DYNAMICS OF SPECIES OF THE GENUS *PRUNUS* IN THE SYLVA ARBORETUM IN GURAHONȚ: ADAPTABILITY, ECOLOGICAL VALUE AND LANDSCAPE ROLE IN GREEN SPACES

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RESEARCH ARTICLE

Abstract

The paper analyzes the diversity, ecological adaptability and landscape value of species of the genus Prunus cultivated in the Sylva Arboretum in Gurahonț (Romania). The study focuses on the ornamental and ecological behavior of the taxa present in the collection, in the context of the climatic and edaphic conditions specific to the western hilly area. The evaluation was carried out through phenological observations, dendrometric measurements and analysis of ornamental characters.

Species identified as present include Prunus cerasifera Ehrh., P. cerasifera var. atropurpurea, P. fruticosa Pall., P. gracilis, P. laurocerasus var. magnolifolia, P. serrulata 'Kiku-Shidare-Zakura', P. virginiana var. melanocarpa and P. brigantina Vill. They demonstrate good acclimatization and provide a significant contribution to the aesthetic and scientific value of the arboretum. The results support the use of species of the genus Prunus in sustainable landscaping and highlight the role of stands as biodiversity conservation centres.

Keywords: Prunus, arboretum, ecological adaptability, biodiversity, landscape value.
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INTRODUCTION

Species included in the genus *Prunus*, when systematically integrated into urban green infrastructure, contribute significantly to increasing biodiversity and improving ecosystem services, by providing habitats for wildlife and enhancing ecological stability. These woody species can facilitate soil rehabilitation and support water retention, playing an important role in adapting cities to climate change. By strategically using *Prunus* species in the urban environment, municipalities can achieve conservation objectives while promoting nature-based solutions that support biodiversity and ecological resilience.

Arboretums are essential structures for the conservation of genetic resources, the study of the ecological behavior of wood species and the promotion of sustainable landscape values (Dosmann, 2012; Culley et al., 2022). They function as living laboratories for testing the acclimatization of species under local conditions, providing scientific support for urban planning and reforestation programs (Dosmann & Schwartz Sax, 2024).

The forestry engineer Eusebiu Ștefan initiated the process of identifying and capitalizing on the old park in the Honțișor Valley, on the territory of Gurahonț commune, laying the foundations of a unique dendrological ensemble between 1965–1990, according to the Park Monograph (Ștefan, 1992) and the document Arboretum Sylva 1983. In Romania, the Sylva Arboretum in Gurahonț (Arad County) stands out for the age, structure and diversity of the species it houses. According to the recent study conducted by Racz et al. (2024), the arboretum has an active area of 4.6 ha, out of an initial area of about 12 ha, the rest being retroceded.

The Sylva Arboretum came into the custody of the University of Oradea in 2003, and since 2015 it has been managed in a university consortium, functioning as a teaching laboratory and applied research center (Budău et al., 2024). In the horticultural and landscape literature, the Sylva Arboretum is considered a representative element of the dendrological heritage of the west of the country, being integrated into the phytogeographical context of the Arad area (Ardelean, 2006).

The genus *Prunus*, belonging to the family Rosaceae, has a wide distribution in the temperate zone of the northern hemisphere and includes more than 400 species of trees and shrubs. Due to their aesthetic value, abundant flowers and high adaptability, numerous species are widely used in the arrangement of green spaces (Rehder, 1947; Bortiri et al., 2001).

The aim of this research is to highlight the adaptability and ecological value of species of the genus *Prunus* cultivated in the Sylva Arboretum, providing an assessment model for the sustainable management of dendrological collections.

MATERIAL AND METHOD

The study was carried out in the Sylva Arboretum in Gurahonț, Arad County, located in the western hilly area of Romania (46°15′ N, 22°20′ E), at altitudes between 165 and 188.7 m. The climate is temperate-humid continental, characterized by an average annual temperature of 10.3°C and average rainfall of about 781 mm/year. The soils are alluvial brown, weakly acidic (pH 5.6–5.7), with a sandy-clay texture and a humus content between 1.4–2.8%, ensuring a balanced water regime and moderate fertility (Racz et al., 2024).

To establish the results, all the specimens of *Prunus* cultivated in the Sylva Arboretum were identified based on the dendrological archive. Field data were collected to verify the presence or absence of these taxa, as well as to assess the main characteristics of existing specimens (height, number of individuals, phytosanitary status). It is mentioned that the evaluations were carried out exclusively in the 19 current plots of the park.

Eight species and varieties of the genus *Prunus were* analyzed, selected on the basis of stable presence in the arboretum and the availability of complete biometric data. Standard dendrometric measurements were made for each specimen, namely the diameter at 1.3 m (DBH) and the total height, according to the methodology described by Pearson (2007).

The average annual temperature is between 8.8°C and 12.2°C, which is considered optimal for the vigorous and healthy growth of many wood species. The same conclusions apply to the analysis on the average minimum and maximum annual temperatures in the studied period, which confirm the stability of a thermal regime favorable to the development of vegetation.

The assessment of the edaphic composition indicates that the soils in the region are predominantly clay-sandy, with a high proportion of particles ranging in size from 0.2 to 1.002 mm, accounting for about 57.2% of the total soil mass. In addition, the soil has a slightly acidic reaction, evidenced by the pH value of 5.65, a level that can influence the biological and chemical processes specific to this type of ecosystem (Budău et al., 2024).

The data were processed by descriptive statistics, being calculated the mean values, medians, standard deviations and extremes (minimum–maximum) for each taxon. These indicators allow the comparative evaluation of the vigor and development of the Prunus species in the pedoclimatic conditions of the arboretum.

The results are presented in Figure 1, which summarizes the main biometric parameters for the species analyzed.

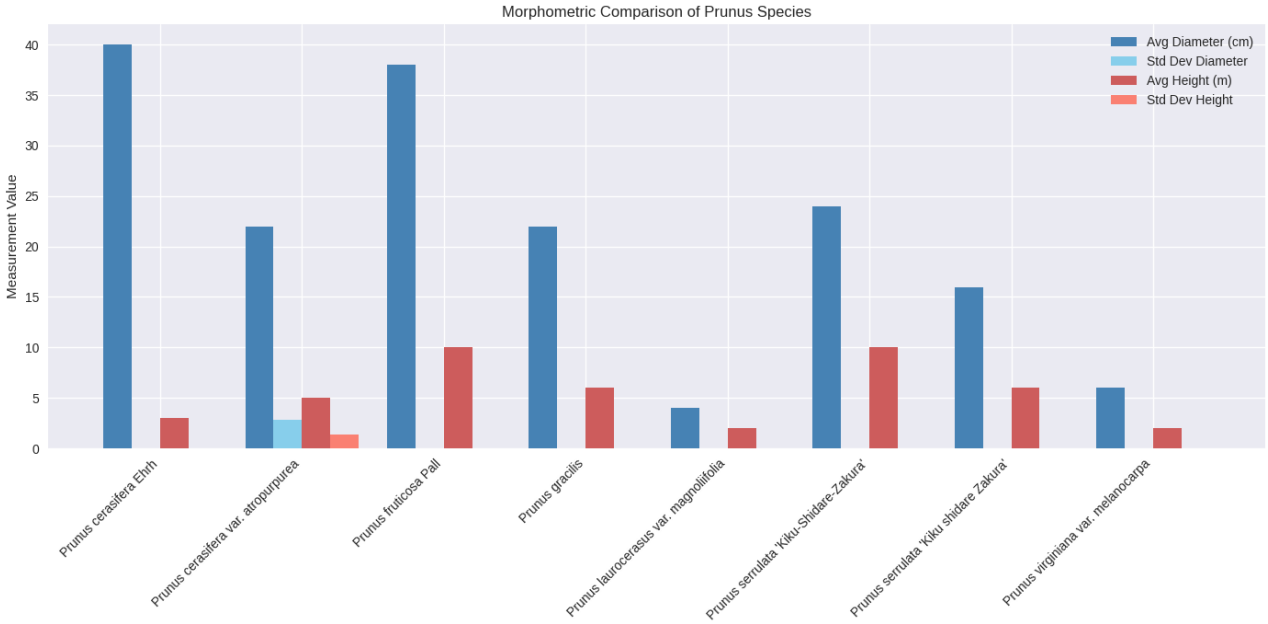

Figure 1. **Descriptive statistics for the genus *Prunus* in Arboretum Sylva**

RESULTS AND DISCUSSIONS

The results obtained confirm the structural diversity of the collection and the adaptive variability of the species of the genus *Prunus* cultivated in the Arad area, where this taxonomic group has a significant ecological and landscape role (Ardelean, 2006). Biometric analysis highlights a pronounced heterogeneity between taxa, characteristic of genera with high ecological plasticity, capable of responding variably to local soil and climatic conditions. The strong positive correlation between diameter and height (r = 0.82) indicates a proportional development, specific to well-acclimatized trees, unaffected by major water or thermal limitations.

Biometric performance of the species analysed

The most vigorous specimens belong to the species *Prunus cerasifera* Ehrh. and P. fruticosa, which reach diameters of 38–40 cm and heights of up to 10 m, reflecting an excellent adaptation to local conditions. In contrast, *P. laurocerasus* and *P. virginiana* var. melanocarpa have small dimensions (4–6 cm diameter; 2 m high), specific to evergreen shrubs adapted to shady microclimates and soils with moderate humidity. P. cerasifera var. atropurpurea stands out for its biometric stability and resistance to pollution, which gives it high ornamental value and potential for use as an indicator species of air quality.

Population declines and ecological filtration

Population structure analysis shows a significant decline of the genus Prunus in the arboretum, with nine extinct taxa (Figure 2). The losses mainly affect exotic or ornamental species, such as *P. triloba, P. serotina, P. incisa, P. mahaleb and P. cerasifera* var. divaricata, which are sensitive to the combined stress generated by prolonged droughts, late frosts and lack of natural regeneration (Racz et al., 2024). Climate modelling confirms that frost episodes after warm periods and rainfall deficit in the growing season reduce the resilience of susceptible species (Hänninen & Tanino, 2011).

Figure 2 clearly illustrates this ecological filtration process: half of the taxa survived, and the other half became extinct, reflecting the cumulative effect of climate stress and uneven management. Lost species exhibit traits associated with vulnerability, such as rapid growth, poorly lignified tissues, and hydraulic conductance sensitive to moisture variations (Charrier et al., 2021).

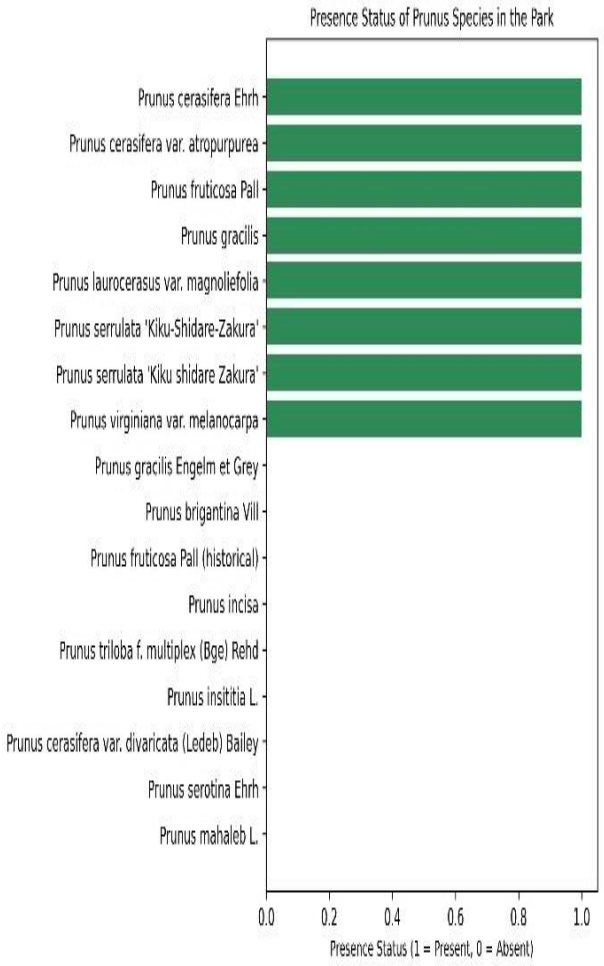

Figure 2. **Distribution of Prunus species according to survival in the Arboretum Sylva**

Ecophysiological mechanisms and adaptability

Surviving species, such as *P. cerasifera* and *P. serrulata*, demonstrate high functional plasticity, efficient stomatal regulation, and morpho-anatomical adaptations that allow recovery after water stress (Petrov et al., 2024). Recent studies on ornamental cherry trees confirm the reduction of photosynthesis and the performance of photosystem II under conditions of water scarcity, useful indicators for establishing the optimal moments of intervention (Jin et al., 2023).

At the ecophysiological level, P. laurocerasus is distinguished by conservative strategies, with leathery leaves and thick cuticles, which reduce sweating but limit growth

in warm periods (Percival & Sheriffs, 2002; Martin et al., 2016). This species is well adapted to shady microclimates but shows sensitivity to compact soils and prolonged exposure to solar radiation.

The decline observed in European collections confirms the vulnerability of the genus *Prunus* to heat and water stress but also highlights its potential for the selection of resistant genotypes (Rodríguez-Robles et al., 2024).

Implications for the management of dendrological collections

To maintain the diversity and stability of the collection, adaptive management is required that includes:

1. introduction of local clones and stress-tolerant hybrids,
2. annual monitoring of morphometric and ecophysiological indicators,
3. ensuring efficient drainage and adjusted irrigation during dry periods,
4. correlation of phenological data with climatic developments for the early identification of moments of vulnerability.

The role of the genus Prunus in urban green infrastructure

The integration of *Prunus* species into a coherently planned green infrastructure contributes to maintaining the continuity of urban and peri-urban habitats (Grabowski et al., 2023). Increasing plant connectivity promotes seed dispersal and wildlife mobility, increasing ecological resilience. At the same time, these species reduce the costs associated with artificial urban climate control and improve air quality, with direct public health benefits (Gallegos Villegas et al., 2023).

By creating shaded areas, *Prunus* contributes to reducing the energy requirement for indoor air conditioning. The multifunctional role of gender is amplified when integrated into a diversified green mosaic capable of simultaneously providing essential ecosystem services: air and water filtration, trophic support and habitat, as well as psychosocial benefits for the community. Contemporary landscape approaches harness this potential in a balanced manner between aesthetic and ecological, contributing to urban resilience and maintaining local biophysical integrity.

CONCLUSIONS

The study on the dynamics of the species of the genus *Prunus* in the Sylva Arboretum highlights a high ecological plasticity, reflected by biometric variability and adaptation differences between the taxa analyzed. In the temperate-humid climatic conditions of the hilly western area, characterized by low-acidic alluvial brown soils and a moderate rainfall regime, the species of *Prunus* showed distinct growth and acclimatization responses.

Vigorous species, such as *Prunus cerasifera* and P. *fruticosa*, have demonstrated proportional development and good resistance to water and heat stress, confirming their adaptability to local conditions. In contrast, sensitive or exotic taxa showed a high rate of decline, indicating a marked vulnerability to prolonged droughts, late frosts, and lack of natural regeneration. The observed ecological filtration, with the loss of half of the original taxa, highlights the cumulative impact of climate stress and uneven management on the collection.

From a landscape perspective, *P. cerasifera* var. atropurpurea and *P. serrulata* remain reference species due to their high ornamental value, biometric stability and contribution to the visual diversity of green spaces. The presence of evergreen species, such as *P. laurocerasus*, emphasizes the role of the genus in improving the microclimate and providing essential ecosystem services.

The results confirm the need for an adaptive management of dendrological collections, based on periodic morphometric and ecophysiological monitoring, the selection of stress-tolerant genotypes and the correlation of phenological data with climatic evolutions. These measures are essential for maintaining the diversity, stability and functionality of the collection in the long term.

Overall, the dynamics of the genus *Prunus* in the Sylva Arboretum reflect an active process of ecological selection, in which adaptable species support the balance of the ecosystem, and sensitive taxa require specific interventions and continuous monitoring. The integration of biometric, climatic and ecophysiological data into conservation and landscape design strategies is a fundamental direction for the development of resilient green spaces in the context of climate change.

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