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Representatives of the genus *Chamaecyparis* Spach in the collections of botanical gardens in Kyiv

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Abstract. Despite their limited use in Kyiv's landscaping due to a perceived sensitivity, representatives of the genus *Chamaecyparis* Spach are actively represented in the city's botanical collections and are valued for the diversity of cultivars with ornamental traits. The purpose of the scientific research was to assess the existing diversity of species and cultivars in the collections of botanical institutions in Kyiv. The collection fund of *Chamaecyparis* Spach representatives in the botanical gardens of Kyiv was analysed: the National Botanical Garden of M.M. Gryshko National Academy of Sciences of Ukraine, the Botanical Garden of the National Taras Shevchenko University of Kyiv, and the Botanical Garden of the National University of Life and Environmental Sciences of Ukraine. It was determined that the largest collection is held at the National Botanical Garden of M.M. Gryshko, where *Chamaecyparis pisifera* (Siebold & Zucc.) Endl. is represented by 8 cultivars, *Chamaecyparis obtusa* (Siebold & Zucc.) Endl. by 5 cultivars, and *Chamaecyparis lawsoniana* (A. Murray bis) Parl. by 11 cultivars. In total, 37 cultivars were found in the botanical collections of Kyiv, with the highest number of taxa recorded in *Chamaecyparis lawsoniana* – 18 cultivars, the smallest in *Chamaecyparis obtusa* – 16 cultivars, and *Chamaecyparis pisifera* represented by 13 cultivars. A brief description of the species and cultivars presented in the collections is provided, the current state of the collection plantings is described, and the prospects for the addition of new taxa to the collections are discussed. It was established that collection plantings provide a

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basis for analysing the adaptation level of cultivars to local climatic conditions and represent specimens of various ages along with their physiological states, depending on age, origin, and maintenance practices. The diversity of plants in the collections, particularly those over 50 years old, demonstrates the sufficient resilience of most cultivars and species to adverse environmental factors and supports their broader use in urban landscaping. The research findings can be utilised to expand the assortment of ornamental coniferous plants in urban greening by introducing promising *Chamaecyparis* Spach cultivars adapted to the conditions of Kyiv

Keywords: species; cultivar; assortment; coniferous plants; coniferetum; dendrarium

Introduction

In contemporary landscape design, there is a growing demand for ornamental evergreen woody plants that maintain aesthetic appeal throughout the year and demonstrate adaptability to urban environmental conditions. Among these, representatives of the genus *Chamaecyparis* Spach hold particular value due to their wide range of cultivars, crown forms, foliage colours, and compact growth habits, making them suitable for both large-scale plantings and container culture. Despite their high ornamental qualities and steady demand in the private sector, their use in urban greening remains limited, partly due to the insufficient study of their ecological adaptability to the climatic conditions of central Ukraine. Therefore, analysing the taxonomic composition and conservation status of existing *Chamaecyparis* Spach collections in the botanical gardens of Kyiv becomes especially relevant, as these collections represent a potential source for introducing promising cultivars into urban landscapes.

Therefore, analysing the taxonomic composition and conservation status of existing *Chamaecyparis* Spach collections in the botanical gardens of Kyiv becomes especially relevant, as these collections represent a potential source for introducing promising cultivars into urban landscapes. A similar methodological approach was successfully applied to assess the ornamental value of *Araliaceae* species in Kyiv botanical gardens, highlighting the relevance of collection-based evaluation in urban greening efforts (Morozko & Kolesnichenko, 2024). Species of the genus *Chamaecyparis* Spach are evergreen plants highly valued for their year-round ornamental appeal. Due to their aesthetic qualities and practical utility, they are widely used around the world and attract interest from researchers across various fields. In their natural habitats, According to C.F. Li *et al.* (2015), *Chamaecyparis* formosensis is one of the principal forest-forming species in Taiwan, particularly in mountainous regions. C. Brischke *et al.* (2023) investigated the biological durability and moisture behaviour of *Metasequoia glyptostroboides* and *Chamaecyparis lawsoniana* under various exposure conditions. They found that both species exhibited high resistance to fungal decay. The authors concluded that their dimensional stability and durability make them suitable for use in outdoor environments. K.M. Górski *et al.* (2024) studied the chemical composition of essential oils derived from *Chamaecyparis obtusa*. The research revealed a wide spectrum of bioactive compounds with antimicrobial and antioxidant properties. The study highlighted the pharmacological potential of this species for future applications in medicine and biotechnology.

Y. Wang *et al.* (2022) investigated the evolutionary history of the relict conifer genus

Chamaecyparis using molecular phylogenetics. They demonstrated that incomplete lineage sorting and regional extinction events played a significant role in shaping its present-day distribution. The study provided new insights into the complex divergence patterns within the Cupressaceae family during the Paleogene period. N.V. Zaimenko *et al.* (2020) presented detailed information on the introduction and conservation practices implemented at the M.M. Hryshko National Botanical Garden of the National Academy of Sciences of Ukraine. Their work highlighted the scientific value of collection plantings and their role in preserving plant diversity under global environmental changes. The study also emphasised the importance of this institution as a centre for research and adaptive strategies in the context of ecological instability.

Research on the taxonomic composition of collections involving *Chamaecyparis* Spach in Ukrainian botanical collections has been comprehensively examined in recent literature. N.S. Boiko (2023) analysed the role of gymnosperm collections in Ukraine's *ex-situ* conservation system, emphasising the significance of *Chamaecyparis* taxa as part of national biodiversity preservation strategies. Their study also identified gaps in institutional coordination and pointed to the need for updated maintenance protocols across major arboreta. Similarly, S.I. Kuznetsov *et al.* (2020) offered an extensive catalogue of trees, shrubs, and vines used in Ukrainian landscape architecture, including several *Chamaecyparis* species. The authors underscored the adaptive potential of these conifers to local climatic zones, which supports their continued integration into urban greening and botanical garden planning. Updating information on the taxonomic structure of the collection plantings, assessing the current condition and development of these collections under climate change, and describing the morphometric characteristics of the cultivars is essential for their broader implementation in urban landscaping.

Based on recent taxonomic revisions, there are 5 recognised species of the genus *Chamaecyparis* Spach: *Chamaecyparis formosensis* Matsum., *Chamaecyparis thyoides* (L.) Britton, Sterns & Poggenb., *Chamaecyparis pisifera* (Siebold & Zucc.) Endl., *Chamaecyparis obtusa* (Siebold & Zucc.) Endl., and *Chamaecyparis lawsoniana* (A. Murray bis) Parl. For a long time, *Callitropsis nootkatensis* (D. Don) Oerst. was considered part of the genus *Chamaecyparis* Spach, but it now occupies a separate taxonomic position (POWO, g.d.).

In Europe and Ukraine, representatives of the genus *Chamaecyparis* Spach are widely distributed and used as ornamental plants for landscaping. A. Cedro *et al.* (2021) investigated the climate sensitivity of *Chamaecyparis pisifera* by analysing its tree-ring width patterns in Poland. Their results confirmed the responsiveness of this species to temperature and precipitation fluctuations, demonstrating its ecological plasticity and potential for adaptation in variable environments. This finding is relevant for understanding the resilience of *Chamaecyparis* species cultivated in Ukrainian urban landscapes under changing climatic conditions. Expanding the range of plants cultivated in Ukraine is an important area of work aimed at solving biodiversity conservation issues, rational use of plant resources, and optimising the state of green spaces. To broaden the plant range used in urban landscaping and enhance the aesthetic and artistic value of plantings in street compositions, more introduced species are being utilised. Modern trends in creating garden-park landscapes, though encouraging a revision of plant selection with a focus on biological species, still require the use of the entire existing within-species diversity of woody plants. The desire to create original compositions

or complete plantings for specific functional purposes generates the need for specific taxa with defined habitus characteristics, crown forms, and distinct color ranges throughout the year. There is significant diversity of cultivars in the species of the genus *Chamaecyparis* Spach.

Despite the wide use of cultivars, especially in private landscaping, their use in urban areas is limited due to the insufficient study of ecological and biological traits under local conditions. The aim of the research was to identify the taxa present in the collections, assess their condition under the environmental conditions of Kyiv, and determine their future potential and applicability in urban landscaping

Materials and Methods

The study was based on an in-depth investigation of representatives of the genus *Chamaecyparis* Spach cultivated in the collections of three leading botanical institutions in Kyiv: the M.M. Gryshko National Botanical Garden of the National Academy of Sciences of Ukraine, the Botanical Garden of the National Taras Shevchenko University of Kyiv named after Academician O.V. Fomin, and the Botanical Garden of the National University of Life and Environmental Sciences of Ukraine (NULES). These institutions serve as key centres for the introduction, acclimatisation, and preservation of ornamental woody plants in central Ukraine and offer a representative diversity of conifer taxa under *ex situ* conditions.

Field investigations were carried out during the 2024-2025 vegetation seasons. The research methodology included both qualitative and quantitative assessments of the taxonomic composition and condition of *Chamaecyparis* specimens. Data collection was based on the route-based field inventory method, which involved systematic surveying of all sections and exhibition zones within each botanical garden where *Chamaecyparis* taxa were present. Morphometric characteristics such as growth habit, crown form, foliage colour, and plant vitality were visually assessed and documented in field journals.

To ensure taxonomic accuracy, plant names were verified according to the latest classification standards provided by the Royal Botanic Gardens, Kew (POWO, n.d.), and synonymy was cross-checked using the World Flora Online plant List (WFO, 2025). Additionally, printed and digital catalogues from the botanical institutions were reviewed, along with archived publications and earlier inventory records, to trace the history of plant introductions and collection dynamics over time. The primary sources for this study were reseaches by T.A. Reshetnyak (1980), S. Kuznetsov (2015), and N.S. Boiko (2023).

The collected data were subsequently systematised and compared across institutions to identify patterns in species and cultivar representation, evaluate the completeness and condition of existing collections, and detect the presence of rare or unique cultivars. Special attention was given to cultivars demonstrating stress symptoms or decline, with descriptive notes recorded on microclimatic conditions, exposure, and associated factors potentially affecting plant health.

Results and Discussion

The study focused on analysing the taxonomic composition, structural features, and representativeness of plantings of the genus *Chamaecyparis* Spach within the *ex situ* collections of major botanical institutions. Representatives of the genus *Chamaecyparis* Spach are well represented in the collections of botanical gardens in Kyiv. The National Botanical Garden of M.M. Gryshko National Academy of Sciences of Ukraine was founded in September 1935 (Boiko, 2023). M. Kokhno (1987), in the catalogue of the collection, mentions that in 1987, the garden contained 9 taxa, mainly in the

dendrarium and the "Vydubytsky slope" section. With the gradual development and opening of new exhibition areas, such as the "Decorative Forms of Woody Plants" and "Japanese Garden" sections, the collection has significantly increased. The coniferetum contains 3 species: *Chamaecyparis pisifera*, *Chamaecyparis obtusa*, and *Chamaecyparis lawsoniana*. In the dendrarium of the National Botanical Garden, we can highlight 3 main locations where representatives of the *Chamaecyparis* Spach genus are concentrated. These include the coniferetum section, where, in addition to the above-mentioned species, there are cultivars over 50 years old: *Ch. Lawsoniana* 'Allumi', *Ch. Pisifera* 'Filifera', *Ch. Pisifera* 'Plumosa', *Ch. Pisifera* 'Plumosa Aurea', and *Ch. Pisifera* 'Squarrosa'. Group plantings of *Ch. Lawsoniana* and *Ch. Pisifera* are also located in the "Vydubytsky slope" area. The majority of cultivars are situated in the "Decorative Forms of Woody Plants" section. The general condition of the plants is good; they are growing under favorable conditions. However, some cultivars of *Ch. pisifera* (mainly those with juvenile foliage) were severely affected during the heatwave of the summer of 2024. Some cultivars of *Chamaecyparis obtusa* were lost in the exhibition area but survived in the parent plantings of the decorative nursery. In total, the collection at the National Botanical Garden of M.M. Gryshko contains 24 cultivars, and their distribution by species is shown in the diagram (Figs. 1-2)

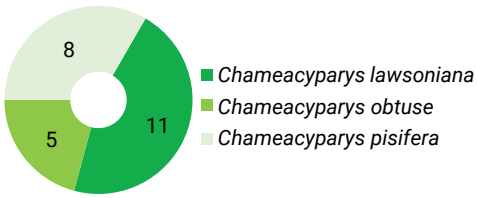

Figure 1. Distribution of cultivars of species from the genus *Chamaecyparis* Spach in the collection of the National Botanical Garden of M.M. Gryshko
Source: developed by the authors

Figure 2. *Ch. lawsoniana* and *Ch. pisifera* in the dendrarium of the National Botanical Garden of M.M. Gryshko (Vydubytsky Slope)
Source: photo by the authors

The Botanical Garden of the National Taras Shevchenko University of Kyiv, named after Academician O.V. Fomin, is one of the oldest botanical institutions in Ukraine, founded in 1839 (Boiko, 2023). The published catalogue of the garden's collection from 2007 was analysed, which indicated the presence of 3 species and 20 cultivars, consistent with the results of our surveys. In the dendrarium, *Chamaecyparis pisifera*, *Chamaecyparis obtusa*, and *Chamaecyparis lawsoniana* grow. It is worth noting the presence of certain specimens. The general condition of the plants is good; however, some specimens of *Ch. pisifera* (mainly those with juvenile foliage) were also severely affected during the heatwave of the summer of 2024. In the botanical garden of O.V. Fomin, a collection of 20 cultivars has been gathered, with *Chamaecyparis lawsoniana* being the most represented with 11 cultivars. The distribution of cultivars by species is shown in the diagram (Fig. 3).

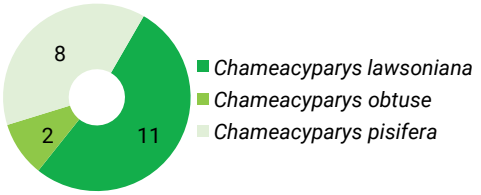

Figure 3. Distribution of cultivars of species from the genus *Chamaecyparis* Spach in the Botanical Garden of Academician O.V. Fomin
Source: developed by the authors

Like all members of the Cupressaceae family, plants of the genus *Chamaecyparis* are well-suited for creating topiary elements of varying complexity. In the collection of the Botanical Garden of Academician O.V. Fomin, the possibilities of using *Chamaecyparis pisifera* cultivars for maintenance in the "Niwaki" style are harmoniously presented (Figs. 4-5).

Figure 4. Topiary pruning of *Chamaecyparis* Spach representatives
Source: photo by the authors

Figure 5. *Chamaecyparis pisifera* cultivars (Botanical Garden of Academician O.V. Fomin)
Source: photo by the authors

The Botanical Garden of the National University of Life and Environmental Sciences of Ukraine was founded in 1928 (Boiko, 2023). The most recent published inventories indicate that as of 2010, 9 cultivars and 2 species were recorded (Kolesnichenko *et al.*, 2010). The results of the study show that the number of taxa in the garden has not changed. The garden contains species plants *Chamaecyparis pisifera* and *Chamaecyparis lawsoniana*, along with several cultivars of *Chamaecyparis pisifera* such as 'Filifera', 'Plumosa', and 'Squarrosa', all over 50 years old. Unfortunately, due to the density of the plantings and heavy shading, the condition of some plants is suppressed. In the Botanical Garden of NULES Ukraine, a collection of 9 cultivars has been gathered, with the distribution by species presented in the diagram (Fig. 6).

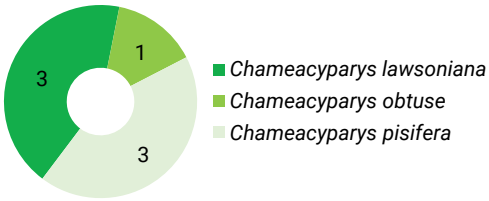

Figure 6. Distribution of cultivars of species from the genus *Chamaecyparis* Spach in the garden National University of Life and Environmental sciences of Ukraine
Source: developed by the authors

The number of taxa in the collections has increased. By analysing catalogs from previous editions and archival publications, we observe a significant growth in the collections, especially since 1990. This expansion has mainly been driven by greater access to global exchanges between botanical gardens, the involvement of plants from trade markets, and nurseries (Table 1). It has been established that the most common species in the collection plantings of botanical gardens are: *Chamaecyparis lawsoniana* and its cultivars – 'Allumi', 'Lutea', 'Globosa'; *Chamaecyparis pisifera* and its cultivars 'Bouleward' and 'Filifera Nana', which are found in all the studied collections. Based on t he conducted research and obtained results, it can be noted that the largest number of cultivars is collected at the National Botanical Garden of M.M. Gryshko: *Chamaecyparis pisifera* (Siebold & Zucc.) Endl. with 8 cultivars, *Chamaecyparis obtusa* (Siebold & Zucc.) Endl. with 5 cultivars, and *Chamaecyparis lawsoniana* (A. Murray bis) Parl. with 11 cultivars. The overall distribution of the number of cultivars in the collections of the botanical institutions of Kyiv is presented in the diagram (Fig. 7).

Table 1. Taxa of *Chamaecyparis* Spach in the Botanical Gardens of Kyiv

Taxonomic name	Representation in the collection		
	Botanical Garden of NULES	Botanical Garden of O.V. Fomin	Botanical Garden of M.M. Gryshko
Chameacyparis lawsoniana (A. Murray bis) Parl.	+	+	+
Ch. lawsoniana 'Allumi'	+	+	+
Ch. lawsoniana 'Lutea'	+	+	+
Ch. lawsoniana 'Globosa'	+	+	+
Ch. lawsoniana 'Blue Surprise'		+	
Ch. lawsoniana 'Chilworth Silver'		+	
Ch. lawsoniana 'Ellwoodii Gold'		+	
Ch. lawsoniana 'Glauca'		+	
Ch. lawsoniana 'Lombartsii'		+	
Ch. lawsoniana 'Nana Albospica'		+	
Ch. lawsoniana 'Stevartii'		+	
Ch. lawsoniana 'Triomf von Booskop'		+	+
Ch. lawsoniana 'Columnaris'			+
Ch. lawsoniana 'Ellwoodii'			+
Ch. lawsoniana 'Fletcheri'			+
Ch. lawsoniana 'Flaseri'			+
Ch. lawsoniana 'Glauca globus'			+
Ch. lawsoniana 'Monumenal'			+
Ch. lawsoniana 'Rogersii'			+
Chameacyparis obtuse (Siebold & Zucc.) Endl.	+		+
Ch. obtuse 'Nana Gracilis'	+		+

Table 1, Continued

Taxonomic name	Representation in the collection		
	Botanical Garden of NULES	Botanical Garden of O.V. Fomin	Botanical Garden of M.M. Gryshko
Ch. obtuse 'Aurea'		+	+
Ch. obtuse 'Coralliformis'			+
Ch. obtuse 'Crippsii'			+
Ch. obtuse 'Nana Aurea'			+
Ch. obtuse 'Tsatsumi gold'			+
Chameacyparis pisifera (Siebold & Zucc.) Endl.	+	+	+
Ch. pisifera 'Filifera'	+	+	
Ch. pisifera 'Filifera Aurea'	+	+	
Ch. pisifera 'Filifera Nana'	+	+	+
Ch. pisifera 'Aurea'	+	+	
Ch. pisifera 'Bouleward'	+	+	+
Ch. pisifera 'Plumosa'		+	+
Ch. pisifera 'Plumosa Aurea'		+	
Ch. pisifera 'Squarrosa'		+	+
Ch. pisifera 'Squarrosa Sulphurea'		+	
Ch. pisifera 'Aurea nana'			+
Ch. pisifera 'Squarrosa dumosa'			+
Ch. pisifera 'Squarrosa minima'			+
Ch. pisifera 'Sungold'			+

Source: developed by the authors based on N. Kokhno (1987), O.V. Kolesnichenko *et al.* (2010), N.S. Boiko (2023)

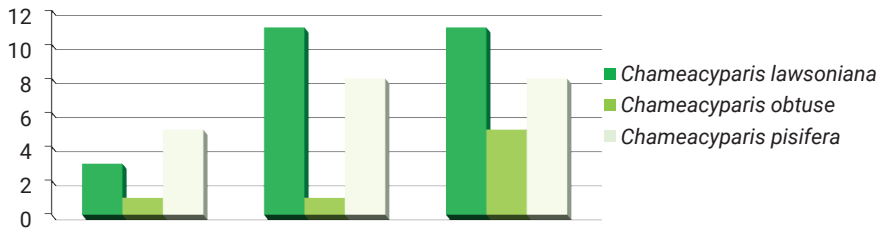

Figure 7. Distribution of cultivars in the collections of botanical gardens of Kyiv
Source: developed by the authors

According to the results of our research, it has been established that today in Kyiv, three species of the genus *Chamaecyparis* Spach are growing: *Chamaecyparis pisifera*, *Chamaecyparis obtusa*, and *Chamaecyparis lawsoniana*, as well as 37 cultivars. The largest number of taxa was recorded in *Chamaecyparis lawsoniana* – 18 cultivars, the smallest in *Chamaecyparis obtusa* – 6 cultivars, and *Chamaecyparis pisifera* is represented by 13 cultivars (Fig. 8).

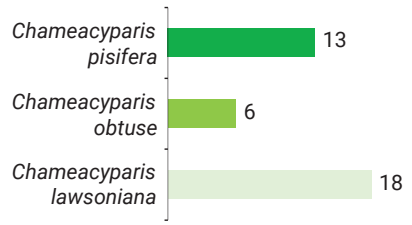

Figure 8. Total number of cultivars present in the research collections
Source: developed by the authors

Below is a brief description of the biological and morphometric characteristics of the original species, with Tables 2-4 providing details of the cultivars observed during the research.

Chamaecyparis lawsoniana – a tree up to 50, sometimes 70 m tall, with a beautiful narrow conical crown and dark green scaly foliage. The bark of the trunk is dark brown, longitudinally cracked. The bark of the annual shoots is green. The leaves are small, dark green on top and grayish beneath, arranged densely on the shoot in a single plane. The top of the tree is often bent sideways. The microstrobiles are dark purple, small, 4-4 mm long. Mature megastrobiles are brown, rounded, 7-10 mm in diameter. The seeds are winged, 4-5 mm wide. It has been cultivated in Ukraine since 1811 and is widely grown in botanical gardens. It grows quickly, but its early years are slow. It reproduces early. Native habitat: California, Oregon (Table 2).

Table 2. Brief characteristics of cultivars of *Chamaecyparis lawsoniana*

Cultivar	Short description
'Alumii'	Tree with a narrow, cone-shaped crown, up to 10 m in height. Branches initially grow at a sharp angle to the trunk but gradually become horizontal with age. Dense crown, foliage is bluish-gray.
'Blue Surprise'	Similar to *Ch.l.* Ellwoodii, but more compact with a narrow pyramidal shape.Needle-like foliage (semi-juvenile) with a rich bluish-silver hue.
'Columnaris'	Tree 5 to 10 m tall, with a narrow columnar crown form, dense. Branches grow straight and at a sharp angle to the trunk. The last-order shoots are thin and flat, with foliage pressed against the branches and a bluish-silver color.
'Chilworth Silver'	Similar to *Ch.l.* 'Ellwoodii', grows slowly, with a straight and dense crown. Foliage is bluish-gray.
'Fletcheri'	Columnar form, up to 8 m tall, sometimes with multiple trunks. Crown formed by upward-growing branches, dense. Foliage is bluish-green, semi-juvenile, and juvenile.
'Fraseri'	Tree of typical size, up to 10 m tall, with thick branches forming a dense, narrow conical crown. Foliage has a bluish tint.
'Ellwoodii'	Tree up to 5 m tall, with a cone-shaped crown (up to 1 m wide). Branches are densely arranged and grow at a sharp angle from the trunk. Juvenile foliage, bluish-green.
'Ellwoodii Gold'	Mutation of the original form, with golden-colored shoots of the latest order and foliage. Compact columnar crown.
'Glauca'	Tree of typical size and crown form, but with bluish-green or grayish foliage.
'Glauca Globus'	Globular form similar to *Ch.l. 'Globus'*, but with slightly bluer foliage. Bush size is 1-1.5 m in diameter, with short, thin shoots and drooping tips.
'Globosa'	Globe-shaped, wide crown. Branches directed upwards, with short, thick shoots that are slightly curved at the tips. Foliage is bright green.
'Lombartsii'	Columnar tree up to 10 m tall. Branches and shoots are branched. Foliage is multi-colored: golden-yellow above, yellowish-green below, which turns bluish with age, and darker in winter.
'Lutea'	Columnar tree up to 10-12 m tall, grows slowly, with a narrow crown. Shoots are yellowish. Foliage is short, bright yellow, darkens in winter.
'Nana Albospica'	Dwarf form, reaching 0.7-0.8 m in 10 years. Young shoots and foliage are short and white, forming a conical crown. With age, foliage turns pale green.
'Monumental'	Columnar tree up to 10 m tall. Shoots are bluish with reddish tips. Foliage is bluish-clear reddish.
'Rogersii'	Pyramidal tree up to 2 m tall, with rounded top. Foliage is thread-like, shiny, with a blue tint. Similar in color to *Ch.l. 'Allumii'*, but less intense.
'Stewartii'	Pyramidal form up to 10 m tall. Crown width up to 3 m, with branches growing at a sharp angle to the trunk. Foliage is golden-yellow.

Table 2, Continued

Cultivar	Short description
'Triomf von Boskoop'	Pyramidal tree up to 15 m tall, dense crown with branches growing at a sharp angle. Branch tips and shoots droop. Foliage is blue-green, turning silver-gray with age.

Source: developed by the authors based on A.C. Fiordi & E. Maugini (1977), D.B. Zobel & G.M. Hawk (1980), A. Nagao *et al*. (2019), J.H. Kitzmiller & R.A. Sniezko (2021)

Chamaecyparis obtusa – a tree up to 30 m in height, with a dense, broad, conical crown shape. The bark of the trunk is reddish-brown, smooth, while the bark of one-year-old shoots is bright green. The leaves are scale-like, blunt, tightly pressed to the shoot, and light green in color. The microstrobili are thick, slightly elongated. The mature megastrobili are spherical, up to 1 cm in diameter. The seeds are small with narrow wings. The natural range is in the mountains of Japan (at altitudes of 600-1500 m above sea level). Cultivated in Ukraine since 1878, though found in only a few botanical gardens (Table 3).

Table 3. Brief characteristics of cultivars of *Chamaecyparis obtusa*

Cultivar	Short description
'Aurea'	Pyramidal form reaching up to 5 meters in height. The branches have a yellow tint, and the foliage is golden-yellow.
'Coralliformis'	A low, slow-growing shrub-like form with a rounded or spreading crown, up to 0.5 meters in height. The foliage is arranged in thread-like clusters that are twisted. The foliage is bluish-green.
'Crippsii'	A pyramidal form with a wide base, of medium size. The tips of the branches are bright golden-yellow, turning yellowish-green over time.
'Nana Aurea'	A bush-like form reaching up to 2 meters in height, characterised by yellowish light-green foliage.
'Nana Gracilis'	A low, spreading, slow-growing form (up to 2 meters), reaching 0.6-0.7 meters in 10 years. The crown is pyramidal with a wide base. The foliage is beautiful, glossy, light green, arranged in shell-like clusters.
'Tsatsumi Gold'	A shrub-like form reaching up to 1 meter in height, with an irregular crown and golden-colored foliage.

Source: developed by the authors based on J.A. Hart & R.A. Price (1990), Y. Osone et al. (2020), D.B. Kang (2021), H. Kato-Noguchi *et al*. (2024)

Chameacyparis pisifera – a tree reaching up to 30 meters in height, with a broadly conical, airy crown. The bark of the trunk is reddish-brown or dark brown, longitudinally cracked even in young trees. The bark of one-year-old shoots is yellow-green, and of two-year-old shoots is light brown. The foliage is dark green on top and whitish underneath, arranged in a single plane on the shoots. The microstrobili are small, somewhat elongated, about 2 mm long. During the pollen maturation, the megastrobili are green, small, nearly spherical, up to 3 mm in diameter. Mature megastrobili are numerous, small, on short pedicels, spherical, 6-8 mm in diameter, yellowish-brown or dark brown, and mature in the first year. The seed scales are 8-10 (12), soft, non-woody, thin, stretched in width, concave at maturity, wrinkled at the top, slightly pointed, with notched edges. Seeds are 1-2 per scale; the wing is thin, transparent, very wide, with 5-6 resin glands on each side. Natural range: Japan. Grows primarily on moist soils. It grows well and reproduces abundantly (Table 4).

Table 4. Brief characteristics of cultivars of *Chamaecyparis pisifera*

Cultivar	Short description
'Aurea'	Typical habit, yellow-golden branches and foliage, which becomes yellowish-green with age or in shade.
'Aurea Nana'	Similar to the previous cultivar, but shorter and more compact.
'Boulevard'	Medium-sized tree (about 5 m in height and 3 m in crown diameter). The crown is pyramidal with a regular shape.
'Sungold'	Compact, similar to *Ch.p.* 'Filifera Aurea'. Reaches 1.5 m in 10 years.
'Squarrosa Sulphurea'	Similar to *Ch.p.* 'Squarrosa', but of medium size (reaches about 1 m in height and 0.7 m in crown width in 10 years). The crown is dense and conical.
'Squarrosa Minima'	Similar to *Ch.p.* 'Squarrosa', but with more compact dimensions.
'Squarrosa Dumosa'	Bushy, compact form reaching 1.5-2 m in height. The crown is dense with short branches. The foliage is grayish-green, changing to a bronze tint in winter.
'Squarrosa'	Wide-pyramidal dense crown with drooping branch tips. Juvenile blue-gray foliage.
'Plumosa Aurea'	Tree up to 12 m tall with a conical crown about 3 m wide. The foliage is matte yellow-golden, and young shoots are light yellow.
'Plumosa'	ree of typical size with a pyramidal crown. The shoots are compressed and threadlike. The foliage is semi-juvenile, transitional, longer and larger than the typical type, green in color, with a bronze tint in winter.
'Filifera'	Widely pyramidal form with a wide base crown, about 5 m tall. The distinguishing feature is the threadlike shoots of the last order and gray-green foliage.
'Filifera Nana'	Similar to *Ch. pisifera* 'Filifera', about 1 m in height.
'Filifera Aurea'	Widely pyramidal tree, reaching 0.9-1.0 m in height in 10 years. The branches and foliage are yellow-golden, drooping in a threadlike manner.

Source: developed by the authors based on C.F. Li *et al*. (2015), A. Nagao *et al*. (2019)

Of the five existing species of the *Chamaecyparis* Spach genus, three species are cultivated in the conditions of Kyiv. *Chamaecyparis formosensis* Matsum. and *Chamaecyparis thyoides* (L.) Britton, Sterns & Poggenb have not yet been encountered in any of the collections. The known number of cultivars worldwide exceeds several hundred. Based on this, the potential for incorporating new taxa into the collections has significant prospects.

Botanical gardens are central to plant introduction. The role of their collection plantings, especially at universities, is crucial, providing an indispensable foundation for students' practical training and specialised education. Beyond their educational function, plant collections, like other urban green spaces, are vital for ensuring the sustainable development of modern cities, promoting the stability and ecological efficiency of green infrastructure in anthropogenic environments. Over years of operation, these gardens have amassed unique plant collections, accumulated cultivation expertise, and explored prospects for introducing or breeding new varieties. Notably, Japan, the homeland of *Chamaecyparis obtusa* and *Chamaecyparis pisifera*, holds deep cultural and gardening traditions for these plants. Many traditional Japanese gardens feature ancient specimens and diverse forms of false cypress. In a foundational study by D. Hoshino *et al.* (2001), the authors investigated the age, size structure, and spatial distribution of dominant tree species in an old-growth *Chamaecyparis* obtusa forest in central Japan. Their findings highlighted the ecological significance and longevity of these trees, as well as their ability to form stable forest communities over centuries. These results underline the importance of long-term conservation and structured spatial planning when cultivating *Chamaecyparis* taxa in managed environments such as botanical gardens.

Limited attention has been given to studying the taxonomic composition of collections and the intraspecific diversity of the genus *Chamaecyparis* in Ukrainian botanical collections. A thorough study on *Chamaecyparis* representatives under introduction conditions in Ukraine was conducted by T.A. Reshetnyak (1980), who listed 51 cultivars. This work focused on the systematics, geographic distribution, and ecological-biological features of *Chamaecyparis*, outlining its introduction potential and proposing practical applications for landscape use. T.A. Reshetnyak provided one of the earliest structured overviews of cultivar diversity in the Ukrainian context. S.I. Kuznetsov (2015), in his work on the phenofund of *Pinophyta* in Ukraine at the beginning of the 21st century, noted that the number of cultivars and forms had reached 64 taxa by 2015. His analysis marked an important update in the taxonomic structure and composition of dendrological collections, tracking changes in assortment dynamics and highlighting the expansion trends across institutional plantings during the post-Soviet period. Research by N.S. Boiko (2023) on Ukrainian dendrological collections indicated the presence of 3 species of the genus *Chamaecyparis* and 110 cultivars, specifically: *Chamaecyparis lawsoniana* (62 cultivars), *Chamaecyparis obtusa* (15 cultivars), and *Chamaecyparis pisifera* (33 cultivars). This work provided a systematised inventory of gymnosperm accessions across leading Ukrainian botanical institutions, with a focus on taxonomic verification, cultivar diversity, and the institutional challenges of maintaining large-scale living collections. The author highlighted Kyiv's botanical centres as the most complete and dynamically developing, due to their established research infrastructure and ongoing accessioning of new decorative forms. These figures demonstrate a continuous increase in the assortment and quantity of plants in the collections of Kyiv's botanical institutions.

The latest published inventory of the botanical garden collection at the National University of Life and Environmental Sciences of Ukraine indicates that as of 2010, 9 cultivars and 2 species (*Chamaecyparis pisifera* and *Chamaecyparis lawsoniana*) were recorded by O.V. Kolesnichenko *et al.* (2010). The catalog compiled by O.V. Kolesnichenko *et al.* systematised the dendrological diversity of the garden and highlighted the stable presence of *Chamaecyparis* taxa within the broader arboreal collection. The work served as a reference point for tracking long-term changes in species composition and maintenance practices. Current research conducted in 2025 revealed that the quantitative indicators of cultivars and species on the garden's territory remained unchanged, though many young plants were observed being planted to maintain the collection in satisfactory condition. An analysis of the published catalog of the O.V. Fomin Botanical Garden collection at Taras Shevchenko National University of Kyiv by Z.H. Boniuk & R.M. Palagechi (2023) indicated the presence of 3 species and 20 cultivars in the collection, which aligns with the results of our surveys in 2025. The guidebook-reference edited by Z.H. Boniuk & R.M. Palagechi provided a detailed overview of the taxonomic diversity and distribution of woody plants within the garden, offering structured data on the introduction history, ecological preferences, and decorative characteristics of *Chamaecyparis* taxa. The inclusion of cultivar-specific information enabled direct comparison with current field observations and confirmed the long-term stability of the collection.

In the catalog of the M.M. Gryshko National Botanical Garden's collection, N. Kokhno (1987) noted that in 1987, 2 species and 18 taxa grew on the garden's territory, primarily in the arboretum and on the "Vydubychi Slope" section Subsequent research has determined that with the gradual development and opening

of new expositional and botanical-ethnographic sections, such as "Decorative Forms of Woody Plants" and "Japanese Garden", the collection has significantly expanded. As of 2025, it comprises 3 species and 24 cultivars. In addition to *Chamaecyparis pisifera* and *Chamaecyparis lawsoniana*, specimens of *Chamaecyparis obtusa* have appeared in the collection, and 6 new cultivars have been added. Traditionally, *Chamaecyparis* representatives in Ukraine are considered less frost-resistant. However, based on observations and experience from maintaining collection plantings in botanical institutions from 2022-2025, the primary limiting factor is considered to be their demand for moisture regimes, particularly air humidity. In total, 41 cultivars have been described in the study of Kyiv's collection plantings, whereas N.S. Boiko (2023) indicated that over 100 cultivars are cultivated in Ukraine. The studied collection plantings feature cultivars of various habits, colors, and needle types, with a significant proportion of plants over 50 years old, demonstrating their high adaptive capacity to local climatic conditions.

Due to their high decorative qualities and diverse morphometric characteristics, species and cultivars of the genus *Chamaecyparis* can be widely used in creating landscape compositions. Globally, *Chamaecyparis* representatives are widely cultivated. As noted, Japan stands out as the homeland of *Chamaecyparis obtusa* and *Chamaecyparis pisifera*, where these plants have deep cultural and gardening traditions. In Europe, *Chamaecyparis* were introduced and also became very popular in ornamental horticulture, and extensive collections exist (Cedro *et al*., 2021). In the plantings of Kyiv's botanical gardens, group plantings, solitaires, alley plantings, and topiary forms are encountered. Although cultivars are in highest demand, *Chamaecyparis lawsoniana* and *Chamaecyparis pisifera* are the most widespread species in plantings. Representatives of the genus *Chamaecyparis* have gained widespread distribution in ornamental horticulture. Ukrainian researchers S.I. Kuznetsov *et al.* (2020) have repeatedly highlighted the possibilities for their extensive use in Kyiv's greening efforts, particularly in their 2020 work on selecting tree, shrub, and liana assortments for landscape construction in Ukraine. Enriching the taxonomic composition of ornamental plantings with new decorative plant species and forms is one of the important ways to improve the state of urban greening. The results of many years of testing introduced plants demonstrate the possibility of expanding the plant assortment for modern landscape construction.

The conducted research confirmed the stable presence and diversity of *Chamaecyparis* taxa within the *ex situ* collections of Kyiv's leading botanical institutions. A comprehensive analysis of current inventories, archival sources, and field data made it possible to determine not only the taxonomic composition and representation of species and cultivars but also to assess their adaptive responses under local urban conditions. The evaluation revealed both long-term successful specimens and those showing signs of stress, particularly under climate-induced extremes such as the 2024 summer heatwave. The comparative review of collections across the three gardens demonstrated significant interinstitutional variability in species composition, age structure, and cultivar diversity, yet collectively they present a substantial foundation for future introduction and selection programmes. The observed vitality, longevity, and decorative traits of numerous specimens confirm their potential suitability for broader application in urban landscaping. These findings reinforce the role of botanical gardens as both centres of ornamental plant conservation and active contributors to sustainable green infrastructure development in metropolitan environments.

Conclusions

During the course of the scientific research, the taxonomic composition of the collection of species and cultivars of the *Chamaecyparis* Spach genus in the botanical gardens of Kyiv was analysed. It was determined that the largest collection is housed in the M.M. Gryshko National Botanical Garden, where *Chamaecyparis pisifera* Sieb. et Zucc. is represented with 8 cultivars, *Chamaecyparis obtusa* Sieb. et Zucc. with 5 cultivars, and *Chamaecyparis lawsoniana* Parl. with 11 cultivars. In total, 37 cultivars were found in the botanical collections of Kyiv, with the highest number of taxa noted in *Chamaecyparis lawsoniana* – 18 cultivars, the lowest in *Chamaecyparis obtusa* – 16 cultivars, and *Chamaecyparis pisifera* represented by 13 cultivars. These data may slightly vary due to a number of objective reasons, such as the addition of new cultivars to the collection, plant losses, etc. A brief description of the morphometric and biological characteristics encountered during the research is provided. The intraspecific diversity of the *Chamaecyparis* Spach genus is vast, with a wide variety of cultivars, both with a typical habitus of the original species and with dwarf, compact crown sizes. The cultivars also vary in type, color, and seasonal coloration of the foliage.

Although the species of the *Chamaecyparis* Spach genus have relatively small natural ranges, due to their characteristics, particularly their ornamental qualities, they have gained widespread use in ornamental horticulture. The large intraspecific diversity of *Chamaecyparis* Spach species worldwide means that only a relatively small portion of the total number of cultivars has been collected in the botanical institutions, so there is enormous potential for the addition of new taxa. Further expansion and enrichment of the collections, including the introduction of new taxa, remains an important objective. In the future, based on continued observations and analysis of the plant condition within these collections, it will be possible to identify the most promising cultivars for widespread use in urban landscaping, selection of species suitable for container planting, and assessment of their potential for shaping topiary forms.

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Conflict of Interest

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Представники роду *Chamaecyparis* Spach у колекціях ботанічних садів міста Києва

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Анотація. Представники роду *Chamaecyparis* Spach, попри обмежене використання в озелененні Києва через уявну примхливість, активно представлені в ботанічних колекціях міста та цінуються завдяки різноманіттю культиварів із декоративними ознаками. Метою досліджень була оцінка існуючого різноманіття видів та культиварів в колекціях ботанічних установ м. Київ. Проаналізовано колекційний фонд представників роду *Chamaecyparis* Spach у Національному ботанічному саду (НБС) імені М.М. Гришка НАН України, ботанічному саду імені академіка О.В. Фоміна Київського національного університету імені Тараса Шевченка та ботанічному саду Національного університету біоресурсів і природокористування України. Визначено, що найбільша колекція зібрана в НБС імені М.М. Гришка, де представлені *Chameacyparis pisifera* (Siebold & Zucc.) Endl. та 8 культиварів, *Chameacyparis obtuse* (Siebold & Zucc.) Endl. та 5 культиварів, *Chameacyparis lawsoniana* (A. Murray bis) Parl. та 11 культиварів. Загалом в ботанічних колекціях м. Києва виявлено 37 культиварів, зокрема найбільша кількість таксонів відмічена у *Chameacyparis lawsoniana* – 18 культиварів, найменша – *Chameacyparis obtuse* – 16 культиварів, *Chameacyparis pisifera* представлений 13 культиварами. Подано стислу характеристику видів та культиварів, що представлені в колекціях, описаний сучасний стан колекційних насаджень та розглянуто перспективи поповнення колекцій новими таксонами. Встановлено, що колекційні насадження дозволяють аналізувати рівень адаптації культиварів до місцевих кліматичних умов, репрезентують різновікові екземпляри та їх фізіологічний стан залежно від віку, походження та умов догляду. Асортимент рослин наявних в колекціях, зокрема віком понад 50 років, свідчив про достатню стійкість більшості культиварів та видових рослин до несприятливих чинників та можуть бути більш широко використані для озеленення в міських умовах. Результати дослідження можна використати для розширення асортименту декоративних хвойних рослин у міському озелененні шляхом впровадження перспективних культиварів *Chamaecyparis* Spach, адаптованих до умов Києва

Ключові слова: вид; культивар; асортимент; хвоїні рослини; коніферетум; дендрарій