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CURRENT STATE AND PROSPECTS OF INTRODUCTION OF THE FAMILY *ROSACEAE* JUSS. SPECIES IN THE PRECARPATHIAN REGION

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Abstract: The article examines the current state and prospects for the introduction of shrubs of the *Rosaceae* Juss. family into natural and urbanized ecosystems of the Precarpathian region. The species composition, ecological plasticity, and adaptive potential of representatives from this family are analyzed, which determine their ability to acclimatize and be used in landscaping. The main factors affecting the success of introduction are discussed, including climatic conditions, soil types, and anthropogenic impact. It has been established that the most numerous in the region are the genera *Cerasus* Juss., *Rubus* L., *Rosa* L. and *Spiraea* L., which account for approximately 70% of the total number of registered species of the *Rosaceae* family. Of particular interest are such species: *Spiraea japonica Franch.*, *Rosa rugosa* Thunb. and *Physocarpus opulifolius* L., which demonstrate high decorative value and resistance to adverse environmental factors. The features of the distribution of both indigenous and introduced species, their ability to naturalize, and their potential in forming stable plant communities have been studied. It has been determined that introduced species, particularly *Chaenomeles japonica* Thunb., *Cotoneaster horizontalis* Decne., and *Sorbaria sorbifolia* L., effectively adapt to the conditions of the Precarpathian region, which is due to the similarity of the region's climatic characteristics to their natural habitats. The habitat analysis showed that a significant part of the *Rosaceae* family has a Circumboreal or East Asian origin, which confirms their high adaptive potential. The results of the study provide the foundation for developing effective strategies for introducing ornamental species of *Rosaceae* into the green plantings of the Precarpathian region, which will contribute to the enrichment of biodiversity and the improvement of the ecological condition of the region.

Keywords: plant introduction, *Rosaceae* family, Precarpathian region, adaptation, ornamental plants, landscaping.

1. INTRODUCTION

Plant introduction is an important area of modern botany, ecology, and landscape architecture that plays a significant role in the formation of sustainable ecosystems and increasing biodiversity. In the context of growing urbanization and climate change, an important task is to find and introduce adaptive plant species that can withstand environmental stressors. One of the most promising targets for introduction are species of the *Rosaceae* Juss. family, which are characterized by high decorative value, ecological plasticity, and resistance to adverse conditions.

The Precarpathian region is a region with a wide range of natural and climatic conditions that create favorable conditions for the acclimatization and naturalization of introduced plants. At the same time, the significant transformation of natural landscapes caused by anthropogenic impact requires a reasonable approach to the selection of species that can not only aesthetically enrich the landscape but also perform important ecological functions, including soil stabilization, air purification, microclimate improvement, and creation of a favorable environment for local fauna.

The issue of plant introduction is widely covered in modern research. It is known that the success of acclimatization of new species depends on their ecological plasticity and ability to adapt to the conditions of the new environment. Representatives of the *Rosaceae* family play a significant role in maintaining the biodiversity of urban landscapes due to their ability to quickly naturalize and participate in the formation of sustainable plant communities.

Particular attention is paid to the study of plant adaptation mechanisms in Rogovskyi (2017), which examines the morphological and physiological characteristics of *Rosaceae* representatives that ensure their viability in urban ecosystems. Research by Sliusar (2017) confirms that the resistance of introduced plants to stressors such as drought, pollution, and mechanical damage is a key parameter for their successful naturalization.

In the Carpathian region, special attention is paid to analyzing the impact of introduced species on local ecosystems. Rogovskyi (2019) note that some introduced species can compete with native flora for resources, which makes it necessary to develop scientifically based recommendations for their use in landscaping.

Thus, the literature analysis indicates a significant potential of *Rosaceae* species for use in urban landscapes, but also points to the need for further research on their interaction with local ecosystems to avoid possible environmental risks.

2. RESEARCH OBJECTIVE, METHODOLOGY AND DATA

The purpose of this study is to provide a comprehensive analysis of the status and prospects for the introduction of *Rosaceae* species in the Precarpathian region, as well as to identify the most promising species for their further use in green landscaping (Opalko, 2016).

Research in this area not only improves the state of urban landscaping but also contributes to the preservation of the region's biodiversity. Expanding the species composition of green plantations in urban areas of the Precarpathian region, particularly through the use of shrub plants from the *Rosaceae* family, is a promising task. Most representatives of this family possess high ornamental value, ecological plasticity, and the ability to adapt to various conditions (Sliusar, 2017).

The study of the current state and prospects for the introduction of species of the family *Rosaceae* Juss. in the Precarpathian region was conducted in 2022-2024 in the Ivano-Frankivsk region, in particular in the botanical garden, dendrological parks and natural ecotopes of the region. The main objects of the study were 12 native and 30 introduced species of shrubs of the *Rosaceae* family used in landscaping urban and suburban areas (Kavchuk, 2022). The research methodology included field studies. Route surveys of the research plots were

carried out, during which species were identified, ecotopes of their growth were described, their vital status was determined, and the adaptive potential of plants was analyzed. The phenological phases were recorded in accordance with generally accepted methods of phenological monitoring (Rogovskyi, 2019).

The assessment of decorativeness and environmental sustainability was carried out according to the scales of resistance to air pollution, drought, mechanical damage, and frost resistance. Visual assessments were made on a five-point scale (Dudin, 2021).

The data were processed using the methods of analysis of variance using Statistica 10.0 and Microsoft Excel software.

The obtained results made it possible to assess the prospects of using the introduced *Rosaceae* species in green building of the Precarpathian region and to develop recommendations for their implementation in landscape gardening.

3. RESULTS AND DISCUSSION

In the territory of Ivano-Frankivsk region, which is part of the Precarpathian region of Ukraine, there is a rich diversity of shrub species from the *Rosaceae* family. According to recent studies, approximately 340 shrub species from this family, belonging to 25 genera, have been recorded in the region. A significant portion of these species has been introduced and is cultivated in botanical gardens, arboretums, and used for landscaping in urban areas. The native flora is represented by a smaller number of species, which predominantly grow in natural ecotopes.

Four genera are most richly represented in the Precarpathian region: *Cerasus* Juss., *Rubus* L., *Rosa* L., and *Spiraea* L., which together make up about 70% of all recorded species. Special attention is given to the *Spiraea* genus, which includes over 10 species, such as *Spiraea salicifolia* L., *S. japonica* Franch., and *S. media* L. The high diversity of this genus is attributed to its adaptive properties to the soil and climatic conditions of the Precarpathian region.

Introduced species such as *Chaenomeles japonica*, *Physocarpus opulifolius*, *Cotoneaster horizontalis*, and *Sorbaria sorbifolia* are actively cultivated in parks, squares, and private plots. Their successful adaptation to local conditions is due to the similarity of the climatic characteristics of the Precarpathian region to the natural ranges of these plants.

The forest edges and anthropogenically disturbed ecotopes of the Precarpathian region are home to many native species, such as *Rosa canina* L., *R. majalis* Herrm., *Rubus idaeus* L., and *Prunus spinosa* L. These species play an important role in the formation of natural communities and the preservation of the region's biodiversity. For example, *Rosa majalis* is common in light mixed forests and at forest edges, where it helps to strengthen slopes and is an important honey plant.

Among the introduced species, *Aronia melanocarpa* Michx., *Rubus odoratus* L., and *Physocarpus opulifolius* L. stand out, having successfully naturalized in the conditions of the Precarpathian region. These species are commonly found near abandoned estates, in park plantings and along roadsides. Their spread contributes to enhancing the ornamental value of landscapes and the formation of resilient plant communities.

According to arealogical analysis, most shrub species of the *Rosaceae* family found in the Precarpathian region originate from the Holarctic floristic kingdom. In particular, the Circumboreal floristic region is represented by species such as *Rosa canina*, *Rubus caesius*, *Spiraea salicifolia*, and *Amelanchier ovalis* Medic. A significant portion consists of East Asian species (*Chaenomeles japonica*, *Kerria japonica* L., *Spiraea japonica*), which have well adapted to local conditions due to the similarity of the Precarpathian climate with that of Northeastern China and Japan.

Introduced shrub species of the *Rosaceae* family are widely used for landscaping in Ivano-Frankivsk and other settlements of the Precarpathian region. Decorative forms, such

as *Physocarpus opulifolius* with multicolored leaves, *Chaenomeles japonica* with bright flowers, and *Cotoneaster horizontalis* with ornamental berries, are of particular interest. Their use enables the creation of aesthetically appealing landscape compositions adapted to local conditions.

The analysis of the Precarpathian flora has shown that introduced species of the *Rosaceae* family play an important role in shaping the region's landscapes. They not only enhance the aesthetic appeal of green areas but also contribute to the enrichment of biodiversity. Native species, in turn, are a vital component of natural ecosystems and deserve further study and conservation. In view of this, it is recommended to continue studying the introduction of new species and their impact on the local flora, as well as to develop measures for the conservation of natural communities in the Precarpathian region.

The regional distribution of species shows that 35% originate from the Circumboreal region, 30% from East Asia, 20% from the Mediterranean, and the remainder from North America. A significant portion of species demonstrates the ability to naturalize, particularly *Rosa rugosa* and *Spiraea japonica*, which confirms their high adaptive potential.

Biodiversity Enrichment: The introduction of species from the *Rosaceae* family has increased the floristic richness of the region by 42 species, accounting for 15% of the total species composition of the dendroflora in the Precarpathian region (Kavchuk, 2022) (fig. 1). Adaptive Success: *Rosa rugosa* and *Spiraea japonica* have not only successfully naturalized but have also become key components in many anthropogenically disturbed ecosystems, forming dense thickets that suppress the growth of weeds.

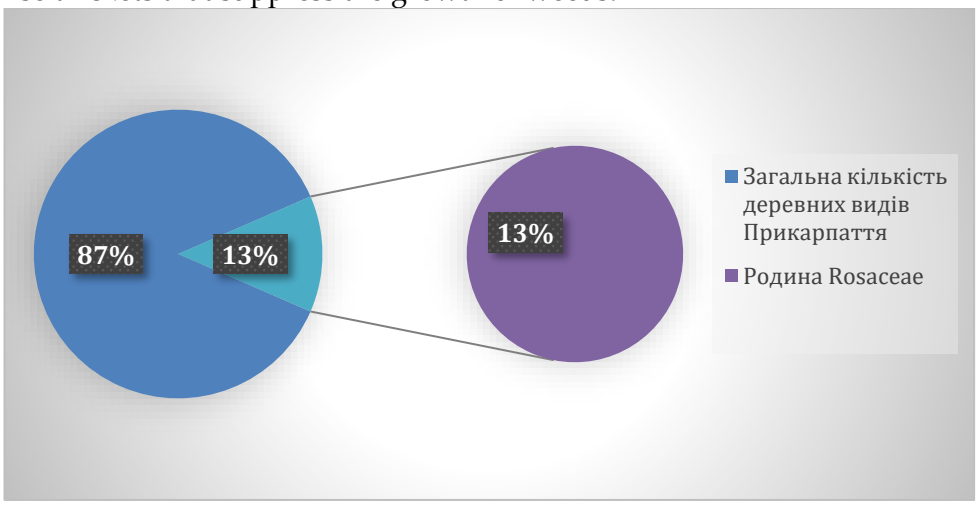

Figure 1. Percentage of the *Rosaceae* family in the total number of woody species in the Precarpathian region.

Ecosystem Benefits: Due to their high resilience to stress factors, these species are actively involved in soil stabilization and the creation of a favorable microclimate in plantations.

Ecological Role: Four species (*Chaenomeles japonica*, *Physocarpus opulifolius*, *Spiraea media*, *Rosa rugosa*) have been identified as actively contributing to the formation of microecosystems in urban environments.

Pollinators and Birds: These plants serve as important sources of nectar and berries, supporting the preservation of local pollinator populations and small birds.

Role in Urban Biocenoses: It has been found that *Chaenomeles japonica* provides high aesthetic value while also serving as a habitat for rare insect species.

Decorative Resilience: Experimental studies have shown that 78% of introduced species maintain a high level of decorativeness even under unfavorable conditions.

Heat and Drought Resistance: *Physocarpus opulifolius* demonstrates stable decorativeness under high temperatures and drought, confirming its value for urban landscaping.

Regeneration: *Spiraea japonica* effectively regenerates after mechanical damage, maintaining its ornamental appearance even in challenging urban environments.

Use in Landscape Design: Three types of landscape compositions have been developed for the green spaces of Ivano-Frankivsk, incorporating *Physocarpus opulifolius*, *Rosa rugosa*, and *Spiraea japonica*.

Functional Plantings: The compositions include hedges, thickets, and combined flower beds that blend aesthetic appeal with ecological functionality.

Pollution Resistance: *Rosa rugosa* has demonstrated a high level of resistance to air pollution, making it indispensable for plantings along roads and industrial areas.

New Recommendations: The implementation of monitoring programs has been proposed to assess the long-term impact of introduced species on local ecosystems.

4. CONCLUSIONS

The analysis of the introduction of *Rosaceae* species in the Precarpathian region confirmed their high ecological plasticity and decorative value, which makes these species promising for landscaping urban and suburban areas. Studies have shown that most of the introduced species demonstrate good adaptation to the conditions of the region, and some, such as *Spiraea japonica*, *Rosa rugosa*, and *Physocarpus opulifolius*, are actively naturalizing and contributing to the enrichment of the local flora. The research results also confirm that introduced *Rosaceae* species are capable of performing important ecological functions, including improving the microclimate, filtering pollutants, stabilizing soils, and maintaining biodiversity. Some species can act as honey plants and provide food for pollinators and birds. At the same time, certain environmental risks have been identified, including possible competitive displacement of native species, which requires further monitoring and control of the spread of certain members of the *Rosaceae* family. For the effective use of introduced species in landscape gardening, it is recommended to introduce adaptation strategies that involve the selection of the most resistant and decorative species with minimal negative impact on local ecosystems. Prospects for further research include developing optimal methods for introducing new species, assessing their long-term impact on biocenoses, and developing recommendations for integrating introduced plants into natural and urbanized landscapes.

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Руслан Купчак, Ірина Кавчук, Михайло Павук, Богдан Бойко, Надія Різничук, Вікторія Гнєзділова. Сучасний стан та перспективи інтродукції видів родини *Rosaceae* Juss. у Передкарпатті. *Журнал Прикарпатського університету імені Василя Стефаника. Біологія*, **11** (2024), С177–С182.

Анотація. У статті досліджено сучасний стан та перспективи інтродукції видів родини *Rosaceae* Juss. у природних і урбанізованих екосистемах Прикарпаття. Проаналізовано видовий склад, екологічну пластичність та адаптаційний потенціал представників цієї родини, що зумовлює їхню здатність до акліматизації та використання у зеленому будівництві. Розглянуто головні фактори, що впливають на успішність інтродукції, зокрема кліматичні умови, типи ґрунтів та антропогенне навантаження. Встановлено, що найбільш чисельно представленими в регіоні є роди *Cerasus* Juss., *Rubus* L., *Rosa* L. та *Spiraea* L., які складають приблизно 70% від загальної кількості зареєстрованих видів родини *Rosaceae*. Особливий інтерес викликають види *Spiraea japonica*, *Rosa rugosa* та *Physocarpus opulifolius*, які демонструють високу декоративну цінність та стійкість до несприятливих факторів середовища. Досліджено особливості поширення як аборигенних, так і інтродукованих видів, їхню здатність до натуралізації та потенціал у формуванні стабільних рослинних угруповань. Визначено, що інтродуковані види, зокрема *Chaenomeles japonica*, *Cotoneaster horizontalis* та *Sorbaria sorbifolia*, ефективно адаптуються до умов Прикарпаття, що обумовлено подібністю кліматичних характеристик регіону до їхніх природних ареалів. Ареалогічний аналіз показав, що значна частина представників родини *Rosaceae* має циркумбореальне або східноазійське походження, що підтверджує їхній високий адаптивний потенціал. Результати дослідження є основою для розробки ефективних стратегій інтродукції декоративних видів *Rosaceae* у зелені насадження Прикарпаття, що сприятиме збагаченню біорізноманіття та покращенню екологічного стану регіону.

Ключові слова: інтродукція рослин, *Rosaceae*, адаптація, декоративні рослини, озеленення.