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# Lichenized fungi (Ascomycota) from Dupkata Reserve (Rhodopi Mts, Bulgaria)

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**ABSTRACT**

Results from the study on lichens in the Dupkata protected area, Rhodopi Mts are presented. Fifty-one species of lichen-forming fungi were reported for the first time from the Reserve. Among them, *Arthopyrenia analepta* s.l. and *Lecanora argentata* were new records from the Rhodopi Mts. Data on some rarely recorded and less common species in Bulgaria were briefly discussed.

**Key words:** Lecanoromycetes, lichen diversity, Pazardzhik, protected area

## Introduction

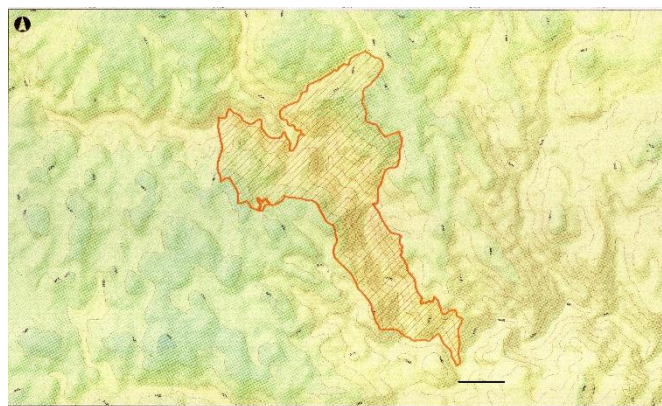
Dupkata Reserve was declared as a strict reserve in 1951 with an area of 65.2 ha. It is situated in Western Rhodopi Mts, mainly occupying the southern slopes of Batashka Mt and part of the Valley of Devinska River, generally between 600 and 1600 m altitude (Fig. 1). To the present days the area of this managed reserve is extended to 1210.8 ha. Its territory belongs to Pazardzhik region, Batak municipality and Fotinovo village. The reserve was proclaimed for protection of wild flora and fauna, mainly century-old Scots pine forests and the Red deer. It is listed in the UNESCO's Man and the Biosphere Programme by the Executive Environment Agency (Register of protected territories and protected areas in Bulgaria, 2025).

Velev et al. (2015) published data on the vascular flora, mycota and the vegetation from Dupkata Reserve. In their work, the fungi are presented with 42 species (ascomycetes, basidiomycetes, and 3 of them of conservation concern). The vegetation cover is composed mainly by spruce forests and mixed spruce and *Pinus sylvestris* communities, and five habitat types of Council Directive 92/43 EEC are found in the area of Dupkata Reserve (Velev et al., 2015).

Prior to the present work the diversity of lichenized fungi from Dupkata Reserve was completely unexplored. General information about the lichens recorded from Rhodopi Mts is available in some works (e.g. Popnikolov & Zhelezova, 1964; Mayrhofer et al., 2005; Denchev et al., 2006; Vondrák, 2006; Vondrák & Slavíková-Bayerová, 2006). Some recently

published data, resulted from regional studies on lichens and lichenicolous fungi in the country and in this mountain, is presented in Atanassova and Mayrhofer (2012), Stoykov (2015, 2018a), Guttová et al. (2020), Mayrhofer et al. (2020), Shivarov et al. (2021), and Stoykov (2023).

The following work aims to contribute to the lichenized fungi on the territory of the Dupkata Reserve.



**Figure 1.** Map of Dupkata Reserve. Size 1: 25000. Scale bar = 1 km. (MOEW & Nishava Consortium. Management Plan of Dupkata Reserve, 2015).

## Materials and Methods

Method of linear transect for collecting of lichen thalli was used. The determination of the collected materials was made generally following Dobson (2000, 2011, 2013), Smith et al. (2009) and Nimis (2025). Colour macro- and microphotographs were made with the help of Canon PS

A460, Canon Ixus and Agfa Photo DC8200 digital cameras. Specimens were found in localities with geographic coordinates, marked with the help of GPS receiver model Garmin Etrex10, all along the track in direction between N 41°46'28", E 24°14'45" and N 41°46'03.5", E 24°15'55.2". The nomenclature of the species follows Denchev et al. (2022). Classification system of the ascomycetous fungi was accepted in accordance with 'Outline of Ascomycota' (Wijayawardene et al., 2018). The specimens were deposited at the Mycological Collection of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia (SOMF).

## Results and Discussion

As a result of the short field trip, held during the summer of 2014, fifty-one species of lichenized fungi were reported in the territory of Dupkata Reserve. They belong to phylum *Ascomycota*, subphylum *Pezizomycotina*, and are united in 3 classes (*Arthoniomycetes*, *Dothideomycetes* and *Lecanoromycetes*), 6 subclasses, 13 orders, 18 families, and 34 genera.

### List of the lichenized fungi from Dupkata Reserve

Phylum *Ascomycota*

Subphylum *Pezizomycotina*

Class *Arthoniomycetes*

Subclass *Arthoniomycetidae*

Order *Arthoniales*

Family *Chrysotrichaceae*

1. *Chrysothrix candelaris* (L.) J.R. Laudon, tree bark

Class *Dothideomycetes*

Subclass *Pleosporomycetidae*

Order *Pleosporales*

Family *Arthopyreniaceae*

2. *Arthopyrenia analepta* (Ach.) A. Massal. s.l., bark of beech

Class *Lecanoromycetes*

Subclass *Candelariomycetidae*

Order *Candelariales*

Family *Candelariaceae*

3. *Candelariella vitellina* (Hoffm.) Müll.-Arg., tree bark, rock

Subclass *Lecanoromycetidae*

Order *Caliciales*

Family *Physciaceae*

4. *Amandinea punctata* (Hoffm.) Coppins & Scheid., bark of twig (Fig. 6)

5. *Rinodina sophodes* (Ach.) A. Massal., bark of twig (Fig. 7)

Order *Lecanorales*

Family *Cladoniaceae*

6. *Cladonia fimbriata* (L.) Fr., soil, old trunk

7. *Cladonia furcata* (Huds.) Schrad., mossy soil

8. *Cladonia pyxidata* (L.) Hoffm., mossy trunk

Family *Lecanoraceae*

9. *Lecanora albella* (Pers.) Ach., bark of *Sorbus*

10. *Lecanora argentata* (Ach.) Röhl., bark of beech

11. *Lecanora pulicaris* (Pers.) Ach., coniferous twig

12. *Lecanora varia* (Hoffm.) Ach., tree bark

13. *Lecanora rupicola* (L.) Zahlbr., rock

14. *Protoparmeliopsis muralis* (Schreb.) M. Choisy, rock (Fig. 10)

Family *Parmeliaceae*

15. *Bryoria fuscescens* (Gyeln.) Brodo & D. Hawksw., coniferous twig

16. *Bryoria implexa* (Hoffm.) Brodo & D. Hawksw., coniferous twig

17. *Bryoria subcana* (Nyl. ex Stizenb.) Brodo & D. Hawksw., coniferous twig

18. *Evernia divaricata* (L.) Ach., tiny apical twig (Fig. 3)

19. *Hypogymnia physodes* (L.) Nyl., bark of twig

20. *Hypogymnia tubulosa* (Schaer.) Hav., bark of twig

21. *Parmelia saxatilis* (L.) Ach., rock

22. *Parmelia sulcata* Taylor, debris at the spruce base

23. *Platismatia glauca* (L.) W.L. Culb. & C.F. Culb., coniferous twig

24. *Pseudevernia furfuracea* (L.) Zopf, bark of twigs

25. *Melanohalea exasperata* (De Not.) O. Blanco et al., tree bark

26. *Melanohalea exasperatula* (Nyl.) O. Blanco et al., tree bark

27. *Usnea dasopoga* (Ach.) Nyl., tree branches and bark

28. *Usnea florida* (L.) F.H. Wigg., coniferous twig

29. *Xanthoparmelia pulla* (Ach.) O. Blanco et al. s.l., rock

30. *Xanthoparmelia conspersa* (Ehrh. ex Ach.) Hale, rock

31. *Xanthoparmelia stenophylla* (Ach.) Ahti & D. Hawksw., rock

Family *Ramalinaceae*

32. *Bacidia* sp., bark of coniferous tree

33. *Ramalina farinacea* (L.) Ach., bark of spruce, deciduous trees

Family *Stereocaulaceae*

34. *Lepraria neglecta* (Nyl.) Erichsen, s.l., bark of pine-tree

Order *Lecideales*

Family *Lecideaceae*

35. *Lecidea fuscoatra* (L.) Ach., rock

36. *Porpidia cinereoatra* (Ach.) Hertel & Knoph, rock

37. *Porpidia crustulata* (Ach.) Hertel & Knoph, rock

38. *Porpidia macrocarpa* (DC.) Hertel & A.J. Schwab, rock

Order *Peltigerales*

Family *Peltigeraceae*

39. *Peltigera canina* (L.) Willd., mossy soil

Order *Rhizocarpales*

Family *Rhizocarpaceae*

40. *Rhizocarpon distinctum* Th. Fr., rock

41. *Rhizocarpon geographicum* (L.) DC., siliceous rock (Fig. 5)

Order Teloschistales

Family Teloschistaceae

42. *Rufoplaca arenaria* (Pers.) Arup, Søchting & Frödén, rock (Fig. 9)

43. *Xanthoria parietina* (L.) Th. Fr., tree bark

Subclass Ostropomycetidae

Order Baeomycetales

Family Baeomycetaceae

44. *Baeomyces rufus* (Huds.) Rebent., rock

Order Ostropales

Family Graphidaceae

45. *Diploschistes scruposus* (Schreb.) Norman, rock (Fig. 8)

Order Pertusariales

Family Icmadophilaceae

46. *Icmadophila ericetorum* (L.) Zahlbr., rotten piece of wood

Family Megasporaceae

47. *Aspicilia cinerea* (L.) Körb., rock

48. *Circinaria caesiocinerea* (Nyl. ex Malbr.) A. Nordin, Savić & Tibell, rock

Family Pertusariaceae

49. *Lepra amara* (Nyl.) Hafellner, beech bark, rock

50. *Lepra albescens* (Huds.) Hafellner, bark of trees, rock

Subclass Umbilicariomycetidae

Order Umbilicariales

Family Umbilicariaceae

51. *Lasallia pustulata* (L.) Mérat, rock (Fig. 4)

Fifteen species of lichenized fungi (29.4%) belonging to 12 genera, collected during this work in the Dupkata Reserve, were assigned to the category *Least Concern* (LC) by Shivarov et al. (2023), i.e. *Baeomyces rufus*, *Candelariella vitellina*, *Hypogymnia physodes*, *Melanohalea exasperata*, *Parmelia sulcata*, *Protoparmeliopsis muralis*, *Pseudevernia furfuracea*, *Rhizocarpon geographicum*, *Rinodina sophodes*, *Usnea dasopoga* (= *U. filipendula*), *U. florida*, *Xanthoparmelia conspersa*, *X. pulla*, *X. stenophylla*, *Xanthoria parietina*.

*Amandinea punctata* was examined in water, under LM from the Dupkata Reserve on bark of twig. It showed 8-spored asci, ca. 45–60 × 14–22 µm, and brown, 1-septate, often slightly curved ascospores, 14–17 (19.5) × 5.5–7 (9) µm (Fig. 6).

*Arthopyrenia analepta* s.l. with hyaline, 1–3-septate, usually biguttulate spores, 23–26.5 × 5–7.5 µm, was found on beech bark from the Dupkata Reserve.

*Baeomyces rufus* (Fig. 2) is a montane species, inhabitant of damp, natural wet places in forest areas, in terrain

depressions near dirt roads, was observed in the Reserve on siliceous rocks, N 41°46'33.6", E 24°14'43.7", alt. ca. 1575 m. Information about the distribution of *B. rufus* in the Rhodopi Mts can be retrieved from publications of Popnikolov, Zhelezova (1964), Mayrhofer et al. (2005), and Stoykov (2023). It was reported recently also from the Rila National Park (Stoykov, 2018b).

*Hypogymnia tubulosa* is well-known lichen throughout the country, growing on trees and is spread in eleven floristic regions of the country (according to Denchev et al., 2022). This less resistant species to air-pollution than *H. physodes* in Bulgaria, has been collected in June 2024 on oak twig from Eastern Forebalkan, at alt. ca. 485 m (SOMF 31583; Stoykov, unpubl.).

*Icmadophila ericetorum* has been collected in the reserve area. This species was known with specimen from Beglika Reserve, and was known in Rila and Rhodopi Mts (Stoykov, 2018b; Denchev et al., 2022).

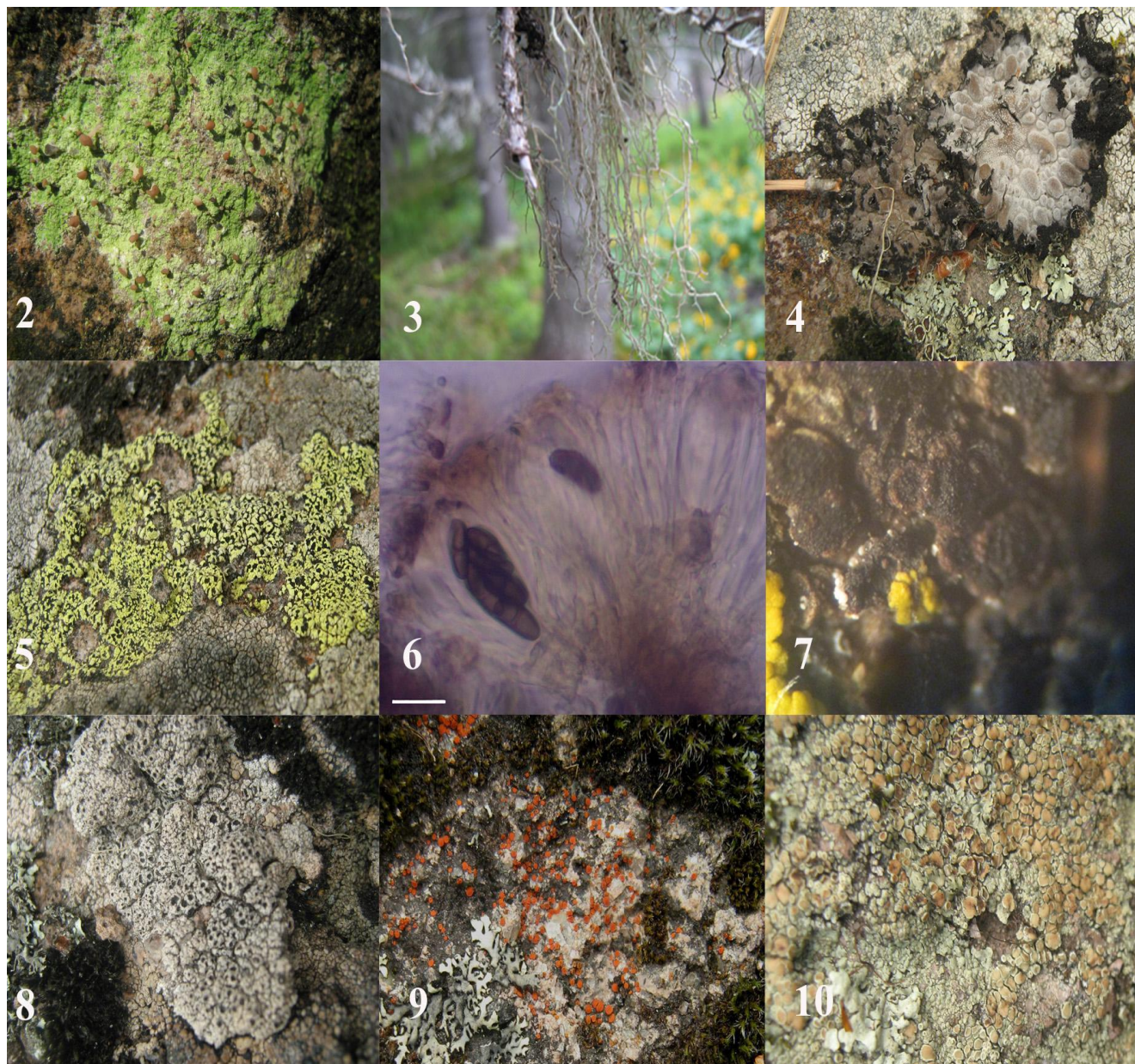
*Lepra albescens* is a more common one in Bulgaria, than the similar *L. amara*, and according to Mayrhofer et al. (2005) was spread almost on all the way from Black Sea coast to West Frontier Mts. It was registered several times on bark of conifers and on pieces of rocks in Dupkata Reserve, but showed negative reactions of soralia under 5% KOH and solution of sodium hypochlorite.

*Lepra amara* has been found on beech bark and on rocks in the Dupkata Reserve. The species is usually remarkable with its violet reaction with KC of the soralia, after putting drops of both solutions, and with bitter taste of its soralia. It is known in Bulgaria on rocks and bark of trees from Black Sea coast, Balkan Range, Valley of Struma River, Belasitsa, Pirin, Rhodopi and Strandzha Mts (Denchev et al., 2022).

*Lecanora pulicaris* has been found on twigs of conifers in the Dupkata Reserve, with 1-celled spores, 10–14.5 × 6.8–9.5 µm (mean = 12.1 × 8.5), n = 11, in water. It was known from Vitosha region, Pirin, Rila and Rhodopi Mts (Denchev et al., 2022; Stoykov 2023).

*Peltigera canina*, a common lichen throughout the country, has been examined from the Dupkata Reserve, N 41°46'28.7", E 24°14'56.9", at alt. ca. 1530 m, with hemispheric dark-brown, sometimes concave, apothecia, and showed 3–5-septate, straight, hyaline ascospores with slightly pointed ends, 45–60 (65) × 3–4 (5) µm, n = 10, in water. *Rufoplaca arenaria* (Fig. 9), with minute dark red discs, was studied under LM from a single locality in the Dupkata Reserve, N 41°46'03.5", E 24°15'55.2", at alt. ca. 1460 m, on siliceous rocks.





**Figures 2-10.** Lichens from Dupkata Reserve: 2. *Baeomyces rufus*, thallus on siliceous rock, in situ; 3. *Evernia divaricata*, pendulose thallus on tree, in situ; 4. *Lasallia pustulata*, on rock, in situ; 5. *Rhizocarpon geographicum*, thallus, in situ; 6. *Amandinea punctata*, ascus and ascospore, in water. Scale bar = 15  $\mu$ m; 7. *Rinodina sophodes*, dark-brown apothecia on bark, ex situ; 8. *Diploschistes scruposus*, thallus on rock, in situ; 9. *Rufoplaca arenaria*, apothecia on rock, in situ; 10. *Protoparmeliopsis muralis*, thalli on rock, in situ.

So far, this species is known only from Black Sea coast, Vitosha region, and Rhodopi Mts in Bulgaria (Popnikolov, Zhelezova, 1964; Mayrhofer et al., 2005; Vondrák & Slavíková-Bayerová, 2006). Its apothecia resemble superficially one collection of *Blastenia crenularia* (With.) Arup, Søchting & Frödén near Primorsko town, with discs staining deep red in K, and broad-ellipsoid ascospores up to  $15\text{--}22 \times 8\text{--}11 \mu\text{m}$  in water. *Usnea florida* is a montane species, known in Bulgaria only from Balkan Range, Vitosha, Rila, Sredna Gora, and Rhodopi Mts (Denchev et al. 2022).

## Conclusion

This study represents the first data about the lichen diversity in the Dupkata Reserve. According to the information obtained from the examined materials 51 species were recorded from the territory of the Reserve. They belong to 34 genera, 18 families, 13 orders, 6 subclasses, and 3 classes: *Arthoniomycetes*, *Dothideomycetes*, and *Lecanoromycetes* of the subphylum *Pezizomycotina*, phylum *Ascomycota*. The diversity of lichenized fungi from the Dupkata Reserve was presented generally by epiphytic



lichens studied from decaying wood, wooden debris, bark and branches (29 species), followed by epilithic or endolithic lichens, growing on siliceous rocks (21 species), one species was found on mossy rock, and three were epigeic species (*Cladonia furcata*, *C. fimbriata*, *Peltigera canina*), collected on soil. Future field excursions, aimed at the establishment and collecting of more species will expand the information on our knowledge about the variety of lichen mycota in this protected area

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## References

- Atanassova A, Mayrhofer H. 2012. *Physciaceae*. Part 1. Foliose genera. – In: Denchev, CM. (ed.), Fungi of Bulgaria. Vol. 9. Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia.
- Denchev C, Gyosheva M, Bakalova G, Fakirova V, Petrova R, Dimitrova E, Sameva E, Stoykov D, Assyov B, Nikolova S. 2006. Fungal diversity of the Rhodopes (Bulgaria). – In: Beron, P. (ed.). Biodiversity of Bulgaria. Vol. 3. Biodiversity of Western Rhodopes (Bulgaria and Greece). I. 81-131. – Pensoft & Natl. Mus. Natur. Hist., Sofia.
- Denchev CM, Shivarov VV, Denchev TT, Mayrhofer H. 2022. Checklist of the lichenized and lichenicolous fungi in Bulgaria. *Mycobiota*, 12: 1-106.
- Dobson FS. 2000. Lichens. An illustrated guide to the British and Irish Species. 4th revised colour Edition. – Richmond Publishing Co, Slough.
- Dobson FS. 2011. Lichens. An illustrated guide to the British and Irish species. 6th Edition. – Richmond Publishing Co. Ltd., Slough.
- Dobson FS. 2013. A Field Key to Lichens on Trees. – New Maiden, Surrey.
- Gutková A, Valachovič M, Tzonev R, Ganeva A, Shivarov VV, Fačkovcová Z. 2020. Lichens recorded in chasmophytic communities associated with relict and endemic plant species in Bulgaria. *Herzogia*, 33(2): 407-419.
- Management Plan of Dupkata Reserve. 2015. MOEW & Prizma-Nishava Consortium. 117 pp. + Addenda. Online at: <https://www.moew.government.bg/bg/priroda/zastiteni-teritorii/planove-za-upravlenie-na-zastiteni-teritorii-vlezli-v-sila/rezervati-i-poddurjani-rezervati> (In Bulgarian)
- Mayrhofer H, Denchev CM, Stoykov DY, Nikolova SO. 2005. Catalogue of the lichenized and lichenicolous fungi in Bulgaria. *Micol. Balcan.*, 2: 3-61.
- Mayrhofer H, Atanassova A, Nikolova SO, Denchev CM. 2020. Additions to the lichenized and lichenicolous fungi in Bulgaria. *Mycobiota*, 10: 39-62.
- Nimis PL. 2025. ITALIC - The Information System on Italian Lichens. Version 8.0. Department of Biology, University of Trieste (<https://dryades.units.it/italic>), accessed on 4.03.2025.
- Popnikolov A, Zhelezova B. 1964. Flora of Bulgaria. Lichens. – Narodna Prosveta, Sofia. (In Bulgarian)
- Register of protected territories and protected areas in Bulgaria. 2025. Dupkata Reserve. ([https://eea.government.bg/zpo/bg/area.jsp?NEM\\_Partition=1&categoryID=1&areaID=10](https://eea.government.bg/zpo/bg/area.jsp?NEM_Partition=1&categoryID=1&areaID=10)), accessed on 22.06.2025. (In Bulgarian)
- Shivarov VV, Varga N, Lőkös L, von Brackel W, Ganeva A, Natcheva R, Farkas E. 2021. Contributions to the Bulgarian lichenicolous mycota - an annotated checklist and new records. *Herzogia*, 34(1): 142-153.
- Shivarov VV, Denchev CM, Denchev TT. 2023. Red List of lichenized fungi in Bulgaria. *Mycobiota*, 13: 1-30.
- Smith CW, Aptroot A, Coppins BJ, Fletcher A, Gilbert OL, James PW, Wolseley PA. 2009. The lichens of Great Britain and Ireland. – British Lichen Society, London.
- Stoykov DY. 2015. *Lobaria pulmonaria* (Ascomycota, Lobariaceae) in Bulgaria. *Trakia J. Sci., Ser. Biomedical Sci.*, 13(2): 109-114.
- Stoykov D. 2018a. Recent finds of *Lobaria pulmonaria* and *L. scrobiculata* in Bulgaria. – In: Chankova S, Danova K, Parvanova P. (eds), Proceedings of 10th anniversary 'Seminar of Ecology – 2017', with international participation. 27-28 April, Sofia, Bulgaria. Farago, Sofia, p. 30-38.
- Stoykov DY. 2018b. Addition to the lichenized fungi (Ascomycota) of Central Rilski Reserve (Rila Mts.). *Ecologia Balkanica*, 10(2): 213-221.
- Stoykov D. 2023. Lichenized fungi (Ascomycota) from Kupena Reserve. – In: Georgiev, G. et al. (eds), XXXII International Conference "Ecology and Management of Forest Resources", Proceedings. 29-30 June, Sofia, Bulgaria. Avangard Prima, Sofia, p. 90-96. (In Bulgarian)
- Velev NI, Ganeva AS, Gyosheva MM, Sopotlieva DG, Terziyska TS, Apostolova II. 2015. Flora, mycota and vegetation of Dupkata Reserve (Rodopi Mts, Bulgaria). *Ann. Sofia Univ. "St. Kl. Ohridski"*, Book 2 – Botany, 99: 61-70.
- Vondrák J. 2006. Contribution to the lichenized and lichenicolous fungi in Bulgaria. I. *Micol. Balcan.*, 3: 7-11.
- Vondrák, J. & Slavíková-Bayerová, Š. 2006. Contribution to the lichenized and lichenicolous fungi in Bulgaria. II, the genus *Caloplaca*. *Micol. Balcan.*, 3: 61-69.
- Wijayawardene NN, Hyde KD, Lumbsch TH, Liu, JK, Maharachchikumbura SSN, Ekanayaka AH, Tian Q, Phookamsak R. 2018. Outline of Ascomycota: 2017. *Fungal Diversity*, 88(1): 167-263.