ORCHID FLORA OF THE DJERDAP NATIONAL PARK (SERBIA): TAXONOMY, LIFE FORMS, AND PHYTOGEOGRAPHICAL ANALYSIS

FLORA ORHIDEJA NACIONALNOG PARKA ĐERDAP (SRBIJA): TAKSONOMIJA, ŽIVOTNI OBLICI I FITOGEOGRAFSKA ANALIZA

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INTRODUCTION

With around 880 genera and 27,800 species and subspecies, the family Orchidaceae is one of the largest and most diverse of plant families. It has a cosmopolitan distribution and includes the highest number of endangered species and genera. The Balkan Peninsula is one of the most important centers of orchid diversity in Europe. However, research on orchids in the central Balkans, including the Djerdap National Park, has been carried out with long temporal gaps, mostly within the framework of floristic or phytocoenological studies of specific areas.

The Djerdap National Park is the largest national park in Serbia, spanning an area of 63,786 hectares along a 100-kilometer stretch on the right bank of the Danube River (**Figure 1**). Established in 1974, it is famous for the majestic Djerdap Gorge (also known as the Iron Gates), which is the longest and deepest composite valley in Europe.

The main objectives of this study were to:
(i) determine total orchid richness in the Djerdap National Park;
(ii) conduct a taxonomic analysis;
(iii) analyse orchid life forms; and
(iv) perform a phytogeographical analysis of the orchid flora in the park.

MATERIAL AND METHODS

Data on the distribution and ecological preferences of orchids in the Djerdap National Park were gathered through field research (2024–2026), herbarium collections, and relevant published sources. Orchid taxa were identified according to Delforge (2006), with nomenclature following Djordjević et al. (2021). Plant life forms were defined based on the classifications of Ellenberg & Mueller-Dambois (1967), as well as Tsiftsis et al. (2019) (**Figure 2**).

For the phytogeographic analysis, chorological types were determined in accordance with Meusel & Jäger (1992)



Figure 2. Different types of orchid underground organ systems: (A) rhizome, (B) palmately lobed tubers, and (C) spherical tubers.

RESULTS AND DISCUSSION

Taxonomical analysis. The presence of 27 species and two hybrids from 13 genera was established (**Figure 3**), including 17 species recorded for the first time in this area. The most species-rich genera are *Anacamptis* and *Orchis*.

Analysis of life forms revealed that tuberous geophytes are the most numerous, while rhizomatous geophytes are represented by nine taxa (**Figure 4**). A more detailed analysis of life forms showed that representatives with spherical or ovoid tubers are dominant, followed by orchids with rhizomes and orchids with palmately lobed and fusiform tubers (**Figure 5**).

Phytogeographical analysis showed that the orchids belong to six basic chorological groups (**Figure 6**). Representatives of the Central European chorological group dominate, followed by orchids of the Mediterranean–Submediterranean and Eurasian groups.

CONCLUSIONS

The presence of 27 orchid species and two hybrids in the Djerdap National Park was established. The most species-rich genera are *Anacamptis* and *Orchis*. Owing to the great diversity of relief, vegetation, climatic conditions, geological substrates, soils, historical factors, and limited orchid research conducted so far, it can be assumed that the number of orchid species in this area is higher and that new taxa will be recorded in future studies. The study highlights the need for continued, detailed research into the distribution patterns and ecological preferences of orchids to improve their conservation planning.

REFERENCES

Delforge, P. 2006. Orchids of Europe, North Africa and the Middle East. A. & C. Black: London, UK.
Djordjević, V., Nikolić, M., Stevanović, V. 2021. Orchids of Serbia: Taxonomy, Life Forms, Pollination Systems, and Phytogeographical Analysis. In Orchidaceae: Characteristics, Distribution and Taxonomy; Djordjević, V., Ed.; Nova Science Publishers, New York, NY, pp. 57–163.
Ellenberg, H., Mueller-Dambois, D. 1967. A key to Raunkiaer plant life forms with revised subdivisions. Ber. Geobot. Inst., ETH, Zurich 37: 56–73.
Meusel, H., Jäger, E. 1992. Vergleichende Chorologie der zentraleuropäischen Flora 3. Karten, Text, Literatur, Register. Gustav Fischer, Jena, Stuttgart
Tsiftsis, S., Štípková, Z., Kindlmann, P. 2019. Role of way of life, latitude, elevation and climate on the richness and distribution of orchid species. Biodivers. Conserv. 28: 73–96.

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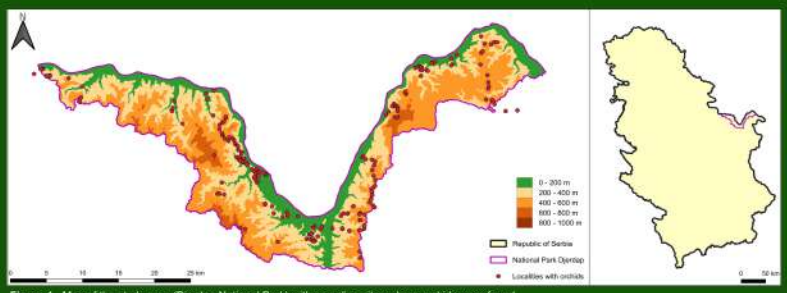
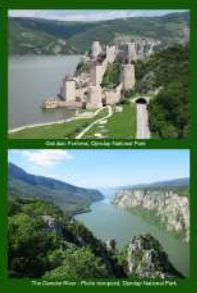


Figure 1. Map of the study area (Djerdap National Park) with sampling sites where orchids were found.



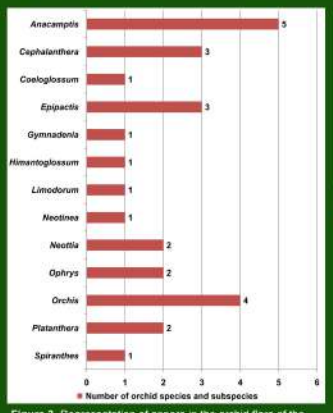


Figure 3. Representation of genera in the orchid flora of the Djerdap National Park.

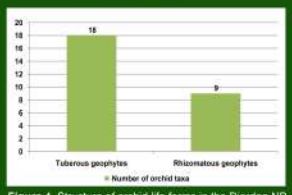


Figure 4. Structure of orchid life forms in the Djerdap NP.

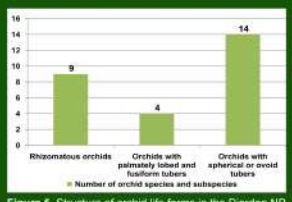


Figure 5. Structure of orchid life forms in the Djerdap NP

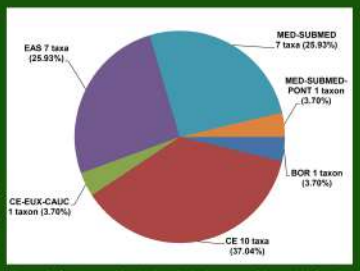


Figure 6. Spectrum of basic chorological groups of the orchid flora in the Djerdap National Park:

CE—Central European;
EAS—Eurasian;
BOR—Boreal;
MED-SUBMED—Mediterranean-Submediterranean;
MED-SUBMED-PONT – Mediterranean-Submediterranean-Pontic;
CE-EUX-CAUC—Central European-Euxine-Caucasian.

THE RAREST ORCHID SPECIES IN THE DJERDAP NATIONAL PARK


Coeloglossum viride


Epipactis purpurata


Ophrys apifera


Platanthera chlorantha

THE MOST WIDESPREAD ORCHID SPECIES AND THOSE WITH MOST OCCURRENCES IN THE DJERDAP NATIONAL PARK


Anacamptis morio


Anacamptis papilionacea


Anacamptis pyramidalis


Epipactis helleborine


Orchis mascula subsp. *speciosa*


Orchis militaris


Orchis purpurea


Spiranthes spiralis