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THE FAMILY BOLETACEAE IN THE MYCOBIOTA OF THE REPUBLIC OF MOLDOVA

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Abstract: The mycological research, conducted in the territory of the Republic of Moldova during 1976-2018, allowed inventorying 39 species of macromycetes of 5 genera (*Boletus, Leccinum, Leccinellum, Phylloporus, Xerocomellus*) in the family *Boletaceae*. The absolute majority of the species of *Boletaceae* in the studied area are mycorrhizal fungi, which form symbioses with the main forest-forming species of oak and beech. For each species in the annotated list, it has been presented: the scientific name, the biological form and the habitat, the phenophase of the spore-containing structures and the frequency, chorological data and information on the significance.

Key words: Boletaceae, taxonomy, ecology, distribution, mycorrhizal fungi.

INTRODUCTION

The family *Boletaceae* includes terricolous, mycorrhizal fungi, very rarely saprophytic or parasitic, with large spore-bearing fruiting body of variable size – from 3-4 to 20-25 cm. The cap (pileus) is initially hemispherical, convex, but over time, it becomes flat, fleshy, with viscid or greasy surface, glabrous, hairy, velvety, smooth or squamous, sometimes cracked. The hymenophore consists of joined tubes, which can be easily separated from the cap, on the inside – covered with a fertile layer, and on the underside, there are round or polygonal pores, which may be white, yellowish, pink, orange or red and may change their colour when damaged. The hymenial trama is bilateral. The stipe is located centrally or, rarely, eccentrically; it is cylindrical, enlarged or pointed toward the base, in some species – ventricose (larger in the midportion), smooth or reticulate. The flesh ranges from very compact to soft, often turns blue or pink when damaged, the taste is sweet, rarely bitter and the smell may be pleasant or unpleasant. The basidiospores are fusoid (spindle-shaped) or ellipsoid, smooth, rarely spherical or reticulate. The spore powder is brown or olive-brown, more rarely purple or reddish-pink.

The vast majority of *Boletaceae* are symbiotic mushrooms and form mycorrhizas with various species of trees and shrubs, some species being linked only to deciduous or only to coniferous plants, and some – to a certain deciduous or coniferous species [12]. As far as the geographical distribution is concerned, the members of the family *Boletaceae* occur on all continents except Antarctica, but at the same time, individual genera and species are distributed very unequally. Most species grow in the temperate forests of Eurasia and North America.

According to Kirk et al. (2008), this family includes 35 genera with 787 species [10]. In the Republic of Moldova, 5 genera have been found (*Boletus, Leccinum, Leccinellum, Phylloporus, Xerocomellus*) and they include 39 species.

MATERIALS AND METHODS

The taxonomic diversity of the family *Boletaceae* was studied during the growing seasons in 1976-2017, and thus 39 species of macromycetes were inventoried. The research was carried out in the present territory of the Republic of Moldova, located in the south-eastern part of Europe, near the geographical centre of the continent. Most of its territory is located between the Dniester and the Prut rivers [3].

The sampling of the biological material for the study was done in various forest sectors, according to the methodical guidelines «Руководство по сбору высших базидиальных грибов для научного их изучения» (Guidelines on collecting higher basidiomycetes for scientific study) [4]. This was preceded by the macroscopic

analysis of carpophores on the spot, recording all phenotypic traits, according to the methodological recommendations from "Guide des Champignons de France et d'Europe" (Guide to the Mushrooms of France and Europe) [8, 9]. The macroscopic analyses were complemented with microscopic-photonic analyses, which helped studying in detail the structure of the hymenium, with a special emphasis on basidia and basidiospores, which aimed in particular the colour, size, ornamentation and the amyloid reaction of spores, phenotypic traits of high taxonomic value. The collected material, which counts more than 500 samples, is stored in the Herbarium of the Botanical Garden and the "Codrii" Scientific Reserve.

RESULTS AND DISCUSSIONS

The mycological research carried out in the territory of the Republic of Moldova, from 1976 to 2017, allowed detecting 39 species of macromycetes of the family *Boletaceae* [1, 2, 5, 6, 7]. The comparative analysis of the data obtained by us, regarding the presence of species of *Boletaceae* in the studied territory, and the previously published data, revealed the presence of new taxa in the mycobiota of the Republic of Moldova [1, 2].

The taxonomic analysis of the annotated list of *Boletaceae* denotes the massive presence of species of the genus *Boletus* – 22 species, followed by the genus *Leccinum* with 10 species, the genera *Liccinelum, Xerocomus* and *Xerocomellus* are represented by 2 species each, and the genus *Phylloporus* – by a single species.

The absolute majority of species of the family *Boletaceae*, in the studied area, are mycorrhizal fungi, which form symbioses with the main forest-forming species of oak (*Quercus robur*, *Q. petraea* and *Q. pubescens*) and beech. The beech forests, followed by the oak forests that also include poplar, are the richest in terms of specific diversity of *Boletaceae*.

The *Boletaceae* are large and fleshy mushrooms and are highly appreciated by the native population. Out of the 39 listed species, 34 are edible and 5 species are toxic.

Being aware that the reference criteria for the characterization of systematic entities are always added and completed, in this paper, we took as a guide the taxonomic system used by Kirk et al. (2008) [10]. For each species in the annotated list, the following information has been given: the scientific name, the biological form and the habitat, the phenophase of the spore-containing structures, the frequency, chorological data and information on the significance.

LIST OF ABBREVIATIONS

Bioforms
Gm - mycetoepigeophyta mycorrhiza
Phytocenoses
Be./s.ok. - beech with sessile oak
S.ok./sm.t. - sessile oak with smoke tree
Be./hbm. – beech with hornbeam
S.ok./hbm. - sessile oak with hornbeam
S.ok./li., ah. - sessile oak with lime and ash
P.ok./bi. - pedunculate oak with birch
P.ok./w.ch. - pedunculate oak with wild cherry
P.ok./btn. - pedunculate oak with blackthorn
P.ok./hbm. - pedunculate oak with hornbeam
P.ok./em. - pedunculate oak with elm
P.ok./po. - pedunculate oak with poplar
D.ok. - downy oak
Geobotanical zone
Bgn - Bugeacul de Nord; Bl - Bălţi; Br – Briceni; Cd – Codrii; Rş - Râşcani; Rz – Rezina; Tgh – Tigheci; Tn - Tighina
Gastronomic significance
♨ - Edible
₦ - Inedible
† - Poisonous

Annotated list of taxa of the family Boletaceae

1. ***Boletus aereus*** Bull. - Bioform: Gm. Phenophase: VI-XI. Very rare species. Found in Bl, Cd, Rz Tgh and Tn, in the phytocenoses: Be./s.ok.; Be./hbm.; S.ok./hbm. ; S.ok./sm.t.; P.ok./btn.; D.ok. ♨.
2. ***Boletus badius*** (Fr.) Fr. - Bioform: Gm. Phenophase: VI-XI. Common species. Found in Cd, Rz, Tgh and Tn, in the phytocenoses: Be./hbm.; S.ok./hbm. ; S.ok./sm.t.; P.ok./bi.; D.ok. ♨.
3. ***Boletus calopus*** Pers. - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd and Rz, in the phytocenoses: S.ok./hbm. ₦.
4. ***Boletus depilatus*** Redeuilh - Bioform: Gm. Phenophase: VI-XI. Common species. Found in Cd, Bl and Rz, in the phytocenoses: Be./hbm.; S.ok./hbm.; P.ok./hbm.; P.ok./w.ch. ₦.
5. ***Boletus edulis*** Bull. - Bioform: Gm. Phenophase: III-XI. Common species. Found in Cd, Br, Bl, Rz, Rş, Tgh and Tn, in forest phytocenoses. ♨.
6. ***Boletus erythropus*** Pers. - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Bl, Cd, Rz, Rş, Tgh and Tn, in forest phytocenoses. ♨.
7. ***Boletus ferrugineus*** Schaeff. - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Bl, Cd, Br and Tgh, in the phytocenoses: Be./s.ok.; Be./hbm.; S.ok./sm.t.; P.ok./btn.; P.ok./em. ₦.
8. ***Boletus impolitus*** Fr. - Bioform: Gm. Phenophase: VI-XI. Common species. Found in Bl, Cd, Tn and Tgh, in forest phytocenoses. ♨.
9. ***Boletus legaliae*** Pilát - Bioform: Gm. Phenophase: VI-XI. Common species. Found in Cd and Bl, in the phytocenoses: Be./hbm.; P.ok./hbm.; P.ok./w.ch. ₦.
10. ***Boletus luridus*** Schaeff. - Bioform: Gm. Phenophase: III-XI. Common species. Found in Cd, in all the forest phytocenoses ♨.
11. ***Boletus luteocupreus*** Bertéa & Estadès - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, Tn, in the phytocenoses: S.ok./hbm.; P.ok./hbm. ₦.
12. ***Boletus pseudoregius*** (Heinr. Huber) Estadès - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, in the phytocenoses: Be./hbm. ₦.
13. ***Boletus pulchrotinctus*** Alessio - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Bl and Cd, in the phytocenoses: Be./s.ok.; Be./hbm.; P.ok./hbm. ₦.
14. ***Boletus pulverulentus*** Opat. - Bioform: Gm. Phenophase: III-XI. Common species. Found in Cd, Bl and Tgh, in the phytocenoses: Be./hbm.; S.ok./li., ah.; P.ok./hbm. ♨.
15. ***Boletus queletii*** Schulzer - Bioform: Gm. Phenophase: III-XI. Common species. Found in Bl, Cd, Rz, Tgh and Tn, in the phytocenoses: Be./hbm.; S.ok./hbm.; S.ok./li., ah.; S.ok./sm.t.; P.ok./btn.; D.ok., cultivated species. ♨.
16. ***Boletus radicans*** Pers. - Bioform: Gm. Phenophase: III-XI. Common species. Found in Bl, Cd and Rz, in the phytocenoses: S.ok./hbm.; P.ok./hbm. ₦.
17. ***Boletus regius*** Krombh**.** - Bioform: Gm. Phenophase: III-XI. Common species. Found in Bl and Cd, in the phytocenoses: Be./s.ok.; Be./hbm.; P.ok./hbm. ♨.
18. ***Boletus reticulatus*** Schaeff. - Bioform: Gm. Phenophase: V-XI. Common species. Found in Bl and Cd, in forest phytocenoses ♨.
19. ***Boletus rhodopurpureus*** Smotl**.** - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, in the phytocenoses: Be./hbm. ♨.
20. ***Boletus satanas*** Lenz – Bioform: Gm. Phenophase: V-XI. Rare species. Found in Bl, Cd, Rz and Tgh, in the phytocenoses: S.ok./li., ah.; S.ok./sm.t.; P.ok./hbm. †.
21. ***Boletus subtomentosus*** L. - Bioform: Gm. Phenophase: V-XI. Common species. Found in Cd, Rz, Tgh and Tn, in the phytocenoses: S.ok./hbm.; S.ok./li., ah.; S.ok./sm.t.; D.ok. and cultivated species♨.
22. ***Boletus xanthocyaneus*** (Ramain) Romagn. - Bioform: Gm. Phenophase: V-XI. Common species. Found in Bl and Cd, in the phytocenoses: P.ok./hbm. ₦.
23. ***Leccinellum crocipodium*** (Letell.) Watling - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, Br, Rş and Tn, in the phytocenoses: Be./hbm.; P.ok./bi.; P.ok./em.♨.

24. ***Leccinellum griseum*** (Quél.) Bresinsky & Manfr. Binder – Bioform: Gm. Phenophase: VI-XI. Common species. Found in Cd, Br, Tn, Tgh, in the phytocenoses: Be./hbm.; S.ok./li., ah.; P.ok./hbm.; P.ok./w.ch. ♨.
25. ***Leccinum albostipitatum*** den Bakker & Noordel. - Bioform: Gm. Phenophase: VI-XI. Rare species. Found in Cd, Tgh and Tn, in the phytocenoses: Be./hbm. and cultivated species. ₦.
26. ***Leccinum aurantiacum*** (Bull.) Gray - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, Rz, Rş and Tn, in the phytocenoses: P.ok./w.ch.; P.ok./po.; P.ok./em. ♨.
27. ***Leccinum cyaneobasileucum*** Lannoy & Estadès - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, Br and Tn, in the phytocenoses: P.ok./bi.; P.ok./po.₦.
28. ***Leccinum duriusculum*** (Schulzer ex Kalchbr.) Singer - Bioform: Gm. Common species. Phenophase: V-VIII. Found in Cd, Rz and Tn, in the phytocenoses: P.ok./w.ch.; P.ok./po. ♨.
29. ***Leccinum holopus*** (Rostk.) Watling - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, Br, Rz and Tn, in the phytocenoses: P.ok./w.ch.; P.ok./bi.; P.ok./po. ₦.
30. ***Leccinum molle*** (Bon) Bon - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, Br, Tn, in the phytocenoses: P.ok./w.ch.; P.ok./bi.; cultivated species. ₦.
31. ***Leccinum pseudoscabrum*** (Kallenb.) Šutara - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd and Tgh, in the phytocenoses: Be./hbm.; S.ok./li., ah. ₦.
32. ***Leccinum scabrum*** (Bull.) Gray - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Cd, Br and Tn, in the phytocenoses: S.ok./hbm.; P.ok./bi.; P.ok./w.ch. ♨.
33. ***Leccinum variicolor*** Watling - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Br and Cd, in the phytocenoses: Be./hbm.; P.ok./bi.; P.ok./w.ch. ₦.
34. ***Leccinum versipelle*** (Fr. & Hök) Snell - Bioform: Gm. Phenophase: V-VIII. Common species. Found in Br, Cd, Rş and Tn, in the phytocenoses: P.ok./bi.; P.ok./w.ch.; P.ok./em. ♨.
35. ***Phylloporus rhodoxanthus*** (Schwein.) Bres. - Bioform: Gm. Phenophase: V-VIII. Very rare species. Found in Cd, Rş and Tn, in the phytocenoses: Be./s.ok.; Be./hbm.; P.ok./em. ₦.
36. ***Xerocomellus armeniacus*** (Quél.) Šutara - Bioform: Gm. Phenophase: III-XI. Rare species. Found in Bl, Cd, Rz, Tgh and Tn, in the phytocenoses: S.ok./hbm.; P.ok./hbm.; D.ok. ₦.
37. ***Xerocomellus chrysenteron*** (Bull.) Šutara - Bioform: Gm. Phenophase: VI-XI. Common species. Found in Bl, Cd, Br, Tgh and Tn, in forest phytocenoses. ♨.
38. ***Xerocomellus pruinatus*** (Fr. & Hök) Šutara - Bioform: Gm. Phenophase: III-XI. Common species. Found in Bl, Cd, Rz, Tn, Tgh, in the phytocenoses: S.ok./hbm.; P.ok./hbm.; D.ok. ₦.
39. ***Xerocomellus rubellus*** Krombh. - Bioform: Gm. Phenophase: III-XI. Common species. Found in Br, Cd, Rz, in the phytocenoses: S.ok./hbm.; P.ok./hbm.; P.ok./bi.; P.ok./w.ch.; P.ok./em.₦.

CONCLUSIONS

1. The natural conditions of the Republic of Moldova: vegetation, relief, hydrographic features, climate and soils largely determine the diversity of species of macromycetes of the family *Boletaceae* in this area.
2. The research on the taxonomic diversity of macromycetes has led to the identification, in the researched mycobiota, of 39 species of *Boletaceae* belonging to 5 genera: *Boletus, Leccinum, Leccinellum, Phylloporus, Xerocomellus.*
3. The absolute majority of species of *Boletaceae*, in the studied area, are mycorrhizal fungi, which form symbioses with the main forest-forming species of oak and beech.
4. The beech forests, followed by the oak forests that also include poplar, are the richest in terms of specific diversity of *Boletaceae*.
5. Of the total number of *Boletaceae* identified in the territory under study, 34 species are edible and 5 are poisonous.

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