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CONTRIBUTIONS TO THE STUDY OF THE RARE PLANT SPECIES IN ORHEI NATIONAL PARK FROM REPUBLIC OF MOLDOVA

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Abstract

The territory of Orhei National Park is located in the central part of the Republic of Moldova and represents an area with a valuable, yet still insufficiently studied, natural heritage. Currently, based on the results of systematic research initiated in 2023 and the most recent published works, the spontaneous flora of Orhei National Park includes 822 species of vascular plants. The article presents updated data on 33 species of rare, highly endangered plants included in the 3rd edition of the Red Book of the Republic of Moldova, obtained as part of the research and monitoring of rare species and the conservation status of their populations within the territory of the protected area.
The researched species are protected by law at the national level, and some of them are also protected at the international level: Cypripedium calceolus L. and Galanthus nivalis L. by the Habitats Directive, and Cypripedium calceolus L., Fritillaria montana Hoppe by W.D.J. Koch, Genista tetragona Besser, Pulsatilla grandis Wender, and Schivereckia podolica (Bess.) Andrz. are protected by the Bern Convention.

Key words*: Orhei National Park, Republic of Moldova, rare tax, conservation.*

INTRODUCTION

The *Orhei National Park* is a valuable protected natural area, which was founded in 2013 by the Parliament Decision no. 201/2013 *"On the Foundation of the Orhei National Park"*. It is located in the central area of the Republic of Moldova (Figure 1), on an area of 33792.09 ha, with the main objective of ensuring the conservation of biodiversity.
It is the first national park in the Republic of Moldova, the creation of which also constitutes the country's international commitment, as part of many European conventions. The regulation on the management of the park was developed in accordance with *Law no. 1538-XIII of 25.02.98 on the Fund of natural areas protected by the state*, in order to ensure, maintain, and preserve the rational use of biological diversity, unique natural complexes, special aesthetic and cultural-historical value, their use for scientific purposes, cultural, tourist, and instructive-educational purposes.
The territory of the park is divided into several functional areas (A-C), the core of the park constituting the area - with integral protection (A), which occupies 3.4% of the park's surface and includes sectors of habitats where rare species are concentrated; only scientific and protection research is allowed.

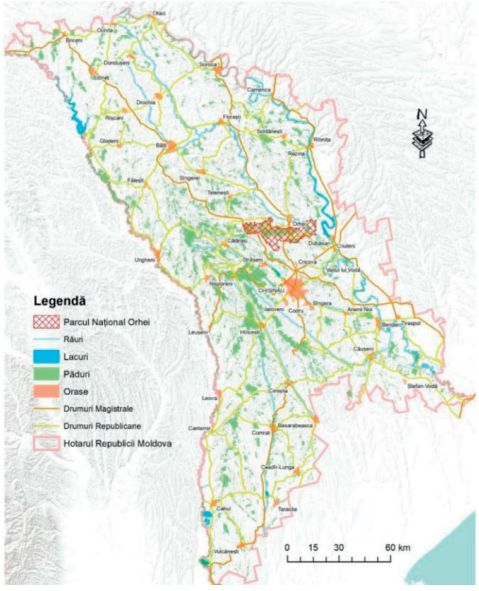

Figure 1. Geographical position of Orhei National Park (Source: Analele naturii, 2023)

The purpose of the study is to identify and confirm the rare species and objects of the Red

Book of the Republic of Moldova, 3rd edition, on the territory of the Orhei National Park, to highlight the growing conditions, and to assess the current state of the populations of the targeted species, to establish the population parameters, to establish the limiting risk factors that threaten them. It is important to identify the causes of the endangerment of rare species preserved *in situ* conditions in protected areas, where a number of measures are already applied, in order to implement effective approaches to their protection.

MATERIALS AND METHODS

This study includes research on rare species, with a high risk of endangerment included in the Red Book of the Republic of Moldova, 3rd edition, reported on the territory of the Orhei National Park. The field investigations and data collection were carried out during the years 2023-2025, on different itineraries so as to encompass all the sectors where rare taxa vegetate. At the same time, in order to specify the chorology, the herborized collections kept in the Herbarium of the National Botanical Garden (Institute) of the State University were consulted, which contain exsiccata of rare species collected from the area of the Orhei National Park. Field floristic research and critical analysis of the materials were carried out in accordance with the classical comparative-morphological method (Korovina, 1986). The nomenclature of species is the one accepted by current databases such as: *The International Plant Names Index* (IPNI, 2026), *Plants of the World Online* (POWO, 2026), *The World Flora Online* (WFO, 2026), and, in some cases, the nomenclature of the species given in the Red Book of the Republic of Moldova has been preserved. The determination of the species was carried out according to the fundamental works in the field (Gheideman, 1986; Negru, 2007, Pînzaru, 2023).

The assessment of the populations of rare species, the estimation of the degree of threat, and the establishment of the endangered category were carried out according to the requirements of the International Union for Conservation of Nature (IUCN, 2012) and the legislation of the Republic of Moldova (Environmental legislation, 1999). The photos in colour are original, taken by the authors.

RESULTS AND DISCUSSIONS

Based on the data presented in the substantiation study on the justification for the need to create the national park, the existence of 700 species of vascular plants was found, 52 of which are rare taxa, and 29 species included in the *Red Book of the Republic of Moldova*, 2nd ed., 2001 (Planul de management, 2023).

As a result of the review of scientific publications and the latest research initiated, in 2023 the flora of Orhei National Park included 816 species of vascular plants, of which 92 species are rare plants.

In the last three years, extensive research has been carried out on rare species that occur on the territory of Orhei National Park, focused mainly on the study and distribution of species at high risk of endangerment included in the 3rd edition of the *Red Book of the Republic of Moldova*. The study was driven by the lack of data necessary for the assessment of rare species populations and the need to update information on their conservation status on the Park's territory, both in the context of field research on endangered taxa proposed for the next edition of the Red Book, and for the creation of a scientific basis for the future monitoring system of rare species reported on the territory of Orhei National Park and for mapping them.

As a result of the study, the floristic inventory of Orhei National Park was established, which, by the end of 2025 included 822 species of vascular plants, 98 of which are rare species, representing about 12% of the total taxa registered in the Park's flora.

At the national level, most of the rare species highlighted on the territory of Orhei National Park are protected by the *Law on the Fund of Natural Areas Protected by the State*, 1998 (*Annex D*), and 33 species are included in the Red Book of the Republic of Moldova (2015), which constitutes 20% of the total number of higher plant species (165 species) contained in the last edition (Table 1).

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Table 1. Endangered plant species from Orhei National Park included in the Red Book of the Republic of Moldova, 3rd edition

No.	Species	Threat category	Habitat	Locality of distribution
1.	*Aconitum lasiostomum* Rchb. ex Besser	EN	forest	Ivancea, Teleșeu, Seliște, Vatici, Trebujeni
2.	*Allium inequale* Janka	VU	steppes	Mășcăuți
3.	*Alyssum gmelinii* Jord.	VU	petrophytic	-
4.	*Athyrium filix-femina* (L.) Roth	VU	forest	Vatici
5.	*Cephalanthera damasonium* (Mill.) Druce	VU	forest	Ivancea, Vatici, Seliște
6.	*Cephalanthera longifolia* (L.) Fritsch	VU	forest	Ivancea, Teleșeu, Țigănești
7.	*Cephalanthera rubra* (L.) Rich.	CR	forest	Ivancea, Vatici, Seliște
8.	*Cotoneaster melanocarpus* Fisch. ex A. Blytt	EN	petrophytic	Trebujeni
9.	*Cypripedium calceolus* L.	CR	forest	Ivancea, Seliște
10.	*Dentaria glandulosa Waldst.* and Kit	VU	forest	Ivancea, Vatici, Bravicea
11.	*Dentaria quinquefolia* M. Bieb.	EN	forest	Ivancea, Vatici, Bravicea
12.	*Dryopteris carthusiana* H.P. Fuchs	EN	forest	Seliște, Vatici
13.	*Dryopteris filix-mas* (L.) Schott	VU	forest	Ivancea, Teleșeu, Seliște, Vatici, Bravicea
14.	*Epipactis purpurata* Smith.	CR	forest	Ivancea, Teleșeu, Seliște, Vatici, Bravicea
15.	*Fritillaria montana* Hoppe ex W.D.J. Koch	VU	forest	Trebujeni, Ivancea
16.	*Galanthus nivalis* L.	VU	forest	Ivancea, Teleșeu, Seliște, Vatici, Bravicea
17.	*Genista tetragona* Besser	VU	petrophytic	Mășcăuți
18.	*Gymnocarpium robertianum* (Hoffm) Newman	CR	petrophytic	Trebujeni
19.	*Helianthemum canum* (L.) horn.	VU	petrophytic	Trebujeni, Butuceni, Morovaia, Mășcăuți
20.	*Jurinea stoechadifolia* (M. Bieb.) DC.	VU	petrophytic	Mășcăuți, Morovaia, Trebujeni
21.	*Koeleria moldavica* M. Alexeenco.	VU	steppes	Ivancea
22.	*Majanthemum bifolium* F.W. Schmidt	CR	forest	-
23.	*Orchis purpurea* Huds	CR	meadow	Seliște, Morozeni, Teleșeu, Donici, Vatici, Bravicea, Codreanca
24.	*Ornithogalum boucheanum* (Kunth) Asch.	EN	meadow	Trebujeni, Brănești
25.	*Paronychia cephalotes* (M.Bieb.) Besser	CR	petrophytic	Mășcăuți, Morovaia
26.	*Pulsatilla grandis* Wender.	EN	steppes	Trebujeni
27.	*Saxifraga tridactylites* L.	CR	petrophytic	Trebujeni, Mășcăuți
28.	*Schivereckia podolica* (Bess.) Andrz.	VU	petrophytic	Trebujeni, Mășcăuți
29.	*Scopolia carniolica* Jacq.	VU	forest	Bravicea, Țîgănești
30.	*Sempervivum ruthenicum* W. D. J. Koch Schnittsp. and C. B. Lehm.	CR	petrophytic	Trebujeni
31.	*Seseli peucedanifolium* Besser	VU	petrophytic	Trebujeni, Butuceni, Morovaia
32.	*Sorbus domestica* L.	EN	forest	Ivancea
33.	*Thelypteris palustris* Schott	EN	meadow	Seliște

From the inventory of floristic taxa from the Red Book found in the Park, five species are included in the Red Book of Vascular Plants in Romania (Dihoru and Negrean, 2009), and 14 species are listed in the Red Book of Ukraine (Chervona kniga Ukraïni, 2009). At the same time, the Park's list of endangered species includes floristic taxa protected internationally as well. Thus, the species *Cypripedium calceolus* and *Galanthus nivalis* (Figures 3, 4) are protected by the *Habitats Directive* (Interpretation… 2013), *Cypripedium calceolus, Fritillaria montana, Genista tetragona, Pulsatilla grandis* and *Schivereckia podolica* are protected by the *Bern Convention* (Convention… 1979). Seven taxa: *Cephalanthera damasonium, C. longifolia*,

C. rubra, *Cypripedium calceolus*, *Epipactis purpurata*, *Orchis purpurea* and *Galanthus nivalis* are also listed in *Annex II* of the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) (Figure 2).

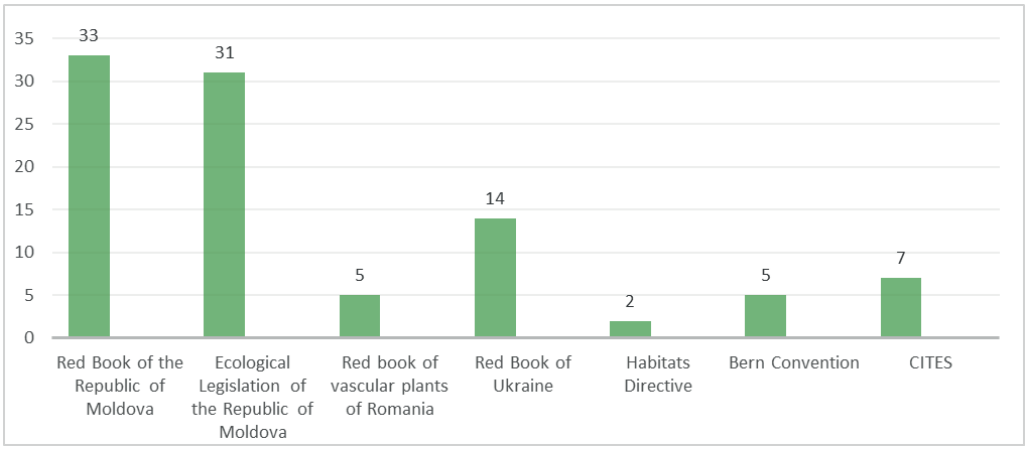

Figure 2. Number of endangered species in Orhei National Park, included in the Red Book of the Republic of Moldova and in other International documents, Conventions and Directive



Figure 3. *Cypripedium calceolus*



Figure 4. *Galanthus nivalis*

Previously, the list of Red Book species reported for the park territory included the critically endangered species *Ophioglossum vulgatum* L., but this was excluded because the species' habitat was completely destroyed by full-scale tillage, a fact recorded both in the specialized literature (Gheideman, 1988; Pînzaru, 2019) and confirmed by recent research.

Although mentioned in the list, the presence of the species *Majanthemum bifolium* F.W. Schmidt on the Park's territory remains uncertain. Currently, there is no proven data published or documented by the herbarium that would confirm the taxa for the researched territory; most likely, it was included erroneously. At the same time, in our field study, which included a

review of the distribution points cited in the Red Book, the species *Alyssum gmelinii* Jord. was not identified on the territory of the Park.

As a result of the research and monitoring activities for rare species carried out during the years 2023-2025, **new breeding sites** were identified for 8 species of endangered plants from the Red Book - *Cephalanthera damasonium, C. longifolia, C. rubra, Epipactis purpurata, Jurinea stoechadifolia, Dryopteris filix-mas, Orchis purpurea* (Figure 5)*, Saxifraga tridactylites,* thus updating and completing their chorology on the park territory.

At the same time, in the period 2023-2025 the list of species of Orhei National Park was supplemented with rare floristic taxa documented **for the first time** for this territory, such as: *Centaurea x pulberiana* Pînzaru, *Centaurea ruthenica* Lam., *Diplotaxis cretacea* Kotov, *Epipactis muelleri* Godfery, *Petasites hybridus* (L.) G. Gaertn. and *Senecio macrophyllus* M. Bieb.

Increased attention is also required to be directed toward the endangered species highlighted in the Park's flora, which, for the time being, are not included in the Red Book nor in the *List of species protected by law*. Out of these, the most important are: *Centaurea ruthenica* Lam., *Epipactis muelleri* Godfery, *Gentiana cruciata* L., *Iris aphylla* L., and *Senecio macrophyllus* M.Bieb.

It is important to note that, at the time the start of the research, for some rare species there was recent information with data regarding the spread and the results of their monitoring on the territory of the Park, while for others it was necessary to identify the breeding sites in the field or to specify and confirm the information regarding their chorology, the assessment of their conservation status, as well as the establishment of the **"zero"** moment of their monitoring.



Figure 5. *Orchis purpurea*

These findings confirm both the scientific importance of the investigations carried out within the framework, as well as the efficiency of monitoring activities, which allow periodic updating of knowledge of local biological diversity.

The **high floristic diversity** of Orhei National Park is due to the varied geographical, climatic, and pedological conditions, which have determined the formation of diverse plant communities, which belong to several types of vegetation: forest, meadow, aquatic and marshy, petrophyte, and anthropic.

Of the total endangered species included in the latest edition of the Red Book of the Republic of Moldova (2015), 16 species are characteristic of forest habitats, 11 of petrophytic habitats, 3 of steppe habitats, and 3 of meadow habitats (Figure 6).

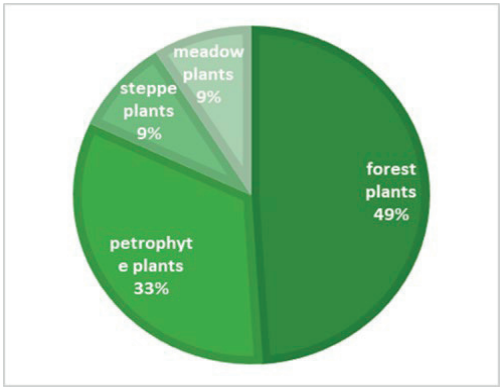

Figure 6. Spectrum of ecotopological elements in Orhei National Park

Forest habitats in Orhei National Park play a key role, as they host approximately half (49%) of the number of Red Book taxa reported here, providing favourable and relatively stable conditions for endangered species.

Even so, the populations of some species are very small, with an extremely low number of individuals, dominated by specimens in the vegetative phase (*Cephalanthera rubra, Cypripedium calceolus*), in addition, flowering and fruiting, under the conditions of our country, do not occur annually. The pronounced climate changes of the last decade have been the main cause of the reduction in the areas occupied by the populations of endangered floristic taxa.

Calcareous slopes of Orhei National Park represent a unique habitat in the region, very valuable, with exclusive vegetation, made up of plants with strict ecological requirements, vulnerable to changes in environmental conditions and anthropogenic actions. The bare limestone, or limestone covered with typical rendzinic soil, rich in the calcareous skeleton of the rocks, includes primary, xerophilic, calciphilic, and endemic phytocenoses (Pînzaru, 2023). Among the taxa taken in the study, important calciphilous species, endemic to Ponto-Sarmatic, such as *Genista tetragona*, *Schivereckia podolica*, *Sempervivum ruthenicum,* and *Seseli peucedanifolium Besser* (Figure 7), as well as rare Ponto-Balkan species such as *Jurinea stoechadifolia* and *Paronychia cephalotes, are* characterized by extensive populations, with a stable number of individuals, which bloom and bear fruit abundantly every year.



Figure 7. Fragment of a calcareous slope with *Genista tetragona*

Paronychia cephalotes is a critically endangered species with a fragmented area, which vegetates only on the limestones of the Middle Sarmatian, currently, it has a certain presence only within the territory of the Orhei National Park (Figure 8).
The endangered species, characteristic of **steppe and meadow** habitats, reported in the Park, include taxa with restricted ecological amplitude and reduced specific habitats, threatened by various degradation factors. Among them is *Koeleria moldavica*, a Podolian endemic species. *Pulsatilla grandis is* found at the southern border of the area and is strongly threatened with extinction due to its high decorativeness. *Thelypteris palustris* - taxon characteristic of humid meadows and marshy areas, strongly affected by changes in habitat conditions (Figure 9).



Figure 8. *Paronychia cephalotes* in the natural habitat

CONCLUSIONS

Both previous and current studies highlight a high potential for conserving rare species in Orhei National Park, which represents a unique and diverse object. The periodic monitoring of rare species carried out in this protected area provides updated data on antatus of populations and their trends, contributing to an understanding of the biology and ecology of rare species, which are extremely important for the application of effective conservation strategies based on the identification of specific threats that endanger their existence and on the promotion of scientifically based conservation practices.
As a result of anesearch, an inventory of rare plants of the Orhei National Park was drawn up, which counts 98 species, constituting 12% of its total flora. The list of plant species included in the Red Book of the Republic of Moldova (3rd ed.) reported in the natural habitats of the Park totals 33 species, 9 of which are critically endangered (CR), 8 endangered (EN) and 16 vulnerable (VU).
The *in situ* protection of threatened species within Orhei National Park is a leading objective, included in the Biodiversity Conservation Strategies, contributing to the maintenance of viable populations in their natural environment and protecting habitats from destruction, taking into account the ecological complex in which they vegetate, in order to quickly understand the direction of change of rare floristic elements.



Figure 9. *Thelypteris palustris*

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