*SKUP, 2019, 10(1)*

**DOI: 10.7251/SKPEN191001052L** **UDC: 577.1:[582.284:635.8 (497.6Glamočani)**

***Original scientific paper***

# DIVERSITY OF BASIDIOMYCOTA IN THE AREA OF GLAMOČANI NEAR BANJALUKA

Svjetlana Lolić[1*], Vuk Stević[1], Radoslav Dekić[1]

[1]*University of Banja Luka, Faculty of Natural Sciences and Mathematics, Mladena Stojanovića 2, 78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina*

*** Corresponding Author, email:** svjetlana.lolic@pmf.unibl.org

**Abstract.** Due to its geographical location, favorable climatic conditions and large areas under the forests, Bosnia and Herzegovina is an ideal habitat for growth of various types of fungi from division Basidiomycota. However, previous research on fungal diversity was based mainly on "interesting" edible and poisonous species, while some more detailed studies of their diversity around the city of Banja Luka were not carried out. During 2015, the qualitative composition of fungi from the division Basidiomycota in the area of Glamočani near Banja Luka was examined. 57 species of macroscopic fungi were collected, which were classified into 28 families. The most frequent family was Russulaceae with 7 species, followed by Polyporaceae with 6 species and Agaricaceae and Mycenaceae with 5 species. The largest number of species in this study was found during spring (38 species), 22 species were found during autumn, and only 11 species during summer. The total number of species at this locality is certainly even greater since the collection took place between May and October in accessible areas of the field.

**Key words**: diversity, Basidiomycota, Glamočani, Banja Luka.

## INTRODUCTION

Bosnia and Herzegovina is characterized by large forested areas and optimal climate for fungal growth and development. However, they are poorly researched in Bosnia and Herzegovina, and most publications related to fungi in our area are oriented towards the identification of edible and economically significant species. About 550 macromycetes species have been described in Bosnia and Herzegovina so far. Their diversity is estimated to be far greater (Đug, 2013). Intensive macromycetes diversity studies in the Republic of Srpska were only performed on the Lisina and the Kozara mountains.

The main objective of this research is to make a list of the present species of macromycetes in the area of Glamočani, which can serve as a starting point for future

research on fungal diversity in forests in the area of Banja Luka, as well as in the Republic of Srpska and Bosnia and Herzegovina as a whole.

Glamočani is situated in northwestern part of Bosnia and Herzegovina at 44°52′ north latitude and 17°15′ east longitude (Figure 1). It is located on a hilly terrain, along the bank of the Vrbas River. In the south, it lies at 132 m above sea level, and in the north, it rises up to 260 m. The climate is humid continental with an average annual temperature between 10 and 11 ºC. The average rainfall during the year is 948 mm, with the highest rainfall in June and the lowest in February. The locality is characterized by deciduous forests dominated by beech, oak and hornbeam communities.

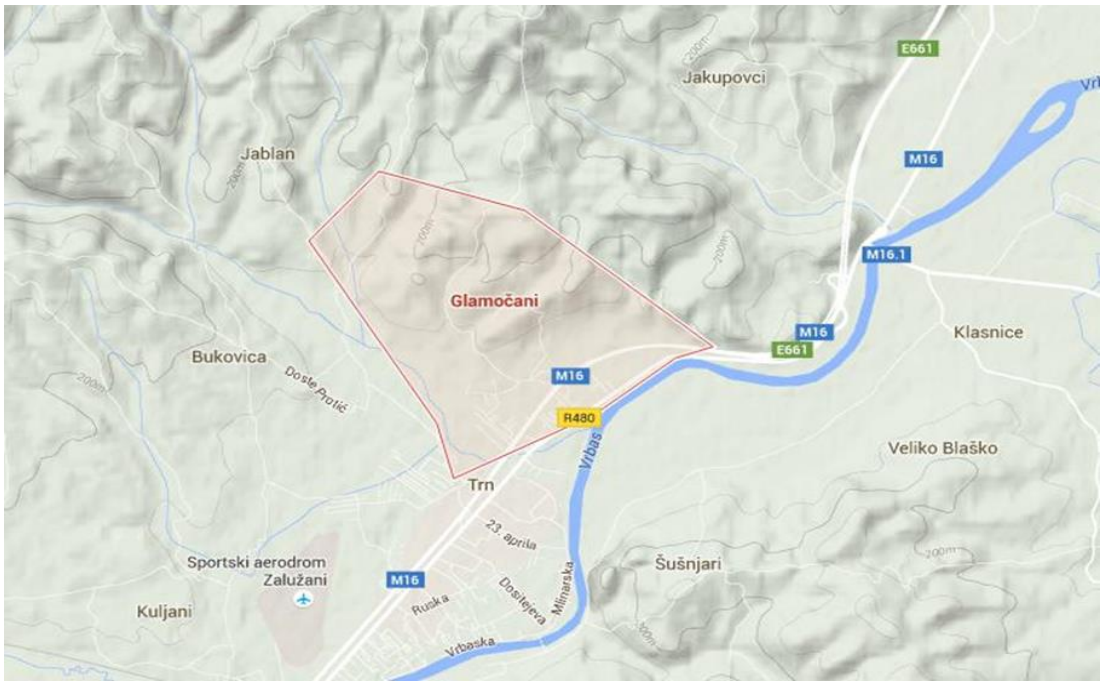


**Figure 1**. Map of Glamočani (www.google.ba/maps, 2016)

## MATERIAL AND METHODS

Sampling was carried out in the area of Glamočani from May to October 2015. The fungi were collected in the early morning, three to five days after rain. Fruiting bodies with an open hat and exposed hymenium were sampled, at the life stage most suitable for determination. The fruiting bodies were first photographed from different angles to capture the characteristics and size of their structures in their native state. Terricolous specimens were then sampled by gentle rotation of the fruiting body, while lignicolous specimens were sampled with a knife together with a part of the substrate.

The following keys and manuals were used to determine the species:„ Ključ za gljive; Ilustrirani uvod u gljivarstvo" (Focht, 1996), „Gljive, enciklopedija" (Keizer, 1998), „Gljive, džepni gljivarski vodič" (Garnweidner, 2006), „Koja je ovo gljiva?" (Flik, 2010), „Key to major groups of mushrooms" (Kuo, 2007). Determined species are represented by current scientific names and taxonomy that are consistent with the catalog of fungal taxa „Species Fungorum" (Kirk, 2016.).

## RESULTS AND DISCUSSION

The total of 57 species of macromycetes were collected in the area of Glamočani from May to October 2015. They are classified into 28 families. Table 1 provides a list of all collected macromycetes by family, season, usable value, type of nutrition and type of habitat where they were found.

**Table 1.** List of macromycetes in the area of Glamočani. Ed-edible species; P- poisonous species; M- medically significant species; E- economically significant species; N- species has no practical significance; Sa- saprobic species; Pa- parasitic species; Mi- mycorrhizal species; T- terricolous species; L- lignicolous species

| species | season | | | usable value | nutrition | habitat |
|---|---|---|---|---|---|---|
| | spring | summer | autumn | | | |
| **1. *Agaricaceae*** | | | | | | |
| *Agaricus arvensis* Schaeff., 1774 | | | **h** | **Ed** | **Sa** | **T** |
| *Lepiota ignivolvata* Bousset & Joss. ex Joss., 1990 | | | **h** | **P** | **Sa** | **T** |
| *Leucoagaricus leucothites* (Vittad.) Wasser, 1977 | | | **h** | **Ed** | **Sa** | **T** |
| *Macrolepiota sp.* | **h** | | | **Ed** | **Sa** | **T** |
| *Macrolepiota procera* (Scop.) Singer, 1948 | | | **h** | **Ed** | **Sa** | **T** |
| **2. *Amanitaceae*** | | | | | | |
| *Amanita gemmata* (Fr.) Bertill., 1866 | **h** | | | **P** | **Mi** | **T** |
| **3. *Boletaceae*** | | | | | | |
| *Tylopilus porphyrosporus* (Fr. & Hök) A.H. Sm. & Thiers, 1971 | **h** | | | **N** | **Mi** | **T** |
| **4. *Cortinariaceae*** | | | | | | |
| *Cortinarius venetus var. venetus* (Fr.) Fr., 1838 | **h** | | | **N** | **Mi** | **T** |
| **5. *Entolomataceae*** | | | | | | |
| *Clitopilus prunulus* (Scop.) P. Kumm., 1871 | | | **h** | **Ed** | **Sa** | **T** |
| **6. *Fomitopsidaceae*** | | | | | | |
| *Daedalea quercina* (L.) Pers., 1801 | **h** | | | **M/E** | **Sa** | **L** |
| *Fomitopsis pinicola* (Sw.) P. Karst., 1881 | | **h** | **h** | **N** | **Pa** | **L** |
| **7. *Ganodermataceae*** | | | | | | |
| *Ganoderma applanatum* (Pers.) Pat., 1887 | | | **h** | **M/E** | **Pa** | **L** |
| *Ganoderma lucidum* (Curtis) P. Karst., 1881 | **h** | | | **M** | **Pa** | **L** |
| **8. *Gomphaceae*** | | | | | | |
| *Ramaria pallida* (Schaeff.) Ricken, 1920 | **h** | | **h** | **P** | **Mi** | **L** |
| **9. *Hygrophoraceae*** | | | | | | |
| *Hygrophoropsis aurantiaca* (Wulfen) Maire, 1921 | | | **h** | **N** | **Sa** | **T** |
| *Hygrophorus eburneus* (Bull.) Fr., 1838 | **h** | | | **Ed/E** | **Mi** | **T** |
| *Hygrophorus unicolor* Gröger, 1980 | **h** | | | **Ed** | **Mi** | **T** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **10. *Hymenochaetaceae*** | | | | | | |
| *Hymenochaete sp.* | **h** | | | **N** | **Sa** | **L** |
| *Hymenochaete rubiginosa* (Dicks.) Lév., 1846 | **h** | **h** | | **N** | **Sa** | **L** |
| *Fomitiporia hippophaëicola* (H. Jahn) Fiasson & Niemelä, 1984 | | **h** | | **N** | **Pa** | **L** |
| *Xanthoporia radiata* (Sowerby) Tura, Zmitr., Wasser, Raats & Nevo, 2012 | | | **h** | **N** | **Pa** | **L** |
| **11. *Hypocreaceae*** | | | | | | |
| *Trichoderma pulvinatum* (Fuckel) Jaklitsch & Voglmayr, 2014 | **h** | | | **N** | **Sa** | **L** |
| **12. *Inocybaceae*** | | | | | | |
| *Crepidotus variabilis* (Pers.) P. Kumm., 1871 | | | **h** | **N** | **Sa** | **L** |
| ***13. Meripilaceae*** | | | | | | |
| *Meripilus giganteus* (Pers.) P. Karst., 1882 | **h** | | | **M** | **Pa** | **L** |
| **14. *Meruliaceae*** | | | | | | |
| *Bjerkandera adusta* (Willd.) P. Karst., 1879 | | | **h** | **N** | **Sa** | **L** |
| ***15. Mycenaceae*** | | | | | | |
| *Mycena sp.* | **h** | | | **N** | **Sa** | **L** |
| *Mycena galericulata* (Scop.) Gray, 1821 | **h** | | | **N** | **Sa** | **L** |
| *Mycena pura* (Pers.) P. Kumm., 1871 | **h** | | **h** | **P/M** | **Sa** | **L** |
| *Mycena luteovariegata* (Gillet) Bugge Harder & Læssøe, 2013 | | | **h** | **N** | **Sa** | **L** |
| *Mycena renati* Quél., 1886 | **h** | | | **N** | **Sa** | **L** |
| **16. Physalacriaceae** | | | | | | |
| *Hymenopellis radicata* (Relhan) R.H. Petersen, 2010 | | | **h** | **Ed** | **Sa** | **T** |
| **17. *Physaraceae*** | | | | | | |
| *Fuligo septica* (L.) F.H.Wigg., 1780 | **h** | | | **M** | **Sa** | **L** |
| **18. *Pleurotaceae*** | | | | | | |
| *Pleurotus pulmonarius* (Fr.) Quél., 1872 | | **h** | | **Ed/M** | **Sa** | **L** |
| **19. *Pluteaceae*** | | | | | | |
| *Pluteus cervinus* (Schaeff.) P. Kumm., 1871 | **h** | **h** | | **Ed** | **Sa** | **T** |
| **20. *Polyporaceae*** | | | | | | |
| *Datronia mollis* (Sommerf.) Donk, 1966 | **h** | | | **N** | **Sa** | **L** |
| *Fomes fomentarius* (L.) Fr., 1849 | **h** | | | **E** | **Pa** | **L** |
| *Polyporus varius* (Pers.) Fr., 1821 | | **h** | | **N** | **Sa** | **L** |
| *Trametes gibbosa* (Pers.) Fr., 1838 | | | **h** | **N** | **Sa** | **L** |
| *Trametes suaveolens* (L.) Fr., 1838 | | **h** | | **E** | **Pa** | **L** |
| *Trametes versicolor* (L.) Lloyd, 1921 | **h** | **h** | **h** | **M** | **Sa** | **L** |
| **21. *Psathyrellaceae*** | | | | | | |
| *Coprinopsis picacea* (Bull.) Redhead, Vilgalys & Moncalvo, 2001 | | | **h** | **P** | **Sa** | **T** |
| *Lacrymaria lacrymabunda* (Bull.) Pat., 1887 | | | **h** | **N** | **Sa** | **T** |
| ***22. Russulaceae*** | | | | | | |
| *Lactarius piperatus* (L.) Pers., 1797 | **h** | | | **M/E** | **Mi** | **T** |
| *Lactarius vellereus* (Fr.) Fr., 1838 | **h** | | | **N** | **Mi** | **T** |
| *Russula sp.* | **h** | | | **N** | **Mi** | **T** |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Russula cyanoxantha* (Schaeff.) Fr., 1863 | **h** | | | **Ed** | **Mi** | **T** |
| *Russula fragilis* Fr., 1838 | **h** | | | **P** | **Mi** | **T** |
| *Russula olivacea* (Schaeff.) Fr., 1838 | **h** | | | **Ed** | **Mi** | **T** |
| *Russula vesca* Fr., 1836 | **h** | | | **Ed** | **Mi** | **T** |
| **23. *Rhizinaceae*** | | | | | | |
| *Rhizina undulata* Fr., 1815 | **h** | | | **N** | **Pa** | **L** |
| **24. *Schizophyllaceae*** | | | | | | |
| *Schizophyllum commune* Fr., 1815 | | | **h** | **Ed** | **Sa** | **L** |
| ***25. Stereaceae*** | | | | | | |
| *Stereum hirsutum* (Willd.) Pers., 1800 | **h** | **h** | **h** | **N** | **Sa** | **L** |
| *Stereum ochraceoflavum* (Schwein.) Sacc., 1888 | **h** | **h** | | **N** | **Sa** | **L** |
| *Stereum subtomentosum* Pouzar, 1964 | | **h** | | **N** | **Sa** | **L** |
| **26. *Strophariaceae*** | | | | | | |
| *Hypholoma fasciculare* (Huds.) P. Kumm., 1871 | **h** | | **h** | **P/E** | **Sa** | **L** |
| **27. *Tricholomataceae*** | | | | | | |
| *Collybia cirrhata* (Schumach.) Quél., 1872 | | | **h** | **N** | **Sa** | **T** |
| **28. *Xylariaceae*** | | | | | | |
| *Hypoxylon fuscum* (Pers.) Fr., 1849 | **h** | | | **E** | **Sa** | **L** |

Table 1 displays 57 species identified. They belong to 40 different genera and 28 families. The genera with the largest number of taxa were *Mycena* (Figure 2) and *Russula*. In the studied locality, they were represented by five species each (8.77% of the total sample). The genera *Trametes* and *Stereum* were represented by three species each (5.26%). Five genera (*Macrolepiota, Ganoderma, Hygrophorus, Hymenochaete* and *Lactarius*) were represented by two species each (3.51%), and other genera (31 genera) were represented by one species (1.75%). The family with the largest number of species was Russulaceae with seven taxons, followed by Polyporaceae with six, Agaricaceae and Mycenaceae with five, Hymenochaetaceae with four, Hygrophoraceae and Stereaceae with three, and Fomitopsidaceae, Ganodermataceae and Psathyrellaceae with two species. Other families (18 families) were represented by one species. The largest number of taxa in the area of Glamočani was found during spring (34). Twenty-two taxa were collected during autumn, and only eleven different taxa were found in summer. Some taxa could be found over two seasons, while *Stereum hirsutum* (Figure 3) and *Trametes versicolor* are the only taxa found during all three seasons.

**Figure 2.** *Mycena renati*

**Figure 3.** *Stereum hirsutum*

When looking at the usable value of the species collected, most of them have practical significance for humans: 22% are edible, 13% are medically significant, 13% are economically significant species and 11% are poisonous. The rest of the species (41%) have no practical significance for humans but they participate in the processes of matter circulation and play a very important role in the functioning of the ecosystem as a whole. Therefore, during the study of fungal diversity, each species should be treated as equally significant and research should not be limited to species that are significant to humans.

Most of the fungal species found (73%) are lignicolous species. These are fungi whose fruiting body grows on trees, stumps and rotting trees and twigs. Only 27% are terricolous species or fungi whose fruiting bodies grow on soil or forest litter. The largest numbers of species are saprotrophs (35 taxa), mycorrhizal communities form 13 species, while 9 species lead parasitic lifestyles.

A research by Blagić and Lolić (2016) in the area of the Banj brdo hill near Banjaluka indicated the presence of a far greater number of species in this area. During the same period, a total of 96 macromycetes from 33 different families were found, with the largest number of taxa found in autumn. Here, as well as in the area of Glamočani, macromycetes of the families Mycenaceae, Polyporaceae and Russulaceae were qualitatively predominant, but there was a significantly higher proportion of terricolous species (58%). The reason for the greater diversity of fungi in the area of the Banj brdo hill is the different types of habitats that can be found in this area. In addition to the dominant beech, oak and hornbeam communities, there are areas with coniferous trees as well as meadow communities, while at the Glamočani area deciduous forests dominate.

## CONCLUSIONS

During the research conducted in the area of Glamočani near Banja Luka from May to October 2015, 57 different taxa of macromycetes were found and identified. Most of the mycological researches in the Republic of Srpska and Bosnia and Herzegovina as a whole are anthropocentrically-oriented and they are limited to those types of fungi that are economically significant to humans. However, it has been shown that "unusable" fungi form a significant proportion of the total species of macromycetes and their presence, due to their importance for the functioning of the ecosystem, should not be neglected. An accurate list of

all species present in specific localities is also a path to creating red lists and red books which the Republic of Srpska does not currently possess. It should not be overlooked that fungi are not present to "satisfy" human needs. They are a highly specialized group of organisms that occupy a significant ecological niche and they are an unbreakable link in an ecosystem without which the sustainability of life processes is impossible.

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**Received 27 February 2018**
**Accepted 20 February 2019**