

***IN-SITU* CONSERVATION OF *EPIPACTIS PALUSTRIS* (L.) CRANTZ IN THE REPUBLIC OF MOLDOVA**

Olga IONIȚA^{1*} , Natalia JARDAN² 

¹ “Alexandru Ciubotaru” National Botanical Garden (Institute), Moldova State University,
Chisinau – Republic of Moldova.

² Reserve “Codrii”, Lozova, Strășeni – Republic of Moldova.

* Corresponding author. E-mail: olgaionita.gbn@gmail.com, ORCID: 0000-0002-9222-6087

Abstract: The given paper provides recent data on the rare species, *Epipactis palustris* (L.) Crantz, (family Orchidaceae) from the “Codrii” Scientific Reserve, Republic of Moldova, including the current state of the taxon population, the degree of threat, the endangered category (according to IUCN requirements). Likewise, it contains the morphological description of the species, the ecological and chorological particularities and the characteristics of the habitat under study. Limiting factors are identified and protective measures are proposed.

Keywords: *Epipactis palustris* (L.) Crantz, rare taxa, bioecology, conservation, Republic of Moldova.

Introduction

In the flora of the Republic of Moldova genus *Epipactis* Zinn represents the most numerous and interesting genus in the family Orchidaceae, especially from a taxonomic perspective. Until 1979, 2 species of the genus *Epipactis* were known in the spontaneous flora of the Republic of Moldova – *E. helleborine* (L.) Crantz and *E. palustris* (L.) Crantz. In the same year, 1979, V. KIRTOKA as a result of field research and analysis of herborized materials identified two more species: *Epipactis purpurata* Smith and *E. atrorubens* (Hoffm.) Schult [KIRTOKA, 1979]. Recently, in 2023, a new species has been identified – *Epipactis leptochila* (Godfery) Godfery [SFECLĂ & al. 2023]. Thus, currently, in the flora of the Republic of Moldova there are 5 species of *Epipactis*, all of which are endangered taxa.

Rare species research is included both in the provisions of national laws and strategies, as well as in the international obligations of the Republic of Moldova, and the protection *in situ* of threatened species is a priority objective, included in the Biodiversity Conservation Strategies. Periodic assessment of the ecological status of rare plant species, as well as monitoring of populations of endangered floristic taxa is necessary, the data obtained provide updated information on the real state of species and the dynamics of their populations [IONIȚA & JARDAN, 2023]. This study refers to *Epipactis palustris* (L.) Crantz – Critically Endangered species (CR), protected by law, included in the Red Book of the Republic of Moldova (2nd and 3rd ed.). Beyond the borders of the republic, the species is spread from Europe to the Caucasus and Mongolia [powo.science.kew.org]. *Epipactis palustris* is distributed throughout Europe, but it is extremely rare in the southern Mediterranean region [JACQUEMYN & al. 2014; DJORDJEVIC & al. 2017] (Figure 1).



Figure 1. *Epipactis palustris* (L.) Crantz distribution worldwide powo.science.kew.org

■ – Native ■ – Introduced

Material and methods

The study is based on floristic field research of the species *Epipactis palustris* (L.) Crantz (family Orchidaceae) conducted during 2021-2023 within the Scientific Reserve “Codrii”, located in the center of the Republic of Moldova. During the investigations, scientific publications containing information about the bioecology and chorology of the species *Epipactis palustris* were reviewed, the existing herborized collections kept in the Herbarium of the National Botanical Garden (Institute) “Alexandru Ciubotaru” and the Museum of Natural Sciences of the State University of Moldova were critically processed, in order to specify the chorology of the species. Floristic research and critical analysis were carried out in accordance with the classical comparative-morphological method [KOROVINA, 1986]. The nomenclature and description of the species is presented according to current databases (The International Plant Names Index [IPNI, 2023], Plants of the World Online [POWO, 2023], The World Flora Online [WFO, 2023]) and fundamental works in the field [GHEIDEMAN, 1986; MOSER & al. 2002; PÂNZARU & al. 2002; NEGRU, 2007; MATCHUTADZE, 2014].

During the study, the area of the population was determined, its number was established, specifying the ontogenetic stage of each individual, vegetative or generative. The geographic coordinates were recorded using the GPSMAP® 64s GPS device CARMIN. The population assessment of *Epipactis palustris* species was carried out, the degree of threat was estimated and the endangered category established, according to the requirements of the International Union for Conservation of Nature [BILZ & al. 2011; IUCN, 2012] and the Legislation of the Republic of Moldova [Legislația, 1999], identifying limiting factors and proposing protection measures. The color photos are original, taken by authors with a Nikon D 3100 digital camera.

Results and discussions

Epipactis palustris (L.) Crantz, Stirp. Austr. Fasc., ed. 2. 2(6): 462 (1769).

Basionym: *Serapias helleborine* var. *palustris* L. Sp. Pl. 2: 950 (1753).

Long, recurrent, branched stoloniform rhizome. Stem 15-60 (80) cm long, erect, pubescent in the upper part, at the base with 1 or more scale-shaped, sheathed leaves. Leaves 4-8, spirally arranged, 5-17 cm long, oblong-ovate to oblong-lanceolate, acute, adaxially concave, abaxially, often purple; the upper ones narrow, acuminate, bracteiform; all ± erect, folded, abaxially prominently veined. Inflorescence – raceme 6-15 (20) cm long, lax, with 7-14 flowers. Bracts 5-25 mm long, lanceolate, acute, the lower ± equal to or slightly longer than the ovary. Flowers inodorous, zygomorphic, bisexual, initially campanulate, nutant, later wide-open, horizontal, finally pendulous, cream-white or, rarely white, more or less purplish-red or brown streaked. Outer perianth segments 7-12 mm long, lateral segments slightly longer than median segment, rounded on one side, brown, whitish or dull green outside, purple-red inside, lanceolate, obtuse to acute apex, concave, prominently 3-5-nerved, abaxially pubescent, adaxially glabrous. Inner perianth segments shorter and narrower than outer, whitish with purple veins at base, lanceolate, obtuse, glabrous, with branched veins. Label 10-12 mm long, equal to the external segments of the perianth. Gynostemium short, yellowish-green, extended upwards. Anther elliptic or subtetraangular, slightly bilobed. Pollen granular, oval, yellowish-white, friable; caudicles missing. Stigma transverse-elliptic or subtetraangular, bilobed. Glandular rostellum; viscidium obvious, white, sticky, present in open flowers. Ovary 9-16 mm long, narrow-pyriform, puberulent. Fruit – capsule 13-18 mm long, pendent. Seeds ovoid, 1.2-1.5 mm long, light brown [PAUCĂ & MORARIU, 1972; MOORE, 1980; CIUBOTARU & al. 2007; JACQUEMYN & al. 2014; OPREA, 2019; FLORA OF CHINA, 2024] (Figure 2).



Figure 2. *Epipactis palustris*: flower; habitus, inflorescence in fruit.

According to literature data, in the flora of the Republic of Moldova, over the last 50 years the state of the population has fluctuated considerably. Although in some publications *E.*

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palustris is quoted from two locations: Răciula village, Călărași district and Lozova commune, Strășeni district [CHIRTOACĂ, 2002; PÂNZARU & al. 2002; POSTOLACHE, 2015], currently the presence of the species in the former remains uncertain, because neither concrete data nor herborized materials have been found from this point of distribution. According to the results of studies published by GHEIDEMAN T. (1986) and KIRTOKA V. (1988) stated that on the territory of the republic *Epipactis palustris* they grow only in the “Codrii” Reserve [GHEIDEMAN, 1986; KIRTOKA, 1988] (Figure 3).

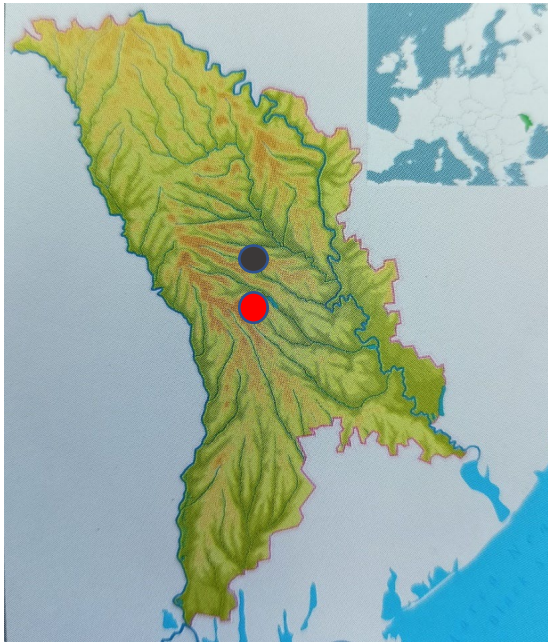


Figure 3. Distribution of *Epipactis palustris* in the Republic of Moldova:

● – currently existing population ● – extinct or probably extinct population

As a result of the critical analysis of the exsiccatae kept in the herborized collections of the country, in the Herbarium of the National Botanical Garden, 11 specimens of *Epipactis palustris* has been identified, three of which were collected from southern Bessarabia in 1927 and 1929 by the renowned scientists C. ZAHARIADI and N. ZELENETSKII, but not part of our study. The other 8 specimens were collected from the same location as follows: 4 specimens collected near the commune Lozova, Strășeni district (Figure 4), from the wet meadow with *Eriophorum latifolium* Hoppe near the Forestry Department (NICOLAEVA, GHEIDEMAN, 17.07.1952); 1 specimen each collected from the same location by other researchers (TEPLOVA, 25.06.1955; BOGONINA, 07.05.1956; CIORNÎH, 24.06.1977; KIRTOKA, 21.07.1977).

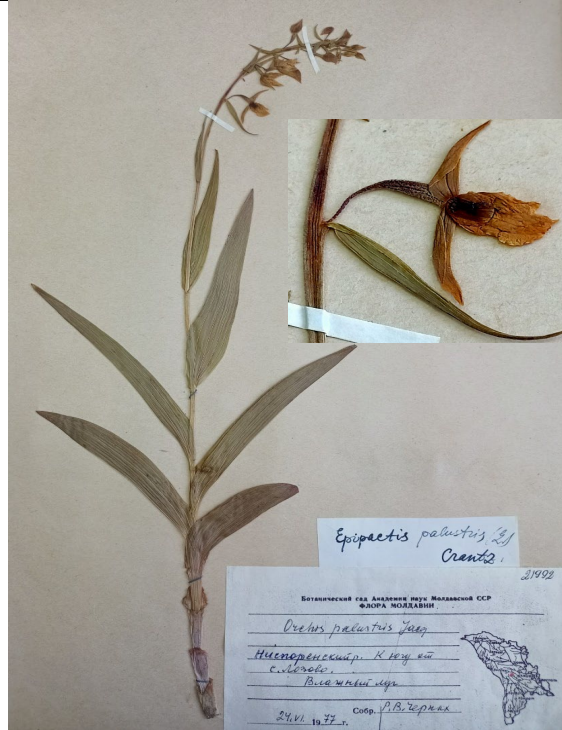


Figure 4. Specimen of *Epipactis palustris* collected from Lozova, in 1977

Thus, as a result of field research in recent years, the population reported in the vicinity of Lozova commune, from the “Codrii” Scientific Reserve, was assessed, the first collections here dating back to 1952. *E. palustris* grows through wet meadows of easily floodplain phytocoenoses. On the territory of the reserve it grows in the meadow located in the wide valley of the river between the forested slopes (N 47°06'16.7", E 28°21'46.9"), with an abundance of 1-2, on a wet meadow with vegetation dominated by grasses and various species of meadow. *Epipactis palustris* is the only species of the genus *Epipactis* that in the spontaneous flora of the Republic of Moldova grows outside the forest habitat and does not tolerate shading.

The sector in which *Epipactis palustris* grows was declared in 1975 a protection zone, being a representative sector with meadow vegetation “Meadow with *Eriophorum latifolium* Hoppe”, association which includes other relict species, such as: *Dactylorhiza incarnata* (L.) Soó, *Thelypteris palustris* Schott, *Hypericum tetrapterum* Fries [KIRTOKA, 1982], all being included in the Red Book of the Republic of Moldova, 3rd ed. In the composition of the grassy carpet were also reported species such as: *Angelica sylvestris* L.f, *Arctium lappa* L., *Cirsium canum* (L.) All., *Cirsium vulgare* (Savi) Ten., *Inula helenium* L., *Orchis palustris* Jacq., *Symphytum officinale* L., *Valeriana officinalis* L., etc. (Figure 5).



Figure 5. *Epipactis palustris* in natural habitat

Bioecology. Perennial plant, Eurasian geophyte [CIOCĂRLAN, 2009], mesohydrophyte species. It blooms in June-July, capsules ripen in August. It is pollinated by insects. Multiply vegetatively, from buds on the rhizome and generatively, but young seedlings, provenient from seeds, were practically not reported. The rhizomes are thin, branched and located close to the soil surface, The tip of the rhizome grows upward each year to produce the aerial stem, while horizontal growth is continued by a new bud (or 2) emerging from the base of the vertical stem. Thus, over the course of a few years, a single plant can emit a considerable number of floriferous stems and vegetative shoots [JARDAN & CHIRIAC, 2008; JACQUEMYN & al. 2014; <http://www.orchidsofbritainandurope.co.uk/Epipactispalustris.html>].

Decorative plant during flowering. It grows in groups, the herd and morphological parameters vary from year to year. In the summer of 2023, the population of the species *E. palustris* covered an area of about 56 m² with \pm 100 phytoindividuals, predominating mature, floriferous specimens reaching 30-70 cm in height. Taking into account the data from the literature, according to which in 2001 the population contained 20-30 phytoindividuals [CHIRTOACĂ, 2002], and in 2015 there were 10-30 specimens [POSTOLACHE, 2015], we find with certainty that the conservation status of the taxon within the habitat is relatively favorable, stimulating the increase of the numerical population. Among the basic threats that can cause a decrease in the number of individuals we can mention: the change in the degree of soil moisture, often caused by long drought, which leads to drying of the biotope and negatively influences plant development, floodplain invasion by woody and/or invasive species, grassland valorization.

Sozologic status. In the Republic of Moldova *Epipactis palustris* is an endangered species, categorized, according to the guide developed by the International Union for Conservation of Nature as Critically Endangered [CR B2ab(ii,iii,v)].

At the same time, *Epipactis palustris* is a rare species in the countries bordering the Republic of Moldova, being included in the Red Book of Ukraine, in the category “Вразливий” – vulnerable [TIMCHENKO & KUZYARIN, 2009], as well as in the Red List of superior plants in Romania [OLTEAN & al. 1994].

At the European level, *Epipactis palustris* is widespread and often forms dense populations. Although populations are decreasing, existing threats are unlikely to cause them to decline severely in the near future. Therefore, in 2014, *Epipactis palustris* was assessed and included in the IUCN Red List as a low-risk threat [LC] species [MATCHUTADZE, 2014]. *Epipactis palustris* is also listed in *Annex II* of the Convention on International Trade in Endangered Species of Wild Fauna and Flora [CITES]. Several national red lists are included in European countries *Epipactis palustris* and are Endangered in Bulgaria [PETROVA & VLADIMIROV, 2009], Czech Republic [HOLUB & PROCHÁZKÁ, 2000], Norway and Finland; Vulnerable in Germany, Near Threatened in France and Hungary [KIRÁLY, 2007], Low risk in Denmark, Switzerland [MOSEER & al. 2002] and the United Kingdom [MATCHUTADZE, 2014].

Protective measures. *Epipactis palustris* is an important species from the point of view of biodiversity conservation. Territorially, in the Republic of Moldova, it is protected in the Scientific Reserve “Codrii”. As effective protection measures, we propose the rigorous observance of the reserve regime, an essential condition for the conservation *in situ* of endangered species, the protection of the only growing place, the monitoring of the population status, the management of grazing and regulated mowing to control the excessive growth of vegetation, ensuring the water regime by avoiding water leakage, the conservation of the species in *ex situ* conditions, preservation of germplasm in gene banks.

Conclusions

It is important to note that although the species has been evaluated by the International Union for Conservation of Nature and categorized as LT (Least Concern) – at low risk of extinction, still requires compliance with conservation and population monitoring measures. Even if currently in the spontaneous flora of the Republic of Moldova the population of the species *Epipactis palustris* apparently it seems stable, its protection should not be reduced, because it is precisely the fact that conservation measures have been rigorously observed that has led to stopping the decline and the favorable status of the population. Estimated regional conservation status in Republic of Moldova: Critically Endangered [CR B2ab(ii,iii,v)].

Because the species is very rare, definitely identified in only one locality, it is necessary to comply with effective conservation measures such as: surveillance and monitoring of the existing population, study of its dynamics, favoring the conditions of expansion. Thus, limiting factors can be quickly identified and urgent and effective measures can be taken to halt the decline of populations of species threatened with their extinction and conservation.

Acknowledgements

The research was supported by the Moldova State University through the Project “Research and *ex situ*, *in situ* conservation of the plant diversity of the Republic of Moldova” (010101).

References

- BILZ M., KELL S. P., MAXTED N. & LANSDOWN R. V. 2011. *European Red List of Vascular Plants*. Luxembourg: Publications Office of the European Union.
https://www.bgci.org/files/Plants2020/Target_2/euplants_final_web.pdf [accessed 25. 01. 2024].
- CHIRTOACĂ V. 2002. *Epipactis palustris* (L.) Crantz. In: *Cartea Roşie a Republicii Moldova*. – 2nd ed. Chişinău: Ştiinţa, 87 pp.
- CIOCĂRLAN V. 2009. *Flora ilustrată a României Pteridophyta et Spermatophyta*. Bucureşti: Edit. Ceres, 1141 pp.
- CIUBOTARU A., POSTOLACHE G., TELEUŢĂ A. & al. 2007. In: *Lumea vegetală a Moldovei. Plante cu flori - III*, Vol. 4, Chişinău: Editura Ştiinţa: 74 pp.
- DJORDJEVIC V., LAKUSIC R. & STEVANOVIC V. 2017. Distribution and conservation status of some rare and threatened orchid taxa in the central Balkans and the southern part of the Pannonian Plain. *Wulfenia*. **24**: 143-162.
- FLORA OF CHINA. http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=242320667 [accessed 23.01.2024].
- GHEIDEMAN T. S. 1986. *Opredelitel' vysših rastenij Moldavskoj SSR*. Chisinau: Ştiinţa: 129-131.
- HOLUB J. & PROCHÁZKA F. 2000. Red list of vascular plants of the Czech Republic. *Preslia*. **72**: 187-230.
- IONIŢA O. & JARDAN N. 2023. *In situ* conservation of *Epipactis palustris* (L.) Crantz in the Republic of Moldova. International Scientific Symposium “Modern Trends in the Agricultural Higher Education”, October 5-6: Book of Abstracts. – Chisinau: [Tehnica-UTM], 2023, p. 91.
- JACQUEMYN H., BRYNS R. & HUTCHINGS M. J. 2014. Biological Flora of the British Isles. No. 276: *Epipactis palustris*. *Journal of Ecology*. **102** (5): 1341-1355. <https://doi.org/10.1111/1365-2745.12287>
- JARDAN N. & CHIRIAC E. 2008. Particularităţile biomorfologice ale unor orhidacee din cadrul rezervaţiei Codrii. *Mediul Ambient*. **5**(41): 29-31.
- KIRÁLY G. (ed.). 2007. Vörös Lista. A magyarországi edényes flóra veszélyeztetett fajai. [Red list of the vascular flora of Hungary]. Saját kiadás, Sopron, 73 pp.
- KIRTOKA V. A. 1979. Novye dlya flory Moldavii vidy roda *Epipactis* Zinn (Orchidaceae). *Izvestiya Akademii Nauk Moldavskoy SSR. Seriya biologicheskikh i khimicheskikh nauk*. **4**: 23-25.
- KIRTOKA V. A. 1982. *Epipactis palustris* (L.) Crantz. In: GEYDEMAN T. S., VITKO K. R., ISTRATIY A. I. i Dr. REDKIE. *Vidy flory Moldavii*. Kishinev: Ştiinţa, 102 pp.
- KIRTOKA V. A. 1988. *Epipactis palustris* (L.) Crantz. Rasteniya lugovye. pribrezhnye. vodnye i solonchakovye. *Rastitelnyy mir Moldavii*. Kishineu. **4**: 67-68.
- KOROVINA O. N. 1986. *Metodicheskie ukazaniya k sistematike rasteniy*. Leningrad. SSSR, 210 pp.
- MATCHUTADZE I. 2014. *Epipactis palustris*. The IUCN Red List of Threatened Species. <https://doi.org/10.2305/IUCN.UK.2014-1.RLTS.T175923A22569935.en>
- MOORE D. M. 1980. *Epipactis* Zinn. In: *Flora Europaea*. Cambridge University Press. **V**: 326-328.
- MOSER D., GYGAX A., BÄUMLER B., WYLER N. & PALESE R. 2002. *Liste Rouge des fougères et plantes à fleurs menacées de Suisse*. Ed. Office fédéral de l'environnement, des forêts et du paysage, Berne; Centre du Réseau Suisse de Floristique, Chambésy; Conservatoire et Jardin botaniques de la Ville de Genève, Chambésy. Série OFEFP «L'environnement pratique», 118 pp.
- NEGRU A. 2007. *Determinator de plante din flora Republicii Moldova*. Chişinău: Edit. Universul, 391 pp.
- OLTEAN M., NEGREAN G., POPESCU A., ROMAN N., DIHORU G., SANDA V. & MIHĂILESCU S. 1994. *Lista roşie a plantelor superioare din România*. In: OLTEAN M. *Studii, sinteze, documentaţii de ecologie*, Academia Română, Institutul de Biologie, Bucureşti, 52 pp.
- OPREA A. 2019. *Epipactis palustris* (L.) Crantz. Harta ilustrativă a speciilor de orhidee dunărene. Manifest SRL, Suceava, p. 40.
- PÂNZARU P., NEGRU A. & IZVERSCAIA T. 2002. Taxoni rari din flora Republicii Moldova. Chişinău, 148 pp.
- PAUCĂ A. & MORARIU I. 1972. Genul *Epipactis* Zinn. In: *Flora Republicii Socialiste România*. Bucureşti: Edit. Academiei Republicii Socialiste Române. **12**: 757-768.
- PETROVA A. & VLADIMIROV V. 2009. Red List of Bulgarian vascular plants. *Phytologia Balcanica*. **15**(1): 63-94.
- POSTOLACHE G. 2015: *Epipactis palustris* (L.) Crantz. In: *Cartea Roşie a Republicii Moldova*, 3rd ed., Ştiinţa, Chişinău, Republica Moldova, 157 pp.
- SFECLĂ V., SFECLĂ I. & GHENDOV V. 2023. *Epipactis leptochila* (Godfery) Godfery (Orchidaceae) – specie nouă pentru flora Republicii Moldova. *Revista Pădurilor*. **138**(2): 37-48.
- TIMCHENKO I. A. & KUZYARIN O. T. 2009. *Epipactis palustris* (L.) Crantz. In: *Chervona kniga Ukraïni. Roslinnyy svit.* / red. Ya. P. Didukha. K.: Globalkonsalting, 179 pp.
- *** CITES. Disponible: <https://checklist.cites.org/#/en> [accessed 22 12 2023].
- *** IUCN. 2012. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0. Disponible: <https://www.iucnredlist.org/resources/regionalguidelines> [accessed 19.12. 2023].

-
- *** IPNI. 2023. International Plant Names Index. Disponibile: <https://www.ipni.org/n/633244-1> [accessed 18.12. 2023].
- *** POWO. Disponibile: <http://www.plantsoftheworldonline.org/> [accessed 19.12.2023].
- *** Legislația ecologică a Republicii Moldova (1996-1998).1999. Chișinău, 233 pp.
- *** WFO. Disponibile: <http://www.worldfloraonline.org/taxon/wfo-4000013619> [accessed 18.12. 2023].
- <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:633289-1> [accessed 25.04.24].
- <http://www.orchidsofbritainandeuropa.co.uk/Epipactispalustris.html> [accessed 19.12.2023].

How to cite this article:

IONIȚA O. & JARDAN N. 2024. *In situ* conservation of *Epipactis palustris* (L.) Crantz in the Republic of Moldova. *J. Plant Develop.* **31**: 137-145. <https://doi.org/10.47743/jpd.2024.31.1.944>
