 2015. Assessing accuracy in citizen science-based plant phenology monitoring. Int J Biometeorol 59:917–926.

Klinger, Y. P., Eckstein, R. L., Kleinebecker, T. 2023. iPhenology: Using open-access citizenscience photos to track phenology at continental scale. Methods in Ecology and Evolution, 14, 1424–1431.

Renner, S. S., Chmielewski, F. M. 2022. The International Phenological Garden network (1959 to 2021): its 131 gardens, cloned study species, data archiving, and future. Int J Biometeorol, 66(1), 35-43.

Romanovskaja D, Bakšienė E. (2007) Influence of a thermal mode on the seasonal phenological phenomena in Lithuania. Ekologija 1:15–20.

Vilnius University Botanical Garden: from its origins to the present day

Audrius Skridaila,
Aida Vida Dobkevičiūtė



Fig. 7.
Botanical Garden in Kairėnai (Rhododendron Garden).

INTRODUCTION

There is growing societal awareness of the importance of connecting people with nature, both body and mind, and botanical gardens provide such an opportunity. This year, Vilnius University Botanical Garden celebrates its 245-year history and outstanding experience in the exchange of science, culture, sports, and education. Thousands of visitors visit the Garden to discover over 40 educational, thematic, biodiversity, scientific, selective, and other plant collections, as well as Lithuania's natural flora. Events for visitors are seen as another way to create possibilities for different communities to meet with nature. Scientists and students, teachers and pupils, educators and botanists, artists and creators, sportsmen and healthy-life-style promoters meet here to forge new relationships with the Garden's living elements. Each year, the Garden hosts a wide range of indoor and outdoor events. These include numerous educational activities, initiatives promoting culture, sports, and a healthy lifestyle, a few commercial concerts, and a diverse program of exhibitions featuring art and natural objects. Events are organized throughout the year, aim to engage diverse target groups, and are linked to natural science. Even the Lights and Installation Park theme during the winter season is linked to nature. Different communities get involved here to teach and learn, to create and participate in active events, and to enjoy different forms of leisure. It is a result of active VU Botanical Garden promotion and communication with the public, Vilnius Municipality, schools, non-profit organizations, artists unions, and sports associations.

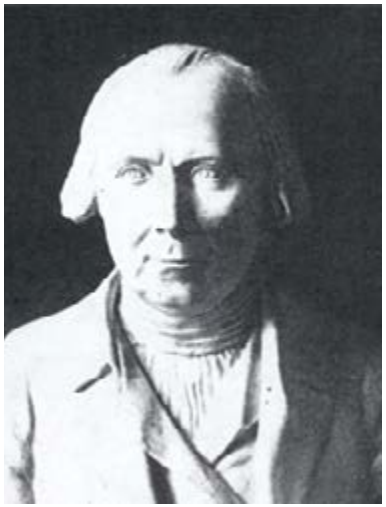


Fig. 1.
Founder of the Vilnius University Botanical Garden, J. E. Gilibert.

ESTABLISHMENT AND CHALLENGING FIRST DECADES IN THE 18TH CENTURY

Vilnius University (VU) Botanical Garden was the first institution where systematic research of the flora of the present-day Lithuanian territory began. It is true that its founder, the renowned French professor and botanist Jean-Emmanuel Gilibert (Joannes Emmanuel Gilibert), had already begun researching the local flora around Grodno in 1775 (GILIBERT, 1798). However, after moving to Vilnius in 1781 and establishing the first Vilnius University Botanical Garden (in the courtyard of 22 Pilies Street), he continued and summarized this work by publishing the first two-volume work devoted to the description of the country's vegetation – "*Flora Lithuanica inchoata*" (GILIBERT, 1781, 1782).

Within a very short time, J. E. Gilibert involved his students in the study of local flora and, with their assistance, collected material for another publication – "*Exercitium Botanicum*" (GILIBERT, 1782b). This work already presented information on local plants not only from the Vilnius area but also from other regions of Lithuania, including Samogitia (the Northwestern region of Lithuania). Although these studies were only initial attempts to comprehend the diversity and richness of the country's vegetation and did not yet constitute environmental protection activity as understood today, they became an important starting point for later researchers who thoroughly studied and inventoried Lithuania's plant wealth. Ultimately, detailed knowledge of the country's vegetation helped to better understand the threats it faced and the necessity of protecting this natural heritage from loss.

Unfortunately, J. E. Gilibert left Lithuania quite soon (in 1783), and with his departure, research into the country's flora came to a temporary halt. Although Vilnius University afterward invited several prominent scientists of the time to teach natural sciences, expand the Botanical Garden, and conduct floristic research—such as Johann Georg Adam Forster (G. Forster), known across Europe as a participant in Captain Cook's second voyage (1772–1775), and Professor Ferdinand Spiznagel (F. Spiznagel) from Vienna—none of them carried out significant studies of local flora in Vilnius. This was due to the simultaneous collapse of the Lithuanian–Polish Commonwealth. Nevertheless, both scientists contributed to the development of the Botanical Garden: thanks to G. Forster, a new plot of land at the foot of Gediminas Castle Hill (then known as Sereikiškės) was purchased in 1787, while F. Spiznagel initiated preliminary work to relocate the garden to the new site and showed interest in local flora. Unfortunately, unfavourable political circumstances prevented them from realizing their plans.

THE GARDEN IN THE 19TH CENTURY

The revival of the Vilnius University Botanical Garden began only in the early 19th century, when Stanisław Bonifacy Jundziłł (S. B. Jundzill) was appointed as its director, having just returned to Vilnius after several years of traineeship abroad. S. B. Jundzill had already distinguished himself earlier as a researcher of local flora by publishing "*Description of Plants of the Province of the Grand Duchy of Lithuania According to the Linnaean System*" in 1791. He officially took charge of the Botanical Garden in 1799 and, in 1800, organized the relocation of most plants from the old site on Pilies Street to the new plot in Sereikiškės (SLAWINSKI, 1947). That same year, he also supplemented the garden's collections with plants collected in the vicinity of Vilnius (KURPIEL, 1905), as research into insufficiently studied local flora remained one of the institution's priorities.



Fig. 2.
Greenhouses of the Vilnius University Botanical Garden in the first half of the 19th century.

Within a few years, the number of cultivated plants had increased. In 1802, the first printed catalogue of the Botanical Garden was published, listing 1,072 species. Between 1806 and 1808, a large new greenhouse complex was built, and an additional land plot of about 2.1 ha on the right bank of the Vilnelė River was purchased, increasing the garden's total area to approximately 4.4 ha. By 1808, the collections already comprised 2,080 plant taxa. In 1810, another low greenhouse was built in front of the earlier large orangery. By 1814, the collection included 3,861 plant taxa, and in 1821, a third greenhouse was constructed. At the end of 1824, S. B. Jundzill published the final catalogue he had prepared, listing 6,565 plant names.

Under S. B. Jundzill's leadership, the Botanical Garden grew into an important university unit, while the Department of Natural History under his direction—rich in mineral collections, herbaria, and zoological exhibits—became the most authoritative center of natural science studies in the territory of the former Grand Duchy of Lithuania.

In early 1825, Józef Jundziłł (J. Jundzill, nephew of S. B. Jundzill) was appointed director of the Botanical Garden and continued expanding the collections assembled by his predecessor. His handwritten catalogue, "Indicis Plantarum Horti Botanici Caesareae Universitatis Vilnensis, Appendix 1827", preserved in the archive (JUA F 53) of Jagiellonian University in Kraków, records the highest number of plant taxa grown in the garden in the 19th century — 8,979.



Fig. 3.
Botanical Garden (K. Raczyński, 1835 Lithograph. VAM reg. G-3711.

Under the leadership of Stanisław Bonifacy and Józef Jundzill, the Botanical Garden was planned and organized according to the system of the Swedish botanist Carl Linnaeus. By the 19th century, however, this system had become outdated. New, modern ideas were introduced by J. Jundzill's assistant, chief gardener Karolis Witzel (K. Witzel), who arrived in Vilnius from Kremenets in 1828. He initiated radical reforms, transforming the garden's geometric layout into a landscape plan and arranging plants according to Antoine de Jussieu's "natural families" system (LVIA F 567 apr. 2 B1985). Unfortunately, K. Witzel died unexpectedly on July 5th, 1830, before completing these reforms.

After the death of K. Witzel, S. Gorskis was appointed head of the Botanical Garden. Prior to this appointment, he had served as an assistant to Professor of Pharmacy J. Wolfgang, who also conducted research on the region's flora. However, the political and economic situation in the country at that time became unfavourable to both the development of the Botanical Garden and the advancement of floristic research, as the uprising of 1830 had begun. Despite these difficulties, S. Gorskis made efforts to expand the Botanical Garden's collections and conducted extensive research on local flora. He continued the reorganization initiated by K. Witzel and arranged the plants according to A. de Jussieu's system.

At that time, the reforms carried out by K. Witzel and S. Gorskis raised the Vilnius University Botanical Garden to a qualitatively higher level, placing it—from the perspective of plant systematics—among the most advanced botanical gardens in

Europe. Unfortunately, following the suppression of the 1830–1831 uprising, Vilnius University was closed, and the progressive reforms initiated in the Garden were no longer able to yield the benefits they could have brought to the development of botanical science in Lithuania. The Botanical Garden was allowed to continue operating for almost another decade (1832–1841) under the Medical–Surgical Academy, which replaced the university; however, its activities were severely restricted. Eventually, the Academy was closed as well, and in 1842, the Botanical Garden was completely liquidated. With the abolition of the last scientific institutions in Vilnius, research into the region's flora came to a complete halt.

REBIRTH IN THE FIRST DECADES OF THE 20TH CENTURY

After the First World War, both Lithuania and Poland gained the opportunity to restore their lost statehood. Unfortunately, numerous disagreements and problems arose in Lithuanian–Polish relations. Neither nation sought to re-establish the former joint state, making it necessary to divide not only territory but also a shared historical and cultural heritage developed over more than four centuries. The restoration of Vilnius University in 1918 was planned by both Lithuanians and Poles (JEGELAVIČIUS, 1994). However, it was the Poles who succeeded first in implementing these plans. On October 11, 1919, the Polish Stefan Batory University (SBU) was opened in Vilnius.

Alongside plans to restore the University, the question of re-establishing the Botanical Garden was also considered. The former Garden territory in Sereikiškės was returned to the University (LCVA F 175, ap. IA, B. 28, p. 307), but it was in such poor condition that the first SBU botanist, P. Wiśniewski, who had arrived in Vilnius from the Warsaw Main School of Agriculture, proposed establishing the Botanical Garden in Vingis (TRZEBIŃSKI, 1929). He was appointed the first official director of the restored Botanical Garden at the beginning of the 20th century. In practice, however, most of the work involved in establishing the Garden in Vingis was directed by Konstanty Hektor Prószyński (K. Proszyński), who was employed as the Garden's inspector in 1920. It was largely on his shoulders that the responsibilities for the creation and maintenance of the Garden rested for a prolonged period of seventeen years (TRZEBIŃSKI, 1929), especially after Professor P. Wiśniewski resigned relatively quickly from the official position of Garden director in 1921, and another director, Professor J. Trzebinski, was officially confirmed in this role only in 1924.



Fig. 4. Supporting Building of the greenhouse complex constructed in 1926–1927.

Creating a Botanical Garden on an undeveloped site was not an easy task; nevertheless, from the very beginning, attention was devoted not only to forming plant collections but also to researching local flora. As early as 1922, sections of native plants and the so-called "general systematics" section were established. In the same year, an artificial dune was constructed and planted with *psammophytes*. In 1925, a collection of cultivated plants was planted; in 1926, the "Plant Ecology Section" was established, several water basins were installed, and the construction of greenhouses was initiated. In 1927, the tree and shrub collection was expanded, a small artificial raised bog was created, and the collection of alpine plants was begun (TRZEBINSKI, 1929).

By 1935, the Garden's collections comprised approximately 2,800 plant species. The size of the Garden's plant collections remained largely unchanged until the end of the SBU existence. On July 31, 1936, after inspector K. Proszyński retired, A. Michalski—previously an assistant at the Department of Plant Systematics and Geography—was appointed to replace him (MOWSZOWICZ, 1950). Shortly thereafter, in 1937, Professor J. Trzebinski also retired, and his position as director of the Garden was taken over by Professor F. Skupienski (Skupieński). Through the efforts of the latter, an additional 2,000 m^2 of land was developed and used for experimental crops (LCVA F 175, ap. IA, B. 927, p. 144), increasing the Garden's total area to 2.2 hectares. Unfortunately, the works he initiated were interrupted by the outbreak of the Second World War.



Fig. 5.
Drawing by K. Prószyński (1920-1936).

After the First World War, most botanical gardens in Europe were experiencing difficult times, with only a few flourishing, unaffected by various adversities (REGEL, 1931). J. Paczoski (PACZOSKI, 1929) noted that by the late 1920s, most Botanical Gardens in Poland were suffering from a deep crisis. According to him, the Polish Gardens of that period were entirely inactive in scientific research and therefore required reform to enable them to perform much broader functions. This assessment also applied to the SBU Botanical Garden; nevertheless, research on local flora was still conducted there. Admittedly, these studies were carried out within a relatively limited area around Vilnius, extending no further than Trakai.

However, for example, the "Atlas of Fungi" prepared by the Garden inspector K. Prószyński—a talented botanical illustrator—consisting of drawings of fungal fruiting bodies, remains unsurpassed in quality to this day. The same can be said of his other illustrations of plants cultivated in the Garden and representatives of local flora, which are currently preserved in the Herbarium of the Vilnius University Life Sciences Center.

NEW CHALLENGES AFTER WORLD WAR II

With the outbreak of the Second World War, Stefan Batory University (SBU) was closed, and the University of Kaunas was transferred to Vilnius to replace it. The Botanical Garden in Vingis became part of this institution. Unfortunately, the Garden was not spared by the hardships of wartime and suffered its greatest damage during the final battles in Vilnius in July 1944, when the greenhouses were destroyed, and many outdoor plants were damaged. Moreover, after the war, following the dismissal of a large part of the Garden's most highly qualified staff, it took a considerable amount of time before activities in the Garden could resume. With the departure of long-serving senior specialists, their replacements initially had only a limited understanding of how many plants had survived in the Garden after the war, and which had not.

Documents from that period record that in 1947, only about 300 plant taxa remained in the Vilnius University Botanical Garden in Vingis (S. DEVEIKIS, 1988). Until 1949, the Garden's scientific activities were supervised by Professor A. Minkevičius. At his suggestion, a small arboretum was established in the Garden, which has survived successfully to the present day and currently contains more than 170 species of woody plants. In 1950, P. Bluzmanas was appointed as the acting head of the Vilnius University Botanical Garden, and in 1952, he was replaced by V. Pūkelis. During this period, the first postwar scientific research projects were initiated in the Garden by P. Bluzmanas, A. Merkys, P. Snarskis, and others (DEVEIKIS, 1988).

However, the true period of recovery of the Botanical Garden in Vingis began only in 1954, when A. Lučinskienė became its director. Under her leadership, the Garden began to develop rapidly. By 1959, the Botanical Garden in Vingis comprised eleven socalled sections, or more precisely, collections: plant systematics, biology, medicinal plants, forage grasses, industrial and cereal crops, vegetable cultivation, floriculture, dendrology, pomology, and an alpine garden. In 1964, three new greenhouses were constructed and the older ones renovated. The territory of the Vilnius University Botanical Garden was expanded to 7.35 hectares. New areas of scientific research were also developed in the Garden (MARGOLYTĖ, 1964; RAŠKAUSKAS, 1965; LUČINSKIENĖ, 1971, and others).

As of 1 January 1969, 2,537 plant taxa were being cultivated in the Vilnius University Botanical Garden; by 1971, this number had grown to approximately 4,000 (LUČINSKIENĖ, 1971). It should be noted that during this period, the Botanical Garden was not particularly active in research on local flora, although around 200 native taxa were cultivated there. Nevertheless, the plant collections maintained in the Garden were intensively used for the implementation of study programs: Vilnius University students studying various disciplines in biology, botany, and genetics visited the Garden throughout the year.

A new stage in the development of the Vilnius University Botanical Garden began in 1974, when a large land plot (150 hectares) was allocated for its expansion on the northeastern outskirts of the city of Vilnius, in Kairėnai, and officially transferred on 14 May 1974 (ŽILINSKAITĖ, 1999). At the same time, a new director of the Garden, J. Meidus, was appointed. The establishment of the Botanical Garden in Kairėnai was undertaken energetically in the second half of the 1970s: a master plan was prepared, extensive landscaping and construction works were initiated, former ponds were reconstructed, six new ponds were created, a large irrigation system was installed, an internal circular road was built, and so forth. Residents were partially relocated from the Garden territory; numerous shanties left behind by them were demolished, and many waste dumps were cleared.

From 1975 onwards, the Departments of Plant Genetics and Pomology began operating in the Botanical Garden in Kairėnai. In 1976, the Department of Dendrology was established. It should be noted that development in the Garden slowed in the 1980s.

THE GARDEN AFTER THE RESTORATION OF LITHUANIA'S INDEPENDENCE

After Lithuania restored its independence in 1990, the Garden development regained momentum. This renewed activity coincided with the beginning of the term of a new Garden director, Associate Professor E. Navys, who assumed this position in late autumn of 1989. Under his leadership, infrastructure development in the Garden (in Kairėnai) was resumed: between 1991 and 1994, the Garden territory was fenced, three kilometers of new road and paths were constructed, several new ponds were excavated, and other works were carried out. The last remaining residents were relocated from the Garden territory, and the area designated for the Garden's development in Kairėnai was expanded to 191.5 hectares.



Fig. 6.
Botanical Garden Museum (former Kairėnai Manor stables, reconstructed in 2006–2008; façades renewed in 2023).

Three new units were established: in 1991, the Laboratory of Plant Physiology and Cell Cultures; in 1992, the Department of Floriculture and the Operations Department. Plant collections in the Botanical Garden (Kairėnai) expanded rapidly, and by 2000, approximately 8,000 plant taxa had been accumulated. In the same year, the Garden officially began admitting visitors. During the 1990s, the Garden also noticeably intensified its scientific research and educational activities.

The Department of Plant Genetics was particularly active in this field, specializing in barley mutagenesis research; its collections included more than 580 named barley varieties, mutants, hybrids, and genetic lines. Considerable work was also carried out by the Department of Pomology, which assembled one of the largest collections of gooseberries and currants in Europe, comprising more than 50 species and over 700 cultivars. Both departments were also engaged in plant breeding activities, resulting in the development of numerous original varieties and hybrids. From 1994 onwards, Vilnius University Botanical Garden joined the national Research Programme on the Genetic Resources of Useful Plants of Lithuania.

Within two decades, from 1990 to 2000, the Botanical Garden hosted several dozen scientific conferences and seminars; students prepared their academic works there, and several PhD theses were completed and successfully defended.

From the autumn of 2002, following the retirement of Associate Professor E. Navys, Dr. A. Skridaila was elected Director of the Garden by the Council of the Faculty of Natural Sciences. Starting in 2003, several major investment projects were prepared and implemented, significantly improving the Botanical Garden's infrastructure in Kairėnai. As a result, all technical infrastructure was fully reconstructed and developed, several new utility buildings were constructed, former manor buildings were restored and adapted to modern needs, the historical structure of the manor park was reestablished, and plant displays were substantially expanded.

At the same time, the Garden expanded its educational and cultural activities, and the number of visitors increased considerably, reaching 15,000 per year in 2005, 50,000 in 2010, and 116 000 in 2025. The Garden became involved in the activities of several national and international organizations coordinating the work of Botanical Gardens and began participating in the implementation of various international projects.

In 2011, the Botanical Garden's organizational structure was reorganized: five new units—Administration and Operations, Plant Collections, Research Programs, Communication and Services, and Vingis Department—were formed. At the same time, the Garden was granted a higher institutional status and became a core unit of Vilnius University.

In 2017, a system for monitoring the quality of plant collections was introduced in the Garden, a methodology for evaluating collections was developed, guidelines for collection development were approved, and their implementation was initiated. These measures aimed to build and maintain the most valuable plant collections—important for scientific research, education, and environmental protection—and to ensure their intensive use across a wide range of activities.

Following the establishment of a new Communication and Services Department in 2011, this unit assumed responsibility for all visitor services and for organizing educational, cultural, and other public events. The number of such events increased significantly, exceeding 150 per year.



Fig. 8.
Diverse communities and events in VU Botanical Garden today (Lilac's Festival).

In addition, the scope of scientific research conducted in the Garden was expanded to include continued genetic studies of various biological objects, research on plant symbiosis with mycorrhizal fungi, and studies on the biology of rare and endangered plant species.

The Garden also became involved in practical work on the restoration of endangered plant populations. One of the first such initiatives was carried out in 2014–2015, during the implementation of a project aimed at restoring and translocating populations of three endangered Lithuanian plant species along the Baltic coast: the sea aster (*Tripolium pannonicum* (Jacq.) Dobrocz.), sea milkwort (*Glaux maritima* L.), and saltmarsh rush (*Juncus gerardii* Loisel).

In 2017, work began on the revitalization of Vingis department infrastructure, which, over the last 4 decades, had deteriorated significantly without serious investment. Fundamental improvements in the unfavourable condition of the Vingis Department's infrastructure began in 2021, when the new Revitalization plan for this Department

was prepared, and the investment project entitled "*Renovation of Infrastructure Facilities of the Vilnius University Botanical Garden to Increase Opportunities for the Development of Educational and Cultural Activities*" was developed.

During the implementation of this project (Stage I of the Vingis Department Revitalization plan), most funds were allocated specifically to the renovation of the general infrastructure elements of the Vingis Department, including the restoration of historic hydrological structures (the historical pond and canal), the reconstruction of the old path system, and the expansion of the information system.

Once the entire investment project is fully implemented (three stages are planned), all buildings and technical networks within the Vingis Department territory will be comprehensively renovated, and a new visitor reception center will be established. It is expected that the implemented investment project will ensure the successful development of activities in this Botanical Garden division, create conditions for attracting several times more visitors, enable the organization of higherquality and more numerous events, support the expansion of educational activities, and promote the dissemination of environmental protection ideas.

REFERENCES

DEVEIKIS S. 1998: Edouard'o Andre architektūrinių sprendimų principai ir dedndroflora.- Dendrologia Lithuaniae, 4. – Vilnius.

DEVEIKIS S., 1989: Vilniaus universiteto Botanikos sodas Vingyje (mašinraštis saugomas VU Botanikos sode).

GILIBERT J.E. 1782 b: Exxercitium botanicum in schola principe universitatis Vilnensis habendum die mensis julii anno 1782.- Vilnae.

GILIBERT J.E., 1781: Flora Lituanica inchoata seu enumeratio plantarum quas circa Grodnam collegitet determinvit Joannes Emmanuel Gilibert, 1,2-Grodnae.

GILIBERT J.E., 1782a: Flora Lituanica inchoata seu enumeratio plantarum quas circa Grodnam collegitet determinvit Joannes Emmanuel Gilibert, 3,4,5. - Vilnae.

GILIBERT J.E., 1798: Hostoire des plantes d'Europe, 1- Lyon.

JEGELAVIČIUS S. 1994: Universiteto atkūrimas (1918-1919). – Vilniaus universiteto istorija 1579ž1994. – Vilnius.

JUNDZILL S. B., 1791: Opisanie roślin w prowincyi W. X. Litewskiego, naturalnie rosnących, według układu Linneusza. -Wilno.

KURPIEL A. M. 1905: Pamiętniki Ks. Stanislawa Jundzilla profesora uniwersytetu Wilienskiego. – Krakow.

LUČINSKIENĖ A., 1971: Vilniusskij Botaniczeskij sad. – Botaniczeskije sady Pribaltiki. – Riga.

MARGOLYTĖ R., 1964: Vilniaus universiteto Botanikos sodo introdukuots vyšnios ir trešnės. – AMMD, Biologija, 12. – Vilnius.

MOWSZOWICZ J., 1950: Z historii dawnych ogrodow botanicznych uniwersytetu Wilienskiego. – Kosmos, Ser. A,66 (1-3).

PACZOSKI J., 1929: Ogrody botaniczne. Nauka Polska. – Warszawa.

RAŠKAUSKAS V. 1965: Kai kurios lanksvų (Spiraea L.) biologinės ir dekoratyvinės savybės. – AMMD, Biologija, 5 – Vilnius.

REGEL K., 1931: Der Botanische Garten der Neuzeit. – London.

SLAWINSKI W., 1947: X. Stanislaw Bonifacy Jundzill, Profesor Historii Natur Wszechnicy Wilenskiej. – Lublin.

TRZEBINSKI J., 1929: Księga pamiątkova ku uczczeniu CCCL rocznicy zalozenia i X wskrezenia uniwersytetu Wilienskiego. - Wilno.

ŽILINSKAITĖ S. 1999: Vilniaus universiteto Botanikos sodas. – Vilnius.

Rosarium of the Tallinn Botanic Garden

Arnet Poola
Tallinn Botanic Garden, Kloostrimetsa tee 52, Tallinn 11913, Estonia, +372 6062666,
arnet.poola@botaanikaaed.ee



Fig. 6.
View of the renovated rose garden and the genealogy garden plots in summer, 2025.
Author: A. Lepp.

ABSTRACT

This research paper focuses on the establishment, development and renovation of the rosarium as a separate but integral part of the Tallinn Botanic Garden's collection. Over the years, the rosarium has become one of the most prominent exhibits in Tallinn Botanic Garden, fulfilling scientific, horticultural, and educational functions simultaneously.

The aim of this research paper is to provide an overview of the rosarium's development as a site of cultural and historical value in a historical, landscape architectural and collections context, and to describe the renovation process and its correspondence to the original vision.

Methodologically, the research paper is based on archival sources, previous scientific and professional publications, project materials and the documentation of Tallinn Botanic Garden. The research paper is structured chronologically, first covering the historical development of the botanic garden and the rosarium, then the evolution of the collection, and finally the changes and current state of the collection following the renovation.

This paper contributes to the systematic study of Tallinn Botanic Garden's rosarium and provides a basis for further research on the role of botanic gardens and the development of plant collections in the Estonian climate.

KEYWORDS

Tallinn Botanic Garden, rose collection, renovation, landscape architecture.

INTRODUCTION

Tallinn Botanic Garden (hereinafter: TBG) is an important scientific, educational and cultural institution established in 1961, dedicated to the conservation and promotion of plant species. One of TBG's attractions is the rosarium, which covers 1 ha of land. This is one of the first more comprehensive open-air collections at the garden. Its history is strongly connected with the establishment of the Botanic Garden itself, and several great figures of Estonian horticulture and landscape architecture, who were also rose breeders to a greater or lesser extent, contributed to its creation, among them Johan Eichfeld, Vello Veski and Aleksander Niine. Many of the rose varieties they bred, some of which were bred at TBG, are still grown today. The rosarium and its collection have undergone many changes throughout its history, but thanks to its continuous work, it still fulfils its original function as a place to experiment with rose varieties suited to Estonian conditions, to introduce visitors to the diversity of roses, their history, local and foreign varieties and species, or simply to provide a delightful experience with its timeless design and rich colours. The rosarium's collection of 700 varieties introduces roses from different breeding periods and groups, the oldest of which were bred in the 15th century (Tallinn Botanic Garden, 2026). The rosarium is one of the oldest, most respectable and popular collections at TBG (Martin, et al, 1981). The only older collection in Estonia is the rosarium at the Botanic Garden of the University of Tartu, which was established by V. Veski in 1949 (Vellak, et al. 2022). Making the decision to renovate TBG's rosarium, starting the work and renewing the collection required the contribution, care and time of countless people. It is thanks to them that we are able to enjoy all this today.





Annex 1.
A. Niine's conceptual design of Tallinn Botanic Garden's rosarium with handwritten notes by A. Pukk.

Annex 2.
Diagram of the rose garden between 1964-2000.

ESTABLISHING THE ROSARIUM

The establishment of a botanic garden in Tallinn was planned as early as the beginning of the 19th century (Tõnisson, 2023). Its establishment in its present form, however, was started by the Institute of Agriculture of the Estonian SSR Academy of Sciences (hereinafter: the academy), which began its activities in 1947. Agricultural scientist and biologist J. Eichfeld, who became president of the academy in 1950 and was himself a breeder of roses, gladiolus, etc., believed that the establishment of a botanic garden was still essential for the academy. (Tammoja, 1998; Ojasalu 2019). In 1959, the Kloostrimetsa Farm of Konstantin Päts, the First President of the Republic of Estonia, which had been operating as an auxiliary building for the Open Air School, was chosen as the botanic garden's location together with a number of surrounding private plots of land, and on 1 December 1961, Tallinn Botanic Garden was established by ministerial decree.

J. Eichfeld was friends with the landscape architect A. Niine, who was also involved in the cultivation of rose seedlings, and soon a group of rose enthusiasts was formed. Among its more active members were A. Pukk and V. Veski, the founders of the TBG rosarium (Ojasalu, 2019). The rosarian A. Pukk, who was also the author of the first comprehensive book on roses in Estonian (Roosikasvatus (1958)), was chosen to be the botanic garden's first director (Liventaal, 2023).

A. Niine, an associate of A. Pukk, had studied horticulture in England. In collaboration with Pukk, they chose the old orchard of Kloostrimetsa farm as the location for the rosarium. At Pukk's request, it was to be a classic formal rose garden with specific elements and a fixed geometric design (Liventaal, 2023).

The rosarium was intended to have the following sections:

- Systematic section of species, ca. 0.1 ha
- Systematic section of cultivars, 0.2 ha
- Section of premier cultivars, 0.3 ha
- Section of new introductions, 0.1 ha
- Section of climbing roses, 0.1 ha (Niine, Pormeister, 1960)

The above is confirmed by a construction drawing of TBG's rosarium from 1960, prepared by "*Eesti Põllumajandusprojekt*" (Estonian Agricultural Design Institute), and the project itself, which was authored by A. Niine and V. Pormeister. A preliminary illustrative conceptual design by A. Niine has also survived, which, the author of this paper conjectures, was made much earlier (Annex 1). This is indicated, for example, by the striking differences in the design and the names of plant varieties written on the hexagonal flowerbeds in A. Pukk's handwriting.

The project envisaged the creation of a rosarium in the north-western side of the botanic garden, with a total area of 1.2 ha. The selected site is situated lower than its surroundings, and it is sheltered by a forest from the west and north-west, which the project considered to be naturally favourable (Promeister, 1960). During the rosarium's planning process, it was decided that as many of the existing natural and architectural elements as possible should be preserved: a 1.6-m-high limestone wall, ponds, bridges. Only some of the apple trees and the scrub along the pond were subject to eradication (Niine & Pormeister, 1960). The abovementioned bridges, wall and ponds were constructed between 1917-1940 while the Kloostrimetsa Farm was active.

On the layout plan, the collection was divided into different sections, including all the main elements visible today: low stone walls with built-in benches, flagstone paths within the flower-beds, gravel-paved main paths, long rectangular beds and hexagonal beds.



Fig. 1.
Rose garden in 1963, before the roses were planted. Author: TBG

13 rectangular flowerbeds were established to demonstrate the genealogy of rose varieties. Niine designed the adjacent area in the shape of a honeycomb – the most perfect structure in nature. This is why the beds are hexagonal in shape (Liventaal, 2023). This design had a practical reason as well as an aesthetic one.

A simple geometric shape (square, rectangle, cone, oval) works better to show off the beauty of the flowers. The bed must be able to accommodate at least 3 rows of roses, so the minimum width is 1 metre. It is easiest to maintain a bed that is 1.4-1.5 m wide. He recommended that the rosebed be flat and level with the surrounding ground, or just a few centimetres above it. Sunken beds (that are lower than the surrounding ground) are not suitable for our climate, as water pooling during winter can destroy the roses (Niine, 1968).

However, not all the works described in the project and the conceptual design were implemented. For example, all regularly shaped flowerbeds were intended to have wooden winter covers. The beds were supposed to be bordered by low boxwood (*Buxus*) hedges, 4 pergolas were to be constructed on the site (Pormeister, 1960), and space was to be left for 2-3 sculptures (Niine, 1960). According to the conceptual design, the rose garden was meant to have 39 hexagonal beds, but 55 were built and the rose garden remained that way until its renovation in 2022 (Annex 2).

Work on the construction of the rosarium began in 1962. The pre-culture was gladiolus (Fig. 1), with roses being planted in the spring of 1964 (Martin et al., 1981). The rosarium was first opened to tours and visitors in 1970 (Paivel, 1973).

ESTABLISHING A COLLECTION OF ROSES

The natural conditions in Estonia are not favourable for the cultivation of ornamental plants of southern origin, including roses. As roses are sensitive to cold and suffer from plant diseases, TBG's research plans consistently included topics that could help solve the problems of rose cultivation (Martin et al. 1983). The rosarium, established in 1962-1964, with its experimental fields and parent plantation, became the basis of this research (Martin et al. 1983). The present discussion only focuses on the collection of roses in the rosarium.

The rosarium consists mainly of an identified and labelled collection of cultivars (rose varieties) of the *Rosa* genus, collected on a scientific basis and exhibited historically, systematically and architecturally (aesthetically). The collection is divided into larger groups of varieties based on their character, use and growth requirements. The groups are bedding roses, park roses, shrub roses and climbing roses (Tallinn Botanic Garden, 2002). The purpose of the collection is to give visitors an overview of the historical development (genealogy) of cultivated roses, to introduce the most suitable rose species and varieties for landscaping in our conditions and to exhibit rose varieties bred in Estonia. (Martin et al. 1981).

New rose varieties for the newly-created botanic garden were brought in from all over the world thanks to Arno's contacts in Moscow, Kyiv, Germany and the Netherlands (Veski, 1972; Liventaal, 2023). In order to enrich the assortment, local rose varieties have been bred in TBG (bred by V. Veski; J. Eichfeld), such as 'F. Tuglas', 'Säde', 'Koit', 'Kati' and others. Two of the varieties bred by V. Veski ('Tiiu' and 'Tibiroos') were recommended for cultivation here and elsewhere by the National Committee for Variety Testing of Agricultural Crops (*Põllumajanduskultuuride Sordikatsete Riiklik Komisjon*) (Paivel, Veski, 1973). Rose breeder Uno Kivistik also contributed to the expansion of the rose collection. He provided the Tallinn Botanic Garden at least 27 of his own cultivars, bred between 1968 and 1976. for cultivation and testing, including varieties such as as 'Pirita', 'Laulupidu' and 'Kirilind' (Kivistik, 1981). They are still in the collection today as new plants.



Fig. 2.
Rose garden presumably in the summer of 1972, annual flowers instead of roses.
Author: TBG

The long-term cultivation of rose varieties in TBG's rosarium and extensive research on nearly a thousand rose varieties have made it possible to develop an assortment suitable for outdoor cultivation in Estonia (Martin, et al. 1983). As far as is known, the first list of rose varieties suitable for landscaping in Estonian (a recommended variety list) was compiled by A. Pukk (1964). Several of the varieties in the list, such as 'Gloria Dei' (syn.'Peace'), 'Mõrsjaroos' (syn. 'Bride's Rose'), 'Orange Triumph', 'Kordes' Sondermeldung' and others are still growing in the rosarium today. The varieties mentioned in the list are also reflected in A. Pukk's own handwriting on A. Niine's conceptual design drawing; therefore, leading the author to assume that these cultivars were actually present in the rosarium in 1964.

However, the collection of rose varieties did not remain the same from year to year. The 1964 planting was devastated by the harsh winter of 1965, which destroyed many of the rose varieties in the garden. Most of the bedding roses perished during the snowless winter of 1971/72 (Liventaal, 2023). Since rose propagation is a time-consuming process, it was decided in the spring of 1972 to plant annual flowers in the beds instead (Fig. 2). Good quality annual flower seeds were not available in the Soviet Union, but A. Pukk sourced high quality flower seed using his contacts in the Netherlands. This provided new experiences for the future development of floriculture in Estonia (Tamm, 2000). In the spring of 1975, after the soil in the garden plots was changed, the roses were replanted and the rosarium (in its original form) was reopened. (Martin et al. 1981; Liventaal, 2023).



Fig. 3.
Rose garden in 2002. Author: A.Kivistik

The number of varieties in the collection has greatly fluctuated. Unfortunately, there is no precise data concerning all the years of operation, but based on the available information, the range of the collection can be estimated to have been between 441-675 varieties up to the renovation in 2022 (Paivel, 1970; Veski, 1974; Martin et al. 1981; Tallinn Botanic Garden, 2012).

RENOVATING THE ROSARIUM 2022-2024

By the early 2000s, the rosarium had become severely dilapidated; some sections of the walls had begun to sink into the pond due to landslides, and the water features, edges of the hexagonal flower beds (Fig. 3) and pathway surfaces etc. needed repair and renewal. Additionally, about ½ of the vegetation had aged beyond its prime (TBG Rosarium Development Plan 2014-2018). As a result, at the beginning of the current decade, it was decided that the rosarium would undergo a complete renovation.



Annex 3.
Plan of the rose garden 2022.
Author: K. Lootus.



Fig. 4.
Drone photo of renovation work on the rose garden in 2023.
Author: I. Jürjendal

The conceptual design for the renovation project was prepared in 2022 by landscape architect Kersti Lootus, Lootusprojekt OÜ. The design-build and construction work were commissioned from Nordpoint OÜ. The landscape architectural works were carried out by Kobras OÜ, the building structures were constructed by Krada OÜ and the electricity supply works were carried out by Elsaro OÜ (Kobras OÜ, 2023).

Renovation work on the rosarium began in the summer of 2022 with the fundraising titled campaign "*Your own Rose from the Tallinn Botanic Garden*" (*Oma roos Tallinna Botaanikaaiast*). The aim of the campaign was to enable plant enthusiasts to participate in the TBG's rosarium's renovation and to support the acquisition of new plants. During the event, participants could select and purchase their favourite rose plants from the collection for a symbolic fee.

Between autumn 2022 and spring 2024, the rosarium was closed to visitors. The first large-scale task involved the renovation of the historic stone bridge of Kloostrimetsa Farm (1917-1940), for which a project had already been prepared, as well as the cleaning of the ponds and the reinforcement of the banks. The work began in autumn of 2022, during which the topsoil and most of the vegetation were removed from the rosarium and the low stone walls were demolished (Fig. 4).

A new irrigation water pipeline with 28 irrigation taps and a total length of 581 m of piping was installed along with an electrical network for new lighting (Kobras LLC, 2023). Only the majority of the park rose collection and one bed of the shrub roses remained in place from the previous collection, as they did not obstruct the construction work.

A. Niine's original design of the rosarium was taken into account as much as possible during the design and construction process. The network of hexagonal and elongated ribbon-shaped beds with original circulation patterns was preserved. The characteristic topography was also maintained, where the garden- bordered by ponds on three sides- sits up to 1.5 m higher than the surrounding area. New bed edges made of concrete, dolomite and limestone slabs, as well as and limestone retaining walls were constructed (Kobras OÜ, 2023). The retaining walls with seating, which follow a beehive pattern, were restored using the dry-stone walling method. The concrete flowerbed borders were cast on-site and finished with a brushed surface and grouting (Kobras OÜ, 2023). At the request of the Botanic Garden, the edging for one hexagonal bed was constructed from limestone slabs, following A. Niine's original design. The edging for another bed was made from dolomite slabs, installed on a base layer according to the previous joint pattern with open joints (Kobras OÜ, 2023). For this purpose, original and reusable edging components were salvaged.

In pace of the pavilion that stood on the site until 2022, a performance area with a concrete surface was constructed. The construction work also included an open-walled steel-frame pergola and a trellis system (espalier) made of square-profile posts at 2-meter intervals for climbing roses. The footpaths are designed with granite screenings and edged with metal borders. Winding paths of limestone stepping stones were laid across the rectangular beds, and the entire soil of the rosarium was replaced. The project specified a 60 cm thick layer of growth soil suitable for roses (Kobras OÜ, 2023), though in some places it became even thicker. It is estimated that over 5,000 m^3 of soil and decomposed horse manure were hauled back for the construction of the beds.

RENEWING THE ROSE COLLECTION 2022-2025

The first procurement for new historic bedding rose varieties was launched in 2022 and the procurement for newer varieties was launched in 2023. In both cases, nearly 3,000 new rose plants were purchased. The priorities in selecting the varieties were: 1. visual appeal 2. interesting from a breeding perspective, including local varieties (TBG Rose Garden Concept, 2002).

Most of the new rose plants were obtained directly from Estonian rose growers or through them from world-renowned rose growing companies: Kordes, Tantau, Delbard, Meiland, Austin and others. To propagate several varieties for the collection, Estonian growers used buds (scions) for budding (oculation) taken from the pre-renovation collection. New plants were obtained through cooperation with Estonian rose growers (Christi Unt, Juhani Puukool, Katrin Ruitlane-Rütli, Mart Ojasalu and Rein Joost). Some varieties were donated, such as the 'Queen Elizabeth' from the British Embassy and the 'Queen Margethe' from the Danish Embassy.

The collection sections are equipped with weather-resistant information panels describing each area (Fig. 5). These panels provide a brief overview of the specific section and its location within the landscape. The text on

The new collection largely follows A. Niine's classification principles mentioned above and is divided as follows:

- Old Roses or Antique Roses;
- Genealogy of Bedding Roses;
- Modern bedding Roses;
- Estonian Rose Varieties;
- Austin Roses or English Roses;
- Shrub roses;
- Miniature roses;
- Park roses;
- Climbing roses.



Fig. 5.
Information panel describing a part of the collection. Author: A. Poola

the panels is presented in both Estonian and English, complemented by photographs of some of the most significant or interesting cultivars mentioned in the descriptions.

According to the new planting plan, the rose varieties in the genealogy of bedding roses beds are arranged in groups of five, based on their growth form, with an average of 20 varieties per bed. In the hexagonal beds, plants are arranged in groups of eight, with an average of 4 varieties per bed (excluding the Estonian rose varieties beds), and an average of 13 varieties per bed for antique roses, and so on. Since not all plants arrived at the same time and some have been lost for various reasons, there is space left in the beds for supplementing the collection and, if necessary, for redesigning it.

In the rose variety genealogy beds (Fig. 6), the varieties are planted according to height and colour, from taller to shorter and darker to lighter, so that a cascade effect will develop over time. The newer varieties in the hexagonal beds (bred since 2005) are grouped into three categories not only by colour, but also by height (except for the Estonian rose beds): 1) up to 80 cm 2) 80-100 cm and 3) over 100 cm. The construction work, including the planting of most of the new rose bushes, was completed by summer 2024. Due to minor works, the installation of information panels, and general maintenance work, the grand opening of the rosarium took place in the summer of 2025 as part of the Rose Days.

While the number of varieties in the rose collection was previously estimated to be between 441 and 675, the number increased after the renovation, and by 2025 there are just over 700 varieties.

RESULTS AND DISCUSSION

The establishment of the Tallinn Botanic Garden and its rosarium was the result of a long and multifaceted development process, influenced by decades of economic hardship and regime changes. Collaboration between scientists and practitioners, in particular J. Eichfeld, A. Pukk and landscape architect A. Niine, played a key role in achieving the current situation. The construction of the rosarium began in 1962 and the initial collection was planted in 1964. The unfavourable winters between 1960 and 1970 caused extensive damage, and the collection had to be restored several times. Nevertheless, the rosarium became an important research and testing base for studies on the cold and disease resistance and horticultural value of roses. Over the decades, the collection grew to several hundred varieties, forming one of the most important rose collections in Estonia.

By the beginning of the 21st century, the infrastructure and vegetation of the rosarium had fallen into extensive disrepair, leading to a very thorough renovation process between 2022 and 2024. During the renovation, the facilities, technical systems, growing area, and pathways were updated while preserving the principles of A. Niine's original design. At the same time, the collection was renewed, with nearly 3,000 new rose plants being acquired, based on their visual appeal, their breeding value and the representation of local varieties.

The results of the research paper show that TBG's rosarium has evolved into a changing but continuous landscape architectural object of scientific, cultural and public value. The renovated rosarium, which opened to visitors in 2025, plays an important role in preserving and promoting rose culture and creates conditions for further research and development of the collection in the Estonian climate.

ACKNOWLEDGEMENTS

Thank you to Andres Tõnisson and Silja Konsa for their help in finding archival data and Anne Jaakson for editing.

REFERENCES

Journal articles

Kivistik U. 1981. Experiences In Rose Breeding. Horticulture and Beekeeping. Valgus, Tallinn. pp. 26-30

Martin J., Rumberg V., Süvalepp A. 1983. Ornamental Horticulture Research In Tallinn Botanic Garden of the Estonian SSR Academy of Sciences. Publications of the Estonian SSR Academy of Sciences, Volume 32. Biology No 1. pp. 83-89

Niine A. 1968 Roses In Urban Landscaping. Socialist Agriculture No. 16, 25 August. pp. 757-760

Paivel A., Veski V. 1973. Establishing And Expanding Plant Collections In Tallinn Botanic Garden. The Estonian SSR Academy of Sciences, 1965-1972. Tallinn. pp. 182-185

Pukk, A. 1964. Assortment of Roses Recommended for Landscaping. Tallinn Botanic Garden of the Estonian SSR Academy of Sciences, Tallinn. p. 13

Veski V. 1974. New Promising Rose Varieties Introduced In Tallinn Botanic Garden. Horticultural Research. Tallinn Botanic Garden of the Estonian SSR Academy of Sciences. Valgus, Tallinn. pp. 53-59

Books

Martin J., Tarand A., Paivel A., Kõressaar L., Süvalepp A., Pihlaste L., Roost V., Zernask M., Kildema K. 1981. A Guide to Tallinn Botanic Garden. Valgus, Tallinn. p. 71

Ojasalu M. 2019. Roses in Estonian Gardens. Varrak, Tallinn. p. 176

Tamm H. 2000 Our Arno. Tallinn Botanic Garden, Tallinn. p. 20

Tammoja N. 1998. A Bibliographic Lexicon of Estonian Horticulture. Estonian Encyclopaedia Publishing House, Tallinn. p. 158

Tõnisson A. 2023. Earlier Attempts to Create a Botanic Garden. Tallinn Botanic Garden. Garden and Time. Tallinn, KP Factory LLC. pp. 20-24.

Tõnisson A. 2023. Roots in the Academy of Sciences. Tallinn Botanic Garden. Garden and Time. Tallinn, KP Factory LLC. pp. 25-28.

Liventaal E. 2023. Rose Garden. Tallinn Botanic Garden. Garden and Time. Tallinn, KP Factory OÜ. pp. 52-56

Vellak K., Tambets K., Escuer O., Mäeots K., Mander S., Nõmmik A. 2022. Botanic Garden and Botanical Collections. University of Tartu Natural History Museum and Botanic Garden. OÜ Greif. p. 137

Web articles

Tallinn Botanic Garden. 2026. https://botaanikaaed.ee/et/botaanikaaiast/ (28.01.2026)

Documentation

Kobras OÜ. 2023. Construction project for the reconstruction of the rosarium of Tallinn Botanic Garden. Construction project commissioned by Nordpoint LLC. Tallinn. p. 21

Krada Engineering OÜ. 2023. Reconstruction project of Tallinn Botanic Garden, Part II. Pergola and a support wall for the climbing roses. Construction project commissioned by Nordpoint OÜ. Tallinn. p. 9

Niine A., Pormeister V. 1960. Single-stage rosarium project of the Tallinn Botanical Garden of the Estonian SSR Academy of Sciences. National Design Institute, Estonian Agricultural Design Institute. Tallinn. (pages unnumbered and order unclear)

Tallinn Botanic Garden "TBG Rosarium's Development Plan 2014-2018" (internal documentation).

Tallinn Botanic Garden, 2002 "TBG Rosarium Concept" (internal documentation).

Astilbes in Tallinn Botanic Garden

Heli Russak
Tallinn Botanic Garden, Kloostrimetsa tee 52, Tallinn 11913, Estonia,
heli.russak@botaanikaaed.ee



Fig. 1.
Tallinn Botanic Garden's collection of astilbes on the banks of the conifer pond.

ABSTRACT

Tallinn Botanic Garden's collection of astilbes was established in 1968. The earliest plants in the collection are currently the Arends' astilbe (*Astilbe* × *arendsii*) varieties 'Kriemhilde' and 'Weisse Gloria' and the Japanese astilbe (*A. japonica*). Based on the results of long-term research, lists of perennial plants including 41 species and varieties of astilbe were compiled in 1990 for widespread use in landscaping and garden design. Tallinn Botanic Garden is currently home to what is known to be the largest collection of astilbes in Estonia. The main goal is to preserve the old and dignified assortment and supplement the collection with new varieties that flower profusely and have diverse leaf colours.

KEYWORDS

Tallinn Botanic Garden, variety collections, astilbes

INTRODUCTION

From the early years of the Tallinn Botanic Garden until today, in addition to the species collections, the collections of different varieties of perennial flowers and bulbs have also played an important role. The collections, with their wide range of varieties, have been designed either on a historical or ornamental basis, and have aimed to identify and popularise the most promising varieties for landscaping. Since the establishment of the Tallinn Botanic Garden in 1961, there were already collections of peony (*Paeonia*), allium (*Allium*), daffodil (*Narcissus*), tulip (*Tulipa*), crocus (*Crocus*), hyacinth (*Hyacinthus*), gladiolus (*Gladiolus*) and lily (*Lilium*). Shortly afterwards, in 1968, collections of iris (*Iris*) and astilbe (*Astilbe*) were established, and in 1969 of garden phlox (*Phlox paniculata*). The daylily (*Hemerocallis*) collection was established in 2003 (Abner 2022).

HISTORY OF THE ASTILBE COLLECTION

The collection of plant material actually started much earlier, when the Tallinn Botanic Garden was founded and moved to Kloostrimetsa. After World War II, Alli Süvalepp (1912-1988), one of the enthusiasts and founders of the botanic garden, started collecting perennials from many Estonian gardens and collectors (Paivel 1991).

Alli Süvalepp first collected perennial flowers for the perennial flower collection at the Polli branch of the Agricultural Institute of the USSR. In 1952, when she started working at the Tallinn Experimental Base of Biology of the USSR Academy of Sciences, the predecessor of TBG, she brought many plants (including astilbes) from Polli. Thus, the year of origin of many varieties is dated considerably earlier than the establishment of the botanic garden (Paivel 1991).

The earliest plants in the collection are currently the Arends' astilbe (*A.* × *arendsii*) varieties 'Kriemhilde' and 'Weisse Gloria' and the Japanese astilbe (*A. japonica*), obtained in 1945 from a private garden in Viljandi.



Fig. 2.
The Arends' astilbe 'Kriemhilde' has been in the collection from the early years of TBG until today.

It is known that Jaan Riet, a photographer working in Viljandi, ordered plants from Karl Foerster in Potsdam in the early 1920s to plant in the terrace in his garden. Pia Werncke, who lived in Viljandi, also collected rare plants, mainly from Italy. From these collections many valuable plants spread to other Estonian gardens. Therefore, there is reason to believe that the above plants also originated from these collectors (Kukk, Russak 2024).

Several varieties, such as Arends' astilbe 'Ceres' and 'Hyazinth', astilbe 'Plumet Neigeux' and Japanese astilbe 'Elisabeth Späth', were obtained in 1947 from the park of Oru Castle in Toila, Ida-Viru County, where the summer residence of Konstantin Päts, the first President of the Republic of Estonia, was located. For the flowerbeds there, flowering plants were sourced from the Späth garden centre in Berlin, Germany (Uustal 2007).

It is also interesting to note that Arends' astilbe varieties 'Brautschleier', 'Irrlicht' and 'Granat' are from Potsdam, 1962. Unfortunately, it is not known exactly how the plants arrived in Estonia. The place of origin of several varieties is simply marked as Polli, suggesting that Alli Süvalepp brought them with her when she came to work in Tallinn.

According to the memories of Mari Seidelberg (1952-2024), daughter of Alli Süvalepp and a long-time employee of the Botanic Garden, the collection of astilbes was established in 1968 on the shore of the rowan pond, in a low, wet area half in the shade of a large bird cherry tree. The planting area was first designed as a free-form area. Exactly how many varieties there were originally is not known. Later the area was extended and the varieties were arranged in rows in the beds to maintain the distinctiveness of the varieties (Kukk, Russak 2024).

In 1983 there were 44 species and varieties of astilbes in the collection (Rumberg 1986) and in 1990 there were already 71. Varietal material was obtained as seedlings from the Pirita Flower Growing Demonstration Society in 1972 and from the Salaspils Botanic Garden in Latvia in 1979 and 1988 (Rumberg 1990). Plants were brought from Salaspils by bus, and in addition to astilbes, a large number of irises and other perennials were also obtained. On both occasions, 20 varieties of astilbes were brought in as young plants, with one variety ('Düsseldorf') being noted in the introduction book as having been lost on the bus.

From 1980 to 1994, the botanic garden was involved in the research project "Introduction of ornamental woody and herbaceous plants". Based on the results of long-term research, lists of perennial plants including 41 species and varieties of astilbe were compiled in 1990 for widespread use in landscaping and garden design. The selection of the assortment was based on decorativeness of plants, flowering time and duration, winter hardiness, tolerance to moisture and drought, reproduction and propagation potential, demandingness regarding of the growing location and susceptibility to plant diseases and pests. It has been pointed out that the Japanese astilbe, the entire-leaved astilbe (*A. simplicifolia*) and the Thunberg astilbe (*A. thunbergii*) are particularly sensitive to drought. Arends' astilbe and Chinese astilbe (*A. chinensis*) are better at tolerating drought. Of the selected varieties, Arends' astilbe 'Bergkristall', 'Diamant', 'Lachskönigin' and 'Irrlicht' have also been noted as drought-sensitive. Among the propagation methods, bud cuttings were tested, with very many varieties giving 100% rooting success. Five varieties have been named as susceptible to disease – Arends' astilbe 'Ceres', Japanese astilbe 'Köln', the astilbe varieties 'Elegans Carnea' and 'Plumet Neigeux' and Thunberg's astilbe 'Professor van der Wielen'. Among diseases, the only one mentioned is rust fungi (*Puccinia* sp.) (Rumberg 1990). The next summary was made in 1995, when only 16 varieties of astilbes were included in the list of plants for widespread use in landscaping (Seidelberg 1995).

The Astilbe collection has been curated by Alli Süvalepp (1961-1981), Sirje Varm (1981-1991) and Mari Seidelberg (1992-2017). From 2017 until today Heli Russak.

ASTILBE COLLECTION TODAY

Due to the cleaning of the TBG ponds, the astilbes got in the way of the machinery in their long-term habitat, and together with landscape architect Kersti Lootus, a new location was chosen for them on the banks of the conifer pond. In the spring of 2022, the entire collection was moved there. The location is sunny, and the soil on the banks of the pond is sufficiently moist for astilbes, but watering is necessary during longer dry periods. The astilbes are doing well in their new habitat, flowering profusely and reproducing vigorously.

In 2025, there were 97 species and varieties of astilbe in the collection. Arends' astilbe varieties are the most numerous, with a total of 33. The collection covers an area of 164 m^2, the plants are arranged in regular beds and 3-5 plants of each variety or species are planted.

Since the establishment of the astilbe collection, 14 species and varieties remain – Arends' astilbes 'Brautschleier', 'Ceres', 'Fanal', 'Granat', 'Grete Püngel', 'Hyatzinth', 'Irrlicht', 'Weisse Gloria', 'Kriemhilde'; astilbe varieties 'Plumet Neigeux', 'Siegfried'; Japanese astilbe 'Elisabeth Späth', low-growing Chinese astilbe 'Pumila' and Japanese astilbe.

Of the 20 astilbes brought from the Salaspils Botanic Garden in 1979, 15 varieties still survive – Arends' astilbe 'Bronzelaub', 'Cattleya', 'Diamant', 'Gloria Purpurea', 'Mont Blanc', 'Opal'; astilbe varieties 'Avalanche', 'Magenta', 'Rubella', 'Rubin', 'Salland'; Japanese astilbe 'Bremen'; Thunberg astilbe 'Betsy Cuperus', 'Professor van der Wielen' and 'Straussenfeder'.

Of the 20 astilbes brought from the Salaspils Botanic Garden in 1988, only 9 varieties still survive – Arends' astilbe 'Amerika', 'Gertrud Brix', 'Gloria', König Albert'; Japanese astilbe 'Bonn' and 'Rubens'; Chinese astilbe 'Intermezzo'; entire-leaved astilbe 'Atrorosea' and Purple Lance Chinese astilbe (*A. taquetii*) 'Purpurlanze'.

There are 7 wild species in the collection, mainly obtained from other botanic gardens through seed exchange, and their original provenance is unknown.

Japanese astilbe (*A. japonica*) has been in the collection since the early years. With glossy dark green leaves and white panicles, this plant overwinters well but cannot tolerate prolonged periods of drought. In our collection, its flowering has been modest, with only a few flower stems each year. The origin is noted as Viljandi 1945.

Appalachian False Goat's Beard (*A. biternata*) is not very common in horticulture and no cultivars have been bred from it. The plants reach a height of 100-180 cm when flowering. An elegant plant that blooms in July with yellowish-white flowers in sparse, delicate, arching panicles. Obtained from the Framingham Botanic Garden in 1990.

Korean astilbe (*A. koreana*) grows to a height of 60 cm, with leaves and stiff stems covered in brown hairs. Plants with white flowers and slightly curved inflorescences. Flowering has been modest. Obtained from private collector Krista Kukk from Viljandi in 2023.

River astilbe (*A. rivularis*) forms sparse clumps with long creeping rhizomes and likes moist habitats. It blooms in August and September, with yellowish-white flowers with a greenish tinge. The inflorescence can be up to 40 cm long. River astilbe overwinters well and flowers profusely every year. Obtained from the Essen Botanic Garden in 1989.

Thunberg's astilbe (*A. thunbergii*) is very decorative and therefore quite common as an ornamental plant. Clumps with thick rhizomes prefer a moist habitat. The flowers are white and are arranged in panicles up to 30 cm long, which curve beautifully above the foliage. It blooms profusely in the collection every year. No information available on time and place of acquisition. **The Thunberg´s astilbe variety** (*A. thunbergii var. congesta*) grows more vigorously than the species in our collection. The main difference from the species is the width of the apical leaflet, which can be up to 10 cm. Obtained from the Dresden Botanic Garden in 1990.

Small-leaved astilbe (*A. microphylla*) grows to a height of up to 80 cm when flowering. It blooms in August with pale pink flowers clustered in a narrow panicle up to 20 cm long. The species is not very common in ornamental gardening, but it has been described as the most graceful and miniature-leaved astilbe. It blooms profusely in the collection almost every year. Obtained from Leiden Botanic Garden in 1989.

The Chinese astilbes in the TBG Rock Garden Collection are of wild origin. One of them was obtained through seed exchange in 2008 from the Vladivostok Botanic Garden and is of local origin, and the other from the Gothenburg Botanic Garden in 2009. Their gardeners went on an expedition to China and offered seeds collected there at ***Index Seminum***.

These undemanding and hardy astilbes grow well in partial or full sun, but it is important that the soil remains sufficiently moist throughout the growing season. The previous habitat lacked an irrigation system, so in some years of drought, a large number of varieties weakened and flowering was modest. In the new habitat, the watering system is better. Drought is the greatest enemy of astilbes. Under favourable growing conditions and with good maintenance, astilbes can grow in one place for up to ten years.

The Tallinn Botanic Garden is home to what is known to be Estonia's largest collection of astilbes. Today, the main goal is to preserve the old and dignified assortment and supplement the collection with new varieties that flower profusely and have diverse leaf colours. It would also be interesting to add a variety bred in Latvia or Lithuania to the collection. There are no varieties of astilbe known to have been bred in Estonia.

BIBLIOGRAPHY

Abner O. 2022. *Index Plantarum. List of outdoor plant collections*. pg. 22-31.

Kukk K., Russak H. 2024. *Astilbes in Tallinn and Tartu Botanic Gardens. Astilbe*. Varrak. Tallinn. pg. 247-249.

Paivel A. 1991. *Notes on the history of the Tallinn Botanic Garden and the creation of its expositions. Studies of Tallinn Botanic Gardens IV*. pg. 16-25.

Seidelberg M. 1995. *Report of the Herbaceous Plants Working Group of the Plant Collections Department.* Estonian Academy of Sciences Tallinn Botanic Garden.

Rumberg V. 1986. *Ornamental gardening. Studies on horticulture and ornamental gardening*. Valgus. Tallinn. pg. 3-5.

Rumberg V. 1990. *Results of the introduction of perennial flowers to Tallinn Botanic Garden. Generalisation of long-term experience of plant introductions to Estonia 1986-1990*. Report. Estonian Academy of Sciences Tallinn Botanic Garden.

Uustal M. "Oru park and promenade" *Eesti Loodus* 2007/9

Integrating Plant Crafts into Learning

Pille Hermann
Tallinn Botanic Garden, Kloostrimetsa tee 52, Tallinn 11913,
pille.hermann@botaanikaaed.ee

ABSTRACT

Using the collections and knowledge of natural plants from the botanical garden, it is an ideal place to bring traditional plant-based skills into the modern day. Dyeing with plants, plant painting, plant printing, collecting and drying plants to for creating natural bouquets are some possible components of an educational program that can be used for both children and adults. Hands-on activities and various art projects also provide opportunities to engage students with special needs. Kindergarten teachers often participate in workshops and look for ideas for hands-on activities to do with children. The participant can always take with them what they made in the workshop. People feel happy and calm when they are in contact with plants.

KEYWORDS

Children, adult, education, principle of thrift, natural dye, plant crafts

INTRODUCTION

In addition to plant gardening, there are many other ways to use plants that can be combined with handicrafts and art. More and more, old knowledge and manual skills are being valued. Plant-related workshops help develop people's manual skills and find balance in the fast pace of daily life.

I conducted my first experiments with plant dyeing about 30 years ago. Since then, I have enhanced my knowledge of various methods, while working at the botanical garden, gained experience with a wider range of plants. Today, a wealth of sample material is available to inspire program participants. I have tried to find activities for the workshops where the whole family can participate. This allows participants not only to acquire plant knowledge, but also to spend quality time together, developing various manual skills, and activating the creativity that is so essential for all of us.

MATERIALS AND METHODS. CREATIVE INSPIRATION FROM PLANTS

To get new ideas, it is worth exploring nature. Estonian folk art is rich, with plants holding their place as a source of inspiration. Many knitting patterns are named after plants; thus, we recognize the bean blossom pattern, the strawberry leaf pattern, and the willow leaf pattern. Flower embroidered carpets have a prominent place in Estonia's textile heritage. In folk art, there are no set rules about which plants can be put together or what definitely cannot be depicted together. Rather, it depends on the master's preference, the beauty of which plants has touched them and given the impulse to capture them. Thus, sometimes plants that do not normally grow together end up in one bouquet, or the flowers in the embroidery are many times larger than they appear in real life.

A walk in the botanical garden can spark the desire to experiment with plants in various hands-on activities. Those who enjoy working with plants and understand their essence can partake in a rich world. One just needs to be clever, try different possibilities, and find the field, style, and plants that are suitable.

In addition to the hands-on activity and the positive emotion of making something yourself, workshops related to plants provide a good opportunity to get to know them. Often, people may know the name of one plant or another, or conversely, they have seen the plant but do not know its name. Therefore, it is important to write down the names of the plants used and, if possible, to introduce each plant separately.

Botanical gardens are a good place to hold workshops based on their collections. It is beneficial if the botanical garden has a meadow or a wasteland where it is possible to collect plants with the workshop instructor. It is good if the instructor can also offer ideas to those who do not have access to a wide selection of plants. For example, in winter, various vegetables, tea blends, and herbs can be used in school lessons with students. At the same time, one can talk about how to reduce food waste, why it is important to do so, and how leftover vegetables can be used. Suitable vegetables for use include red beet, red cabbage, bell pepper, carrots with purple peels, turmeric, and others.

Collecting materials. In horticulture, there is increasing talk about long-term plants (perennials) that grow for years in the same location. They are environmentally friendly to grow because they generally do not require pesticides or frequent fertilization. Growing them is not as labor-intensive and costly as it is for annuals. Many of them can be used in various hands-on activities.



Fig.1.
Pille Hermann made poster presentation Integrating Plant Crafts into Learning in conference "Botanic Gardens in the UN Decade of Ecosystem Restoration" (10th European Botanic Gardens Congress). Author: Merlyn Pajur.

Material for workshops can be collected year-round from the collections (branches, leaves, stems, cones, etc.). However, some plant material, especially flower material, must also be specifically grown for the workshops. Plants collected for dyeing can be dried for winter dyeing (most plant material) or preserved in the freezer (especially berries). A lot of material is needed; growing, collecting, and drying is labor-intensive. Therefore, it is good if seasonal workers, interns, and volunteers can be involved in this work. For interns, this provides an exceptionally good experience and broadens their horizons, helping them see how diverse the world of plants and their uses are. Practical knowledge also helps to reinforce what is learned in school and to make connections. This applies not only to the field of horticulture but also to art and craft studies. Volunteers, when it is explained to them why such material is collected and where it is used, always feel proud to participate in such projects.

For the workshops, plants have been chosen that are easy to grow, collect, and provide a sufficient amount of material. In addition, they have been previously tested and are known to produce results. When plants in greenhouses are thinned, it is also possible to use them. Participants always enjoy such an exotic opportunity. However, the workshops are not intended to be built solely around exotic plants. Rather, the participant should have the opportunity to experiment independently later if they wish. It is important that there is enough sample material in the workshops to inspire visitors; in addition, they appreciate it when the instructor also shows examples of failures.

Dyeing yarn and fabrics

More and more artisans and artists are finding their way back to ancient wisdom, and dyeing with plants is gaining popularity again. Natural fibers are suitable for dyeing, whether it be linen, wool, silk, or cotton. Natural colors are harmonious, and they all complement each other.

The process of preparing the dye liquid is time-consuming, so I prepare the liquid a day or two before the workshop. Pour hot water over the chopped plants and let it sit. The liquid with the plants can stand for a day or even longer. Then, bring the liquid with the plants to a boil and let it simmer for an hour or two. If there is a lot of fine plant debris in the liquid (for example, from ***Filipendula***), strain the liquid before dyeing. For stronger plant materials like birch leaves, walnut shells, etc., there is no need to strain. Add a mordant, a substance that makes the colour durable. The best-known of these are alum ($AlK(SO_4)_2 \cdot 12H_2O$), copper sulphate ($CuSO_4 \cdot 5H_2O$), and iron sulphate ($FeSO \cdot 5H_2O$). Copper sulphate brings out more green tones, and iron sulphate supports grey and brown colours. The aforementioned substances can be found in gardening and hardware stores.

Before placing it in the dye liquid, wet the pre-washed skein of yarn in lukewarm water. In workshops, we experiment with small skeins of yarn; about twenty grams is enough. This is the best way to learn how the yarn behaves in the dye liquid. Keep the dye pot on low heat for an hour and then remove the pot to cool. The yarn can be washed out the next day; the longer it stays in the dye, the more colour it will absorb. I mostly buy yarn from second-hand stores; friends, acquaintances, and colleagues have also brought leftover yarn.

Sun dye

Also known as light dyeing. It is one of the simplest ways to get dye pigment onto yarn or fabric. The best time to do this is in spring or early summer, when we have the most sunlight. When selecting plants, it is worth consulting literature to see which ones yield colour with this method. Place plants in the bottom of a glass jar, then the yarn do not press them down too tightly and then another layer of plants. Pour water over it and place the jar in a spot that receives a lot of light. The jar is left to stand for 2-3 weeks. If the water level becomes too low, more should be added. This type of workshop is good for situations where a thorough preparation process is not possible or for an outdoor learning day where participants go together with an instructor to collect plants. The participant can take the material home with them.



Fig. 2.
Sun dyeing yarn in process. It takes only water, plant and yarn. The timeline is approximately 2-3 weeks. Author: Pille Hermann.

Plant print

The beauty of plants can be captured on fabric with plant printing. This workshop is especially popular among children and is best done outdoors with fresh plants. Collect green leaves, both large and small, flower blossoms in different shades, and whole plants. Place a soft towel on the table and on top of it a cotton fabric, on which you arrange the plants one by one. Cover with a paper towel and gently tap with a hammer until the colour pigment begins to be released. To fix the colour, iron the dried work through a thin cloth. The finished motifs can be used to make cards, bags, or wall hangings.

Plant ink

Plant ink can be made from both fresh and dried plants. Put the chopped plants in a pot, pour hot water over them, and let them stand for a day. It is better to have plenty of plants and less liquid, as this will result in a more intense colour. The next day, boil for an hour and let the liquid stand again for a day. Then, strain the liquid and pour it into a bottle, labelling it with the plant it was made from. The easiest way to get ink is from fresh dandelion flowers. Pick a handful of flowers, put them in a bowl, and mash them with a pestle. Pour a little water over them, just enough so that the mixture resembles sour cream. Strain, and the ink is ready to use. The ink can be stored in the freezer.



Fig. 3.
Work process. Author: Pille Hermann.



Fig. 4.
Solidago (whole plant), Sambucus canadensis (berries), Juglans cinerea (fruits) are boiling in water and it takes approximately 3 hours. Author: Pille Hermann.

Dry plant

When gathering plants for winter dry arrangements, collect them in dry weather and try to put them to dry as soon as possible. Clean them of excess leaves, tie them into small bunches, and hang them with the flowers facing down to dry. If possible, dry only one type of plant in each bunch. This way, you will have an overview of how much and what kind of material has been collected. Dried plants are delicate, so it is good to prepare smaller bunches for the workshop.

If possible, smaller plants can be pressed. Place the fresh plants between newspapers and put a weight on top. The next day, check to make sure there are no small folds or wrinkles, change the newspapers, and put the weight back. Pressed plants are perfect for making botanical cards.

SUMMARY

The natural material used in the workshops teaches the value of simple things and develops resourcefulness. Additionally, it has a principle of thrift, as often weeds and rustical plant are used as dye plants. Creative self-expression brings a sense of accomplishment.

As Estonians, we are a people of plants and forests. Foreign visitors have pointed out that the plant craft workshops at Tallinn Botanic Garden are valuable due to the diverse plant material collected from the botanical garden. Also highlighted is the instructor who knows the plants from many different angles.

Overview of Estonian spring bulb cultivars and their conservation at the University of Tartu Botanical Garden

Olesja Escuer
Botanical Garden, University of Tartu, Lai 38, Tartu, 51005, Estonia, +372 7376180,
olesja.escuer@ut.ee

ABSTRACT

The collection and conservation of plant genetic resources in Estonia began with the approval of the Estonian National Programme in 2002. Since then, the University of Tartu Botanical Garden has become the responsible institution for the collection and long-term preservation of ornamental plant genetic resources. During the national programme, the University of Tartu Botanical Garden has enriched its spring bulb collection with 40 cultivars, currently representing around 35% of all local spring bulbs. Activities such as mapping, data digitization, and phenotypic characterization of local bulbs at the botanical garden are ongoing.

KEYWORDS

PGR programme, local spring bulb cultivars, plant collection, botanical garden

INTRODUCTION

The conservation of biological diversity in Estonia started with the ratification of the Convention on Biological Diversity (CBD) in 1994. In accordance with the CBD and other international commitments, the Estonian National Programme "Collection and Conservation of Plant Genetic Resources for Food and Agriculture" was established in 2002, marking the beginning of the conservation of plant genetic resources for food and agriculture in Estonia. The establishment of the programme marked the inception of the collection, preservation, evaluation, and characterization of the genetic resources of ornamental, medicinal, and aromatic plants at the University of Tartu Botanical Garden. Information regarding local breeding material has been collected from existing literature, the archives of local botanical gardens, and via interviews with private breeders and growers (Volkova 2006; Escuer, Uibo 2019; Escuer 2021; Escuer 2024). The aim of the present paper is to present an overview of Estonian cultivars of spring bulbs and to introduce the work performed during the Estonian National Programme at the University of Tartu Botanical Garden within the framework of the collection and conservation of local bulbs during 2002–2025.

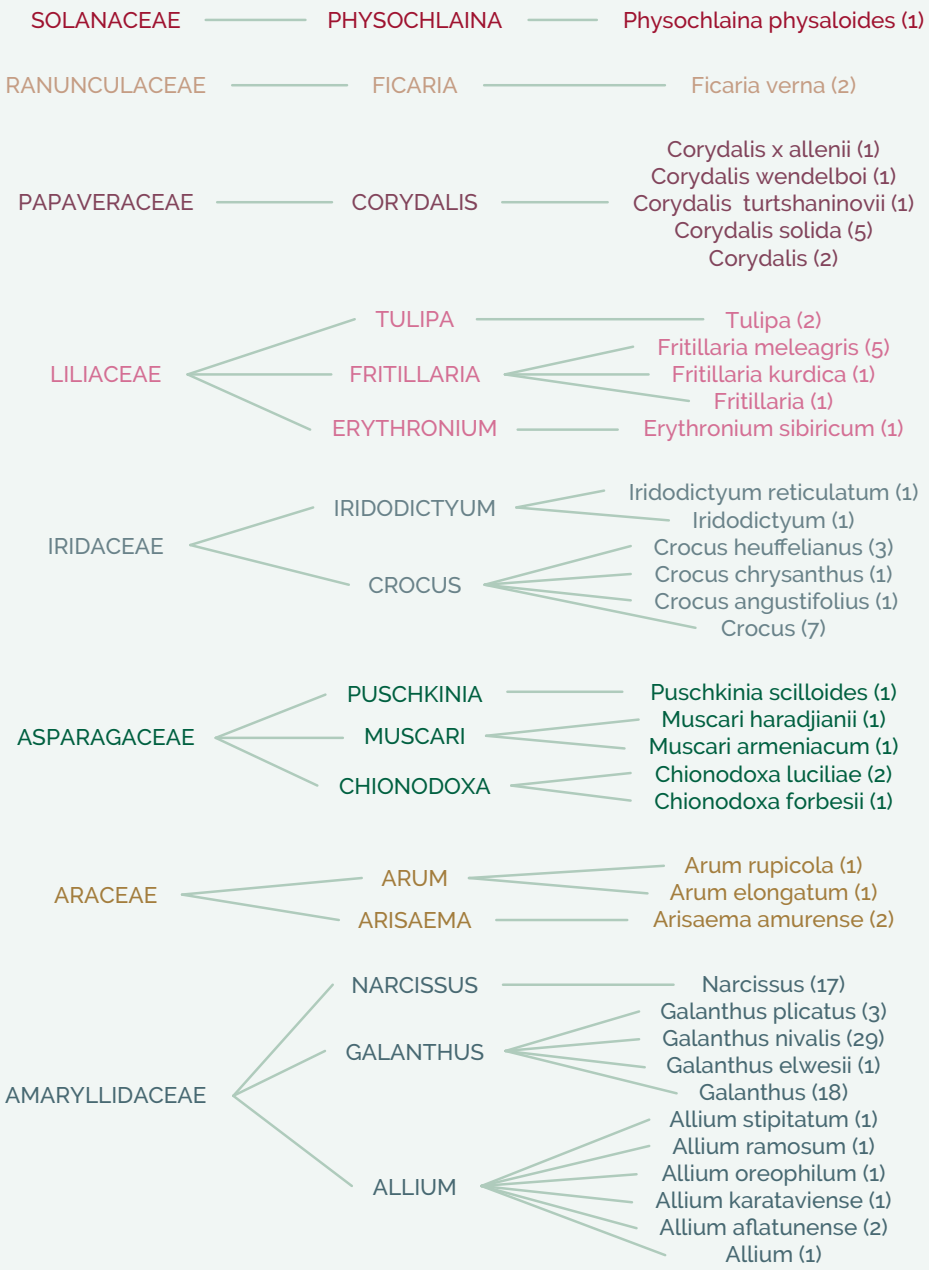


Fig. 1.
Distribution of Estonian spring bulb cultivars by species, genus and family.

ESTONIAN CULTIVARS OF SPRING BULBS

The end of the 20th century can be regarded as the beginning of spring bulb breeding work in Estonia. To the best of our knowledge, nine breeders are known to have dedicated part of their lives to the hybridization and selection of new bulb cultivars. Agronomists Leo Rehela, Jevgenia Ignatova, and Enno Zupping were the first breeders who started bulb breeding in their home gardens. Nowadays, the breeding work is being continued by private plant growers such as Sulev Savisaar, Taavi Tuulik, Aivar Saatmann, Adi Luukas, Silvi Õnne, and Maret Vähejaus. Over the last 50 years, more than 120 cultivars of spring bulbs have been selected and named. The largest number, 51 cultivars bred in Estonia, belongs to the genus *Galanthus*. The list of local spring bulb cultivars also includes such genera as *Narcissus*, *Crocus*, *Allium*, *Corydalis*, *Fritillaria*, *Chionodoxa*, *Arisaema*, *Arum*, *Ficaria*, *Muscari*, *Tulipa*, *Erythronium*, *Iridodictyum*, *Puschkinia*, and *Physochlaina* (Fig. 1) (Savisaar 1998; Savisaar 2004; Savisaar 2012).

Agronomist Jevgenia Ignatova was the first breeder who began spring bulb breeding. Her only cultivar of tulip, 'Jevgenia', was bred in 1975 and named later by her daughter. The breeding of narcissi started at the end of the 20th century in the private gardens of agronomist Leo Rehela, plant growers Enno Zupping, and Aviv Mihhailov. Leo Rehela bred and selected 14 cultivars: 'Harald Meri', 'Heli', 'Kadri', 'Koit', 'Liivi', 'Mailis', 'Milvi', 'Valve Klein', 'Martin', 'Onu Valdu', 'Uno Juubel', 'Ülle', 'Kelt Nr. 6', and 'Tõnu' (Rehela 1992; Savisaar 2004). However, none of these cultivars has survived to the present day. No information about the named cultivars of Enno Zupping and Aviv Mihhailov or their current location was found. Plant grower Adi Luukas started breeding narcissi about 15 years ago, and his most famous cultivar is 'Miku' (2014).

Plant physiologist Sulev Savisaar started with spring bulb breeding approximately 30 years ago and continues today, having many seedlings under observation. His breeding work is not based on cross-breeding, but on selecting unusual seedlings from plants grown from seeds, self-sown plants, and interesting forms received from other plant growers. Sulev Savisaar has selected and named 43 different bulb cultivars, which belong to the genera *Allium* (7), *Arisaema* (2), *Arum* (2), *Chionodoxa* (3), *Corydalis* (5), *Crocus* (4), *Erythronium* (1), *Iridodictyum* (2), *Fritillaria* (7), *Galanthus* (5), *Muscari* (2), *Puschkinia* (1), *Physochlaina* (1), and *Tulipa* (1) (Savisaar 1998; Savisaar



Fig. 2.
Physochlaina physaloides 'Mulgi Valge' (A), ***Corydalis wendelboi*** 'Adi' (B), ***Fritillaria meleagris*** 'Silvi Õnne' (C), ***Fritillaria meleagris*** 'Silvi Kihiline' (D) (photo: Sulev Savisaar, Olesja Escuer).

2004; Savisaar 2012; Savisaar 2019). Some forms, such as *Allium* 'Miku' (2017), *Fritillaria* 'Suur Roheline' (2026), and *Corydalis* 'Öö' (2015), are of hybrid origin. His cultivars differ from the species in flower size, form, and colour, as well as in the number of flowers per inflorescence, foliage longevity, leaf size and colour, plant height, and flowering time. The rarest forms are the white-flowered *Physochlaina physaloides* 'Mulgi Valge' (Sulev Savisaar, Evi Oja, 2008) discovered in the garden of Evi Oja, the red-flowered *Corydalis turtschaninovii* 'Koit' (2025), and the dark-flowered *Corydalis wendelboi* 'Adi' (Sulev Savisaar, Adi Luukas, 2011) (Fig. 2A, B). Spectacular and unique forms of snake's head fritillary, which were discovered by Silvi Õnne in her home garden and named by Sulev Savisaar, are the double-flowered *Fritillaria meleagris* 'Silvi Kihiline' (Sulev Savisaar, Silvi Õnne, 2005) and the white double-flowered *Fritillaria meleagris* 'Silvi Õnne' (Sulev Savisaar, Silvi Õnne, 2005) (Fig. 2C, D).

Biologist Taavi Tuulik has been breeding and selecting spring bulbs since 2005. The list of cultivars consists of 29 snowdrops, the violet-flowered *Crocus* 'Tipp ja Täpp' (2015), and the lilac- to whitish-flowered *Corydalis* 'Virve' (2006).



Fig. 3.
Galanthus nivalis 'Kullake' (A), ***Galanthus*** 'Meltsas' (B), ***Galanthus*** 'Luik' (C), ***Galanthus nivalis*** 'Mäki' (D) (photo: Anne Wright).

The semi-double-flowered *Ficaria verna* 'Sulli' (Taavi Tuulik, Maret Vähejaus, 2005) was discovered in the Sulli farm on Hiiumaa island by Maret Vähejaus and named by Taavi Tuulik in 2005. His most famous snowdrops are 'Hõbevalge' (2009), 'Kudrus' (2018), 'Kullake' (2009) from Estonian Spirit Group, which were found in abandoned gardens and woods of Hiiumaa island (Fig. 3A) (Tuulik 2020; Wright 2024). The name of the group was given due to their pale, ghostly colouration and their residual presence in abandoned or secluded areas. The cultivars are distinguished by their generally compact stature, very pale leaves and ethereal colouring of the ovary and inner mark, which is very pale creamy yellow. Sixteen spectacular double-flowered snowdrop cultivars from the Estonian Birds Group are the result of hand-pollination of different snowdrop species with *Galanthus nivalis* 'Flore Pleno' in 2007–2008. Cultivars were named in 2017 after bird names 'Aul', 'Kakk', 'Kaur', 'Kiur', 'Lagle', 'Luik', 'Meltsas', 'Ristpart', 'Sabatihane', 'Siisike', 'Sõtkas', 'Tihane', 'Tikk', 'Tutkas', 'Vart', and 'Vutt' (Fig. 3B, C) (Wright 2024). In 2007–2018, Taavi Tuulik found in the gardens of Hiiumaa also 7 double-flowered forms and named them – 'Armilde', 'Aunaku', 'Hatpin', 'Kassari', 'Muku', 'Mäki', and 'Priki' (Fig. 3D) (Tuulik 2020).



Fig. 4.
Galanthus nivalis 'Roheline Maasikas nr 9' (A), ***Galanthus nivalis*** 'Mõisa Uks' (B), ***Crocus*** 'Kaire Lemmik' (C), ***Corydalis solida*** 'Korall' (D) (photo: Aivar Saatmann, Sulev Savisaar).

Forestry specialist Aivar Saatmann has selected and named more than 30 spring bulb cultivars, including *Corydalis solida* 'Karksi Hele' (2026), around 20 snowdrops and 7 crocuses. Many snowdrop cultivars belong to the Green Strawberry Group, characterized by irregular green spots on the outer tepals. These forms, named 'Roheline Maasikas' (No. 1–20), were found in an old strawberry bed of Polli village in 2013–2019, hence the name of the cultivar group (Fig. 4A). Other snowdrop cultivars differ from the species in the marking of the inner and outer tepals, flower size, flower type, and structure. The most famous are 'Erelinea', 'Mulgi Puder', 'Vireline' (2018), 'Allaste' (2015), and 'Tala' with green marks in the outer tepals. Some snowdrops have various colour patterns of the inner tepals, such as 'Helve' (2024), 'Peen Joon' (2020), 'Malbe', and 'Kiivita' (2018). *Galanthus* 'Mõisa Uks' has a double flower and longer inner tepals in the first row (Fig. 4B). Aivar Saatmann's crocus cultivars, such as the lilac-flowered 'Aitre', the yellow-flowered 'Aprikoos' and 'Õnnelik Leida', the white-flowered 'Arma Valge' and 'Edas', the purple-flowered 'Sügav Kaev', and the pink-flowered 'Kaire Lemmik', have spectacular colour and flower shape (Fig. 4C). Other breeders have selected several interesting and distinctive spring bulbs. Enno Zupping's cultivars are the creamy-rose-flowered *Corydalis* × *allenii* 'Enno' (2011) and *Allium ramosum* 'Enno' (2007) with persistent foliage and semi-double flowers.

Adi Luukas has selected and named the red-flowered *Corydalis solida* 'Adi' (2023) and 'Sura Jõgi' (2016), the orange-pink-flowered 'Korall' (2025), the dark-purple-flowered *Corydalis wendelboi* 'Adi' (2011) and the cultivar *Corydalis* 'Longa Rega' (Fig. 4D). Maret Vähejaus has discovered in her home garden the semi-double-flowered *Ficaria verna* 'Männi' (2021) and in the Sulli farm *Ficaria verna* 'Sulli' (2005); the last semi-double-flowered cultivar was named by Taavi Tuulik.

CONSERVATION OF LOCAL SPRING BULB CULTIVARS IN THE UNIVERSITY OF TARTU BOTANICAL GARDEN

The collection and conservation of spring bulb cultivars in the botanical garden started in 2005. Since that year, the collections have been enriched with 40 cultivars of the genera *Galanthus* (12), *Allium* (5), *Fritillaria* (5), *Chionodoxa* (3), *Corydalis* (3), *Crocus* (3), *Muscari* (2), *Arisaema* (1), *Ficaria* (1), *Narcissus* (1), *Puschkinia* (1), *Tulipa* (1), *Iridodictyum* (1), and *Physochlaina* (1). Local bulbs are grown in different collections of the garden, such as the Clematis Garden, the Plant Systematics section, and the Department of European and East Asian Plants, as well as in the rose, alpine, and heather gardens. The largest number of bulbs in the collections belongs to the breeder Sulev Savisaar (19) and Taavi Tuulik (11); cultivars of Adi Luukas (4), Silvi Õnne (2), Aivar Saatmann (2), Maret Vähejaus (1), and Jevgenia Ignatova (1) can also be found.

CONCLUSIONS

In the period 1975–2026, cultivars of the genera *Galanthus* (51), *Crocus* (12), *Corydalis* (10), *Allium* (7), *Fritillaria* (7), *Chionodoxa* (3), *Arisaema* (2), *Arum* (2), *Ficaria* (2), *Iridodictyum* (2), *Muscari* (2), *Tulipa* (1), *Erythronium* (1), *Narcissus* (1), *Puschkinia* (1), and *Physochlaina* (1) were bred, found, selected, and named in the gardens of Estonia. During the Estonian National Programme, the spring bulb collection of the botanical garden has been enriched with 40 cultivars. Within the framework of the PGR programme, the exhibition "Estonian Bulbs – Heralds of Spring in the Garden" of local spring bulb cultivars is planned for April and May 2026, continuing the series of exhibitions dedicated to Estonian ornamental plant cultivars. Activities such as mapping, data digitization, and phenotypic characterization of local bulbs at the botanical garden are ongoing.

REFERENCES

Escuer O., Uibo E-K. 2019. Digitalization and conservation in geodatabase of plant genetic resources at the Botanical Garden of the University of Tartu. The Baltic Botanic Gardens in 2015–2017: pp. 74-77.

Escuer O. 2021. An overview of Estonian rose breeding and conservation of local roses at the Botanical Garden of the University of Tartu. The Baltic Botanic Gardens in 2018–2020: pp. 55-61.

Escuer O. 2024. An overview of Estonian anemone (*Anemone*) varieties and conservation at the University of Tartu Botanical Garden. The Baltic Botanic Gardens in 2021–2023: pp. 83-89.

Rehela, L. 1992. Nartsissid: 16. Türi lillelaada kataloog (Daffodils: Catalogue of the 16th Türi Flower Fair). Türi Aianduse ja Mesinduse Selts, Paide Trükikoda. 24 p.

Savisaar, S. 1998. Sulev Savisaar's bulbs. https://sibullilled.ee/kataloog/et/

Savisaar, S. 2004. Eesti sibullille-entsüklopeedia (Estonian Bulb Flower Encyclopedia). Varrak, Tallinn. 438 p.

Savisaar, S. 2012. Eesti kevadised sibullillesordid (Estonian Spring Bulb Cultivars). Aed. May/June: pp. 10-14.

Savisaar, S. 2019. Lumevärvi kellukeste kirev maailm (The Colourful World of Snowdrops). Maakodu. March: pp. 54-58.

Tuulik, T. 2020. Lumikellukeste mikrokosmos (The Microcosm of Snowdrops). Aed. Nr. 1: pp. 12-20.

Volkova O., Tamm H., Sild J. 2006. Conservation of ornamental and medical plant resources in botanical gardens of Estonia. The Baltic Botanic Gardens in 2004–2006: pp. 69-71.

Wright, A. 2024. Anne Wright Dryad Nursery.

https://www.dryad-home.co.uk/estonian-bird-double-snowdrops/

https://www.dryad-home.co.uk/estonian-spirit-snowdrops/

Structural Differentiation of Root Endophytic Communities in *Festuca* Tourn. ex L., *Lolium* L. and Hybrid Grasses

Violeta Stakelienė
Botanical Garden of Vilnius University,
Kairėnų 43, LT-10239 Vilnius, Lithuania
violeta.stakeliene@bs.vu.lt

ABSTRACT

In this study, the diversity of endophytic microorganisms in the roots of *Festuca* spp., *Lolium* spp. and *Lolium* × *Festuca* hybrids was re-evaluated using 119 isolates (60 fungal and 59 bacterial) previously isolated and identified in an earlier study. The microorganisms were classified into taxonomic categories based on their relative abundance and distribution across plant groups. The results showed that the root endophytic communities of *Festuca* spp., *Lolium* spp. and *Lolium* × *Festuca* hybrids differ in their structure and taxon prevalence. The genus *Microdochium*, detected in all plant groups, functioned as a stable but non-dominant community component, whereas *Alternaria* and *Bacillus* exhibited variable relative abundance depending on the host group. Taxa occurring at high local abundance, such as *Plectosphaerella* in hybrids and *Bacillus* in *Festuca* and *Lolium*, emerged as structurally important dominant members associated with specific hosts. The endophytic communities of *Festuca* and *Lolium* groups showed greater diversity and a more even distribution of taxa, while those of hybrids were narrower and consisted of several dominant genera. These differences indicate that plant species and hybridity status significantly influence the formation of endophytic microbial communities and their potential functional roles within the ecosystem.

KEYWORDS

Poaceae grasses, *Festuca*, *Lolium*, endophytic microorganisms, Host–microbe interactions

INTRODUCTION

Endophytic microorganisms – fungi and bacteria – are widespread in plants and colonise both their above-ground and below-ground parts asymptomatically. Endophytic fungi are found in a variety of ecosystems, including grasslands, the Alpine region, deserts and temperate forests (Glynou et al. 2016; Knapp et al. 2018, 2019; Mandyam et al., 2010; Porras-Alfaro et al. 2008; Toju et al. 2013). These microorganisms can help plants absorb nutrients and provide protective benefits,

such as increasing resistance to biotic and abiotic stress, reducing pest impact, and promoting growth and development (Andrade-Linares et al. 2013; Knapp et al. 2018; Pašakinskienė et al. 2025). Similarly, some bacteria may act as growth-promoting rhizobacterial endophytes, contributing to plant productivity (Aloo et al. 2023; Backer at al. 2018).

Empirical studies show that most grass species are hosts to endophytic fungi (Addy et al. 2005; Hardoim et al. 2015; Knapp et al., 2019; Wearn et al. 2012). However, research on *Epichloë/Neotyphodium* endophytes characteristic of the genera *Festuca* and *Lolium* (Poaceae) has focused almost exclusively on leaf and seed colonisation (Garces et al. 2022; Hume et al. 2020; Krauss et al. 2020; Leyronas, Raynal 2001; Müller, Krauss 2005; Saikkonen et al. 2000; Schardl 2010; Soto-Barajas et al. 2019; Tadych et al. 2014). These fungi systematically colonise leaf and stem tissues but are typically not found in grass roots. Although the distribution of endophytes in the above-ground parts of *Festuca* and *Lolium* is studied extensively (Leuchtmann 1994; Leuchtmann et al. 2000; Leyronas, Raynal 2001; Roberts 2022; Siegel et al. 1990), data on the root endophytes of these plants are still limited. To date, descriptions of fungal and bacterial endophytes from the roots of Festuca spp. and Lolium spp. are known only from our own experiments (Pašakinskienė et al. 2024; Stakelienė et al. 2025), while in the case of *F. arundinacea*, only root-associated bacterial endophytes have been investigated (de los Santos et al. 2016). Only a small proportion of studies analyse both fungi and bacteria simultaneously within the same plant species or ecosystem (Coombs, Franco 2003; Groenewald et al. 2013; Hardoim et al. 2015; Pašakinskienė et al. 2024; Stakelienė et al. 2025; Toju et al. 2019). Toju and co-authors (2019), having examined more than 100 meadow plant species, found that the below-ground microbiome has a different structure and dynamics from the above-ground one. These data indicate the need for more detailed investigations of root fungal and bacterial communities in order to better understand the mechanisms of plant–microorganism interactions.

The aim of this study was to assess the distribution and occurrence of endophytic microorganisms in the roots of *Festuca* spp., *Lolium* spp. and *Lolium* × *Festuca*, and to determine their potential ecological significance in forming the endophytic communities of different plant groups. The results provide insights into the distribution models of endophytic microorganisms across various plant groups, reveal their ecological differences, and contribute to a deeper understanding of plant–microbe interactions in an ecological research context.

METHODS

Original Data

The primary data obtained by isolating endophytic microorganisms from the root samples of *Festuca arundinacea* L., *F. gigantea* (L.) Vill., *F. pratensis* Huds., *Lolium multiflorum* Lam., *L. perenne* L., *L. temulentum* L. and *Lolium perenne* × *Festuca gigantea* hybrids were presented in our previous study. In that work, we isolated microbial cultures (60 fungal isolates assigned to 21 species and 59 bacterial isolates assigned to 26 species) and assessed their morphology and molecularly identified them (Stakelienė et al. 2025). A detailed description of sample collection, isolation, cultivation and taxonomic identification procedures is provided in the aforementioned publication.

Classification of Plant and Microorganism Taxa into Categories

In this study, we re-analysed our previous data in order to assess the distribution and occurrence of endophytic microorganisms across different plant groups and to determine their ecological significance in shaping plant endophytic communities. The plants were divided into three groups: *Festuca* spp., *Lolium* spp. and *Lolium* × *Festuca* hybrids. The identified microorganisms were grouped into taxonomic categories based on their relative abundance. Relative abundance within each plant group was calculated as the percentage of isolates of a given taxon in relation to the total number of isolates in that group.

Rare taxa that were found in only one plant group and isolated 1–2 times were combined into the category “others” to provide clearer visualisation and facilitate comparative analysis. The relative abundance percentages and graphs were calculated and plotted using MS Excel software.

Classification of Taxa by Relative Abundance

The taxonomic groups of microorganisms were evaluated according to their distribution among plant groups (detected in all, in two, or only in one group) and their relative abundance, distinguishing dominant, subdominant, locally restricted and rare community components (Table 1). Based on the percentage values of relative abundance, the taxa were classified into three classes: “Low” (<10%), “Moderate” (10.0–29.9%) and “High” (≥30%).

Occurrence Across Plant Groups	Relative Abundance Class	Recommended Ecological-Structural Component	Recommended Wording in Discussion
All groups	High	Dominant	It may represent a core structural component of the studied microbiota.
All groups	Moderate–High	Dominant	It may be possible that taxon functions as a core community component with substantial structural importance across host-associated assemblages.
All groups	Moderate	Subdominant	It may represent a stable core-associated taxon that contributes to community structure, though not necessarily as a dominant member.
All groups	Low–Moderate	Subdominant / Rare	It may represent a persistent but secondary component of the community rather than a dominant structural element.
All groups	Low	Rare	It may suggest only a minor contribution to the overall community structure.
2 groups	High	Local dominant	It may be possible reflecting preferential ecological association with specific plant groups.
2 groups	Moderate–High	Local dominant / Subdominant	It may play an important structural role within a subset of the studied community.
2 groups	Moderate	Subdominant	It may represent a host-associated subdominant taxon with a selective distribution pattern.
2 groups	Low–Moderate	Local	It may have limited structural importance.
2 groups	Low	Rare	It likely represents a rare taxon with only a minor or sporadic contribution to the studied communities.
1 group	High	Local	It may represent a strongly host-associated, locally dominant taxon, potentially reflecting pronounced ecological specialisation.
1 group	Moderate–High	Local / Subdominant	It may contribute substantially to local community structure.
1 group	Moderate	Local dominant	It may represent a local subdominant taxon rather than a broadly important community member.
1 group	Low–Moderate	Local / Rare	It may potentially be linked to specific host conditions but not form a major component of the community.
1 group	Low	Rare	It may represent a weakly represented local associate, potentially linked to specific host conditions but not forming a major component of the assemblage.

Table 1.
System of methodological approaches for the ecological interpretation of endophytic microbial taxa.

In cases where the relative abundance of the same taxon got into different classes across the plant groups, its overall abundance level was assessed as intermediate ("Low–Moderate" and "Moderate–High"), or the plant group in which the taxon was most widespread was additionally specified. This classification was applied solely for descriptive ecological analysis to compare the contribution of taxa to community structure across different plant groups; it was not used as evidence of the ecological functions or biological activities of the taxa.

RESULTS AND DISCUSSIONS

Relative Distribution of Endophytic Microorganisms

We evaluated the relative distribution of endophytic fungal genera isolated from the roots of *Festuca* spp., *Lolium* spp. and *Lolium* × *Festuca* hybrids, which differed among all three plant groups (Fig. 1). Although the genus *Microdochium* Syd. & P.Syd. was detected in all groups, and *Alternaria* Nees Von Esenb. ex Fries in two out of three, their percentage distributions were uneven. This indicates pronounced structural differences in the root fungal communities. In the *Festuca* and *Lolium* groups, *Microdochium* and *Alternaria* constituted one of the main components of the endophytic fungal communities. In contrast, the *Lolium* × *Festuca* hybrid group prevailed by only two major genera – *Microdochium* and *Plectosphaerella* Kleb. (28.5% and 43%, respectively), while rarer taxa were combined into the general category "Other(s)".

When analysing the relative distribution of bacterial genera (Fig. 2), it was found that only *Paenibacillus* Ash et al. was detected in all plant groups. The genera *Bacillus* Cohn, *Kosakonia* Brady el al. and *Peribacillus* Patel & Gupta were found in the *Festuca* and *Lolium* groups, while *Pantoea* occurred in the *Festuca* and *Lolium* × *Festuca* groups. The relative distribution of bacterial genera also differed between the groups. In the *Festuca* and *Lolium* groups, *Bacillus* constituted one of the main components of the endophytic bacterial communities. In contrast, in the *Lolium* × *Festuca* hybrids, the community consisted of only two main genera – *Paenibacillus* and *Pantoea* Gavini et al. (20% each), while the less frequently detected taxa accounted for the largest part of the community.

When comparing the three plant groups, significant differences in the diversity of endophytic microorganisms became evident. In the *Festuca* and *Lolium* groups, microbial diversity was higher than in the hybrids. Although the genera *Microdochium* and *Bacillus* were detected in these plant groups, their relative abundance differed, with *Bacillus* constituting a larger proportion of the bacterial communities in the *Festuca* and *Lolium* groups. In contrast, the hybrid group exhibited a narrower composition of fungi and bacteria: it was prevailed by only two main genera, while the less frequent taxa accounted for a relatively larger share of the community.

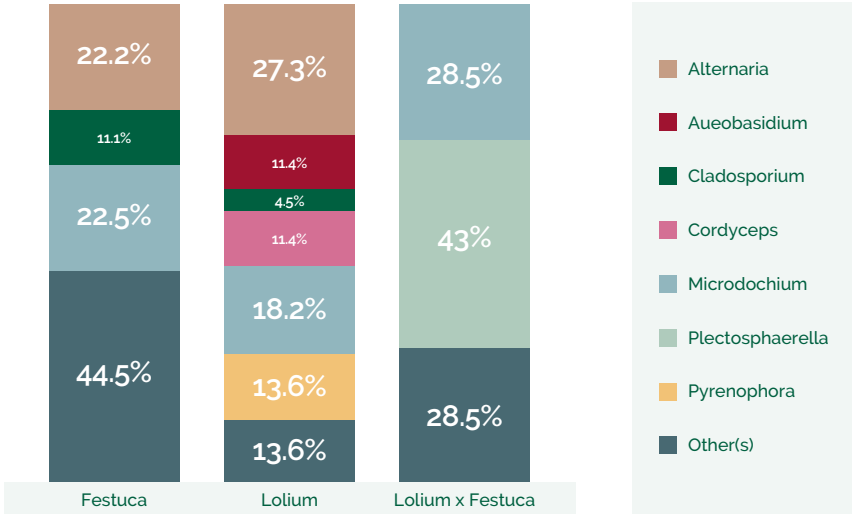


Fig. 1.
Distribution (%) of endophytic fungal genera in roots of ***Festuca***, ***Lolium*** and ***Lolium* × *Festuca*** plant groups.

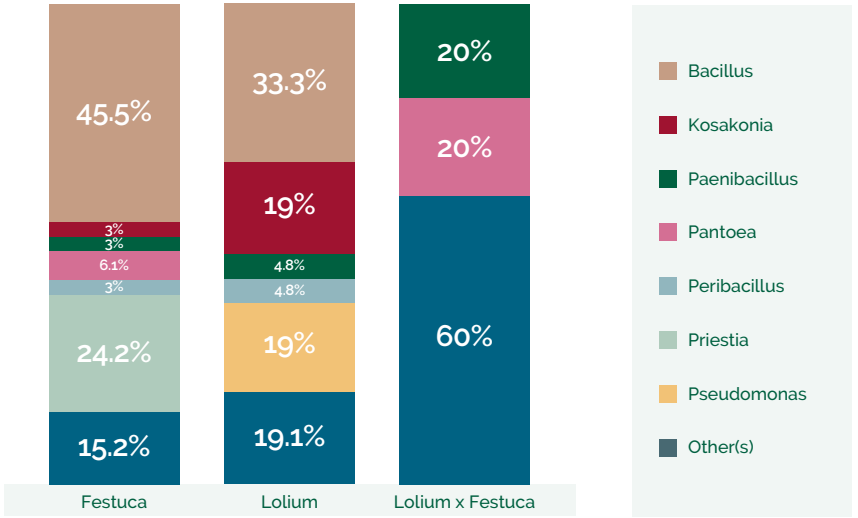


Fig. 2.
Distribution (%) of endophytic bacterial genera in roots of ***Festuca***, ***Lolium*** and ***Lolium* × *Festuca*** plant groups.

A Model of the Distribution of Dominant Endophytic Microorganisms

The main fungal genera detected in the studied grass groups are presented in Table 2. The results show that the root-associated endophytic fungal communities were made up of eight components: *Alternaria* Nees Von Esenb. ex Fries, *Aureobasidium* Viala & Bayer, *Cladosporium* Link ex Fries, *Cordyceps* Fr., *Microdochium* Syd. & P.Syd., *Plectosphaerella* Kleb., *Pyrenophora* Fr. and "Other(s)". *Microdochium* was found in all plant groups and exhibited moderate abundance, suggesting it may be a stable, secondary structural component of the community, although not a dominant member. This conclusion is consistent with data reported in the literature, indicating that *Microdochium* is frequently detected in the root tissues of grass species (Gao et al. 2022; Hong et al. 2008; Sánchez Márquez et al. 2010).

Meanwhile, *Alternaria* spp. and *Cladosporium* spp. are widely distributed across various ecosystems (Banerjee et al. 2018; Bensch et al. 2012; Zhang et al. 2023). In our study, these genera were found in two out of the three groups – in the roots of *Festuca* and *Lolium* – although the abundance of *Cladosporium* was lower. This suggests that their host range is broad, but their ecological significance differs: *Alternaria* exhibited higher relative abundance and may therefore have a greater influence on community structure.

In contrast, the distribution of *Plectosphaerella* was limited – it was detected only in the roots of *Lolium* × *Festuca*, yet it exhibited high abundance. This suggests that *Plectosphaerella* may be closely associated with a specific host and locally dominant, having a significant influence on community structure. Considering that the literature indicates *P. cucumerina* promotes the growth of *Lolium multiflorum* plants (Pašakinskienė et al. 2025), the high frequency of this genus in hybrid roots may indicate a functional role, although this was not directly analysed in the present study.

Pyrenophora, *Aureobasidium* and *Cordyceps* exhibited a limited distribution – they were detected only in the *Lolium* group and constituted a medium-abundance portion of the community. This suggests that these genera are local subdominants rather than widely distributed community components.

Fungal Genus	Distribution Across Plant Groups	Relative Ecological Importance	Host Association Pattern	Comment
Alternaria	Two Groups	Moderate	Shared	Common is distributed among non-hybrid groups.
Aueobasidium	*Lolium* only	Moderate	Restricted	Group restricted with moderate relative abundance.
Cladosporium	Two Groups	Low-Moderate	Shared	Detected in two plant groups, but abundance varies from low to moderate (5–11 %).
Cordyceps	*Lolium* only	Moderate	Restricted	Group restricted with moderate relative abundance.
Microdochium	All Groups	Moderate	Broad	Most widespread, moderate relative abundance.
Plectosphaerella	Hybrid only	High	Restricted	Strongly associated with hybrid roots.
Pyrenophora	*Lolium* only	Moderate	Restricted	Group restricted with moderate relative abundance.
Other(s)	Variable	Moderate-high	Mixed	Rare taxa, exhibiting moderate to high relative abundance in communities.

Table 2.
Interpretation of the distribution patterns of dominant root-associated endophytic fungal genera in the studied grass groups.

The root-associated endophytic bacterial communities were made up of eight groups: *Bacillus* Berthold, *Kosakonia* Brady et al., *Paenibacillus* Ash et al., *Pantoea* Gavini et al., *Peribacillus* Patel & Gupta, *Priestia* Gupta et al., *Pseudomonas* Migula and "Other(s)" (Table 3). *Paenibacillus* was detected in all plant groups; however, its abundance was relatively low, and therefore this genus is considered a secondary component of the community. By contrast, the genus *Bacillus* was characteristic of the roots of *Festuca* and *Lolium* and constituted a large proportion of the communities in these groups, suggesting that *Bacillus* may be functionally more important in these plant groups than *Paenibacillus*. Nevertheless, the literature indicates that *Bacillus* is not regarded as specific to particular plant species and displays a wide host range (Mandic-Mulec et al. 2015; Tsotetsi et al. 2022).

Kosakonia, *Pantoea*, and *Peribacillus* were detected in two of the three groups; however, the abundance of *Peribacillus* was low, and therefore its contribution to community structure is likely to be limited. *Priestia* and *Pseudomonas* are known to be widespread in various environments (Magome et al. 2024; Misra et al. 2022), but in our study they occurred in only one plant group – either rarely or moderately – and thus their host specificity is not confirmed, while their structural importance is limited.

In summary, the root-associated endophytic fungal communities were characterised by one locally dominant taxon, two secondary components and several locally occurring groups, while the category "Other(s)" comprised rare taxa. Meanwhile, the bacterial communities consisted of components whose relative abundance varied greatly – from locally dominant to rare. In the hybrid group, the microbial communities had a narrower structure: *Microdochium* and *Plectosphaerella* dominated among the endophytic fungi, whereas *Paenibacillus* and *Pantoea* dominated among the bacteria.

Becteral Genus	Distribution Across Plant Groups	Relative Ecological Importance	Host Association Pattern	Comment
Bacillus	Two Groups	High	Shared	Strongly associated with *Festuca* and *Lolium* roots.
Kosakonia	Two Groups	Low-Moderate	Shared	Detected in non-hybrid groups but abundance varies from low to moderate (3–19 %).
Paenibacillus	All Groups	Low-Moderate	Broad	Detected in all plant groups, but abundance varies from low to moderate (3–20 %).
Pantoea	Two Groups	Low-Moderate	Shared	Detected in two plant groups but abundance varies from low to moderate (6–20 %).
Peribacillus	Two Groups	Low	Shared	Detected in two plant groups at low relative abundance.
Priestia	*Festuca* only	Moderate	Restricted	Group restricted with moderate relative abundance.
Pseudomonas	*Lolium* only	Moderate	Restricted	Group restricted with moderate relative abundance.
Other(s)	Variable	Moderate-high	Mixed	Rare taxa, exhibiting moderate to high relative abundance in communities.

Table 3.
Interpretation of the distribution patterns of dominant root-associated endophytic bacterial genera in the studied grass groups.

CONCLUSIONS

The study showed that root endophyte communities of *Festuca* spp., *Lolium* spp., and *Lolium* × *Festuca* hybrids differ in their structure and taxon distributions. Across all plant groups, the genus *Microdochium* was a stable but non-dominant component of the community, while *Alternaria* and *Bacillus* showed variable relative abundances depending on the host group. Taxa occurring at high abundance locally, such as *Plectosphaerella* in the roots of hybrids and *Bacillus* in the *Festuca* and *Lolium* groups, emerged as structurally important and host-specific dominants.

Endophytic communities in *Festuca* and *Lolium* exhibited greater diversity and a more even distribution of taxa, while those in hybrids were narrower and concentrated around a few dominant genera. These differences indicate that plant species and hybridity have a significant influence on the formation of endophytic microbial communities and their potential functional roles in the ecosystem.

ACKNOWLEDGEMENTS

I would like to thank my colleagues – Prof. Hb. Dr. Izolda Pašakinskienė, Justas Martūnas, and Saulė Matijošiūtė – for their support.

REFERENCES

Addy H.D., Piercey M.M., Currah R.S. 2005. Microfungal endophytes in roots. Can. J. Bot. 83, pp. 1–13.

Aloo B.N., Nyongesa B.O., Were J.O., Were B.A., Tumuhairwe J.B. 2023. Rhizobacterial biomolecules for sustainable crop production and environmental management: Plausible functions and molecular mechanism. In: Kumar A., Bilal M., Ferreira L.F.R., Madhuree K. (eds) Microbial Biomolecules Emerging Approach in Agriculture, Pharmaceuticals and Environment Management. Academic Press: Cambridge, MA, USA, pp. 1–30.

Andrade-Linares D., Franken P. 2013. Fungal endophytes in plant roots: Taxonomy, colonization patterns, and functions. In Symbiotic Endophytes; Springer: Berlin/Heidelberg, Germany, pp. 311–334.

Backer R., Rokem J.S., Ilangumaran G., Lamont J., Praslickova D., Ricci E., Subramanian S., Smith D.L. 2018. Plant growth promoting Rhizobacteria: Context, mechanisms of action, and roadmap to commercialization of biostimulants for sustainable agriculture. Front. Plant Sci. 9, 1473.

Banerjee S., Schlaeppi K., van der Heijden M.G.A. 2018. Keystone taxa as drivers of microbiome structure and functioning. Nat. Rev. Microbiol. 16: pp. 567–576.

Bensch K, Braun U., Groenewald J.Z., Crous P.W. 2012. The genus *Cladosporium*. Studies in Mycology. 72: pp. 1–401.

Coombs J.T., Franco C.M.M. 2003. Isolation and identification of actinobacteria from surface-sterilized wheat roots. Appl. Environ. Microbiol. 69: pp. 5603–5608.

de los Santos M.C., Taulé C., Mareque C., Baracochea M., Battistoni F. 2016. Identification and characterization of the part of the bacterial community associated with field-grown tall fescue (*Festuca arundinacea*) cv. SFRO Don Tomás in Uruguay. Ann. Microbiol. 66: pp. 329–342.

Gao Y., Ren G.-C., Wanasinghe D., Xu J.-C., Farias A., Gui H. 2022. Two new species and a new record of *Microdochium* from grasses in Yunnan province, South-West China. Journal of Fungi. 8: pp. 1297.

Garces K.R., Sage H.E., Christian N., Emery S.M. 2022. *Epichloë* increases root fungal endophyte richness and alters root fungal endophyte composition in a changing world. J. Fungi. 8: pp. 1142.

Glynou K., Ali T., Buch A.-K., Haghi Kia S., Ploch S., Xia X., Çelik A., Thines M., Maciá-Vicente J.G. 2016. The local environment determines the assembly of root endophytic fungi at a continental scale. Environ. Microbiol. 18: pp. 2418–2434.

Groenewald J.Z., Nakashima C., Nishikawa J., Shin H.-D., Park J.-H., Jama A.N., Groenewald M., Braun U., Crous P.W. 2013. Species concepts in *Cercospora*: Spotting the weeds among the roses. Stud. Mycol. 75: pp. 115–170.

Hardoim P.R., van Overbeek L.S., Berg G., Pirttilä A.M., Compant S., Campisano A., Döring M., Sessitsch A. 2015. The hidden world within plants: Ecological and evolutionary considerations for defining functioning of microbial endophytes. Microbiol. Mol. Biol. Rev. 79: pp. 293–320.

Hong S.K., Kim W.G., Choi H.W., Lee S.Y. 2008. Identification of *Microdochium* bolleyi associated with basal rot of creeping bent grass in Korea. Mycobiology, 36: pp. 77–80.

Hume D.E., Stewart A.V., Simpson W.R., Johnson R.D. 2020. *Epichloë* fungal endophytes play a fundamental role in New Zealand grasslands. J. R. Soc. N. Z. 50: pp. 279–298.

Knapp D.G., Németh J.B., Barry K., Hainaut M., Henrissat B., Johnson J., Kuo A., Lim J.H.P., Lipzen A., Nolan M., et al. 2018. Comparative genomics provides insights into the lifestyle and reveals functional heterogeneity of dark septate endophytic fungi. Sci. Rep. 8: pp. 6321.

Knapp D.G., Imrefi I., Boldpurev E., Csíkos S., Akhmetova G., Berek-Nagy P.J., Otgonsuren B., Kovács G.M. 2019. Root-colonizing endophytic fungi of the dominant grass *Stipa krylovii* from a Mongolian steppe grassland. Front. Microbiol. 10: 2565.

Krauss J., Vikuk V., Young C.A., Krischke M., Mueller M.J., Baerenfaller K. 2020. *Epichloë* endophyte infection rates and alkaloid content in commercially available grass seed mixtures in Europe. Microorganisms 8: pp. 498.

Leyronas C., Raynal G. 2001. Presence of *Neotyphodium*-like endophytes in European grasses. Ann. Appl. Biol. 139: pp. 119–127.

Leuchtmann A. 1994. Isozyme relationships of *Acremonium endophytes* from twelve Festuca species. Mycological Research 98: pp. 2533.

Leuchtmann A., Schmidt D., Bush L.P. 2000. Different levels of protective alkaloids in grasses with stroma-forming and seed-transmitted *Epichloë/Neotyphodium* endophytes. J. Chem. Ecol. 26: pp. 1025–1036.

Magome T.G., Ochai S.O., Hassim A., Bezuidenhout C.C., Heerden H., Lekota K.E. 2024. A genome-based investigation of the *Priestia* species isolated from anthrax endemic regions in Kruger National Park. Infection, Genetics and Evolution 123: 105649.

Mandic-Mulec I., Stefanic P., van Elsas, J.D. 2015. Ecology of Bacillaceae. Microbiology Spectrum, 3.

Mandyam K., Loughin T., Jumpponen A. 2010. Isolation and morphological and metabolic characterization of common endophytes in annually burned tallgrass prairie. Mycologia, 102: pp. 813–821.

Misra P., Archana, Uniyal S., Srivastava A.K. 2022. Chapter 8 - *Pseudomonas* for sustainable agricultural ecosystem. In: Developments in Applied Microbiology and Biotechnology, Microbial Syntrophy-Mediated Eco-enterprising. Academic Press, pp. 209–223.

Müller C.B., Krauss J. 2005. Symbiosis between grasses and asexual fungal endophytes. Curr. Opin. Plant Biol. 8: pp. 450–456.

Pašakinskienė I., Stakelienė V., Matijošiūtė S., Martūnas J. 2024. Diversity of Endophytic Fungi and Bacteria Inhabiting the Roots of the Woodland Grass, *Festuca gigantea* (Poaceae). Diversity, 16: 453.

Pašakinskienė I., Stakelienė V., Matijošiūtė S., Martūnas J., Rimkevičius M., Būdienė J., Aučina A., Skridaila A. 2025. Growth Promoting Effects of Grass Root-Derived Fungi *Cadophora fastigiata*, *Paraphoma fimeti* and *Plectosphaerella cucumerina* on Spring Barley (*Hordeum vulgare*) and Italian Ryegrass (*Lolium multiflorum*). Microorganisms, 13: 25.

Porras-Alfaro A., Herrera J., Sinsabaugh R.L., Odenbach K.J., Lowrey T., Natvig D.O. 2008. Novel root fungal consortium associated with a dominant desert grass. Appl. Environ. Microbiol. 74: pp. 2805–2813.

Roberts E.L. 2022. Plant growth promoting fungal and bacterial endophytes of Tall Fescue: A Review. Grass Research, 2: 2.

Saikkonen K., Ahlholm J., Helander M., Lehtimäki S., Niemeläinen O. 2000. Endophytic fungi in wild and cultivated grasses in Finland. Ecography, 23: pp. 360–366.

Sánchez Márquez S., Bills G.F., Domínguez Acuña L., Zabalgogeazcoa I. 2010. Endophytic mycobiota of leaves and roots of the grass *Holcus lanatus*. Fungal Diversity, 41: pp. 115–123.

Schardl C.L. 2010. The epichloae, symbionts of the grass subfamily Poöideae. Ann. Mo. Bot. Gard. 97: pp. 646–665.

Siegel M.R., Latch G.C.M., Bush L.P., Fannin F.F., Rowan D.D., Tapper B.A., Bacon C.W., Johnson M.C. 1990. Fungal endophyte-infected grasses: Alkaloid accumulation and aphid response. J. Chem. Ecol.16: pp. 3301–3315.

Soto-Barajas M., Azquez-De-Aldana B., Alvarez A., Zabalgogeazcoa I. 2019. Sympatric *Epichloë* species and chemotypic profiles in natural populations of *Lolium perenne*. Fungal Ecol. 39: pp. 231–241.

Stakelienė V., Pašakinskienė I., Matijošiūtė S., Martūnas J., Štukėnienė G. 2025. Identifying Root-Associated Endophytic Fungi and Bacteria in *Festuca* and *Lolium* Grasses from a Site in Lithuania. Microorganisms, 13: 799.

Tadych M., Bergen M.S., White J.F. 2014. *Epichloë* spp. associated with grasses: New insights on life cycles, dissemination and evolution. Mycologia, 106: pp. 181–201.

Toju H., Yamamoto S., Sato H., Tanabe A.S., Gilbert G.S., Kadowaki K. 2013. Community composition of root-associated fungi in a Quercus-dominated temperate forest: "Codominance" of mycorrhizal and root-endophytic fungi. Ecol. Evol. 3: pp. 1281–1293.

Toju H., Kurokawa H., Kenta T. 2019. Factors influencing leaf- and root-associated communities of bacteria and fungi across 33 plant orders in a grassland. Front. Microbiol. 10: 241.

Tsotetsi T., Nephali L., Malebe M., Tugizimana F. 2022. *Bacillus* for Plant Growth Promotion and Stress Resilience: What Have We Learned? Plants (Basel), 11: 2482.

Wearn J.A., Sutton B.C., Morley N.J., Gange A.C. 2012. Species and organ specificity of fungal endophytes in herbaceous grassland plants. J. Ecol. 100: pp. 1085–1092.

Zhang D., Zheng J., Chu M., Feng Y., Li H. 2023. Secondary metabolites from the endophytic fungus *Cladosporium* sp. ZLM-6. Biochemical Systematics and Ecology, 111: 104741.

Ericaceae Family Collection in Vilnius University Botanical Garden

Ramunė Žemgulytė
Vilniaus universiteto botanikos sodas,
Kairėnų 43, 10239 Vilnius, Lietuva
+370 5 219 3139, ramune.zemgulyte@bs.vu.lt



ABSTRACT

The *Ericaceae* family is a large, globally distributed group of nearly 5,000 species, many of which are valued in horticulture for their ornamental and nutritional qualities. At the Vilnius University Botanical Garden, the *Ericaceae* collection has been developed since 1991 as part of its dendrological collections. Although the genus *Rhododendron* is the largest in the family – and perhaps the most ornamental – the collection has, from the very beginning, focused not only on rhododendrons but also on other genera within *Ericaceae*. Today, it stands as one of the most extensive collections in the Vilnius University botanical garden and the largest collection of *Ericaceae* (and also genera *Rhododendron*) in Lithuania. As of 2025, the collection comprises 24 genera, 559 taxa, and 686 living specimens.

The primary aim of the collection is to represent as many genera of *Ericaceae* as possible that are capable of growing outdoors under Lithuanian climatic conditions, while also demonstrating the morphological diversity of the family. Most of the plants are displayed together in a dedicated area, a pine forest, and creating a cohesive and visually engaging exhibit, especially during the rhododendron flowering season.

KEY WORDS

Ericaceae, Rhododendron, plant collection, botanical garden, dendrological collections, ornamental shrubs.





DEVELOPMENT OF THE COLLECTION OF ERICACEAE FAMILY

The *Ericaceae* Juss. family is numerous, widely distributed in the world and currently comprising 138 genera and nearly 5,000 species Many of these plants are prized in horticulture for their striking flowers, colorful fruits, evergreen leaves, or vivid autumn foliage. Alongside their ornamental value, an equally important group comprises genera that produce edible fruits – many of which are significant in human nutrition – as well as medicinal and aromatic plants used in medicine and pharmacy. The collection of the heath family (*Ericaceae* Juss.) plants at the Vilnius University Botanical Garden was initiated in 1991. This date is somewhat conventional, as *Ericaceae* plants (mainly *Rhododendron* L., *Erica* L. and *Calluna* Salisb.) had already been introduced to the garden shortly after the the Kairėnai Department of Vilnius University Botanical Garden was established in 1974. However, from 1991 onward *Ericaceae* plants (seeds, mainly from Seed exchange network, also seedlings and cuttings from other botanical gardens) began to be acquired in large quantities. At the same time, cultivation methods were improved in response to plants specific requirements: a greenhouse for seedlings and shaded nursery beds was constructed and acidic peat was purchased. Moreover, the oldest *Ericaceae* plants still surviving in our collection were acquired in 1991, with one important exception in the Vingis Department of Vilnius University Botanical Garden, where three rhododendron taxa donated by the Riga University Botanical Garden in 1980 are still growing.

During the first decade, a relatively large collection of *Ericaceae* plants was assembled, and in 2002 work began on transferring the plants to a specially prepared area of approximately 1 ha in the north-western part of the botanical garden. A sparse, gently undulating pine forest with naturally acidic soil proved to be an ideal setting for establishing a collection of *Ericaceae* plants. Since the genus *Rhododendron* constitutes the dominant part of the collection, the new area came to be known as the Rhododendron Garden (Fig. 1).

Fig. 1.
Rhododendron Garden in 1998 and 2010



Fig. 2.
Rhododendron garden in 2025.

In the Rhododendron Garden, *Ericaceae* plants are arranged together with companion plants from other families, particularly conifers: pines (*Pinus* L.), yews (*Taxus* L.), hemlocks (*Tsuga* Endl.) Carrière), and hiba arborvitae (*Thujopsis* Siebold & Zucc. ex Endl.). But also, Hydrangeas (*Hydrangea* Gronov. ex L.), spindles (*Euonymus* L.), spireas (*Spiraea* L.), ivies (*Hedera* Conti-Jerpe & Freshwater) and many other shrubs and herbaceous plants capable of growing under similar conditions are cultivated there (Fig. 2).



Fig. 3.
The new area of Rhododendron Garden, 2025.

In 2016 *Ericaceae* plants began to be planted in a nearby new area, following the same principles: an understory layer of shrubs and herbaceous plants is created in a sparse pine forest, dominated by *Ericaceae* plants but also including companion plants. As the collection is continuously supplemented with new specimens, the new area is slowly but steadily expanding and currently covers approximately 0.8 hectares. Soil preparation work is carried out not only by the botanical garden staff, but also with significant contributions from volunteers. (Fig. 3).

THE PRINCIPLES GUIDING THE COLLECTION

The collection is developed with the aim of including as many genera of the *Ericaceae* family as can successfully grow under Lithuanian climatic conditions. Within each genus, efforts are made to gather a wide range of species that clearly differ in their morphological traits, thereby illustrating the diversity of forms characteristic of that group. Whenever possible, representatives of the same genus are selected from different continents or geographic regions to highlight their ecological and evolutionary variation.

Strict standards are applied to the origin of the plants. Priority is given to specimens collected from natural habitats. When this is not possible, preference is given to plants whose parent material is of well-documented geographic origin, ensuring scientific reliability and value.

When collecting cultivated varieties, the goal is similarly to capture as broad a range of morphological diversity as possible. At the same time, historical and cultural aspects are also taken into account. This includes heritage cultivars, representing different cultivar groups, and showcasing the work of various breeders, nurseries, and countries of origin – thus reflecting not only biological diversity, but also the rich history of plant cultivation.

In 2025, the collection comprised 24 genera, 559 taxa, and 686 specimens of *Ericaceae*. As shown in Figure 4, the genus *Rhododendron* L. is the most numerous in the collection with 360 taxa and 467 specimens, of which 244 taxa are varieties and 116 taxa are species. Other well-represented genera include *Calluna* Salisb. (65 taxa, 72 specimens), *Erica* L. (46 taxa, 49 specimens), and *Vaccinium* L. (18 taxa, 23 specimens). However, some less numerous genera, such as *Pieris* D.Don (7 taxa, 9 specimens), *Kalmia* L. (7 taxa, 7 specimens), and *Gaultheria* Kalm ex L. (5 taxa, 10 specimens), make a particularly significant contribution to the attractiveness and interest of the collection for visitors. Nevertheless, each genus is important in broadening the overall understanding of the *Ericaceae* family. The collection is constantly used for educational purposes and is a permanent visitor attraction, along with the nearby Japanese Garden.

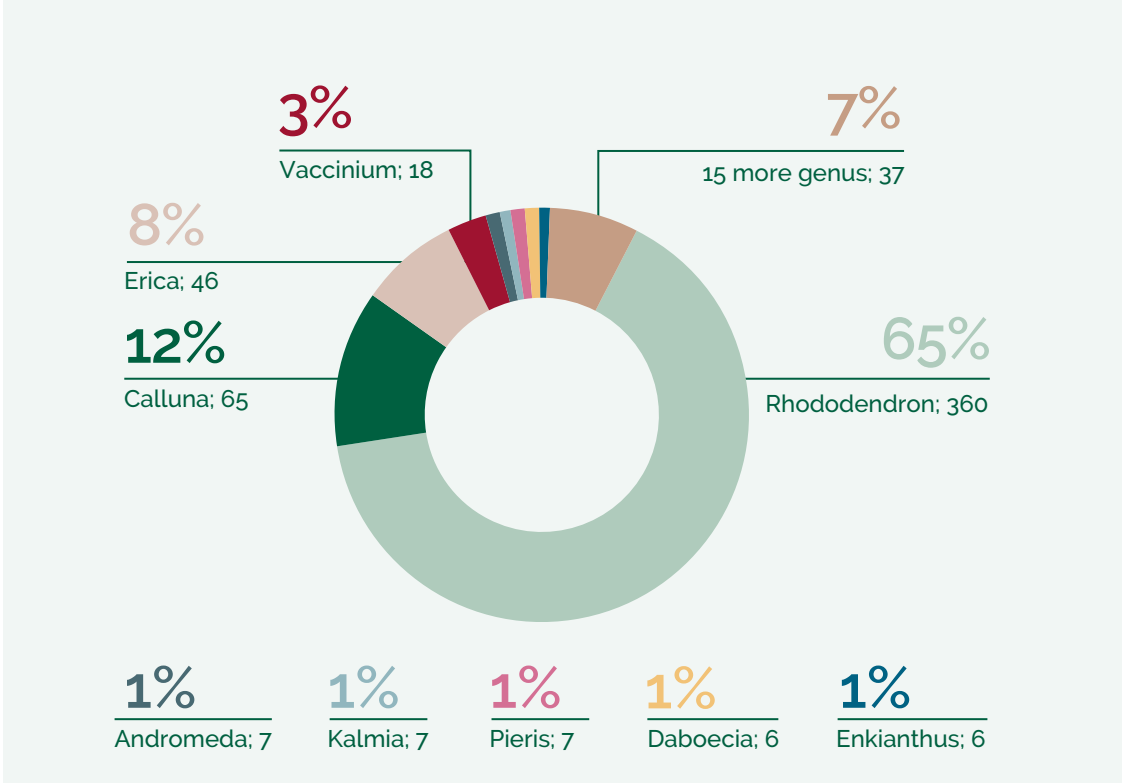


Fig. 4.
Ericaceae family collection in Vilnius HBU with the number and percentage of taxa of the most numerous genera, 2025.

Plants in the collection have been propagated from seeds, by cuttings, by grafting, through micropropagation in the laboratory, or acquired as nursery-grown plants.

Ericaceae plants are generally long-lived but present certain cultivation challenges: they require acidic, organic-rich soil conditions, adequate moisture, light shade and many species are sensitive to cold in our hardiness zone. The seeds of the most commonly cultivated genera have good germination rates, but the seedlings are tiny, requiring specific cultivation conditions and a long period of care (4–6 years or even longer before the first flowering).

During the development of the collection, a large number of specimens were received from donors; however, survival rates have not been high, particularly among young or recently planted individuals, most often due to environmental conditions. At present, alongside 686 living specimens, there are 706 well-documented specimens that have been lost (since database was established in 2012,

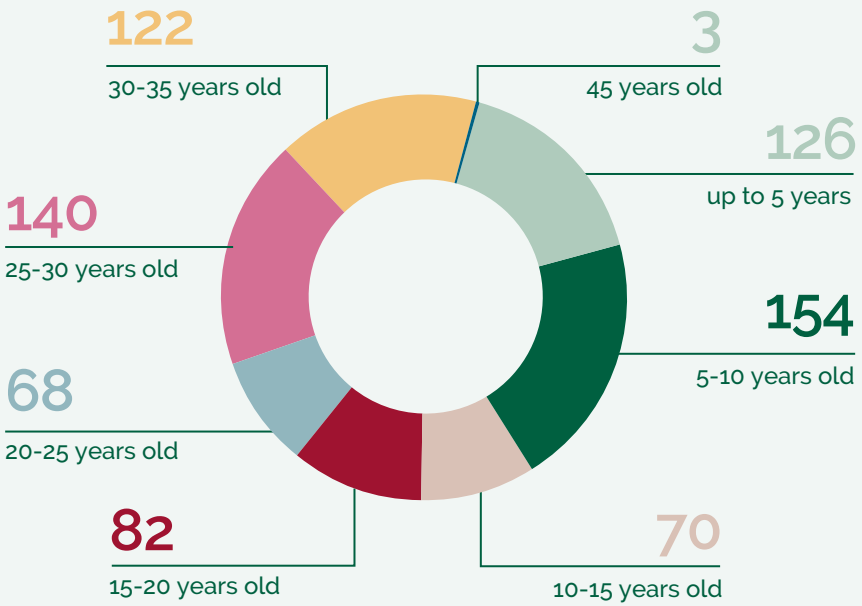


Fig. 5.
Age structure of the ***Ericaceae*** collection in Vilnius HBU, 2025.

and even more from earlier years). These data provide valuable information on acclimatization potential, climate change, and the persistence of the collection's curators. Despite these challenges, the age structure of the *Ericaceae* collection is relatively well represented by plants of various ages (Fig. 5).

The very first and still living specimens were obtained from our closest colleagues from the Botanical Gardens of Lithuania, Latvia and Estonia, but as opportunities to collaborate with botanical gardens worldwide emerged, the geography expanded significantly, and now living specimens have been acquired from botanical gardens and nurseries in 25 countries across Europe, North America, and Asia.

CONCLUSIONS

Over the past nearly 35 years, a valuable and the largest collection in Lithuania – not only of rhododendrons but of the entire Ericaceae family – has been established at the Vilnius University Botanical Garden, serving to educate visitors about both popular and lesser-known plants of this family, support student learning, and provide a highly attractive point of interest for visitors.

ACKNOWLEDGEMENT

I am very grateful to Inga Raubaitė from Vilnius University Botanic Garden for the historical photo (Fig. 1) of Rhododendron Garden.

Conference

BALTIC BOTANIC GARDENS FOR PLANT CONSERVATION AND SUSTAINABILITY

June 5th, 2026,
University of Latvia Botanical Garden
Jāņa Šteinhauera str. 2, Rīga

PROGRAMME

Oral presentations

Growing anew. The process behind rebranding and retelling the story of the University of Latvia Botanical Garden
Renāte Lagzdiņa
University of Latvia Botanical Garden

An overview of ornamental plant breeding in Estonia and conservation of local cultivars in the University of Tartu Botanical Garden
Olesja Escuer
Tartu University Botanical Garden

Changes in the greenhouses of the VMU Botanical Garden over the last decade
Renata Čanovienė
Vytautas Magnus University Botanical Garden

New Status of the National Botanical Garden of Latvia
Ludmila Višņevska, Artis Vītiņš
National Botanic Garden of Latvia

The role and challenges of Klaipėda University Botanic Garden plant collections in biodiversity conservation
Asta Klimienė
Klaipeda University Botanical Garden

Assessment and Management Perspectives of Protected Dendrological Plantations in Latvian State Forests
Liene Opincāne
Latvia's State Forests Arboretum in Kalsnava

Vilnius Botanical Garden in 2025: collections, research, and public engagement
Darius Ryliškis
Botanical Garden of Vilnius University

Collection of ornamental Norway spruce *Picea abies* forms of wild local origin in the Latvia's State Forests Arboretum in Kalsnava
Linda Strode
Latvia's State Forests Arboretum in Kalsnava

From Taxonomic to Genetic Representation: Strengthening the Conservation Value of *Ex Situ* Collections
Rūta Katrīna Berga
University of Latvia Botanical Garden Rhododendron Testing and Breeding Nursery "Babīte"

Poster presentations

The Cornflower of Prussia: Queen Louise's Role in the Klaipėda's history and Her Legacy in the KU Botanical Garden
Ana Timonina – Mickevičienė
Klaipeda University Botanical Garden

German chamomile (*Matricaria chamomilla*): biological properties and aspects of its effects
Laura Žalienė, Erika Kaškelienė
Klaipeda University Botanical Garden

The collection of hardy ferns at the University of Latvia Botanical Garden
Inese Nāburga
University of Latvia Botanical Garden

Assessment of evergreen rhododendron winter hardiness following the winter of 2026
Gunita Riekstiņa
University of Latvia Botanical Garden Rhododendron Testing and Breeding Nursery "Babīte"

Hidden in the flora: new national records of insect species from the University of Latvia Botanical Garden
Lauma Ķeire[1], Uģis Piterāns[2], Mārtiņš Dakša[1]
[1] University of Latvia Botanical Garden,
[2] Latvian National Museum of Natural History

Biological Pest Control in the Conservatory of the National Botanic Garden of Latvia
Iveta Zuja
National Botanic Garden of Latvia

Nature education at the National Botanic Garden of Latvia
Laura Līdaka
National Botanic Garden of Latvia

University of Latvia Botanical Garden's Greenhouse Azalea Collection Dynamics
Inga Apine
University of Latvia Botanical Garden

Vegetative propagation performance of lingonberry (*Vaccinium vitis-idaea*)
Signe Tomsone, Madara Lazdāne, Jeļena Kalniņa
University of Latvia Botanical Garden

From wild populations to living collections: conserving Latvia's threatened plant species at the University of Latvia Botanical Garden
Ieva Akmane, Lauma Ķeire, Madara Lazdāne, Mārtiņš Dakša
University of Latvia Botanical Garden

Magnolia collection in the Botanical garden of the University of Latvia
Madara Lazdāne
University of Latvia Botanical Garden

Impact of Interior Blinds and Forced Ventilation on Heat Flux Through a Polycarbonate Greenhouse Wall: A Palm House Case Study
Staņislavs Gendelis[1], Kristaps Kunrads[2]
[1] University of Latvia Faculty of Science and Technology,
[2] University of Latvia Botanical Garden

Baltic Botanic Gardens

2026