ECOLOGIA BALKANICA
2024, Vol. 16, Issue 2 December 2024 pp. 16-22

New data on the distribution of Spiranthes spiralis (L.) Chevall. (Orchidaceae, Asparagales) in Eastern Bulgaria

Desislav Dimitrov[1*], Petya Boycheva[2]

[1]Provadia, 23 Danube Str., 9200 Varna, BULGARIA
[2]Department of Biology, Medical University Varna, 84 Tsar Osvoboditel Blvd., 9000 Varna, BULGARIA
*Corresponding author: desislav.geo@gmail.com

Abstract. For the first time *Spiranthes spiralis* (L.) Chevall. family Orchidaceae has been proven for the floristic region of Northeastern Bulgaria. It is considered a rare species of the flora of Bulgaria and is included in Appendix III to the Law on Biological diversity as a protected species. Regarding the light regime, it is a typical heliophyte, preferring open habitats and well-lit ecological niches. In October 2022, we discovered a new deposit of the species on the territory of the protected area Provadiysko - Rojaksko plateau, between the villages of Dobrina and Staroselets, municipality of Provadia, which is the first deposit for Northeastern Bulgaria. The population is represented by single specimens distributed in a meadow on the periphery of forest massifs and shrub communities, and the habitat is characterized by a rich floristic diversity. Undoubtedly, studying the population characteristics of this species is important for its protection.

Key words: *Spiranthes spiralis*, new locality, Northeastern Bulgaria, protected area Provadiysko - Rojaksko plateau.

Introduction

Spiranthes spiralis is the only representative of the *Spiranthes* genus in Bulgaria from the Orchidaceae family. It is a perennial herb with up to 25 fragrant white flowers (4-6 mm) arranged in a single row spiraling clockwise or counterclockwise up the stem. The stems are glandular-fibrous, pale green and can reach 15-20 cm in height (Stace, 2010). Each stem has 3(to 7) pale green, lanceolate-acuminate, adherent bracts with membranous margins. The rosette leaves are 2-6, shiny, with transparent edges, ovate-lanceolate, narrowed into a broad petiole, pointed at the apex, 3-4 cm long and 0.5-1.5 cm wide, and dry with the onset of summer heat (Willems & Dorland, 2000). The flowers are in a single row, twisted spirally, on, or counter-clockwise around the axis, or less often, all turned to one side. The upper lip of the flower is white, slightly glandular-fibrous, with oblong outer perianth lobes with a slight green tinge. Seeds ripen in October or November, and are dispersed by the wind. It reproduces generatively and vegetatively, but under unfavorable conditions, vegetative reproduction prevails as an effective survival strategy. (Jacquemyn et al., 2005; Jacquemyn et al., 2007; Jacquemyn & Hutchings, 2010). Morphologically, the genus is well defined and shows little variability. According to the ecological classification of Raunkiaer (1934), the species belongs to geophytes, and according to the degree of adaptation to the water regime, it belongs to mesophytes.

Its distribution area covers the Mediterranean, the Atlantic Ocean (except for the northern regions) and Central Europe. The species is also given for the Mediterranean coast of Africa, North Caucasus and Transcaucasia, Western Asia and the Western Himalayas, especially Nepal (Fig. 1).

It probably expanded its range after the clearing of forests and forest habitats during the Neolithic.

It is included in Annex III of the Law on Biological diversity as a protected species. It is also listed in the Convention on International Trade in Endangered Species (CITES) - Appendix II. According to the IUCN Red list for Bulgaria, the species is Vulnerable (VU) (www.iucnredlist.org). Practically, the entire range of the species is protected at the state level. In Bulgaria, the species is relatively rare. According to Assyov et al. (2012), it is distributed almost throughout the country, excluding the Struma River valley (north and south), the Mesta River valley and Northeastern Bulgaria. According to the same authors, the altitude at which the species occurs ranges from 0 to 1000 meters, with the most common being up to 800 m.

The number of populations in general in the country has been quite dynamic over the years, and the number of plants in most of them is quite limited.

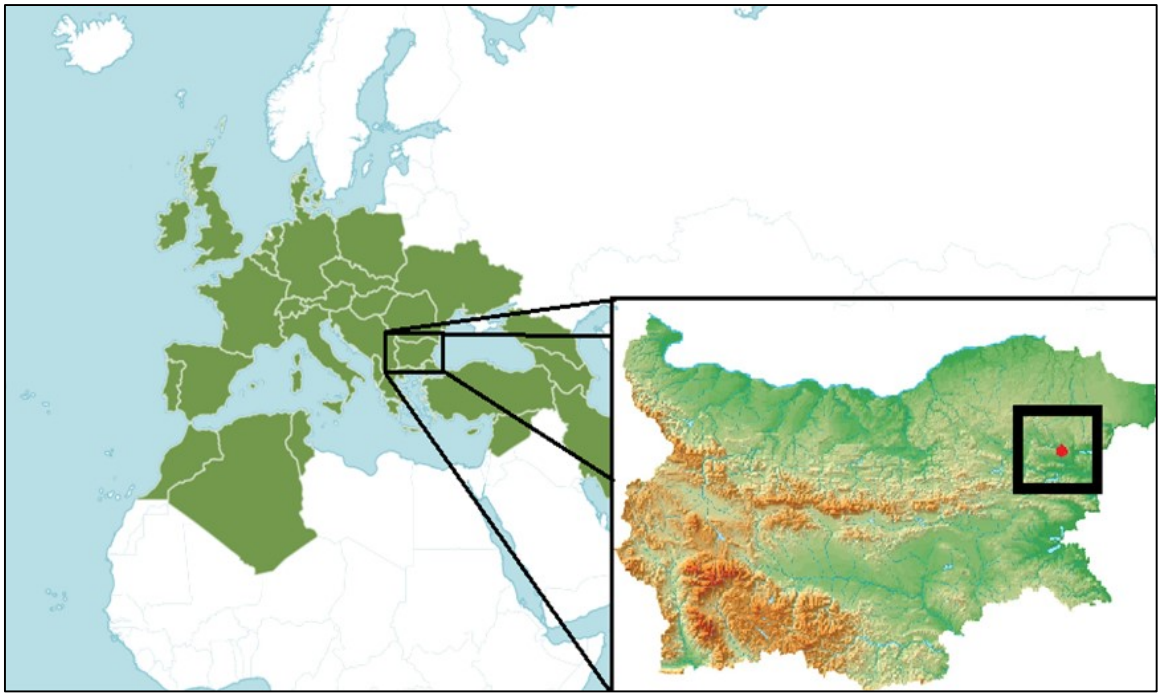

Fig. 1. Distribution map of *Spiranthes spiralis* (L.) Chevall. according to Euro+Med PlantBase.

A number of reports and publications give us more detailed information about the horology and ecological characteristics of the species - for Strandzha by Bergman (2004); Vladimirov (2016) informs us about Golo Burdo mountain (Znepol region) with interesting symbiotic relationships with representatives of Bryophyta. For a floristic region, the Danube Plain is described by Vladimirov et al. (2017) in a protected area "Kaylaka", with a small population of 15 individuals. The publications of Asenov & Dimitrov (2012), as well as Aleksandrova et al. (2018) give us information about the distribution of the species in Zemenska Mtn and Slivenska Mtn, respectively. In the Nature Park "Vrachanski Balkan" a small population was established on the banks of the Cherna River, in meadows on the periphery of beech forests (Petrova, 2014). In the area of Lakatnishki skali, the locality is represented by single specimens (Petrova, 2014). In the southern part of the Struma River valley it is reported with more than 20 specimens described (Domozetski & Petrova, 2021). Another deposit in the same area is reported by Kunev (2021). A brief report on the current locality of the species in Northeastern Bulgaria is provided by Sabovljevic et al. (2023).

Most of the existing populations develop primarily on limestone substrates, clayey and impermeable soils, poorly used pastures on the periphery of forest massifs and shrub communities. Regarding the light regime, it prefers full light and does not tolerate strong shading, but it is also able to survive in moderate shade, with which plant development is suppressed to a large

extent (Kindlmann & Balounova, 2001). The main danger for the species in recent years is the destruction of its habitats related to human activities, such as ploughing, construction, etc.

The aim of the present study is the establishment of new localities of the conservation-important species *Spiranthes spiralis* (L.) Chevall on the territory of the protected area Provadiysko - Rojaksko plateau, and Northeastern Bulgaria, as well as to lay the foundations for further studies of the discovered populations, regarding of their ecological requirements, and the possible threats of an anthropogenic nature.

Materials and Methods

The field surveys were carried out in the months of October 2022 and April-May 2023. To determine the species accompanying *Spiranthes spiralis* in the habitats, we used the "Identifier of plants in Bulgaria" (Stoyanov et al., 2022).

Herbarium specimens have been deposited in the collection of the Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences (SOM 178005).

The names of the taxa are according to Conspectus of the higher flora of Bulgaria (Assyov et al., 2012).

Life forms of associated species are after Raunkiaer (1934), and are placed in parentheses after the author's plant names. The designations are as follows: Cr - Cryptophytes, H – Hemicryptophytes, Th - Therophytes, Ch – Hamephytes, Ph - Phanerophytes. Abbreviations of author and plant names are according to the International Plant Name Index (IPNI). Marking of the species and determining the altitude was done using a SAMSUNG GPS receiver, with the OruxMaps program.

Fig. 2. Location of the deposit on the territory of the protected area Provadiysko - Rojaksko plateau.

Results and Discussion

Until now, *Spiranthes spiralis* - (Cr) was not established for the floristic region of Northeastern Bulgaria. At the beginning of the month of October 2022, we discovered a deposit in the eastern part of the Provadiysko plateau, between the villages of Staroselets and Dobrina, northeast of the city of Provadia. At the current stage, 15 species of the representatives of the Orchidaceae family have been described on the territory of the plateau (Zahariev, 2012). The population falls into the European ecological network NATURA 2000 in the protected area Provadiysko - Rojaksko plateau (BG0000104) (MOEW). The coordinates in the center of the deposit are N 43.199963°, E 27.479045° and the altitude is 320 m (Fig. 2). The area is located in an area with a pronounced Black Sea climate influence, characterized by relatively mild winters, cool spring, cool summer and warm autumn. The geographical distribution of *Spiranthes spiralis* on the Balkan Peninsula, and in general, is probably influenced by the fact that it flowers late in the growing season (September-October) (Fig. 3). For the nearby town of Provadia, the average July temperature is 22.6°C, and the average January temperature is 1.2°C degrees. Precipitation in the area is relatively low, with an average annual amount of 534 mm. About 60% of the annual precipitation falls during the growing season (from April to September).

It is assumed that the species was originally found only in the Mediterranean region, but now it can be found in suitable open habitats in most of Bulgaria and Europe.

The soil in the area of the deposit is humus-carbonate, shallow, very stony, with a pronounced influence of the limestone base (Borisov, 1965).

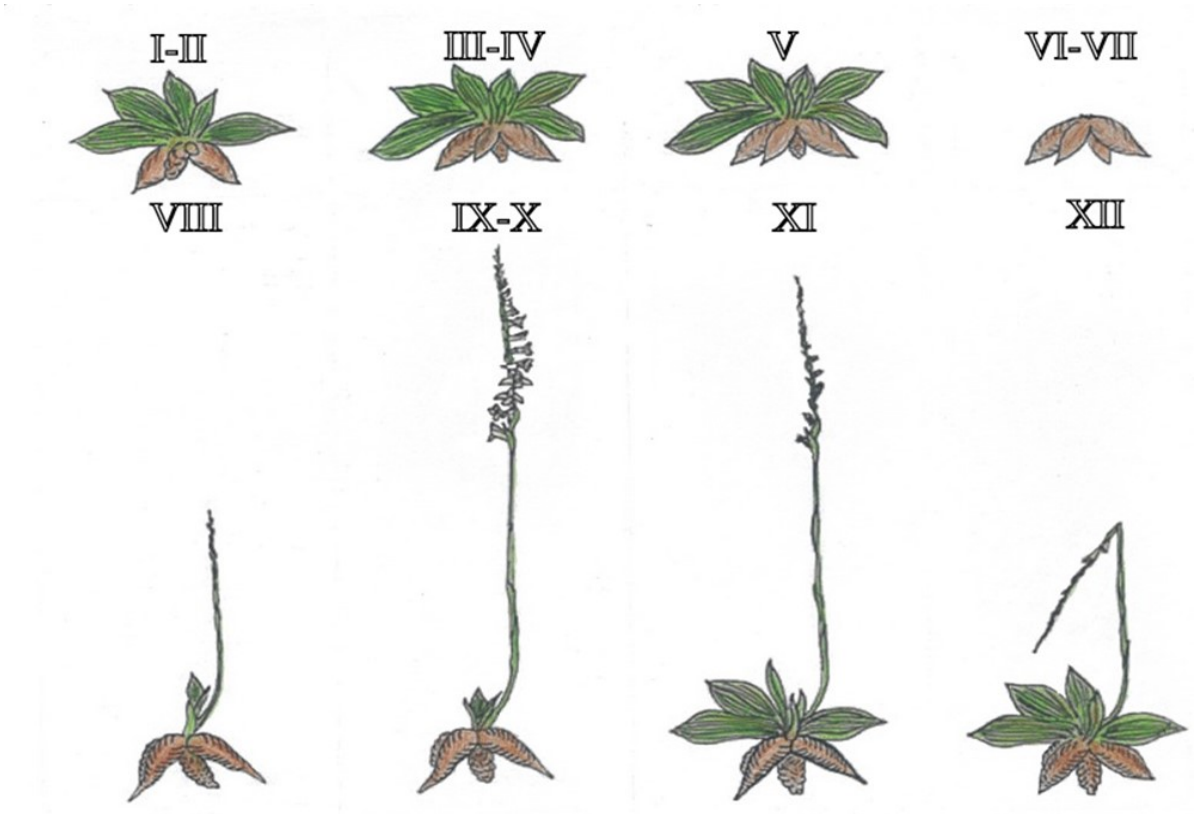

Fig. 3. Phenological cycle of *Spiranthes spiralis* (L.) Chevall. in the first and second half of the year in Bulgaria.

In the west-northwest direction, there is a belt of open-type shrub formations and mixed broad-leaved forest. The slope is 3° and the grass cover is 100%. The population consists of 5 specimens in a generative state scattered over a small area around the boundaries of the complex coenoses characteristic of the area (Bondev, 1991). Two of the plants were damaged, apparently by trampling and grazing by wildlife. The plants are a component of *Festuco-Brometea* class communities,

with xerothermic grasslands dominated by the species *Chrysopogon gryllus* L. - (H), *Botriochloa ischaemum* L.- (H). Other associated species are *Achillea millefolium* L. - (H), *Acinos arvensis* Dandy - (Th), *Daucus carota* L.- (Th), *Eryngium campestre* L. - (H), *Teucrium polium* L. - (Ch), *Teucrium chamaedrys* L. - (Ch), *Poa pratensis* L. - (H), *Bituminaria bituminosa* (L.) C. H. Stirt. - (H), *Polygala major* Jacq. - (H), *Sanguisorba minor* Scop. - (H), *Carex flacca* Schreb. - (H), *Dactylis glomerata* L - (H), *Trifolium alpestre* L. - (H), and others. Considering that the above-mentioned class is common in the area, we can assume that the species has a wider distribution on the plateau, due to the availability of suitable habitats. In the vicinity, small populations of the species *Colchicum autumnale* L. (Cr) and *Sternbergia colchiciflora* Waldst. & Kit. - (Ch) have also been described. *Anacamptis morio* (L.) Bateman, Pridgeon & Chase - (Cr), *Orchis simia* L. - (Cr). Accompanying shrub species are represented by single specimens of *Paliurus spina-christi* Mill. - (Ph), *Crataegus monogina* Jacq. - (Ph), *Carpinus orientalis* Miller- (Ph), *Fraxinus ornus* L. - (Ph). Tree species are represented by single specimens of *Pyrus pyraster* Burgsd - (Ph), and *Ulmus minor* Mill. - (Ph). In North-East Bulgaria, summer drought is a common phenomenon and due to its summer dormancy it is assumed that *Spiranthes spiralis* can withstand significant drought. The height of the grass cover is also crucial for the existence of the population because of the relatively small size of the individuals. The lack of intensive grazing in the area may prove to be a limiting factor for the development of *Spiranthes spiralis* (Jacquemyn & Hutchings, 2010). Therefore, the open space and the low level of competition in the phytocenosis seem to be the most favorable factors for its abundant development. There are no roads nearby that pose a threat. The nearest dirt road is about 300 meters away, and the villages of Staroselets and Dobrina are about 3000 meters away.

Fig. 4. *Spiranthes spiralis* (L.) Chevall. (photo Desislav Dimitrov).

Conclusions

The newly discovered site on the protected area Provadiysko - Rojaksko plateau is the first for the floristic region of Northeastern Bulgaria. In general, the abiotic factors and environmental conditions provided by the area are suitable for the development of the population. The late flowering of the species limits its distribution in

the north, as well as above the temperate zone, where low temperatures and the occurrence of snow inhibit the development of seeds.

We believe that the main danger for the species could be habitat destruction due to plowing and construction, which seems unlikely for the area. Tall grass can be considered as one of the factors that could suppress the spread of the species. It is well adapted to survive in open habitats, and can become more abundant when vegetation is kept low by grazing animals. According to some studies, *Spiranthes spiralis* is the only species of orchid with the strongest preference for pasture biotopes. Therefore, the most effective way to protect the existing populations is to maintain short grass by grazing animals, most often sheep, which should be stopped during flowering in order to improve the reproduction process. Its limited distribution in some areas, as well as changes in the dynamics of some local species, have a negative impact on the population status of the species. Thanks to the main leaf rosette, which is located close to the ground, good protection against grazing animals is provided, and it is also easily renewed after damage from being stepped on.

References

Alexandrova, A., Tashev A, Dimitrov M., & Apostolova-Stoyanova, N. (2018). Floristic analysis of Mt. Slivenska (Eastern Stara Planina, Bulgaria). *Phytologia Balcanica*, 24(1), 55–74.

Asenov, A., & Dimitrov, D. (2012). Plants with protection statute, endemics and relicts on Mt Zemenska, West Bulgaria. *Phytologia Balcanica*, 18(2), 187–195.

Assyov, B., Petrova, A., Dimitrov, D., & Vassilev, R. (2012). *Conspectus of the Bulgarian Vascular Flora. Distribution maps and floristic elements. Fourth revised and updated edition*. Bulgarian Biodiversity Foundation, Sofia, 494 p.

Brabec, J., Krenova, Z., & Nesvadbova, J. (2004). Psvihlík krutiklas – A remarkable type of flora of the Czech Republic. *Živa*, 5, 209–211.

Bergman, B., Draleva, S., & Uzunov, S. (2004). *Ophrys reinholdii* (Orchidaceae) a new species for the Bulgarian flora. *Phytologia Balcanica*, 10(2-3), 175-177.

Bondev, I. (1991). *The vegetation of Bulgaria. 1:600000 scale map with explanatory text*. "St. Kliment Ohridski" University Publishing House, Sofia. [in Bulgarian]

Borisov, I. (1965). *Petrographic studies of the magmatites north of the city of Burgas and comparative petrochemical characteristics of the Upper Cretaceous volcanics in Bulgaria*. Sofia University yearbook, Faculty of Geology and Geography, vol. 1.

Bozhanska, T., & Iliev, M. (2021). Changes in the Composition of Natural Grassland (*Chrysopogon gryllus* type) in Grazing and Haymaking Mode of Use. *Ecologia Balkanica*, 13(1), 143-153.

Buttler, K. (1991). *Orchids of Britain and Europe*. The Crowood Press, Swindon, 288 p.

CITES. (2009). Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendix II. Retrieved from: https://cites.org/eng/app/index.php

Delforge, P. (1995). *Orchids of Britain and Europe (Collins Photo Guide)*. Collins, London, 480 p.

Euro+Med Plantbase. (2024). Retrieved from: http://www.europlusmed.org

IUCN Red List of Threatened Species, Version 2016-1, Retrieved from: www.iucnredlist.org

Jacquemyn, H., & Hutchings, M. J. (2010). Biological Flora of the British Isles: *Spiranthes spiralis* (L.) Chevall. *Journal of Ecology*, 98(5), 1253–1267. doi: 10.1111/j.1365-2745.2010.01701.x

Jacquemyn, H., Brys, R., Hermy, M., & Willems, J. H. (2007). Longterm dynamics and population viability in one of the last populations of the endangered *Spiranthes spiralis* (Orchidaceae) in the Netherlands. *Biological conservation*, 134, 14–21. doi: 10.1016/j.biocon.2006.07.016

Jacquemyn, H., Micheneau, C., Roberts, D.L., & Pailler, T. (2005). Elevational gradients of species diversity, breeding system and floral traits of orchid species on Réunion Island. *Journal of Biogeography*, 32, 1751-1761 doi: 10.1111/j.13652699.2005.01307.x

Kindlmann, P., & Balounova, Z. (2001). Irregular flowering patterterrestrial orchids: theories vs empirical data. *Web Ecologia*, 2, 75–82. doi: 10.5194/we-2-75-2001

Law on Biological diversity, Annex III. (2002). State Gazette, No. 77 of August 9, 2002. Retrieved from: https://lex.bg/laws/. [in Bulgarian]

MOEW - Ministry of Environment and Water. Available at: http://natura2000.moew.government.bg/

Petrova, A. (2014). *Photoidentifier of the orchids of the Nature Park "Vrachanski Balkan"*. UNICART, p. 91-92. [in Bulgarian]

Raunkiaer, C. (1934). *The Life Forms of Plants and Statistical Plant Geography*. Oxford University Press, London, 632 p.

Sabovljevic, M., Tomovic, G., Niketic, M., Denchev, T., Denchev, C., Sabovljevic, A., Ştefanut, S., Tamas, G., Szelag, Z., Assyov, B., Savic, D., Janosik, L., Dudas, M., Kolarcik, V., Veljkovic, M., Djordjevic, V., Šovran, S., Knezevic, A., Dimitrov, D., Papp, B., Pantovic, J., Lazarevic, P., Kabas, E., Kutnar, L., & Kermavnar, J. (2023). New records and noteworthy data of plants, algae and fungi in SE Europe and adjacent regions, 11. *Botanica Serbica*, 47(1), 163–172. doi: 10.2298/BOTSERB2301163S

Stace, C. (2010). *New flora of the British Isles. 3rd edition*. Cambridge university press, 1266 p.

Stoyanov, P., Mladenov, R., Mileva, S., Todorov, K., (2022). Monitoring of Vascular Plant Species from the Southeastern Part of Strandzha Nature Park, Bulgaria. *Ecologia Balkanica*, SE 5, 7-15.

Stoyanov, K., Raycheva, Ts., & Cheschmedzhiev, I. (2022). *Key to the native and foreign vascular plants in Bulgaria. Interactive extended and supplemented edition.* Academic Publishing House of the Agricultural University, Plovdiv. [in Bulgarian].

Vladimirov, V., Dane, F., Matevski, V., & Tan, K. (2016). New floristic records in the Balkans 29. *Phytologia Balcanica*, 22, 93–123.

Vladimirov, V, Aybeke, M., & Tan, K. (2017). New floristic records in the Balkans 32. *Phytologia Balcanica*, 23, 119–146.

Vladimirov, V., Aybeke, M., & Tan, K. (2021). New floristic records in the Balkans 45. *Phytologia Balcanica,* 27, 239–276.

Willems, J.H., & Dorland, E. (2000). Flowering frequency and plant performance and their relation to age in the perennial orchid *Spiranthes spiralis* (L.) Chevall. *Plant Biology*, 2, 344–349. doi: 10.1055/s-2000-3707

Zahariev, D. (2012*). Flora of Northeastern Bulgaria. Volume 1. Flora of the Provadiysko plateau.* Chimera, Shumen. [in Bulgarian]

Received: 28.03.2024
Accepted: 05.10.2024