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RESEARCH ARTICLE

Hemerophytes of the State Dendrological Park "Trostianets" of the NAS of Ukraine (Chernihiv Oblast, Ukraine): history of plantation formation, current state of acclimatization and naturalization, and distribution of invasive plants

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Abstract

This study analyzes the acclimatization and naturalization processes of hemerophytes in the State Dendrological Park "Trostianets" of the National Academy of Sciences of Ukraine (Chernihiv Oblast, Ukraine). The research focuses on the systematic and ecological assessment of 151 alien plant species that were introduced to the park for cultivation. The study reveals that 72 species have escaped from the cultivation area and are actively naturalizing within the park's spontaneous flora, while 79 species remain within managed plantations. Due to active naturalization, in the spontaneous flora on the park's territory, among 123 wild alien plants, the majority (58.5 %) are ergasiophygophytes. Among ergasiophygophytes, woody plants predominate (73.6 %).

The systematic composition of naturalized species indicates dominance of eudicots (125 species), followed by gymnosperms (18 species) and monocots (seven species). Woody plants, including trees, shrubs, and lianas (the total share is 82.1 %) demonstrate the highest potential for long-term acclimatization and further expansion beyond cultivated areas. By geographical origin, the largest number of acclimatized hemerophytes originates from North America (34.4 %), Asia (24.5 %), and the regions of the Ancient Mediterranean (20.6 %). The research highlights 16 invasive species, with 12 already forming spontaneous populations in the park. Among them, *Acer negundo, Parthenocissus inserta, Robinia pseudoacacia, Quercus rubra,* and *Fraxinus pennsylvanica* are actively spreading, forming dense populations within and beyond the park boundaries. Potentially invasive taxa, such as *Ailanthus altissima*, also demonstrate the ability to establish self-sustaining populations. The spread of certain species, particularly woody lianas like *Clematis vitalba* and *Vitis riparia*, suggests a high potential for ecological transformation of local habitats.

Keywords: alien plants, inventory, naturalization, spontaneous flora, plant introduction, historic parks

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Introduction

The State Dendrological Park "Trostianets" of the National Academy of Sciences of Ukraine (shortened – Dendrological Park "Trostianets") is the largest park in Left-Bank Ukraine. It was founded in the first half of the 19th century as a plantation in the magnate residence of I.M. Skoropadskyi, a descendant of a hetman family (Kochubey, 1888; Klymenko, 1999; Iljenko, 2004; Tarabun & Medvedyev, 2021). Currently, it is a part of the Ichnianskyi National Nature Park (Zhyhalenko & Andriyenko, 2012). The history of the formation of many historic parks, including the Dendrological Park "Trostianets", has endured periods of prosperity and decline for a long time. Today, the park's ancient trees have exceptional value, while during the park's creation, plants were introduced as exotic decorations and a source of pride for landowners. Nowadays, the taxonomic composition of historic park plantations is the subject of floristic and dendrological studies (Kokhno, 2002; Khodosovtsev et al., 2019; Boiko, 2023).

The acclimatization and naturalization of hemerophytes (intentionally introduced alien plants) are among the main tasks of practical botanical science (Klymenko, 2012; Rakhmetov & Zaimenko, 2022; Zaimenko & Rakhmetov, 2022). However, a downside of this process is the escape of many ergasiophygophytes and their subsequent spread beyond the initial introduction sites, with the most naturalized alien plants becoming invasive (Nagodă et al., 2014; Protopopova & Shevera, 2019). This underscores the importance of studying the spontaneous flora of such areas (Galera & Sudnik-Wójcikowska, 2004; Bomanowska et al., 2012; Protopopova & Shevera, 2014; Burda & Koniakin, 2019). Monitoring the acclimatization and naturalization of hemerophytes in historic parks is a relevant task, considering the irreversible processes of climate change (Rakhmetov & Zaimenko, 2022) and the importance of monitoring biodiversity in significant conservation areas.

The aim of the study was: (a) to summarize information on the history of plantation formation in the Dendrological Park "Trostianets"; (b) to study the state of acclimatization and naturalization of alien cultivated plants; (c) to assess their invasive activity in relation to the spontaneous flora.

Material and methods

Territorial features

The State Dendrological Park "Trostianets" of the National Academy of Sciences of Ukraine is located in the southeastern part of Chernihiv Oblast, in the Trostianets village, Parafiivka community, Pryluky district. The park's main entrance coordinates are 50.786272° N, 32.812757° E. The park currently covers a 204.7 ha area. Over 190 ha represent historic and other plantations, while the rest includes nurseries, fields, and residential areas (Fig. 1). Today, the Dendrological Park "Trostianets" is one of the largest centers for plant introduction, acclimatization, and conservation in the Left-Bank Forest-Steppe zone of Ukraine.

Research matter

The subject of this research was to summarize information on the acclimatization and naturalization of hemerophytes — intentionally introduced alien plants cultivated within the Dendrological Park "Trostianets" (Holub & Jirásek, 1967; Pyšek et al., 2004). Hemerophytes are categorized based on their habitat into ergasiophytes (cultivated plants intentionally planted in the park's plantations; in Ukrainian literature, the term 'introducents' is widely applied to characterize this group – Rakhmetov et al., 2004; Iljenko & Medvedev, 2012; Zaimenko & Rakhmetov, 2022) and ergasiophygophytes (escapees from cultivation that have spontaneously established in new habitats – Naegeli & Thellung, 1905; Pyšek et al., 2004). This study focused on acclimatized ergasiophytes – cultivated plants that have achieved complete acclimatization, meaning they reproduce by self-seeding or vegetatively in their cultivation sites (Kokhno, 1983). The objective was to determine what proportion of ergasiophytes in the park's plantations had achieved complete acclimatization, and, among them, which had expanded beyond cultivation and begun to naturalize. The processes of acclimatization and naturalization of hemerophytes were considered as a continuous spectrum. Acclimatization is regarded as the adaptation of a plant or species to environmental conditions within cultivation, whereas naturalization is the process of a species adapting to spontaneous

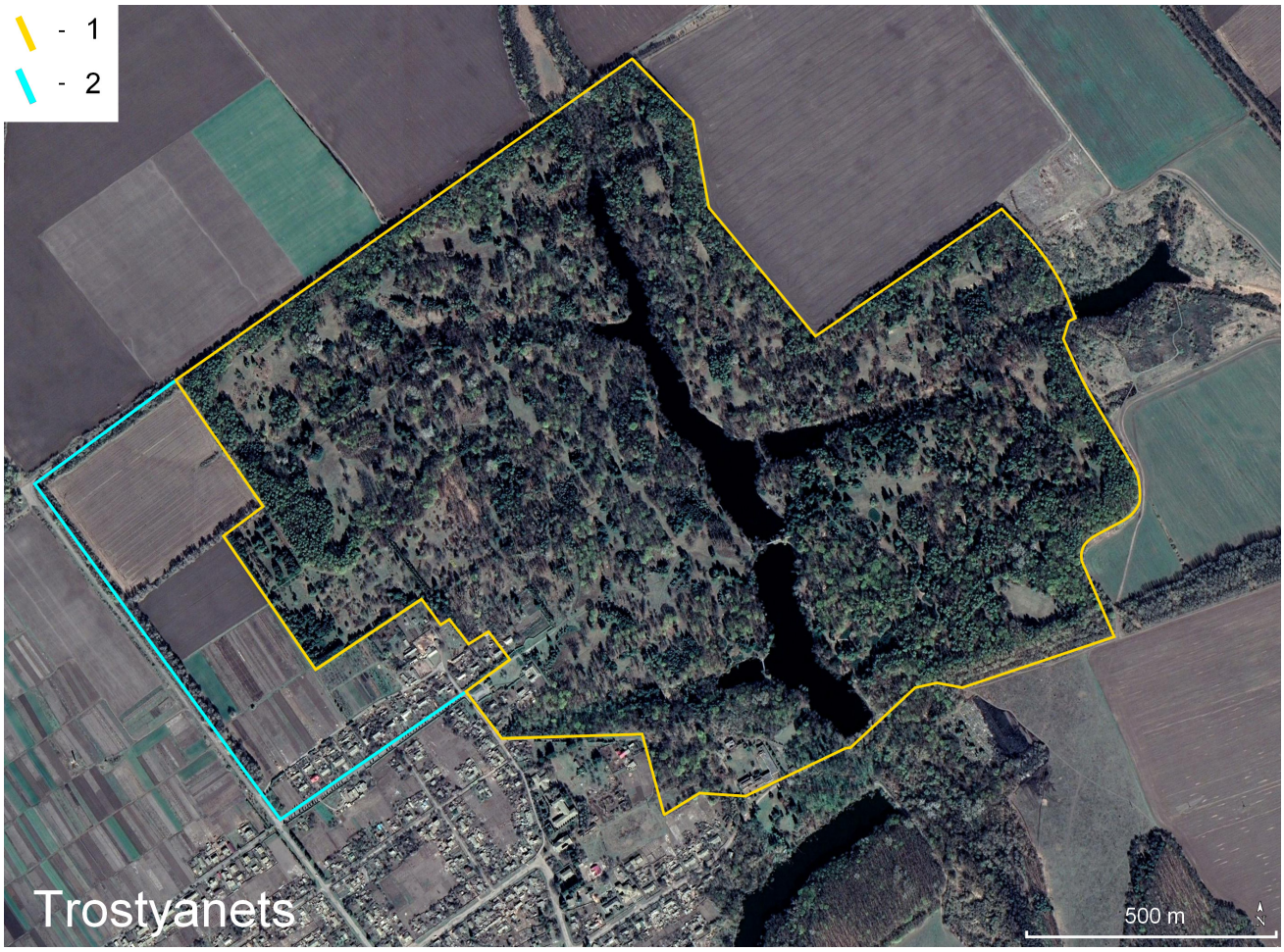

Figure 1. Map of the Dendrological Park "Trostianets": **1** – main park area; **2** – nurseries, fields and residential development.

growth conditions in a given area (Richardson et al., 2000). If naturalization is considered as an alien species overcoming successive limiting barriers (as suggested in the scheme by Richardson et al., 2000), acclimatization can be considered a process parallel to the initial stages of naturalization under controlled cultivation conditions (we will explore this issue in more detail in another publication). Since the objects of this study were hemerophytes cultivated in the Dendrological Park "Trostianets", all of them are ergasiophytes, and those plants that have escaped cultivation additionally belong to the category of ergasiophygophytes. The differentiation between ergasiophygophytes and acclimatized ergasiophytes was conducted based on prior research experience (Shynder, 2019a; Chorna et al., 2021). Invasive plants were identified following Protopopova & Shevera (2019). Species naturalized in Ukraine as a result of earlier introductions but arrived at the studied area spontaneously (i.e., xeno-ergasiophytes – Mosyakin & Yavorska, 2002) were not included in this study.

The nomenclature of species applied during this research follows POWO (2025) with minor additions.

Field studies of the vegetation cover were conducted in 2022–2024. The existing archival and literature data (i.e., Misnik, 1962; Nesterenko et al., 2007, 2009, 2010; Iljenko & Medvedev, 2012; Medvedev & Iljenko, 2015) were also analyzed.

Results and discussion

History of the establishment and research of the Dendrological Park "Trostianets"

The foundation of the Dendrological Park "Trostianets" dates back to 1834, when a system of ponds was created by deepening ravines and constructing dams. The central

water body, the Great Pond, is approximately 1.3 km long and nearly 100 m wide at the dam. It divides the park from north to south and serves as its compositional axis. Two smaller ponds, Swan Pond and Kutsykha, were later established nearby.

Around these artificial water bodies, the first tree plantations were established, primarily with large saplings of spruce and poplar. Later, birch, linden, maple, and oak trees sourced from local forests were planted. However, only the specimens planted directly near water survived. These early planting results encouraged the park's founder, Ivan Skoropadskyi, to establish his own nursery, where large-scale propagation of both local and exotic plants began.

By the late 19th century, the Dendrological Park "Trostianets" was actively enriched with exotic species delivered from Kyiv, the Nikita Botanical Garden (Crimea), Paris, and other locations in Ukraine and abroad. Plant acclimatization became a key activity, and introduced species were often grafted onto local rootstocks (Lypa & Stepunin, 1951). Since 1858, the natural flat terrain of the park has transformed into a scenic landscape, with several hills up to 35 meters high being artificially created (Rubtsov, 1949). In 1886, the first inventory of the park's plantations was conducted, and a topographic plan was developed. The park covered 170 ha at that time, with a fully formed landscape, paths, benches, pavilions, sculptures, and small architectural structures. It contained 623 species and cultivars of trees, including 161 coniferous and 462 deciduous species (Kochubey, 1888).

Alongside the park's formation, protective forest plantations were created in the open plains surrounding the park. Various artificial forest belts were established within 2 km of the park, denser on the windward side. These consisted mainly of monospecific stands (e.g., pine, birch, spruce, and oak), though mixed coniferous-deciduous plantations were also present (Iljenko, 2004).

From the late 19th century to the middle of the 20th century, the Dendrological Park "Trostianets" fell into decline. Initially, this was due to the death of Ivan Skoropadskyi in 1887, followed by a long period of sociopolitical upheaval and Russian (Soviet) occupation. From 1918, the park was managed by a local livestock farm, but in 1938, a decree from the Council of People's Commissars of the Ukrainian SSR allocated the main part of the park as an independent economic unit under the Ministry of Agriculture. In 1940, the park was designated a state reserve, and 30 ha of arable land was added for nursery and collection plots (Plevako et al., 1927; Iljenko, 2004; Andriyko & Shulha, 2013).

The decline period negatively affected the park's floristic diversity. By 1948, an inventory revealed only 391 species and cultivars, including 79 conifers and 312 deciduous trees in the Dendrological Park "Trostianets" (Lypa & Stepunin, 1951). However, when the park was transferred to the Academy of Sciences of Ukraine in 1951, it became a research institution focused on plant introduction, acclimatization, restoration of park landscapes, and conservation efforts. In 1960, the park was officially designated a landscape architecture monument, and in 2003, its plant collection was declared an object of national heritage of Ukraine (Andriyko & Shulha, 2013).

Today, Dendrological Park "Trostianets" holds the status of a mid-19th-century landscape park-monument. The latest inventory recorded 880 species and cultivars, including 110 gymnosperms and 770 angiosperms. Of these, 772 taxa are ergasiophytes, while 108 are native plants (Tarabun & Medvedyev, 2021).

In recent decades, studies in the park have focused on the acclimatization of alien woody species, their propagation, evaluation of their economic and ornamental potential, and their practical use in plantations (Misnik, 1962; Mysnyk, 1969; Iljenko & Medvedev, 2008, 2009, 2011). Some ergasiophytes were found unsuitable for local conditions (Iljenko, 2004). Additionally, researchers analyzed the herbaceous vegetation of park meadows and landscapes, recognizing its role in the park's ecosystem (Nesterenko et al., 2007, 2009, 2010).

Modern research focuses on the naturalization of alien plants in the park's plantations, particularly in the context of biological invasions. In plant acclimatization centers, invasive alien trees and native anthropophilic edificators negatively impact the structure and diversity of historic plantations, leading to continuous thinning and reconstruction efforts.

Spontaneous seed reproduction of some alien ergasiophytes has been recorded in the Dendrological Park "Trostianets"; particularly it was registered for 16 coniferous species (Iljenko & Medvedev, 2012; Medvedev & Iljenko, 2015). Some species, such as *Acer negundo* L. and *Parthenocissus inserta* (A.Kern.) Fritsch (former incorrectly applied name – *P. quinquefolia* (L.) Planch.), have expanded beyond the park into adjacent territories (Iljenko & Medvedev, 2012). Newly recorded naturalized species in the Chernihiv Oblast include *Clematis vitalba* L., *Juglans mandshurica* Maxim., and *Vitis riparia* Michx. (Moysiyenko et al., 2023), while *Ampelopsis aconitifolia* Bunge and *Clematis serratifolia* Rehder have been identified as new species for Ukraine (von Raab-Straube & Raus, 2024).

Structure of acclimatized hemerophytes

As a result of the study, 151 acclimatized and naturalized hemerophytes were recorded in the Dendrological Park "Trostianets", including 72 ergasiophygophytes that have spread beyond the park's plantations (Appendix).

Several native species introduced to the Dendrological Park "Trostianets" were excluded from the checklist, as they are not considered hemerophytes, given that the study area falls within their natural ranges (e.g., *Anemone sylvestris* L., *Chamaecytisus ruthenicus* (Fisch. ex Woł.) Klásk.). In addition, an essential forest-forming species, *Carpinus betulus* L., is also found in the Park beyond its natural range (Slobodyan, 1963), but since it is a native plant in the study region (Left-Bank Forest-Steppe), it is also not considered as an object of study. Additionally, four wild-growing hemerophytes (xeno-ergasiophytes) were recorded as external intrusions into the Park: *Ambrosia artemisiifolia* L., *Malva pusilla* Sm., *Triticum aestivum* L., and *Veronica persica* Poir. These species were also excluded from the analysis. The acclimatization of *Styphnolobium japonicum* (L.) Schott (= *Sophora japonica* L.) in the park was mentioned earlier (Mysnyk, 1969), but only the winter hardiness of the plant and the formation of mature seeds, which were specially sown, were written about. Since *S. japonicum* has not been found in a state of spontaneous growth at the moment, it was also not included in the checklist.

Thus, the species in the checklist form a substantial group of plants bridging cultivated and spontaneous floras. Of the 151 hemerophytes studied, all were acclimatized ergasiophytes in the Park's plantations. From this number, 79 remained in this stage, whereas 72 species transitioned beyond cultivation sites, entering the group of ergasiophygophytes and initiating their path to naturalization. Experience shows that most of the highly acclimatized ergasiophytes that form self-renewal in cultivation sites will be registered in spontaneous habitats over time. Meanwhile, ergasiophygophytes (species that have penetrated the spontaneous flora within the study area) continue to thrive in artificial plantations and remain acclimatized ergasiophytes within them. Previously, Iljenko & Medvedev (2012) noted the ability of approximately 80 woody ergasiophytes in the Park to regenerate naturally. At least 19 of these species are now observed in the spontaneous flora. Recent trends indicate that global warming facilitates the acclimatization of many ergasiophytes originating from warmer regions (Rakhmetov & Zaimenko, 2022). For instance, *Ailanthus altissima* (Mill.) Swingle has been cultivated in the Park for a long time, but its first recorded self-seeding occurred only in 2012 (Iljenko & Medvedev, 2012).

Systematically, these hemerophytes belong to 52 genera within 31 families. Among higher taxonomic groups, gymnosperms are represented by 18 species, eudicots by 125 species and subspecies, and monocots by seven species.

The families exhibiting the most remarkable propensity for complete acclimatization were Rosaceae (25 species), Pinaceae (13 species), Fabaceae (11 species), Caprifoliaceae (nine species), and Asteraceae (eight species).

The most frequently acclimatized hemerophytes at the genus level include *Lonicera* L. (seven species and hybrids), *Crataegus* L. (six species), *Acer* L., *Philadelphus* L., and *Picea* A.Dietr. (five species and infraspecific taxa each). These genera and families are generally well-represented in plantations.

Conversely, the systematic diversity of ergasiophygophytes (as a narrower sample) was lower – all belonged to angiosperms (i.e., three monocot and 69 eudicot species). No gymnosperms have yet been identified in the spontaneous flora, although many

Table 1. Biomorphological structure of acclimatized and naturalized hemerophytes in the Dendrological Park "Trostianets".

Life form	Acclimatized hemerophytes		Ergasiophygophytes (spontaneous flora)	
	number of species	%	number of species	%
Trees	60	39.7	26	36.1
Shrubs	51	33.8	17	23.6
Lianas	13	8.6	10	13.9
Herbs	27	17.9	19	26.4
Total	151	100.0	72	100.0

gymnosperm ergasiophytes have achieved high acclimatization levels in the park (Iljenko & Medvedev, 2012). Based on spontaneous flora analyses of various botanical gardens and dendrological parks in the Forest-Steppe zone (Boiko, 2023), including naturalized occurrences of *Abies alba* Mill., *Picea laxa* (Münchh.) Sarg., and *Taxus baccata* L. in gardens and parks of the Middle Dnipro natural region (Shynder et al., 2018a, 2018b; Doiko et al., 2021; Kovtonyuk, 2021; Kolomiychuk & Shynder, 2021; Boiko, 2023), gradual naturalization of some conifers in the Dendrological Park "Trostianets" is anticipated. Notably, the number of acclimatized gymnosperms in the park is among the highest recorded in lowland Ukraine for botanical gardens and parks (Boiko, 2023).

Among acclimatized ergasiophytes that remained in cultivation, 67 species exhibited seed or both seed and vegetative regeneration, and 12 species relied solely on vegetative reproduction (e.g., *Actinidia kolomikta* (Maxim.) Maxim., *Rhus typhina* L., *Zanthoxylum americanum* Mill., and several *Juniperus* L. and *Rosa* L. species).

In contrast, nearly all ergasiophygophytes spread via seed dispersal, which enabled their naturalization. Partial vegetative reproduction contributed to the expansion of certain lianas, particularly *Parthenocissus inserta* (A.Kern.) Fritsch (Iljenko & Medvedev, 2012). Based on our findings, only *Lonicera caprifolium* L. seems to propagate exclusively through vegetative means. Consequently, we propose adjusting the introduction classification system by Kokhno (1983) – considering vegetatively propagating, stable ergasiophytes as conditionally acclimatized ergasiophytes.

Woody plants dominate the acclimatized hemerophytes, comprising 82.1% of all species (Table 1). This reflects the park's emphasis on tree species in acclimatization research, whereas herbaceous plants were out of primary focus.

The acclimatized hemerophytes exhibit diverse geographic origins, though nearly all are from temperate Holarctic regions, with only a few originating from Central and South America (e.g., ephemeral *Ipomoea purpurea* (L.) Roth) and subtropical Asia and Mediterranian regions (*Ailanthus altissima*, *Ampelopsis glandulosa* (Wall.) Momiy., and *Cercis siliquastrum* L.). In general, the introduced flora of the park is dominated by ergasiophytes from North America, Asia, and the regions of the Ancient Sub-Mediterranean. Notably, the geographical distribution of ergasiophytophytes is proportionally quite consistent with the indicators of the entire group (Table 2).

The predominance of plants of American origin among acclimatized hemerophytes is a consequence of similar natural and climatic conditions in the natural range of such plants – these are mainly temperate regions of North America. The massive introduction and adaptive capacity of alien plants of North American origin in Ukraine (and Europe in general), which carries the threat of phytopollution, is a well-known fact (Burda & Tokhtar, 1998; Korzhan & Chorhej, 2010; Nemertsalov et al., 2016). At the same time, the acclimatization and naturalization of plants from more southern regions than the study area (the Mediterranean and various parts of Asia) is a modern consequence of global warming (Rakhmetov & Zaimenko, 2022). A typical example of the impact of changing

Table 2. Geographical structure of acclimatized and naturalized hemerophytes in the Dendrological Park "Trostianets".

Origin	Acclimatized hemerophytes		Ergasiophygophytes (spontaneous flora)	
	number of species	%	number of species	%
American	52	34.4	26	36.1
Asian	37	24.5	17	23.6
Mediterranean	31	20.6	14	19.4
European	13	8.6	7	9.8
Anthropogenic	11	7.3	6	8.3
Eurasian	7	4.6	2	2.8
Total	151	100.0	72	100.0

natural conditions in the dendrological park is the wilding of *Ailanthus altissima*, a plant of Chinese origin (Iljenko & Medvedev, 2012) due to a significant extension of the growing season and an increase in the sum of active temperatures. Therefore, the current trend is a gradual increase in the proportion of acclimatized thermophilic hemerophytes.

Naturalization and invasions of ergasiophytophytes

A critical objective of this study was assessing the impact of plant acclimatization on the spontaneous flora of the Dendrological Park "Trostianets". According to the research results, the spontaneous flora of the park comprises 423 species and subspecies of wild plants from 73 families, including 300 native plants (70.9%) and 123 alien plants (29.1%). A more detailed examination of their diversity will be conducted in a separate publication. The ergasiophygophyte group comprises 72 taxa from 49 genera and 30 families, representing 58.5% of all alien plants within the spontaneous flora and 17.0% of all wild plant species in the Dendrological Park "Trostianets". Such a high proportion of escapees from cultivation is characteristic of spontaneous floras of botanical gardens and parks (Shynder, 2019b).

By contrast, the proportion of cultivated plant escapees in urban floras is usually lower. For example, within the Kyiv metropolitan flora, 46.5% of alien species were identified as ergasiophygophytes (Mosyakin & Yavorska, 2002).

The group of escapee plants in the park's territory results from long-term acclimatization efforts primarily focused on introducing and testing woody species, which now dominate (73.6%) among ergasiophygophytes. Among trees, the highest number of ergasiophygophytes (seven species) was recorded in the Rosaceae family, as well as in the genera *Juglans* L. (four species), and *Acer* (three species). Species such as *Acer negundo* and *Juglans mandshurica* (Iljenko & Medvedev, 2012; Moysiyenko et al., 2023) have been identified outside the park, in adjacent shelterbelts and fallow fields. However, the actual number of these species may be higher. There are grounds to believe that *Celtis occidentalis* L., *Crataegus submollis* Sarg., *Fraxinus pennsylvanica* Marshall, *Juglans cinerea* L., *J. regia* L., *Morus alba* L., *Prunus cerasifera* Ehrh., and *Tilia platyphyllos* Scop. have also spread from the park plantations to surrounding areas. However, since most of these woody ergasiophytes are widely cultivated, determining their exact source in spontaneous growth is often difficult.

Among shrubs and lianas, the most significant number of species belong to the genus *Lonicera* (six species) and the families Caprifoliaceae (six species), and Vitaceae (five species). Several of these plants have spread beyond multiple sections of the park and even beyond its boundaries, including *Parthenocissus vitacea* (A.Kern.) Fritsch (Iljenko & Medvedev, 2012), *Ampelopsis aconitifolia*, *Clematis serratifolia*, *C. vitalba*, and *Vitis riparia* (Moysiyenko et al., 2024; von Raab-Straube & Raus, 2024). This list demonstrates that woody lianas are particularly active and prone to naturalization. Several other widely cultivated species have also spread beyond the

park's limits, including *Amorpha fruticosa* L., *Cornus sanguinea* L. subsp. *australis* (C.A.Mey.) Jáv., *Ligustrum vulgare* L., *Lonicera tatarica* L., and *Ptelea trifoliata* L.

Among herbaceous plants, 19 species have been identified as ergasiophygophytes within the park's spontaneous flora, having escaped from ornamental plantings, flower beds, and other designed compositions. Most of these herbaceous escapees were initially planted in the park to enrich understory vegetation or create decorative compositions (e.g., *Alkekengi officinarum* Moench and *Telekia speciosa* (Schreb.) Baumg.). However, others (including *Allium altissimum* Regel, *Aquilegia vulgaris* L., *Heliopsis helianthoides* (L.) Sweet, *Myosotis sylvatica* Ehrh. ex Hoffm., *Solidago canadensis* L., various *Symphyotrichum* Nees species, and *Viola hissarica* Juz.) originated from flower beds. A few species, such as *Arrhenatherum elatius* (L.) P.Beauv. ex J.Presl & C.Presl and *Medicago sativa* L., spread from grass seed mixtures. Ornamental grasses are typically an integral part of park plantings (Sydoruk, 1970; Glukhova et al., 2016a, 2016b), which facilitates their spontaneous spread and naturalization, particularly in botanical gardens (Kucherevskiy & Shol, 2011; Kolomiychuk & Shynder, 2021; Shynder, 2019a; Didenko & Shynder, 2023). In botanical gardens and dendrological parks with extensive herbaceous plant collections and active acclimatization programs, the number of wild herbaceous ergasiophygophytes can reach several dozen species (Kuzemko et al., 2011; Chorna et al., 2021). However, in the Dendrological Park "Trostianets", herbaceous plants were out of priority focus for introduction and acclimatization research, so their proportion is relatively low.

Among the studied hemerophytes, 16 species belong to the list of highly invasive plant species of Ukraine (Protopopova & Shevera, 2019), but only 12 species have already established wild populations within the park, with varying degrees of distribution. Some species, including *Ailanthus altissima*, *Amelanchier* × *spicata* (Lam.) K.Koch, *Fraxinus ornus* L., and *Ulmus pumila* L., have not yet spread beyond their primary introduction sites but have demonstrated a capacity for seed regeneration, making their spontaneous expansion across the park highly likely. Among other invasive perennials, *Arrhenatherum elatius*, *Lupinus polyphyllus* Lindl., and *Solidago canadensis* dominate meadow vegetation and open areas, while *Rudbeckia laciniata* L. remains a localized colonizer along a single riverbank. Woody invasive species, including *Acer negundo*, *Amorpha fruticosa*, *Fraxinus pennsylvanica*, *Prunus serotina* Ehrh., *Parthenocissus inserta* (A.Kern.) Fritsch, *Quercus rubra* L., *Robinia pseudoacacia* L., and *Salix* × *fragilis* L., are widely distributed throughout the park, often forming dense populations that negatively impact tree plantations. However, this list does not fully encompass all problematic species within the park. Several other ergasiophygophytes with potential invasive tendencies have been identified, such as *Celastrus orbiculatus* Thunb., *Clematis vitalba*, *Lonicera caprifolium*, and *Vitis* L. species. Future research should focus on assessing their invasive potential.

Some naturalized invasive and potentially invasive ergasiophygophytes have also begun spreading beyond the park boundaries, although their expansion is limited by the fact that the surrounding landscape consists mainly of agricultural land, which hinders their establishment. However, certain species benefit from long-distance dispersal mechanisms, such as bird dispersal (e.g., wild fruit-bearing plants) or wind dispersal (e.g., *Clematis* L. species). Additionally, some alien plants, such as *Allium* L. and *Viola* L. species, are dispersed by local residents, which can facilitate their further naturalization.

It is crucial to note invasively active hemerophytes native to other regions of Ukraine. These include *Arrhenatherum elatius*, *Cornus sanguinea* subsp. *australis*, *Ligustrum vulgare*, *Sambucus racemosa* L., *Telekia speciosa*, *Tilia platyphyllos* subsp. *cordifolia* (Besser) C.K.Schneid., and others. Their naturalization within the park and subsequent expansion beyond its borders confirm that highly competitive and ecologically active species can become invasive when introduced outside their native range, even within the same country.

Overall, the observed trends demonstrate a progressive decline in species numbers along the introduction–naturalization–invasion continuum (Richardson et al., 2000). Of the 880 woody ergasiophytes cultivated in the Dendrological Park "Trostianets" (Tarabun & Medvedev, 2021), approximately 670 are alien

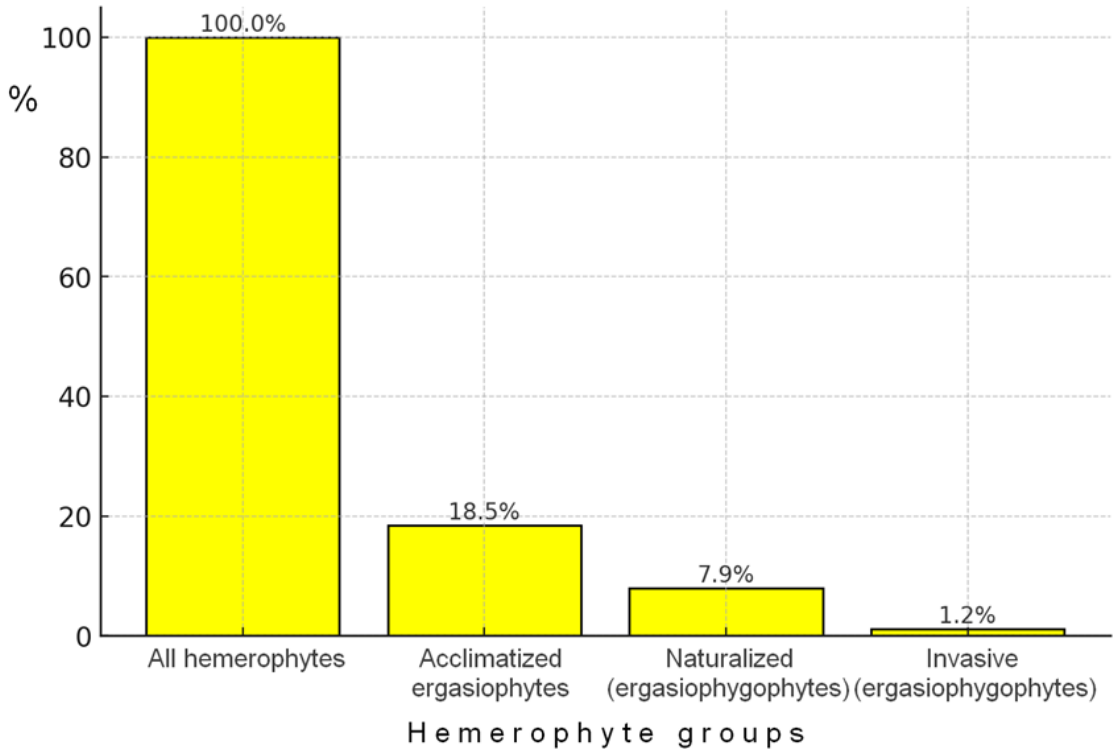

Figure 2. Distribution of hemerophytes in the Dendrological Park "Trostianets" regarding acclimatization and naturalization degrees.

species. According to preliminary results, only 124 species and subspecies have reached high acclimatization levels. However, this number may be underestimated, as the actual number of fully acclimatized ergasiophytes is likely much higher. A long-term systematic monitoring program is required to document these processes accurately. Currently, 53 woody ergasiophygophytes have successfully entered the spontaneous flora, while eight species have become invasive. The distribution of these plant groups (Fig. 2) aligns with ecological principles describing the stepwise decline in species numbers along naturalization gradients (Williamson, 1993; Williamson & Fitter, 1996). The graph also suggests that the number of acclimatized ergasiophytes in the park is likely underestimated, emphasizing the need for further research.

Based on these findings, we predict that number of ergasiophytes with high degrees of acclimatization and naturalization will continue to increase: (1) newly introduced ergasiophytes will achieve high acclimatization levels, forming self-sustaining populations; (2) currently acclimatized ergasiophytes will gradually disperse beyond their original planting sites due to seed bank accumulation; (3) ergasiophygophytes will undergo further naturalization; (4) with some of the most ecologically active species exhibiting invasive tendencies.

This process is usually expected to be gradual, reflecting long-term adaptation and stepwise expansion. However, climate aridization trends will likely accelerate these processes, particularly for hemerophytes from warmer regions. Conversely, certain gymnosperms from boreal climates may struggle to naturalize under changing climatic conditions in the Dendrological Park "Trostianets".

A significant proportion of ergasiophygophytes in the Dendrological Park "Trostianets" is typical for the spontaneous floras in botanical gardens and parks across Ukraine. Many of these species thrive in forested and humid areas, including *Alcea rosea* L., *Berberis aquifolium* Pursh, *Cotoneaster acutifolius* Turcz., *Lonicera tatarica*, *Lupinus polyphyllus*, *Morus alba*, and *Quercus rubra* (Gavrylenko et al., 2008; Kucherevskiy & Shol, 2011; Kuzemko et al., 2011; Protopopova & Shevera, 2014; Galkin & Doiko, 2015; Shynder, 2019a; Kucher et al., 2023). However, a considerable proportion of

the spontaneous flora in the Dendrological Park "Trostianets" consists of relatively rare ergasiophygophytes, such as *Corylus colurna* L., *Gymnocladus dioicus* (L.) K.Koch, *Lonicera caprifolium*, *L. ruprechtiana* Regel, *Philadelphus coronarius* L., and *Phytolacca acinosa* Roxb. These species have been recorded in only a few locations in Ukraine (Shynder, 2019a, 2022; Shynder et al., 2020; Mosyakin & Mosyakin, 2021; Koniakin & Gubar, 2022; Moysiyenko et al., 2024; Chorna, 2020). Additionally, due to the park's high taxonomic richness, some escapee species have only been recorded in isolated locations from Ukraine, including *Allium altissimum*, *Lonicera maackii* (Rupr.) Maxim., *Menispermum dauricum* DC., *Philadelphus pubescens* Loisel., and *Vitis amurensis* Rupr. (Galkin & Doiko, 2015; Shynder, 2019a; Chorna et al., 2021; Orlov et al., 2022; Shynder et al., 2024).

Notably, many acclimatized woody ergasiophytes (including *Ampelopsis glandulosa*, *Diervilla lonicera* Mill., *Picea laxa*, *Pterocarya fraxinifolia* (Poir.) Spach, *Sorbaria kirilowii* (Regel) Maxim., *Tilia americana* L. var. *neglecta* (Spach) Fosberg, *Zanthoxylum americanum*, and others) represented in the Dendrological Park "Trostianets" are rare even in scientific collections across Ukraine. The successful acclimatization and naturalization of these underrepresented species highlight the unique value of Dendrological Park "Trostianets" as a long-term research center for plant introduction and conservation in the Left-Bank Forest-Steppe zone of Ukraine.

Conclusions

Thus, a general overview of the history of the establishment and research of the plantations in the Dendrological Park "Trostianets" has been provided. Today, the Dendrological Park "Trostianets" is one of the largest botanical institutions specializing in acclimating ergasiophytes in Left-Bank Ukraine. As a result of the study, 151 acclimatized ergasiophytes were identified within the park's territory. Among them, 79 species reproduce locally only within the sites where they were initially planted, while 72 species have transitioned into ergasiophygophytes, initiating the naturalization process. The most successful acclimatization was observed among species from the Rosaceae, Pinaceae, Fabaceae, Caprifoliaceae, and Asteraceae families. Most ergasiophygophytes (73.6%) are woody plants, which aligns with the overall focus of the park on tree cultivation. The current trend is a gradual increase in the proportion of acclimatized plants originating from more southern regions compared to the location of the study area, primarily the Mediterranean and Asian regions. A total of 16 invasive species were identified, 12 of which have already established wild populations, while some (e.g., *Ailanthus altissima*) demonstrate potential invasive activity. Further monitoring is required to track new stages of naturalization, assess the impact of climate change on acclimatization processes, and control the spread of potentially hazardous invasive species.

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Appendix. Annotated checklist of acclimatized and naturalized hemerophytes in the State Dendrological Park "Trostianets" of the NAS of Ukraine.

Designations:
Cult. – exclusively cultivated plant (ergasiophyte).
accl. – acclimatization degree:
high. – highly acclimatized;
cond. high. (veg.) – conditionally high (vegetative self-regeneration).
Spont. – spontaneously spreading plant, a culture escape (ergasiophygophyte).
Orig. – geographical origin of the hemerophyte:
Am – America;
As – Asia;
Euras – Eurasia;
Euro – Europe;
EuroMed – Euro–Mediterranean;
Med – Mediterranean;
antr. – anthropogenic origin.
underlined names – highly invasive species of Ukrainian flora following Protopopova & Shevera (2019).

Gymnospermae

Cupressaceae
1. *Juniperus pseudosabina* Fisch. & C.A.Mey. – Cult., accl.: cond. high. (veg.). – Orig.: As
2. *Juniperus sabina* L. – Cult., accl.: cond. high. (veg.). – Orig.: Med
3. *Thuja occidentalis* L. – Cult., accl.: high. – Orig.: Am
4. *Thuja plicata* Donn ex D.Don. – Cult., accl.: high. – Orig.: Am

Pinaceae
5. *Abies alba* Mill. – Cult., accl.: high. – Orig.: Euro
6. *Abies balsamea* (L.) Mill. – Cult., accl.: high. – Orig.: Am
7. *Abies concolor* (Gordon & Glend.) Lindl. ex Hildebr. – Cult., accl.: high. – Orig.: Am
8. *Abies nordmanniana* (Steven) Spach. – Cult., accl.: high. – Orig.: Med
9. *Larix decidua* Mill. – Cult., accl.: high. – Orig.: Euro
10. *Picea abies* (L.) H.Karst. . – Cult., accl.: high. – Orig.: Euro
11. *Picea jezoensis* (Siebold & Zucc.) Carrière. – Cult., accl.: high. – Orig.: As
12. *Picea laxa* (Münchh.) Sarg.(= *P. canadensis* (Mill.) Britton). – Cult., accl.: high. – Orig.: Am
13. *Picea obovata* Ledeb. – Cult., accl.: high. – Orig.: Euras
14. *Picea omorika* (Pančić) Purk. – Cult., accl.: high. – Orig.: Med
15. *Pinus peuce* Griseb. – Cult., accl.: high. – Orig.: Med
16. *Pinus strobus* L. – Cult., accl.: high. – Orig.: Am
17. *Pseudotsuga menziesii* (Mirb.) Franco. – Cult., accl.: high. – Orig.: Am

Taxaceae
18. *Taxus baccata* L. – Cult., accl.: high. – Orig.: EuroMed

Angiospermae

Monocots

Amaryllidaceae
19. *Allium altissimum* Regel. – Spont. – Orig.: As
20. *Allium cristophii* Trautv. – Cult., accl.: high. – Orig.: As
21. *Allium rosenorum* R.M.Fritsch. – Cult., accl.: high. – Orig.: As

Asparagaceae
22. *Ornithogalum umbellatum* L. – Cult., accl.: high. – Orig.: Euro

Iridaceae
23. *Iris* × *germanica* L. – Cult., accl.: high. – Orig.: Euro

Liliaceae
24. *Tulipa* × *hybrida* hort. – Spont. – Orig.: antr.

Poaceae
25. *Arrhenatherum elatius* (L.) P.Beauv. ex J.Presl & C.Presl. – Spont. – Orig.: EuroMed

Eudicots

Actinidiaceae
26. *Actinidia kolomikta* (Maxim.) Maxim. – Cult., accl.: cond. high. (veg.). – Orig.: As

Anacardiaceae
27. *Cotinus coggygria* Scop. – Cult., accl.: high. – Orig.: Med
28. *Rhus typhina* L. – Cult., accl.: cond. high. (veg.). – Orig.: Am
29. *Toxicodendron rydbergii* (Small ex Rydb.) Greene. – Cult., accl.: high. – Orig.: Am

Asteraceae
30. *Heliopsis helianthoides* (L.) Sweet var. scabra (Dunal) Fernald (= *H. scabra* Dunal). – Spont. – Orig.: Am
31. *Petasites hybridus* (L.) G.Gaertn., B.Mey. & Scherb. – Cult., accl.: cond. high. (veg.). – Orig.: EuroMed
32. *Rudbeckia hirta* L. – Spont. – Orig.: Am
33. *Rudbeckia laciniata* L. – Spont. – Orig.: Am
34. *Solidago canadensis* L. – Spont. – Orig.: Am
35. *Symphyotrichum novi-belgii* (L.) G.L.Nesom. – Spont. – Orig.: Am
36. *Symphyotrichum* × *versicolor* (Willd.) G.L.Nesom. – Spont. – Orig.: antr.
37. *Telekia speciosa* (Schreb.) Baumg. – Spont. – Orig.: Med

Berberidaceae
38. *Berberis aquifolium* Pursh. – Spont. – Orig.: Am

Betulaceae
39. *Corylus colurna* L. – Spont. – Orig.: Med

Bignoniaceae
40. *Catalpa bignonioides* Walter. – Cult., accl.: high. – Orig.: Am
41. *Catalpa* × *erubescens* Carrière. – Cult., accl.: high. – Orig.: antr.

Boraginaceae
42. *Myosotis sylvatica* Ehrh. ex Hoffm. – Spont. – Orig.: Euras

Cannabaceae
43. *Celtis occidentalis* L. – Spont. – Orig.: Am

Caprifoliaceae
44. *Diervilla lonicera* Mill. – Cult., accl.: high. – Orig.: Am
45. *Lonicera caprifolium* L. – Spont. – Orig.: Med
46. *Lonicera caucasica* Pall. – Spont. – Orig.: As
47. *Lonicera maackii* (Rupr.) Maxim. – Spont. – Orig.: As
48. *Lonicera* × *notha* Zabel. – Spont. – Orig.: antr.
49. *Lonicera ruprechtiana* Regel. – Spont. – Orig.: As
50. *Lonicera tatarica* L. – Spont. – Orig.: Euras
51. *Lonicera xylosteum* L. – Cult., accl.: high. – Orig.: Euras
52. *Symphoricarpos albus* (L.) S.F.Blake. – Cult., accl.: cond. high. (veg.). – Orig.: Am

Celastraceae
53. *Celastrus orbiculatus* Thunb. – Spont. – Orig.: As

Convolvulaceae
54. *Ipomoea purpurea* (L.) Roth. – Spont. – Orig.: Am

Cornaceae
55. *Cornus sanguinea* L. subsp. *australis* (C.A.Mey.) Jáv. (= *Swida australis* (C.A.Mey.) Pojark. ex Grossh.). – Spont. – Orig.: Med

Fabaceae
56. *Amorpha fruticosa* L. – Spont. – Orig.: Am
57. *Caragana arborescens* Lam. – Spont. – Orig.: As
58. *Cercis siliquastrum* L. – Cult., accl.: high. – Orig.: Med
59. *Cladrastis kentukea* (Dum.Cours.) Rudd. – Cult., accl.: high. – Orig.: Am
60. *Colutea arborescens* L. – Cult., accl.: high. – Orig.: Med
61. *Gleditsia triacanthos* L. – Spont. – Orig.: Am
62. *Gymnocladus dioicus* (L.) K.Koch. – Spont. – Orig.: Am
63. *Laburnum anagyroides* Medik. – Cult., accl.: high. – Orig.: Med
64. *Lupinus polyphyllus* Lindl. – Spont. – Orig.: Am
65. *Medicago sativa* L. – Spont. – Orig.: Med
66. *Robinia pseudoacacia* L. – Spont. – Orig.: Am

Fagaceae
67. *Quercus castaneifolia* C.A.Mey. – Cult., accl.: high. – Orig.: Med
68. *Quercus rubra* L. – Spont. – Orig.: Am

Grossulariaceae
69. *Ribes alpinum* L. – Cult., accl.: high. – Orig.: EuroMed
70. *Ribes oxyacanthoides* L. – Cult., accl.: high. – Orig.: Am

Hydrangeaceae
71. *Deutzia* × *hybrida* hort. – Cult., accl.: high. – Orig.: antr.
72. *Hydrangea arborescens* L. – Cult., accl.: high. – Orig.: Am
73. *Philadelphus coronarius* L. – Spont. – Orig.: Med
74. *Philadelphus coronarius* × *Philadelphus* sp. – Cult., accl.: high. – Orig.: Med
75. *Philadelphus* × *hybrida* hort. – Spont. – Orig.: antr.
76. *Philadelphus* × *nivalis* Jacques. – Cult., accl.: high. – Orig.: antr.
77. *Philadelphus pubescens* Loisel. – Spont. – Orig.: Am

Juglandaceae
78. *Juglans cinerea* L. – Spont. – Orig.: Am
79. *Juglans mandshurica* Maxim. – Spont. – Orig.: As
80. *Juglans nigra* L. – Spont. – Orig.: Am
81. *Juglans regia* L. – Spont. – Orig.: Med
82. *Pterocarya fraxinifolia* (Poir.) Spach (= *P. pterocarpa* (Michx.) Delchev.). – Cult., accl.: high. – Orig.: Med

Magnoliaceae
83. *Liriodendron tulipifera* L. – Cult., accl.: high. – Orig.: Am

Malvaceae
84. *Alcea rosea* L. – Spont. – Orig.: Med
85. *Tilia americana* L. var. *neglecta* (Spach) Fosberg. – Cult., accl.: high. – Orig.: Am
86. *Tilia* × *europaea* L. – Spont. – Orig.: Euro
87. *Tilia platyphyllos* Scop. subsp. *cordifolia* (Besser) C.K.Schneid. – Spont. – Orig.: Euro

Menispermaceae
88. *Menispermum dauricum* DC. – Spont. – Orig.: As

Moraceae
89. *Morus alba* L. – Spont. – Orig.: As

Oleaceae
90. *Forsythia* × *intermedia* Zabel. – Cult., accl.: cond. high. (veg.). – Orig.: antr.
91. *Forsythia suspensa* (Thunb.) Vahl. – Cult., accl.: cond. high. (veg.). – Orig.: As

92. *Fraxinus ornus* L. – Cult., accl.: high. – Orig.: Med
93. *Fraxinus pennsylvanica* Marshall var. *lanceolata* (Borkh.) Sarg. – Spont. – Orig.: Am
94. *Ligustrum vulgare* L. – Spont. – Orig.: Med
95. *Syringa vulgaris* L. – Spont. – Orig.: Med

Paeoniaceae
96. *Paeonia lactiflora* Pall. – Cult., accl.: high. – Orig.: As

Phyllanthaceae
97. *Flueggea suffruticosa* (Pall.) Baill. – Cult., accl.: cond. high. (veg.). – Orig.: As

Phytolaccaceae
98. *Phytolacca acinosa* Roxb. – Spont. – Orig.: As

Polemoniaceae
99. *Phlox paniculata* L. – Cult., accl.: high. – Orig.: Am

Ranunculaceae
100. *Aquilegia vulgaris* L. – Spont. – Orig.: Euro
101. *Clematis serratifolia* Rehder. – Spont. – Orig.: As
102. *Clematis vitalba* L. – Spont. – Orig.: Med

Rosaceae
103. *Amelanchier* × *spicata* (Lam.) K.Koch. – Cult., accl.: high. – Orig.: antr.
104. *Chaenomeles japonica* (Thunb.) Lindl. ex Spach. – Cult., accl.: high. – Orig.: As
105. *Cotoneaster acutifolius* Turcz. (= *C. lucidus* Schltdl.). – Spont. – Orig.: As
106. *Crataegus crus-galli* L. – Cult., accl.: high. – Orig.: Am
107. *Crataegus horrida* Medik. – Cult., accl.: high. – Orig.: Am
108. *Crataegus macracantha* (Lindl.) Lodd. ex Loudon. – Cult., accl.: high. – Orig.: Am
109. *Crataegus meyeri* Pojark. (= C. ucrainica Pojark.). – Cult., accl.: high. – Orig.: EuroMed
110. *Crataegus sanguinea* Pall. – Spont. – Orig.: Med
111. *Crataegus submollis* Sarg. – Spont. – Orig.: Am
112. *Hedlundia hybrida* (L.) Sennikov & Kurtto. – Spont. – Orig.: Euro
113. *Karpatiosorbus latifolia* (Lam.) Sennikov & Kurtto s. l. – Cult., accl.: high. – Orig.: Euro
114. *Malus domestica* (Suckow) Borkh. – Spont. – Orig.: antr.
115. *Physocarpus opulifolius* (L.) Maxim. – Cult., accl.: high. – Orig.: Am
116. *Prunus cerasifera* Ehrh. – Spont. – Orig.: As
117. *Prunus serotina* Ehrh. – Spont. – Orig.: Am
118. *Rosa acicularis* Lindl. – Cult., accl.: cond. high. (veg.). – Orig.: Euras
119. *Rosa spinosissima* L. – Cult., accl.: cond. high. (veg.). – Orig.: Euras
120. *Rubus odoratus* L. – Cult., accl.: cond. high. (veg.). – Orig.: Am
121. *Scandosorbus intermedia* (Ehrh.) Sennikov. – Spont. – Orig.: Euro
122. *Sorbaria kirilowii* (Regel) Maxim. var. *arborea* (C.K.Schneid.) J.H.Song & S.P.Hong (= *S. arborea* C.K.Schneid.). – Cult., accl.: high. – Orig.: As
123. *Sorbaria sorbifolia* (L.) A.Braun. – Cult., accl.: high. – Orig.: As
124. *Spiraea chamaedryfolia* L. – Cult., accl.: high. – Orig.: Euras
125. *Spiraea japonica* L.f. – Cult., accl.: high. – Orig.: As
126. *Spiraea salicifolia* L. – Cult., accl.: high. – Orig.: As
127. *Spiraea sargentiana* Rehder. – Cult., accl.: high. – Orig.: As

Rutaceae
128. *Phellodendron amurense* Rupr. – Cult., accl.: high. – Orig.: As
129. *Ptelea trifoliata* L. – Spont. – Orig.: Am
130. *Zanthoxylum americanum* Mill. – Cult., accl.: cond. high. (veg.). – Orig.: Am

Salicaceae
131. *Salix* × *fragilis* L. (= *S. alba* L. × *S. euxina* I.V.Belyaeva). – Spont. – Orig.: antr.
132. *Salix purpurea* L. – Cult., accl.: high. – Orig.: EuroMed

Sapindaceae
133. *Acer negundo* L. – Spont. – Orig.: Am
134. *Acer pseudoplatanus* L. – Spont. – Orig.: Euro
135. *Acer saccharinum* L. – Spont. – Orig.: Am

136. *Acer tataricum* L. subsp. *ginnala* (Maxim.) Wesm. – Cult., accl.: high. – Orig.: As
137. *Acer tataricum* subsp. *semenovii* (Regel & Herder) A.E.Murray. – Cult., accl.: high. – Orig.: As
138. *Aesculus flava* Sol. – Cult., accl.: high. – Orig.: Am
139. *Aesculus hippocastanum* L. – Spont. – Orig.: Am

Simaroubaceae
140. *Ailanthus altissima* (Mill.) Swingle. – Cult., accl.: high. – Orig.: As

Solanaceae
141. *Alkekengi officinarum* Moench. – Spont. – Orig.: EuroMed

Ulmaceae
142. *Ulmus pumila* L. – Cult., accl.: high. – Orig.: As

Viburnaceae
143. *Sambucus racemosa* L. – Spont. – Orig.: Euro

Violaceae
144. *Viola hissarica* Juz. (~ *V. prionantha* Bunge s. l.). – Spont. – Orig.: As
145. *Viola sororia* Willd. – Cult., accl.: high. – Orig.: Am

Vitaceae
146. *Ampelopsis aconitifolia* Bunge. – Spont. – Orig.: As
147. *Ampelopsis glandulosa* (Wall.) Momiy. var. *brevipedunculata* (Maxim.) Momiy. – Cult., accl.: high. – Orig.: As
148. *Parthenocissus inserta* (A.Kern.) Fritsch. – Spont. – Orig.: Am
149. *Vitis amurensis* Rupr. – Spont. – Orig.: As
150. *Vitis riparia* Michx. . – Spont. – Orig.: Am
151. *Vitis vinifera* L. – Spont. – Orig.: As

Гемерофіти Державного дендрологічного парку “Тростянець” НАН України (Чернігівська область, Україна): історія формування насаджень, сучасний стан акліматизації та натуралізації, поширення інвазійних рослин

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У роботі проаналізовано процеси акліматизації та натуралізації гемерофітів у Державному дендрологічному парку “Тростянець” НАН України (Чернігівська область). Дослідження спрямовані на систематичну та екологічну оцінку 151 акліматизованих інтродуцентів, які використовувалися для культивування у насадженнях парку. За результатами дослідження було встановлено, що 72 ергазіофігофітів поширилися за межі культури та активно натуралізуються в спонтанній флорі парку, тоді як 79 ергазіофітів залишаються рости лише в насадженнях. Завдяки натуралізації у спонтанній флорі на території парку серед 123 дикорослих адвентивних видів рослин більшість (58,5 %) становлять ергазіофігофіти, а серед останніх переважають деревні рослини (73,6 %).

Систематичний склад натуралізованих видів свідчить про домінування дводольних (125 видів), і невелику участь акліматизованих голонасінних (18 видів) і однодольних (7 видів) рослин. Деревні рослини, у тому числі дерева, кущі та ліани (разом 82,1 %), демонструють найвищий потенціал для

стійкої акліматизації та подальшої натуралізації за межі культурних насаджень. За географічним походженням найбільша кількість акліматизованих гемерофітів походить із Північної Америки (34,4 %), Азії (24,5 %) і Давнього Середземномор’я (20,6 %). На території парку виявлено 16 інвазивних видів рослин, 12 з яких поширені спонтанно, а решта – культивуються у насадженнях. Серед них активно розповсюджуються, утворюючи численні популяції в межах парку та за його межами наступні: *Acer negundo, Fraxinus pennsylvanica, Parthenocissus inserta, Quercus rubra* та *Robinia pseudoacacia*. Потенційно інвазивні таксони, такі як *Ailanthus altissima*, також демонструють здатність створювати самопідтримувані популяції. Поширення деяких видів, зокрема деревних ліан *Clematis vitalba* та *Vitis riparia*, свідчить про їх потенційно високу інвазійну здатність, зокрема щодо трансформації насаджень парку.

Ключові слова: чужорідні рослини, інвентаризація, натуралізація, спонтанна флора, інтродукція рослин, історичні парки