ГОДИШНИК НА СОФИЙСКИЯ УНИВЕРСИТЕТ „СВ. КЛИМЕНТ ОХРИДСКИ“
БИОЛОГИЧЕСКИ ФАКУЛТЕТ
Книга 2 – Ботаника
Том 108, 2024

ANNUAL OF SOFIA UNIVERSITY “ST. KLIMENT OHRIDSKI”
FACULTY OF BIOLOGY
Book 2 – Botany
Volume 108, 2024

https://doi.org/10.60066/GSU.BIOFAC.Bot.108.83-112

BIODIVERSITY OF MACROMYCETES IN THE VICINITY OF CHELOPECH TOWN, STARA PLANINA MTS (2020-2021, 2023). I. SPECIES COMPOSITION, ECOTROPHIC GROUPS AND CONSERVATIONALLY IMPORTANT SPECIES

BLAGOY A. UZUNOV*, KRISTIAN R. IVANOV, MIROSLAV I. ANDROV, BOYAN T. MICHEV & MAYA P. STOYNEVA-GÄRTNER

[1] Sofia University “St. Kliment Ohridski”, Faculty of Biology, Department of Botany, 8 Dragan Tsankov Blvd., BG-1164, Sofia, Bulgaria
[2] Bulgarian Academy of Sciences, Institite of biodiversity and ecosystem services, Gagarin str. 2, BG-1113, Sofia, Bulgaria

Abstract. The paper presents first results obtained on the biodiversity in terms of species composition and ecotrophic groups of macromycetes from Sredna Stara Planina Mts in the vicinity of Chelopech town. The studied area (20 km^2) was visited in the late spring/ early summer periods of 2020 and 2023, as well as in late autumn/early winter periods of the years 2021 and 2023, covering 23 days. The field work was conducted in eight representative polygons of two main areas with application of transect method. Altogether 219 taxa, mostly Basidiomycota (208), were recorded with differences in their distribution in terms of area and seasons. The variation in these differences allows us to suppose the strong influence of local climate conditions on the results obtained. Regarding ecotrophic groups, most of the macromycetes were saprotrophs (147) which develop on different substrata, followed by mycorrhizal fungi (67) and very less, only five, were parasites. Among the recorded species, six were of conservational importance according to the Red List of Bulgarian macromycetes and contemporary Red Data Book of R Bulgaria. Comparison of the results obtained with updated list of Bulgarian macromycetes demonstrate the great biodiversity of the studied area, which comprises 83% of the biodiversity of macromycetes in Sredna Stara Planina Mts, 35%

**corresponding author*: B. A. Uzunov - Sofia University “St. Kliment Ohridski”, Faculty of Biology, Department of Botany, 8 Dragan Tsankov Blvd., BG-1164, Sofia, Bulgaria; buzunov@ uni-sofia.bg

of their diversity in the entire Stara Planina Mts, 14% of the total macromycetous biodiversity of Bulgaria and is compatible, even exceeding, the fungal diversity in other mountains of the country. Six species were of conservational importance according to the Red Data Book of R Bulgaria (1) and Red List of Bulgarian macromycetes (6). The paper presents a new locality for the species *Gomphidius roseus* monitored in the Bulgarian National Biodiversity Monitoring System (part Monitoring of Fungi) and currently obtained data indicate the favourable trends of its development in the country.

Key words: Ascomycota, Basidiomycota, biodiversity, critically endangered species, Dikarya, endangered species, fungi, mycorrhizal fungi, parasitic fungi, saprotrophic fungi, vulnerable species

INTRODUCTION

The importance of Fungi for the biosphere is practically undisputable since being devoid of chlorophyll and the possibility of self-feeding from solar energy, they are ecological consumers that break down organic compounds into simple inorganic substances with the help of a variety of enzymes. The role of Fungi in forest ecosystems is particularly important because they are the only organisms on the planet capable of breaking down the lignin of trees. On the other hand, Fungi help increase soil fertility, and some of them, known as mycorrhizal fungi, live together, in symbiosis, with woody, shrubby or herbaceous plants and are essential for their nutrition and development.

Macromycetes are well known in people's daily life with their practical division into edible/poisonous, medicinal and parasitic fungi. But in purely ecological terms, their usual division is different and more detailed, being based on lifestyle, habitat and typical substrate. In the frame of the both projects conducted on macromycetes in the vicinities of the town Chelopech in Sredna Stara Planina Mts, which provide the bases for the present paper, both approaches (practical and ecological) are reflected along with the taxonomic assessment in order to achieve the best knowledge on both the biodiversity of the studied macromycetes and their ecosystem services with the possibilities of their practical use. This paper presents the first part of the work in regard of species composition, ecotrophic groups and conservationally important species in the studied area.

MATERIAL AND METHODS

Investigated region

The region of investigation covers the south slopes of Stara Planina Mts in the part considered as Middle Stara Planina. It is situated between 530 and 1170 m a.s.l., being a part of the Zlatishko-Pirdopska kettle in the closest vicinity of Chelopech town. The typical climate is temperate continental with spring

maximum and winter precipitation minimum. In particular, the southern mountain slopes are in the rain shadow area with average precipitation values of about 550 mm. In this

area, the cinnamon forest soils predominate.

The investigated region occupies a territory of about 20 km^2 and besides natural mountain habitats and natural wetlands, including parts of the streams of the river Topolnitsa and its right tributary Vozdol, contains also arable lands and urban areas. For the purposes of the study, it was operationally divided in two parts: I - upper, northern part with territory of ca. 12 km^2, and II – lower, southern part of ca. 7.5 km^2.

Period of investigation

Field work was conducted during two seasons of the years 2020-2021 and 2023 – spring (May-June 2021, 2023) and autumn (October-December 2020, 2023) with 23 daily visits of the region. In the period 2020-2021 there were totally 14 visits, 7 in each season, on the following dates: 15.10.2020, 22.10.2020, 29.10.2020, 25.11.2020, 26.11.2020, 8.12.2020, 11.12.2020 and 12.05.2021, 14.05.2021, 17.05.2021, 26.05.2021, 29.05.2021, 04.06.2021, and 11.06.2021. In 2023, nine daily visits, four in spring and five in autumn, were conducted on the following dates: 25.05.2023, 19.06.2023, 20.06.2023, 27.06.2023, 13.10.2023, 14.10.2023, 27.10.2023, 8.12.2023 and 9.12.2023. All these dates were selected regarding the most favourable metereological conditions with an attempt to make visits on the close dates for different years.

For easier reading, in the text below, the autumn and spring periods of 2020-2021 will be named as “first period of investigation”, and the spring-autumn period of 2023 will be noted as “second period of investigation”.

During the field work initially, the entire area was visited to select representative working polygons, which would contain various types of habitats and include places suitable for the development of macromycetes, excluding the main urban areas, arable lands and water surfaces. Looking for suitable places for macromycete development, we tried to embrace all ecological groups of macromycets from different types of natural habitats: open and shadowed areas in deciduous forests (birch, beech, mixed), coniferous forests and plantations, mixed coniferous and deciduous forests, pastures and meadows, screes, riverside habitats, etc. The total area of these polygons was 1.2 км^2, and each of them had the following area: 1 - 394 592 m^2; 2 - 83 266 m^2; 3 - 156 217m^2; 4 - 44 825 m^2; 5 - 198 124 m^2; 6 - 16 543 m^2; 7 - 172 265 m^2 and 8 - 133 915 m^2.

Special attention was also paid to forest areas with a more active anthropogenic presence and activities such as roads and recreation places, as well as to some of the tourist trails located in the area and the designed eco-path

"Chervenata Puteka" (which in Bulgarian language means The Red Pathway). As a result, 8 representative polygons were selected. Six of these polygons were situated in the first, northern part, and two were situated in the second, southern part of the area (**Figure 1**). Special attention was also paid to areas with a more active anthropogenic presence and activities of the enterprise (roads for the movement of equipment, built facilities, places for recreation, etc.), as well as to some of the tourist trails located

in the area and the designed eco-path "Cherveniyat Kamuk" (which in Bulgarian language means The Red Stone). There, the work was conducted according to the transect method using a different number of sub-transects depending on the specific conditions of the terrain. All transects were repeatedly visited during both seasons, and each transect was covered 2-4 times in the frame of a single season.

Fig. 1. Representative polygones in northern and southern part of the investigated region (mod ified after *Google Earth*).

Methods for collection, transportation, processing and identification of the macromycetes

The macromycetes, which are the subject of this investigation, usually are defined as large, multicellular and visible with naked eyes fungi, the fruiting bodies of which are larger than 5 mm. Taxonomically, macromycetes traditionally belong to two main phyla, Ascomycota and Basidiomycota, united in the subkingdom Dikarya (Hibbett et al. 2018).

According to the National Biodiversity Monitoring System (NBMS), and its part on the monitoring of fungi in particular (Denchev et al. 2013), when working with macromycetes, the reporting unit is the fruiting body. According to this methodology, the unit of observation is a point, and the reading is within a radius of 30 m around the point where fruiting bodies were observed for the first time in the presence of a suitable substrate for the development of the species. In accordance with this, when finding a fruiting body along a given transect, we investigated the local area within a radius of about 30 m (when the terrain conditions allow this).

The species were documented in situ using a camera and mobile phones with a positioning system for mapping purposes (**Figure 2**). After completing the transect determination, for the implementation of the subsequent laboratory work, the fruiting bodies were collected (1-5 specimens of each species according to the specific number in a given locality). They were cleaned on site using a special

knife equipped with a brush (**Figure 2**) and transported on the same day to the laboratory in paper bags (large fruiting bodies) or in plastic tubes with a volume of 50 ml (small fruiting bodies) – **Figure 2**. The collected specimens were also subjected to drying using electric dehydrators (**Figure 2**) for their preservation and further inclusion in a herbarium. Their drying time varies according to the size and texture of the fruiting body and is between 4-15 hours.

The identification of macromycetes follows the standard modern European mycological literature (*e.g.,* Breitenbach & Kränzlin 1984, 1986, 1991, 1995, 2000, 2005; Hansen & Knudsen 1992, 1997, 2000; Laessoe & Petersen 2019) with actualization of the taxonomy according to the world-wide accepted on-line database Index Fungorum. It was made in a final version in laboratory conditions by applying a macroscopic examination of the fruiting bodies and microscopic methods for observing and determining the spore-bearing parts of the fruiting bodies, the size, type and sculpture of the spores, the type of cystids, etc., which are commonly used as diagnostic features.

In cases when only one fruiting body of a species has been found, but the species identification requires records of different developmental stages, or the fruiting body has been damaged (found in the form of parts left from knife cuts or broken by foragers that have passed before us the area, or as eaten by animals), the determination is made to the Genus level (indicated in standard nomenclature with "sp.") or to the closest species by available characters (which is indicated in standard nomenclature with "cf." before the species name).

After determination, the macromycete species are classified according to their ecotrophic requirements (*e.g.*, the substrate on which they occur) according to the available literature data (*e.g.,* Ollson et al. 2000, Harding 2008 for parasites) and according to our own field observations in the following three main ecological (ecotrophic) groups:

- saprotrophs (S)
- mycorrhizal fungi (M)
- parasites (P).

In cases of double mode of life, two ecological groups are shown (*e.g.,* S/P, or M/P).

The conservation status was evaluated according to the Red Data Book of R Bulgaria (Peev 2011) and Red List of Bulgarian macromycetes (Gyosheva et al. 2006). Fungi, included in the NBMS (part Monitoring of Fungi – Denchev et al. 2013), have been also taken into account and their status was evaluated according to the criteria and parametres enlisted in NBMS.

Fig. 2. Documentation, transportation and dehydration of the fruiting bodies.

RESULTS

Biodiversity of macromycetes

In total, 219 macromycetous species were found (**Table 1, Appendix 1**). They belonged to 187 genera, 57 families, 35 orders, 14 classes, 3 subphyla and 2 phyla – Ascomycota and Basidiomycota. The 171 species recorded in the period October 2020-June 2021 were from 83 genera, 40 families, 12 orders, 4 classes, 3 subphyla and 2 phyla. The 88 recorded species in the period June-December 2023 belonged to 57 genera, 32 families, 8 orders, 3 classes, 2 subphyla and 2 phyla (**Table 1)**.

Table 1. Taxonomic list of the macromycetes found in the Chelopech region of Stara Planina Mts and their distribution in both parts of the investigated region in different seasons and periods and in ecotrophic groups: I – northern, upper part; II – southern, lower part; Au – autumn, SP – spring, 20 – year 2020, 21 – year 2021, 23 – year 2023; EG – ecotrophic group: M – mycorrhizal fungus, S – saprotroph, and P – parasite. Inside the phyla subphyla, classes,

orders, families, genera and species are organized in alphabetical order for easier reading.

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**III**	**I**	**III**	**I**	**II**	**MSP**
Phylum Ascomycota									
Subphylum Ascomycotina									
Classis Ascomycetes									
Ordo Helotiales									
Familia Gelatinodiscaceae									
Genus *Ascocoryne* J. W. Groves & D. E. Wilson									
Ascocoryne sarcoides (Jacq.) J. W. Groves et D. E. Wilson	x								S
Subphylum Pezizomycotina									
Classis Pezizomycetes									
Ordo Pezizales									
Familia Helvellaceae									
Genus *Helvella* Fr.									
Helvella crispa (Scop.) Fr.						x			S
Helvella fibrosa (Wallr.) Korf						x			S
Helvella lacunosa Afzel.						x			S
Familia Pezizaceae									
Genus *Peziza* Fuckel									
Peziza saniosa J. F. Gmel.						x			S
Peziza varia (Hedw.) Alb. et Schwein.						x			S

Taxonomic categories / Macromycetes	Au 20		Sp 21		Sp 23		Au 23		EG
	I	II	I	I I	I	I I	I	II	MS P
Familia Pyronemataceae									
Genus *Humaria* Fuckel									
Humaria hemisphaerica (F. H. Wigg.) Fuckel						x			S
Ordo *Xylariales*									
Familia Hypoxylaceae									
Genus *Hypoxylon* Bull									
Hypoxylon fragiforme (Pers.) J. Kickx						x		x	S
Familia Xylariaceae									
Genus *Poronia* Willd.									
Poronia punctata (L.) Fr.					x	x			S
Genus *Xylaria* Hill ex Schrank									
Xylaria hypoxylon (L.) Grev.	x	x	x						S
Xylaria polymorpha (Pers.) Grev	x	x	x						S
Phylum Basidiomycota									
Subphylum Agaricomycotina									
Classis Agaricomycetes									
Ordo Agaricales									
Familia Agaricacae									
Genus *Agaricus* L.: Fr. emend Karst.									
Agaricus arvensis Schaeff.	x	x				x			S

Agaricus campestris L.	x	x	x			x		x	S
Agaricus cf. *sylvicola* (Vittad.) Peck	x								S
Agaricus sylvaticus Schaeff.	x	x							S
Agaricus cf. *xanthodermus* Genev.	x	x							S
Genus *Chlorophyllum* Massee									
Chlorophyllum rhacodes (Vittad.) Singer	x								M
Genus *Coprinus* Pers.									
Coprinus comatus (O. F. Müll.) Pers.	x							x	S
Genus *Lepiota* P. Browne									
Lepiota cristata (Bolton) P. Kumm	x	x					x		S
Lepiota erminea (Fr.) P. Kumm.						x			S
Lepiota ochraceodisca Bon	x								S
Lepiota cf. *subalba* Kühner ex P. D. Orton	x								S
Genus *Macrolepiota* Singer.									

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**III**	**I**	**III**	**I**	**II**	**MSP**
Macrolepiota procera (Scop.) Singer	x	x				x	x		S
Macrolepiota mastoidea (Fr.) Singer	x								S
Familia Amanitaceae									
Genus *Amanita* Pers.									
Amanita excelsa (Fr.) Bertill.					x				M

Amanita muscaria (L.) Lam.	x								M
Amanita rubescens Pers.		x			x				M
Amanita pantherina (DC.) Krombh.	x					x			M
Amanita vaginata (Bull.) Lam.		x							M
Genus *Limacellopsis* Zhu L. Yang, Q. Cai et Y. Y. Cui									
Limacellopsis guttata (Pers.) Zhu L. Yang, Q. Cai et Y.Y. Cui	x								
Familia Bolbitiaceae									
Genus *Bolbitius* Fr.									
Bolbitius titubans (Bull.) Fr.		x							S
Genus *Conocybe* Fayod									
Conocybe pulchella (Velen.) Hauskn. & Svrček					x				S
Conocybe rickenii (Jul. Schäff.) Kühner	x								S
Familia Cortinariaceae									
Genus *Cortinarius* (Pers.) Gray									
Cortinarius cf. *alcalinophilus* Rob. Henry	x								M
Cortinarius anomalus (Fr.) Fr.	x								M
Cortinarius caperatus (Pers.) Fr.	x								M
Cortinarius cf. *decipiens* (Pers.) Fr.	x								M
Cortinarius helvelloides (Fr.) Fr.					x				M
Cortinarius lepidopus Cooke	x								M
Cortinarius purpureus (Bull.) Bidaud, Moënne Locc. et Reumaux		x							M
Cortinarius sanguineus (Wulfen) Gray	x					x			M

Cortinarius semisanguineus (Fr.) Gillet	x								M
Cortinarius sp. 1	x								M
Cortinarius sp. 2	x	x							M
Familia Entolomataceae									
Genus *Clitopilus* (Fr. ex Rabenh.) P. Kumm.									
Clitopilus scyphoides (Fr.) Singer	x	x							S

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**I I**	**I**	**I I**	**I**	**II**	**MS P**
Genus *Entoloma* P. Kumm.									
Entoloma cetratum (Fr.) M. M. Moser						x			S
Entoloma juncinum (Kühner et Romagn.) Noordel.	x					x			S
Entoloma vernum S. Lundell					x				S
Entoloma sp.		x							S
Familia Hydnangiaceae									
Genus *Laccaria* Berk. & Broome									
Laccaria laccata (Scop.) Cooke	x	x			x	x		x	M
Laccaria proxima (Boud.) Pat.	x								M
Familia Hygrophoraceae									
Genus *Arrhenia* Fr.									
Arrhenia spathulata (Fr.) Redhead								x	S

Genus *Hygrocybe* (Fr.) P. Kumm.									
Hygrocybe conica (Schaeff.) P. Kumm.						x			S
Hygrocybe miniata (Fr.) P. Kumm.						x			S
Hygrocybe sp.	x								S
Genus *Hygrophorus* Fr.									
Hygrophorus sp.	x								M
Hygrophorus hypothejus (Fr.) Fr.	x								M
Cf. *Hygrophorus unicolor* Gröger	x								M
Familia Hymenogastraceae									
Genus *Hebeloma* (Fr.) P. Kumm.									
Hebeloma crustuliniforme (Bull.) Quél.	x	x							M
Genus *Psilocybe* (Fr.) P. Kumm.									
Psilocybe liniformans Guzmán et Bas			x						S
Psilocybe tuberifera Fraiture	x								S
Psilocybe sp.	x								S
Familia Inocybaceae									
Genus *Inocybe* (Fr.) Fr.									
Inocybe praetervisa Quél.	x								M
Inocybe sp.	x								M
Genus *Inosperma* (Kühner) Matheny et Esteve-Rav									
Inosperma cervicolor (Pers.) Matheny et Esteve-Rav.	x								M

Taxonomic categories / Macromycetes	Au 20		Sp 21		Sp 23		Au 23		EG
	I	II	I	II	I	II	I	II	MSP
Genus *Mallocybe* (Kuyper) Matheny, Vizzini et Esteve-Rav									
Mallocybe terrigena (Fr.) Matheny, Vizzini et Esteve-Rav.			x	x					M
Genus *Pseudosperma* Matheny et Esteve-Rav.									
Pseudosperma rimosum (Bull.) Matheny et Esteve-Rav						x			M
Familia Lycoperdaceae									
Genus *Apioperdon* (Kreisel et D. Krüger) Vizzini									
Apioperdon pyriforme (Schaeff.) Vizzini					x	x	x	x	S
Genus *Bovista* Pers.									
Bovista cf. *aestivalis* (Bonord.) Demoulin	x								S
Bovista plumbea Pers.	x	x	x	x	x	x	x	x	S
Bovista nigriscens Pers.	x	x	x	x					S
Genus *Bovistella* Morgan									
Bovistella utriformis (Bull.) Demoulin et Rebriev	x	x	x	x	x	x	x	x	S
Genus *Lycoperdon* P. Micheli									
Lycoperdon echinatum Pers.	x	x							S
Lycoperdon perlatum Pers.	x	x				x			S
Lycoperdon pyriforme Willd.	x	x							S
Lycoperdon cf. *umbrinum* Pers.	x								S
Familia Marasmiaceae									

Genus *Crinipellis* Pat.									
Crinipellis scabella (Alb. et Schwein.) Murrill	x								
Genus *Marasmius* Fr.									
Marasmius oreades (Bolton) Fr.	x		x		x	x	x	x	S
Marasmius rotula (Scop.) Fr.				x					
Marasmius siccus (Schwein.) Fr.	x								S
Marasmius torquescens Quél.	x								S
Marasmius cf. *wynneae* Berk. et Broome	x								S
Marasmius sp.	x								S
Familia Mycenaceae									
Genus *Hemimycena* Singer									
Hemimycena cucullata (Pers.) Singer						x			S
Genus *Mycena* (Pers.) Roussel									

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**III**	**I**	**III**	**I**	**II**	**MSP**
Mycena crocata (Schrad.) P. Kumm.	x	x							S
Mycena flavescens Velen.	x					x			S
Mycena galopus (Pers.) P. Kumm.	x					x			S
Mycena inclinata (Fr.) Quél.	x								S
Mycena pura (Pers.) P. Kumm.	x					x			S
Mycena rosea Gramberg	x					x			S

Mycena tenerrima (Berk.) Quél.		x							S
Mycena zephirus (Fr.) P. Kumm).	x								S
Familia Omphalotaceae									
Genus *Collybiopsis* (J. Schröt.) Earle									
Collybiopsis ramealis (Bull.) Millsp.						x			S
Genus *Gymnopus* (Pers.) Roussel									
Gymnopus dryophilus (Bull.) Murrill	x	x				x			S
Gymnopus foetidus (Sowerby) P.M. Kirk						x			S
Gymnopus fusipes (Bull.) Gray						x			S
Genus *Marasmiellus* Murrill									
Marasmiellus peronatus (Bolton) J. S. Oliveira	x								S
Marasmiellus ramealis (Bull.) Singer		x							S
Genus *Mycetinis* Earle									
Mycetinis alliaceus (Jacq.) Earle ex A.W. Wilson & Desjardin	x	x							S
Genus *Omphalotus* Fayoud									
Omphalotus olearius Singer		x							S
Genus Paragymnopus J. S. Oliveira									
Paragymnopus perforans (Hoffm.) J. S. Oliveira	x								S
Familia Pluteaceae									
Genus *Pluteus* Fr.									
Pluteus nanus (Pers.) P. Kumm.						x			S
Pluteus romellii (Britzelm.) Lapl.						x			S
Pluteus salicinus (Pers.) P. Kumm.		x							S

Pluteus semibulbosus (Lasch) Quél.	x								S
Familia Porotheleaceae									
Genus *Phloeomana* Redhead									
Phloeomana hiemalis (Osbeck) Redhead		x							S
Familia Psathyrellaceae									

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**II**	**I**	**II**	**I**	**II**	**MSP**
Genus *Coprinopsis* P. Karst									
Coprinopsis atramentaria (Bull.) Redhead, Vilgalys et Moncalvo						x			S
Coprinopsis cinerea (Schaeff.) Redhead, Vilgalys et Moncalvo						x			S
Coprinopsis stercorea (Fr.) Redhead, Vilgalys et Moncalvo								x	S
Genus *Parasola* Redhead, Vilgalys & Hopple									
Parasola conopilea (Fr.) Örstadius et E. Larss.	x								S
Parasola plicatilis (Curtis) Redhead, Vilgalys et Hopple		x				x			S
Genus *Psathyrella* (Fr.) Quél									
Psathyrella candolleana (Fr.) Maire	x								S
Psathyrella corrugis (Pers.) Konrad et Maubl.	x								S
Psathyrella fusca (J. E. Lange) A. Pearson	x								S
Genus *Lacrymaria* Pat.									

Lacrymaria lacrymabunda (Bull.) Pat.	x								S
Cf. *Lacrymaria pyrotricha* (Holmsk.) Konrad et Maubl.	x								S
Familia Schizophyllaceae									
Genus *Schizophyllum* Fr.									
Schizophyllum commune Fr.	x	x	x	x	x	x	x	x	S
Familia Strophariaceae									
Genus *Agrocybe* Fayod									
Cf. *Agrocybe pediades* (Fr.) Fayod	x				x				S
Genus *Hypholoma* (Fr.) P. Kumm.									
Cf. *Hypholoma fasciculare* juv. (Huds.) P. Kumm.		x							S
Hypholoma capnoides (Fr.) P. Kumm.	x								S
Genus *Pholiota* (Fr.) P. Kumm.									
Pholiota aurivella (Batsch) P. Kumm.	x								S
Pholiota carbonaria (Fr.) Singer	x	x							S
Pholiota cf. *flammans* (Batsch) P. Kumm.	x								S
Pholiota lenta (Pers.) Singer	x								S
Genus *Protostropharia* Redhead, Moncalvo & Vilgalys									

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**II**	**I**	**II**	**I**	**II**	**MSP**
Protostropharia semiglobata (Batch.) Redhead, Moncalvo et Vilgalys	x	x	x	x	x	x	x	x	S

Familia Tricholomataceae									
Genus *Delicatula* Fayod									
Delicatula integrella (Pers.) Fayod						x			S
Genus Infundibulicybe Harmaja									
Infundibulicybe geotropa (Bull.) Harmaja					x				S
Infundibulicybe gibba (Pers.) Harmaja						x			S
Genus *Lepista* (Fr.) W. G. Sm.									
Lepista nuda (Bull.) Cooke	x	x			x				S
Genus *Tricholoma* (Fr.) Staude									
Tricholoma lascivum (Fr.) Gillet	x								M
Tricholoma portentosum (Fr.) Quél.	x	x							M
Tricholoma terreum (Schaeff.) P. Kumm.	x								M
Tricholoma cf. *virgatum* (Fr.) P. Kumm.	x								M
Incertae sedis									
Genus *Clitocybe* (Fr.) Staude									
Clitocybe dealbata (Sowerby) P. Kumm.	x	x							S
Clitocybe odora (Bull.) P. Kumm.	x	x							S
Clitocybe sp.	x								
Genus *Collybia* (Fr.) Staude									
Collybia sp.	x	x							S
Genus *Cystoderma* Fayod									
Cystoderma superbum Huijsman	x								S
Cystoderma sp.	x								S
Genus *Gamundia* Raitelh.									

Gamundia striatula (Kühner) Raithelh.	x								S
Genus *Infundibulicybe* Harmaja									
Infundibulicybe geotropa (Bull.) Harmaja	x	x							S
Infundibulicybe gibba (Pers.) Harmaja	x	x							S
Genus *Lepista* (Fr.) W. G. Sm.									
Lepista nuda (Bull.) Cooke	x	x			x				S
Genus *Melanoleuca* Pat.									
Melanoleuca melaleuca (Pers.) Murrill	x				x				S
Genus *Panaeolus* (Fr.) Quél.									

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**II**	**I**	**II**	**I**	**II**	**MSP**
Panaeolus papilionaceus (Bull.) Quél.	x	x			x				S
Panaeolus semiovatus (Sowerby) S. Lundell et Nannf.	x								S
Panaeolus subfirmus P. Karst.	x	x	x	x	x				S
Panaeolus sp.	x								S
Genus *Panaeolina* Maire									
Panaeolina foenisecii (Pers.) Maire	x				x				S
Genus *Phaeolepiota* Maire ex Konrad et Maubl									
Phaeolepiota aurea (Matt.) Maire	x								S
Ordo Auriculariales									

Familia Auriculariaceae									
Genus Auricularia Bull.									
Auricularia auriculae-judae Vail.	x								S/P
Genus *Exidia* Fr.									
Exidia glandulosa (Bull.) Fr.					x				S
Exidia nigricans (With.) P. Roberts	x								S
Ordo Boletales									
Familia Boletaceae									
Genus *Boletus* L.									
Boletus reticulatus Schaeff.		x							M
Genus *Chalciporus* Bataille									
Chalciporus sp.	x								M
Genus *Imleria* Vizzini									
Imleria badia (Fr.) Vizzini	x								M
Genus *Leccinum* Gray									
Leccinum melaneum (Smotl.) Pilát et Dermek						x			M
Leccinum scabrum (Bull.) Gray	x	x			x	x	x		M
Genus *Leccinellum* Bresinsky et Manfr. Binder									
Leccinellum pseudoscabrum (Kallenb.) Mikšik.	x								M
Genus *Xerocomellus* Šutara									
Xerocomellus chrysenteron (Bull.) Šutara					x				M
Genus *Xerocomus* Quél.									
Xerocomus ferrugineus (Schaeff.) Alessio					x				M
Familia Gomphidaceae									

Genus *Chroogomphus* (Singer) O. K. Mill.									

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**I I**	**I**	**I I**	**I**	**II**	**MS P**
Chroogomphus rutilus (Schaeff.) O. K. Mill.	x								M
Familia Diplocystidiaceae									
Genus *Astraeus* Morgan									
Astraeus hygrometricus (Pers.) Morgan			x		x	x	x	x	S
Genus *Gomphidius* Fr.									
Gomphidius glutinosus (Schaeff.) Fr.	x								M/P
Gomphidius roseus Massee	x								P
Familia Gyroporaceae									
Genus *Gyroporus* Gray									
Gyroporus cyanescens (Bull.) Quél.	x								M
Genus *Hortiboletus* Simonini, Vizzini & Gelardi									
Hortiboletus bubalinus (Oolbekk. et Duin) L. Albert et Dima	x								M
Familia Paxillaceae									
Genus *Paxillus* Fr.									
Paxillus involutus (Batch.) Fr.		x							S
Paxillus rubicundulus P. D. Orton					x	x	x	x	S
Familia Sclerodermataceae									

Genus *Pisolithus* Alb. & Schwein.									
Pisolithus arhizus (Scop.) Rauschert					x				S
Genus *Scleroderma* Pers.									
Scleroderma citrinum Pers.							x		S
Familia Suilaceae									
Genus *Suillus* Gray									
Suillus bovinus (L.) Roussel.	x								M
Suillus cavipes (Klotzsch) A. H. Sm. & Thiers		x							M
Suillus granulatus (L.) Roussel	x	x			x				M
Suillus luteus (L.) Roussel	x								M
Suillus variegatus (Sw.) Richon & Roze	x								M
Suillus sp.	x								M
Familia Tapinellaceae									
Genus *Tapinella* E.-J. Gilbert									
Tapinella panuoides (Fr.) E.-J. Gilbert	x		x						S
Ordo Gantharellales									
Familia Hydnaceae									

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**III**	**I**	**III**	**I**	**II**	**MSP**
Genus *Cantahrellus* Adans ex Fr.									
Cantharellus cibarius Fr.		x			x	x			S

Ordo Geastrales									
Familia Geastraceae									
Genus *Geastrum* Pers.									
Geastrum striatum DC	x								S
Ordo Hymenochaetales									
Familia Hymenochaetaceae									
Genus *Fomitiporia* Murrill									
Fomitiporia robusta (P. Karst.) Fiasson et Niemeläl		x		x					
Genus *Fuscosporia* Murrill									
Fuscoporia ferruginosa (Schrad.) Murrill.		x		x					S
Ordo Polyporales									
Familia Incrustoporiaceae									
Genus *Tyromyces* P. Karst.									
Tyromyces lacteus (Fr.) Murrill		x		x					S
Familia Polyporaceae									
Genus *Daedalea* Pers.									
Daedalea quercina (L.) Pers.							x		S
Genus *Daedaleopsis* J. Schröt.									
Daedaleopsis confragosa (Bolton) J. Schröt	x		x						S
Genus *Fomes* (Fr.) Fr.									
Fomes fomenatarius (L.) Fr.	x		x		x	x	x	x	S
Genus *Lentinus* Fr.									
Lentinus substrictus (Bolton) Zmitr. et Kovalenko						x			S

Genus *Neofavolus* Sotome & T. Hatt.									
Neofavolus suavissimus (Fr.) Seelan, Justo et Hibbett				x					S
Genus *Trametes* Fr.									
Trametes hirsuta (Wulfen) Lloyd	x	x	x	x	x	x	x	x	S
Trametes versicolor (L.) Lloyd							x	x	S
Ordo Russulales									
Familia Auriscalpiaceae									
Genus *Lentinellus* P. Karst.									
Lentinellus ursinus (Fr.) Kühner		x		x					S/P

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**I I**	**I**	**I I**	**I**	**II**	**MS P**
Familia Russulaceae									
Genus *Lactarius* Pers.									
Lactarius deliciosus (L.) Gray	x	x							M
Lactarius cf. *fulvissimus* Romagn.	x								M
Lactarius pallidus Pers.						x			M
Lactarius pubescens Fr.		x					x		M
Lactarius rufus (Scop.) Fr.	x	x			x				M
Lactarius scrobiculatus (Scop.) Fr.	x								M
Lactarius cf. *subdulcis* (Pers.) Gray	x								M

Lactarius torminosus (Schaeff.) Gray	x								M
Lactarius cf. *zonarius* (Bull.) Fr.	x								M
Genus *Lactifluus* (Pers.) Roussel.									
Lactifluus piperatus (L.) Roussel		x				x			M
Genus *Russula* Pers.									
Russula adusta (Pers.) Fr.						x			M
Russula cyanoxantha (Schaeff.) Fr.						x			M
Russula densifolia Secr. ex Gillet						x			M
Russula heterophylla (Fr.) Fr.		x							
Russula ochroleuca Fr.	x					x			M
Russula olivacea Pers.	x	x							M
Russula sanguinea Fr.	x								M
Russula vesca Fr.		x			x				M
Russula veternosa Fr.	x	x							M
Russula sp.		x							M
Familia Stereaceae									
Genus *Stereum* Hill ex Pers.									
Stereum hirsutum (Willd.) Pers.					x	x	x	x	S
Stereum insignitum Quél.	x		x						S
Stereum rugosum Pers.						x		x	S
Stereum subtomentosum Pouzar	x		x						S
Ordo Thelephorales									
Familia Thelephoraceae									
Genus *Thelephora* Ehrh. ex Willd.									

Thelephora anthocephala (Bull.) Fr.						x			S
Thelephora hirsuta Will.	x	x	x	x					S

Taxonomic categories / Macromycetes	**Au 20**		**Sp 21**		**Sp 23**		**Au 23**		**EG**
	I	**II**	**I**	**I I**	**I**	**I I**	**I**	**II**	**MS P**
Thelephora terrestris Ehrh.	x				x				S
Classis Dacrymycetes									
Ordo Dacrymycetales									
Familia Dacrymycetaceae									
Genus *Calocera (*Fr.) Fr.									
Calocera cornea (Batch.) Fr.	x								S

The richest in species during the entire investigated period were Basidiomycota, represented by 171 taxa, and Agaricomycetes as their richest class (**Table 1**, **Figure 3**). Basiodiomycota were the main biodiversity constituents also during both periods of investigation: 1) In 2020-2021, 168 basiodiomycetes were found, which represent 98% of the total macromycetous biodiversity in the region with richest class Agaricomycetes; 2) In 2023, 80 basidiomycetes represent 91% of the total macromycetous biodiversity in the region and, once more, most of them belong to the class Agaricomycetes. By contrast, the total number of Ascomycota species was only 11, with three species found in the first investigation period, and eight in the second period, respectively (**Table 1**, **Figure 3**).

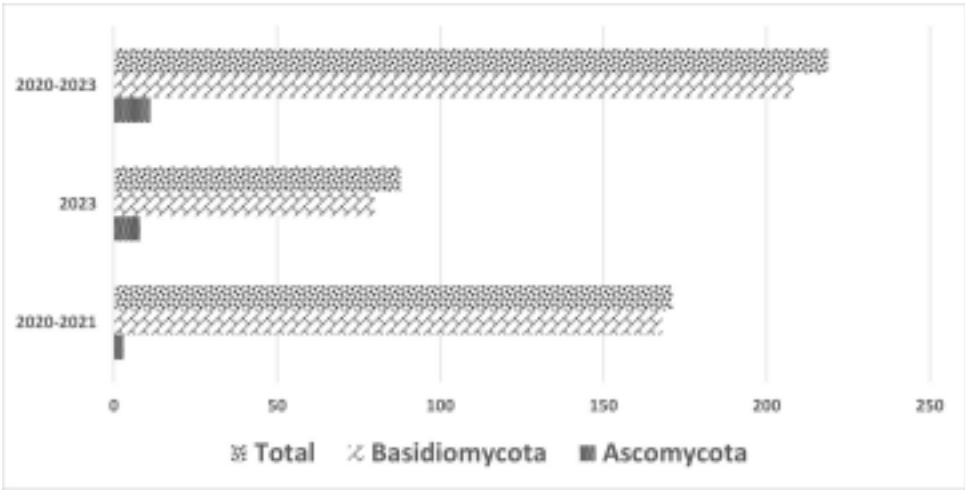

Fig. 3. Distribution of macromycete species in the phyla Ascomycota and Basidiomycota compared to the total number of macromycetes found in the study area during the entire investigation period (2020-2023) and during both main subperiods 2020-2021 (May-June 2020 and October-December 2021) and 2023 (May-June 2023 and October-December 2023).

According to the taxonomic wealth of the orders, the richest is Agaricales (141 species, or 65% from the total macromycetous biodiversity) followed by Russulales

(25, or 11%), Boletales (24, or 11%), Polyporales (7, or 3%) and Pezizales (6, or 3%). The wealth of the other orders is as follows: Thelephorales and Xylariales (each with 4 species), Auriculariales (3), Hymenocladales (2), Cantharellaes, Geastrales and Helotiales (each with a single species) – **Figure 4**.

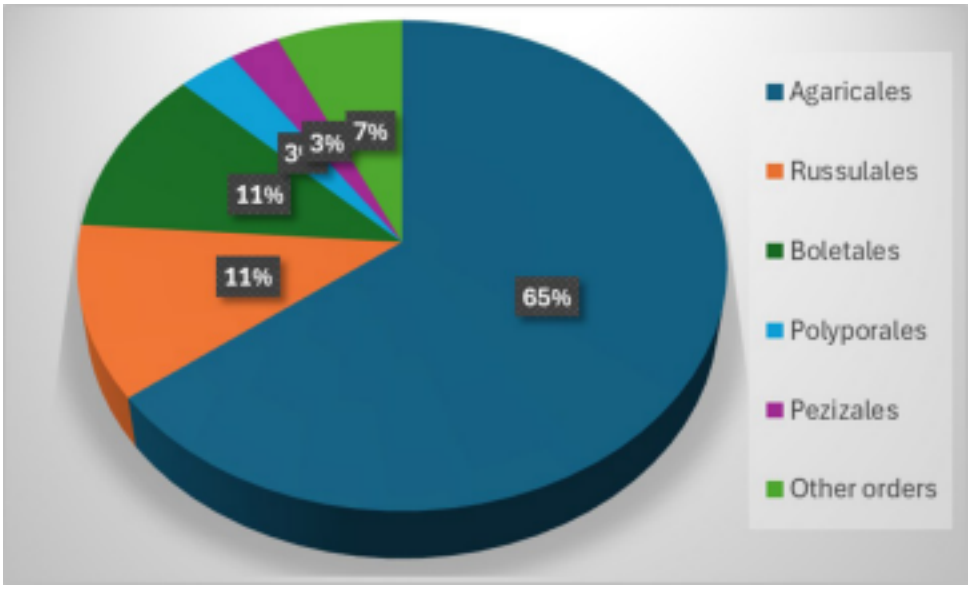

Fig. 4. Biodiversity (species wealth) of orders of macromycetes from the Chelopech region found during the entire period of investigation (2020-2023).

In the period 2020-2021, the taxonomic wealth of orders is similar: Agaricales (117 species, or 69% from the total biodiversity for this period), Russulales (20, or 12%), Boletales (19, or 11%), and Polyporales (4, or 2%). The other eight orders comprise 6% of the total biodiversity for the period, each of them being represented by 1-2 species: Xylariales, Hymenochaetales and Thelephorales (each with 2 species), Helotiales, Auriculariales, Cantharellales, Geastrales and Dacrymycetales (each with one species) – **Figure 5**.

In 2023, the order is also similar: Agaricales (52 species, or 59%), Russulales (11, 13%), Boletales (9, 10%), Pezizales (6, or 7%), and Polyporales (5, or 6%). The other three orders comprise 5% of the total biodiversity for this period, as follows: Xylariales and Thellephorales (each with 2 species, or 2%) and Cantharellales with a single species, or 1% (**Figure 6**).

Regarding the genera, the richest during the entire period of investigation were *Cortinarius* (11), *Russula* (10) and *Lactarius* (9), followed by *Mycena* (8), *Marasmius* (6), *Agaricus* and *Amanita* (each with five species), *Entoloma*, *Lepiota, Lycoperdon*, *Panaeolus*, *Pholiota*, *Pluteus*, *Stereum* and *Tricholoma* (each with four species) – **Table 1**. In 2020-2021, the biggest number of species had the genus *Cortinarius* (10), followed by *Lactarius*, *Mycena* and *Russula* (each with

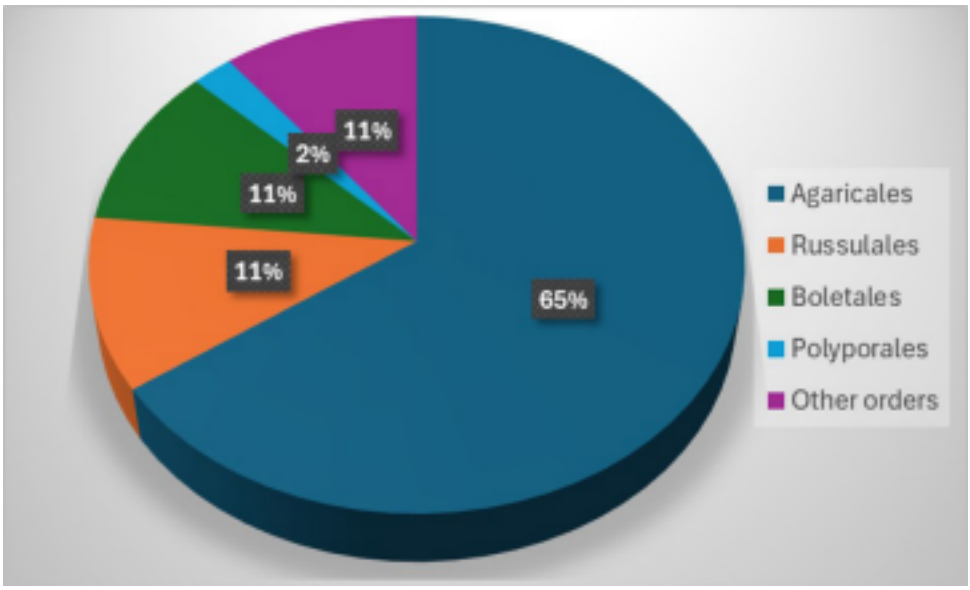

Fig. 5. Biodiversity (species wealth) of orders of macromycetes from the Chelopech region found during the first period of investigation (2020-2021).

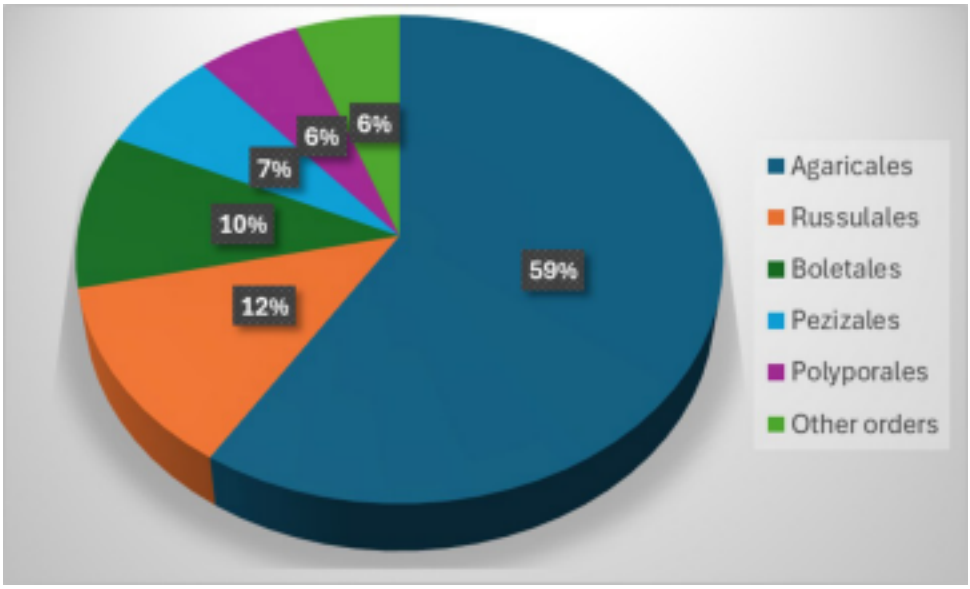

Fig. 6. Biodiversity (species wealth) of orders of macromycetes from the Chelopech region found during the first period of investigation (2023).

eight sspecies) – **Table 1**. Relatively rich were the genera *Marasmius* and *Suillus* (each with six species), *Agaricus* (5 species), followed by *Lycoperdon*, *Panaeolus*, *Pholiota* and *Tricholoma* (each with four species), and from 50 genera only a single

species was found. In 2023, most of the found species were from the genus *Russula* (5), followed by *Mycena* (4) – **Table 1**. Each one of the genera *Amanita*, *Coprinopsis, Helvella* and *Lactarius* was represented by three species, followed by *Agaricus, Cortinarius*, *Hygrocybe*, *Infundibulocybe, Leccinum*, *Lepiota*, *Panaeolus*, *Peziza, Thellephora* and *Trametes* (each with two species), and 47 genera were represented
by a single species.

During the entire period of investigation, in the upper, northern part of the studied area 161 macromycetes have been found (**Figure 7**). They represent 74% of the total biodiversity in the region, In the lower, southern part of the examined area this number was 117 (or 53% of the total biodiversity) and common, found in both parts, were 62 species, which constituted 28% of the total biodiversity. The floristic similarity between both parts, estimated according to Sorensens Similarity Index, was 45%.

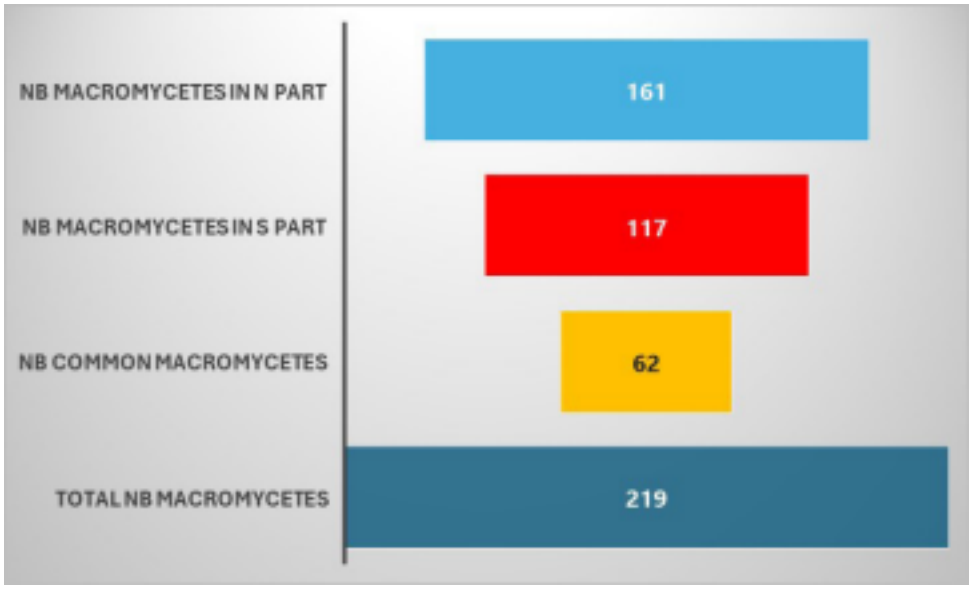

Fig. 7. Comparison of the total number (NB) of macromycetous species in the upper, northern (N) part of the investigated area, in the lower, southern (S) part of the investigated area, common species found in both areas and total number in the entire area in the period 2020-2023.

In the first investigated period, 2020-2021, in the upper, northern part of the area we found 142 species, while in the lower, southern part only 64 species were recorded (**Figure 8**). Common for both parts out of all 171 macromycetes were only 37 species (**Figure 8**), which represented 22% of all macromycetes, and the floristic similarity, expressed as Sorensens Similarity Index, was only 35%.

By contrast, in 2023 the biodiversity of macromycetes in the southern part was higher: 64 species against the 41 species in the northern part (**Figure 9**). Out of the total number of 88 macromycetes recorded during this period, common were only

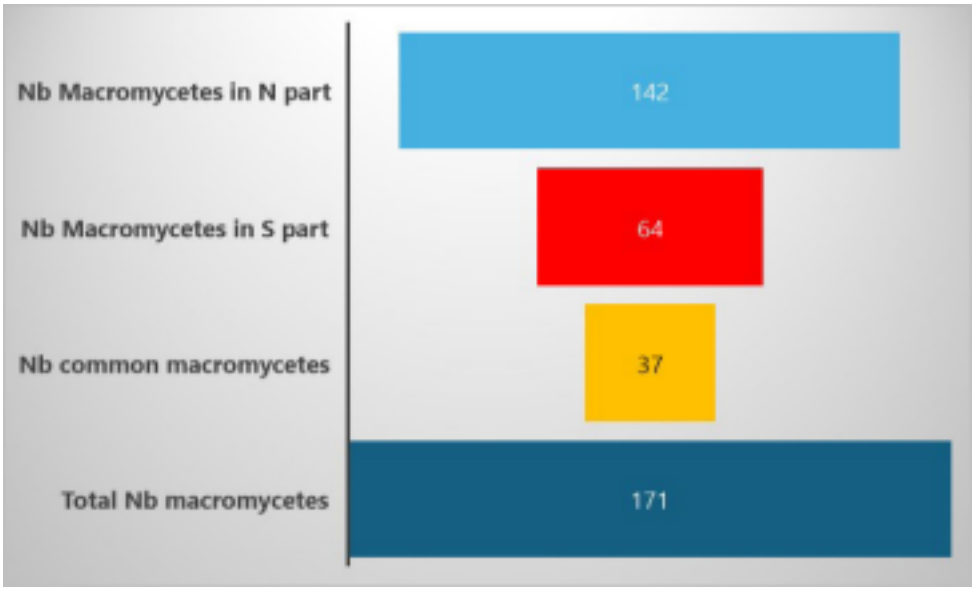

Fig. 8. Comparison of the total number (Nb) of macromycetous species in the upper, northern (N) part of the investigated area, in the lower, southern (S) part of the investigated area, common species found in both areas and total number in the entire area in the period May-June 2020 and October-December 2021.

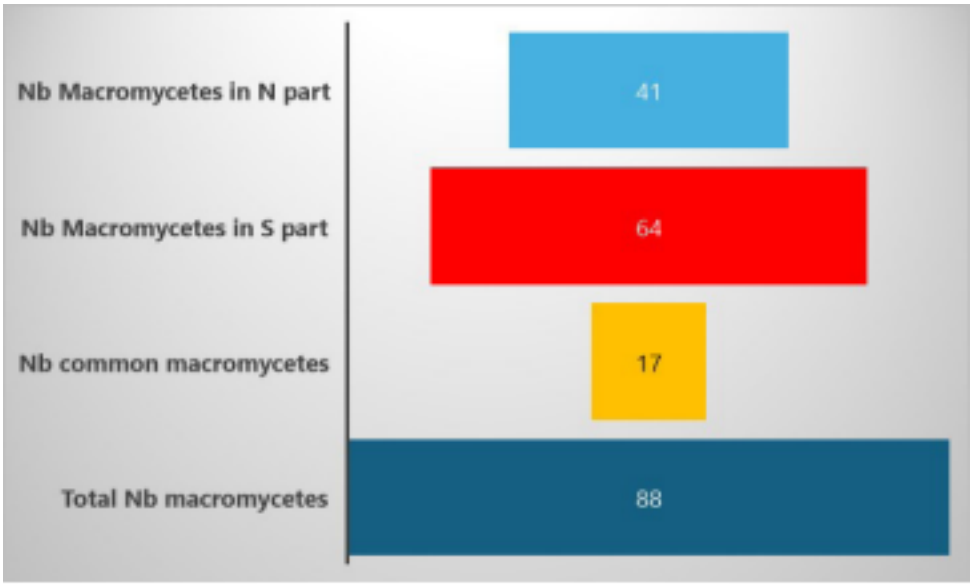

Fig. 9. Comparison of the total number (Nb) of macromycetous species in the upper, northern (N) part of the investigated area, in the lower, southern (S) part of the investigated area, common species found in both areas and total number in the entire area in the period May-June and October-December 2023.

17 species (**Figure 9**), which represented 19% of the biodiversity, and the Sorensen Similarity Index was 39%.

Biodiversity in spring and autumn was quite different: 186 macromycetes were found in the autumn/early winter periods of investigation, and almost twice as few, 94, were found in the spring/early summer periods. Common for both periods were 52 species. In 2020-2021, common for both seasons were 21 macromycetes, with 165 species found in the autumn and 27 in the spring due to the untypically cold and rainy weather in May-June 2020. Just the opposite, in 2023, the number in spring/summer period was much higher (80 species) in comparison with the autumn/winter period (25 species) due to the extremely dry autumn of 2023.

Regarding the ecological mode of life and trophicity, 147 species (67% of all recorded macromycetes) were saprotrophs, 67 (31%) were mycorrhizal formers and only five (2%) were parasites (**Table 1**, **Figure 10**).

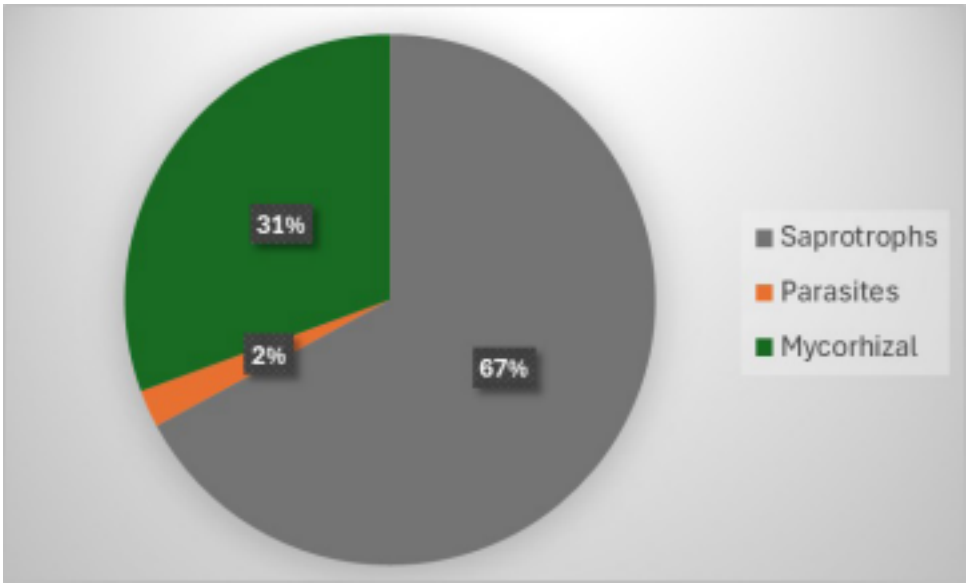

Fig. 10. Biodiversity in ecotrophic groups of macromycetes in the region of Chelopech (2020-2023).

In 2020-2021, all three groups were found in the investigated area (**Table 1**). The lowest was the number of parasitic fungi (5, or 3% of the diversity), some of which were considered ectomycorrhizal, and it has to be mentioned that for one of them, *Gomphidius glutinosus*, the host is yet unknown. Another fungus, *Gomphidius roseus*

is considered as a parasite upon the mycelium of *Suillus bovinus* (Olsson et al. 2000). Although usually considered as a classical saprotroph, *Auricularia auriculae judae* has been pointed also as a weak parasite (Harding 2008). The biggest is the number of saprotrophs (101, or 59%) which inhabit different substrata. For example, among them are saprotrophs on soils (*e.g.*, *Bovista nigriscens*), forest litter (*e.g.*,

Mycena flavescens), dead wood (*e.g.*, *Ascocoryne sarcoides*), excrements (*e.g.*, *Protostropharia semiglobata*), fireplaces and fire stations (*e.g.*, *Pholiota carbonaria*). Some of the saprotrophs found (*e.g.*, *Bolbitius titubans*) are characterized by broad spectra and occur on various substrata. All ascomycetous fungi were saprotrophs on dead wood (xylotrophs), and all 93 other saprotrophic species were basidiomycetous species. The mycorrhizal fungi were 65 species (38%), some of which form mycorrhiza with coniferous trees (*e.g.*, with *Pinus* - *Russula sanguinea*, or with *Picea* - *Tricholoma terreum*), with deciduous trees (*Betula*, *Carpinus*, *Corylus*, *Fagus*, *Fraxinus* – *Russula olivacea*, and *Tricholoma*

lascivum with *Fagus*), with both coniferous and deciduous trees (*e.g*., *Laccaria proxima*).

During the field work in 2023 we did not find parasitic macromycetes. Then, again, the biggest was the number of saprotrophs (67 species, or 76% of the diversity), which occupied different substrata: soil (*e.g.*, *Agaricus campestris*), forest litter (*e.g.*, *Mycena rosella*), decaying wood (*e.g.*, *Daedalea quercina*, *Trametes hirsuta*), or excrements (*e.g.*, *Protostropharia semiglobata*, *Poronia punctrata*). Mycorhizal species were 21 species (24% of the diversity), some of which interracted with coniferous trees (*e.g.*, with *Pinus – Lactarius rufus*), with different deciduous trees (*Amanita pantherina*), or with both types of trees (*e.g*., *Lactifluus piperatus*, *Russula vesca*).

Among the recorded species, there were six conservationally important species, threatened to a different degree in the context of the Red List of Bulgarian macromycetes (Gyosheva et al. 2006) and the Red Data Book of RBulgaria (Peev et al. 2011):

Lentinellus ursinus – Critically endangered (CR) according to the Red List and Red Book

Cortinarius caperatus – Endangered (EN) according to the Red List *Arrhenia spathulata* - Vulnerable (VU) according to the Red List *Gomphidius roseus* – Vulnerable (VU) according to the Red List *Peziza saniosa* – Vulnerable (VU) according to the Red List

Poronia punctata – Vulnerable (VU) according to the Red List The paper presents a new locality for the species *Gomphidius roseus*, included in NBMS (part Monitoring of Fungi), which is included there with three referent localities: two in Rila Mts (over the hut Treshtenik and in the National Park Rila) and in Middle part of Rodopi MTS (Denchev et al. 2013). This new finding in a non-disturb and non-polluted locality indicates the favourable trend in the status of this macromycete, which is not collected for food, according to Criterium 1, parameter 1,1, and Criterium 3, parameters 3.1-36 of NBMS.

DISCUSSION

The study demonstrates the great biodiversity of the macromycetes in the investigated area in the vicinity of Chelopech in the middle part of Stara Planina

Mts (Sredna Stara Planina): 219 species with prevalence of basidiomycetous representatives (171). Comparison with the actualized list of macromycetes found in Bulgaria during the last 100 years (**Table 2**) shows that this diversity represents:

Table 2. Comparison of the number of macromycete species in the 14 floristic regions and subregions of Bulgaria according to Denchev & Assyov (2013) with the number of the recorded

by us species in the studied area of Chelopech (*), situated in Sredna Stara Planina Mts. In brackets the popular geographic Bulgarian names are transliterated.

Floristic region/subregion	Number of species
Black Sea Coast	364
North-Eastern Bulgaria	181
Danube Plain ("Dunavska Ravnina")	134
Forebalkan ("Predbalkan)	86
Stara Planina Mts	619
***Western Stara Planina ("Zapadna Stara Plnina") - 268 species	
***Middle Stara Planina ("Sredna Stara Planina") - 264 species	219* (Chelopech)
***Eastern Stara Planina ("Iztochna Stara Planina") - 364 species	
Sofia	258
Znepolski Region	405
Vitosha Mt	599
Western Border Mts ("Zapadni Granichni Planini")	39
Struma Valley	63
Belastsa Mt	24
Slavyanka Mt	3
Valley ot the River Mesta	14
Pirin Mts	342
Rila Mts	643
Sredna Gora Mts	411
***Western Sredna Gora ("Zapadna Sredna Gora") – 393 species	
***Eastern Sredna Gora ("Iztchna Sredna Gora") - 32 species	
Rodopi Mts	758
***Western part ("Zapadni Rodopi") - 456 species	

***Central part (“Centralni Rodopi”) - 455 species	
***Eastern part (“Iztochni Rodopi”) - 233 species	
Thracian Valley (“Trakiyska Nizina”)	246
Tundzha Hilly Plain (“Tundzhanska Hulmista Rvnina”)	67
Strandzha Mts	219

108

- 83% from the biodiversity of macromycetes in Sredna Stara Planina Mts (264 species);
- 35% from the biodiversity of macromycetes of the entire Stara Planina Mts (619 вида);
- 14% from the biodiversity of macromycetes in the whole territory of Bulgaria (1537 species).

Data in **Table 2** clearly show that the macromycetous diversity in the investigated region in the vicinity of Chelopech town, that occupies ca. 20 km^2, is compatible with their diversity in other mountains and larger regions of the country. Moreover, the diversity documented from Chelopech region of Stara Planina Mts strongly exceeds the numbers of species in many regions of the country. However, we have boldly to underline that such comparison is very relative since there are many “white spots” in the knowledge about the distribution of mushrooms in Bulgaria and there is a great unevenness in the studies of different regions during different periods. But the comparison with the summarized data for Bulgaria (Denchev & Assyov 2013) clearly demonstrates the perspectivity of future investigations of the mycota, monitoring and conservation of the fungi in the studied area.

The differences in the total number of species found in different areas, seasons and periods of investigation is logically explainable with the different local climatic conditions considering that in 2023 the precipation in the region was seven times lower than in 2020. Nevertheless, in this second period of investigation, 49 macromycetes (227 of the total diversity) were observed for first time in the studied area.

ACKNOWLEDGEMENTS

The work was conducted in a frame of two subsequent projects, financed by contracts DPMCH-180/29.10.2020 and DPMCH-100333/27.04.2023.

AUTHORS CONTRIBUTION

The contribution of both PhD students K. Ivanov and M. Androv is equal and is based on their field work during the second period of investigation (2023).

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this article.

References

Breitenbach J. & F. Kränzlin F. (Eds.) 1984. Fungi of Switzerland. A contribution to the knowledge of the fungal flora of Swizerland. Volume 1. Ascomycetes.

Verlag Mycologia, CH-6000 Lucerne 9 (Switzerland), 310 pp.

Breitenbach J. & F. Kränzlin F. (Eds.) 1986. Fungi of Switzerland. A contribution to the knowledge of the fungal flora of Swizerland. Volume 2. Heterobasidiomycetes, Aphyllophorales, Gasteromycetes. Verlag Mycologia, CH-6000 Lucerne 9 (Switzerland), 411 pp.

Breitenbach J. & F. Kränzlin F. (Eds.) 1991. Fungi of Switzerland. Volume 3. Boletes and agarics. 1st part. StrobiIomycetaceae and Boletaceae, Paxillaceae, Gomphidiacea, Hygrophoraceae, Tricholomataceae, Polyporaceae (lamellate) Edition Mycologia, P.O Box 165, CH-6000 Lucerne 9, Switzerland, 350 pp.

Breitenbach J. & F. Kränzlin F. (Eds.) 1995. Fungi of Switzerland. Volume 4. Agarics, 2nd part. Entolomataceae, Pluteaceae, Amanitaceae, Agaricaceae, Coprinaceae, Bolbitiaceae, Strophariaceae. Edition Mycologia, P.O Box 165, CH-6000 Lucerne 9, Switzerland, 370 pp.

Breitenbach J. & F. Kränzlin F. (Eds.) 2000. Fungi of Switzerland. Volume 5. Agarics, 3rd part. Cortinariaceae. Fred Kränzlin, Edition Mycologia, P.O Box 165, CH-6000 Lucerne 9, Switzerland, 338 pp.

Breitenbach J. & F. Kränzlin F. (Eds.) 2005. Fungi of Switzerland. Volume 6. Russulaceae, *Lactarius, Russula*. Fred Kränzlin, Verlag Mycologia, Postfach, CH-6000 Lucerne 9, 320 pp.

Denchev C. M. & Assyov B. 2013. Checklist of the larger Basidiomycetes in Bulgaria. – Mycotaxon 111: 279-282.

Denchev C. M., Gyosheva M. M., Assyov B., Denchev T. C., Shivarov V. 2013. Methodology for assessment of the condition of fungal species. 16 pp. https://eea.government.bg/bg/bio/nsmbr/prakticheskо-rakovodstvo-metodiki za-monitoring-i-otsenka/Metodika_otsenka_gabi.pdf (Last accessed 5th November 2024) (In Bulgarian).

Gyosheva M., Denchev Cv. M., Dimitrova E. G., Assyov B., Petrova R. D.,

Stoichev G. T. 2006. Red List of Fungi in Bulgaria. – Mycologia Balcanica 3: 81-87.

Hansen L. & Knudsen H. (Eds.) 1992. Nordic Macromycetes. Vol. 2. Polyporales, Boletales, Agaricales, Russulales. Nordsvamp – Copenhagen, 474 pp. Hansen L. & Knudsen H. (Eds.) 1997. Nordic Macromycetes. Vol. 3. Heterobasidioid, Aphyllophoroid and Gastromycetoid Basidiomycetes. Nordsvamp – Copenhagen, 445 pp.

Hansen L. & Knudsen H. (Eds.) 2000. Nordic Macromycetes. Vol. 1. Ascomycetes. Nordsvamp – Copenhagen, 285 pp.

Harding P. 2008. Mushroom Miscellany. HarperCollins. ISBN 978-0-00-728464-1. Hibbett D. S., Blackwell M., James T. Y., Spata□ora J. W., Taylor J. W., Vilgalys R. 2018. Phylogenetic taxon definitions for Fungi, Dikarya, Ascomycota and Basidiomycota. - IMA Fungus 9 (2): 291–298.

Index Fungorum. http://www.indexfungorum.org/names/names.asp Laessoe T. & Petersen J. H. 2019. Fungi of temperate Europe. Princeton University

Press. 1708 pp. ISBN: 9780691180373

Olsson P. A., Munzenberger B., Mahmood S., Erland S. 2000. Molecular and anatomical evidence for a three-way association between *Pinus sylvestris* and the ectomycorrhizal fungi *Suillus bovinus* and *Gomphidius roseus*. - Mycological Research. 104 (11): 1372–78.

Peev D. (Ed-in-Chie□) 2015. Red Data Book of the Republic of Bulgaria. Vol.1. Plants and fungi, 887 pp.

Received 27th August 2024
Accepted 26th November 2024

Appendix 1

Arrhenia spathulata Peziza saniosa

Agaricus campestris Poronia punctata

Humaria hemisphaerica