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Ecologo-taxonomic investigations of fungi on Dragoica Mountain Ridge (Forebalkan) in Bulgaria

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Abstract. A list of lignicolous and terricolous fungi recorded on Dragoica mountain ridge is given in this article. Here are presented a total of 169 species, mainly from Ascomycota and Basidiomycota, and the largest part of them belong to the orders: *Agaricales, Boletales, Hymenochaetales, Polyporales* and *Russulales*. Of these fungi 76 species are reported for the first time from the Forebalkan floristic region, and for 93 species are reported new localities from the Forebalkan floristic region. Eight (8) species includes in the Red List of Fungi in Bulgaria: *Agaricus macrocarpus, Amanita caesarea, A. vittadinii, Discina ancilis, Hericium coralloides, Lenzites warnieri, Tuber aestivum* and *Tulostoma fimbriatum*. The research was conducted in different habitats: beech-oak forest, oak forest, beech- hornbeam forest, azonal vegetation and the shrubs along the Batulska river, Panega river and Malki Iskar river, in meadows and pastures. Of the fungi species registered, 95 are lignicolous and 74 are terricolous. Most of lignicolous species are saprobionts (80) and 15 species are parasites. From terricolous fungi, there are 44 mycorrhizal and 30 saprobionts. Some of the species such as *Clavaria fumosa, Geastrum schmidelii, Hygrocybe punicea, Leccinum quercinum, Mycena aetites, M. bulbosa, Lepiota erminea* and *Vuilleminia cystidiata* could be highlighted as rare. Other species such as *Armillaria mellea, Bovista plumbea, Lactarius piperatus, Cantharellus cibarius, Marasmius oreades, Russula cyanoxantha, Trametes hirsuta, Xerulla radicata*, etc. are abundant in certain periods of the year. The xerothermic species – *Leucopaxillus lepistoides* deserve special attention.

Key words: larger fungi, fungal conservation, fungal diversity, Forebalkan floristic region.

Introduction

The Forebalkan floristic region in Bulgaria is mycologically relatively poorly investigated. Separate data and sporadic records of single species were given by (Burzakov, 1926; Hinkova, 1961, 1965; Stoichev, 1981, 1982, 1983, 1987, 1995ab; Stoichev & Dimcheva, 1982, 1984, 1987; Vanev & Reid, 1986; Lacheva, 2006). Previous mycological investigations were carried on some neighboring areas (Central Balkan Mountain and Central Balkan National Park) out by Fakirova et al. (2000, 2002) produced checklists of these regions. So far, comparative detailed mycological study of the wood-decaying macrofungi of the southwestern slopes of Vasilyovska Mountain (Forebalkan (Central) floristic subregion) is conducted by Lacheva (2014a) and systematic research of the lignicolous macrofungi for the locality of Lisec mountain ridge (Forebalkan (Western) floristic subregion) was conducted by Lacheva (2014b). No additional studies from the Forebalkan region are known, except for Natcheva & Gyosheva (2016) from mycota of Uchilishtna Gora Managed Reserve, Forebalkan (Western) floristic subregion.

This first contribution presents the fungal diversity of Dragoica mountain ridge. There is no earlier data on the fungi in this mountain ridge. It lies in the Forebalkan floristic region. In general,

there are very few records of larger fungi in this region: about 210 larger ascomycetes and basidiomycetes (Dimitrova & Gyosheva, 2009, 2010; Denchev & Assyov, 2010; Assyov et al., 2010, 2012; Lacheva, 2014 a,b) have been reported.

The aim of this work was to determinate the lignicolous and terricolous macrofungi of Dragoica Mountain ridge and make contribution to fungal diversity of the Forebalkan floristic region, as well as of the Bulgarian larger fungi.

Materials and methods

Investigated area

The Dragoica mountain ridge is situated in Northern Bulgaria, Forebalkan (Western) floristic subregion (Bondev, 2002). According to the physical and geographical characteristics it is situated within the Stara Planina (Balkan) region where highest is Nishana peak (956 m) (Georgiev, 1985; Yordanova et al., 2002). The climate is temperate-continental belonds to Temperate-continental climatic zone (Velev, 2002). The relief is low-mountainous, with well-developed gullies and ridges. The bedrock consists of lower Cretaceous sediments (sandstones and marls) (Ninov, 1982; Angelov et al., 1992). The soils are slightly acidic light-grey forest soils (Albic Luvisols).

Composition of plant communities consists of woody, shrubbery and herbaceous species. The canopy vegetation of the study area is composed of oak forests (mainly *Qercus frainetto* Ten., *Quercus petraea* (Matt.) Liebl and *Q. dalechampii* Ten., but also *Q. cerris* L., *Fagus sylvatica* L., and *Carpinus betulus* L.), of Black pine (*Pinus nigra* Arnold) and broadleaved trees (*Populus alba* L., *Salix alba* L., etc.). Oak (*Quercus* spp. Liebl.) and Hornbeam (*Carpinus betulus* L.) are dominant species, sometimes forming mixed forest with Fir (*Abies alba* Miller) and Black pine (*Pinus nigra*). Deciduous forests interspersed with *Acer* sp., *Fraxinus* sp., *Tilia* sp., *Carpinus betulus*, *Corylus avellana*, etc. Moreover, the forests are recognized well by *Carpinus orientalis* and isolated *Pinus nigra* are widespread in the western and southern regions of the collecting area. Typical representatives of the shrub species are *Crataegus monogyna* Jacq., *Prunus spinosa* L., *Rosa canina* L., *Sambucus nigra* L, etc. (Bondev, 1991).

The members of Russulaceae growing under oak, pine, and beech trees form ectomycorrhizhae with them, as wel as the members of Boletaceae under pine, oak and beech trees form ectotroph mycorrhizae with their roots according to Nedelin (2014). Therefore, the research area is an ideal habitat for mycological studies.

Collection localities

The material was collected in localities around Yablanitsa town, Batultsi village, Zlatna Panega village, Ravnishte village and Shumnene village, as well as along the Batulska river, Panega river and Malki Iskar river (Fig. 1), in the following plant communities: (1) Plant community of *Fagus sylvatica* in the locality Drakata, under Nishana pesk, 850-950 m alt.; (2) Plant communities of *Fagus sylvatica, Quercus petraea* and *Q. cerris*, with participation of *Carpinus betulus* in the Kulata locality, 850 m alt.; (3) Plant communities of *Fagus sylvatica* and *Quercus petraea* with participation of *Abies alba* and pine plantation (*Pinus nigra*) below the Nishana peak, 800-950 m alt.; (4) Plant communities of *Quercus petraea* and *Quercus cerris* with single participation of *Fagus sylvatica*, around Nishana pesk, 800-900 m alt.; (5) Mezophylous community of *Quercus cerris, Quercus petraea,* with participation of *Acer campestre, Carpinus betulus, C. orientalis, Corylus avellana, Populus tremula, P. nigra*, and smaller plantation of *Pinus nigra* in the Prisoeto locality, near Yablanitsa town, Ravnishte and Shumnene villages, 500-750 m alt.; (6) Plant communities of cereal and other grasses in meadows and pastures, as well as azonal vegetation along the rivers, in the whole investigated area to 500 m alt.

Determination, nomenclature and keeping of the fungal samples

Transects were selected in order to cover the entire range of habitats for larger fungi. The material was collected during the period of 2018-2024 using the transect method in different plant communities, on soil, on fallen branches, stumps, logs or living trees. Many fungi inhabit substrates such as (moist soil, decaying wood, the bark of living trees, burnt soil and wood in fireplaces, etc.). Fungi often develop among mosses as saprotrophs or parasites (Arnolds, 1992; Lissievska, 1992; Nacheva & Gyosheva, 2016).

Data about the substrata and host plants of the fungal species were collected in the course of the work. Relevant morphological and ecological characters were recorded for the fungi, which

were photographed in their natural habitats. Some of the species were determined while still in a fresh condition (Agaricales), and the others were to undergo further laboratory analyses.

The determination of the species was done during the field research and at the Botanycal Laboratory of the Agricultural University – Plovdiv, microscopically by using reagents (Melzer`s reagent, sulfovanilin, 5% KOH, H_2O, etc.).

The following keys and monographs were used as resources for determination of the collected specimens: Michael et al. (1983–1988), Eriksson & Ryvarden (1975), Eriksson et al. (1978, 1981), Breitenbach & Kränzlin (1986, 1991, 1995, 1996, 2000), Phillips (1981, 2006), Jülich (1984), Alessio (1985), Ellis & Ellis (1990), Hansen & Knudsen (1992–2000), Dähncke (1993), Jordan (1995), Heilmann-Clausen et al. (1998), Kränzlin (2005), Moser (1967, 1978, 1983), Neubert et al. (1993), Ryvarden & Gilbertson (1993, 1994), Galli (1996), Pegler et al. (1997), Heilmann-Clausen et al. (1998), Holec (2001), Wald et al. (2004), Parra (2005), Razaq & Shahzad (2007), Lacheva (2010), Klaus et al., 2013, etc. The author's names of the fungal taxa are abbreviated according to Kirk (2004) and Kirk & Ansell (1992) and the plants taxa by Brummit & Powell (1992). The nomenclature follows Kirk et. al. (2001, 2008), Turland et al. (2018) and Index Fungorum.

The conservation status of the species was based on the Red List of fungi in Bulgaria (Gyosheva et al., 2006) and the Red Data Book of the Republic Bulgaria Volume 1 (Peev et al., 2015), using the Red Book categories of IUCN (IUCN 2001, 2003a,b). The fungus species with conservation value are designed in the list with CV.

The ecological-trophic groups were carried out after direct observations and based on literature data (Arnolds, 1982; Kalamees, 1979; Read, 1991; Gyosheva & Vasilev, 1994; Vulchev et al., 2000; Dimitrova & Gyosheva, 2009, 2010; Gyosheva & Denchev, 2000). Different wood substrates were studied: dead wood (branches, stumps, trunks, bark, etc.) and living trees (Arnolds 1982, 1992).

Part from the specimens have been preserved in the herbarium of Agricultural University–Plovdiv, Bulgaria. Specimens were collected by the authors, unless otherwise stated.

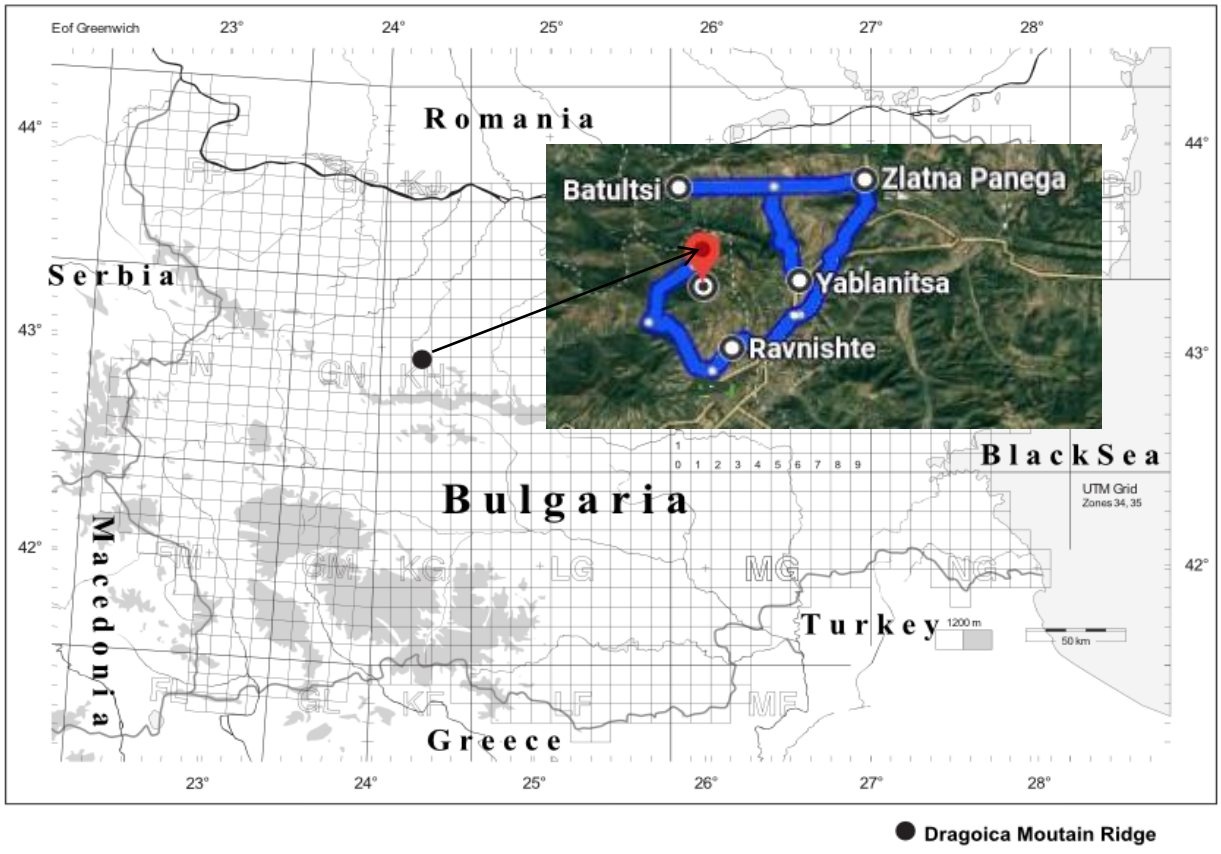

Fig. 1. Map of Bulgaria showing the location of Dragoica Mountain Ridge.

Results and Discussion

The total number of larger fungi recorded during the present study is 169. Of them, 95 lignicolous and 74 terricolous. Of them, 11 species belong to Ascomycota (2 classes, 3 orders, 8 families, 10 genera) and 158 species belong to Basidiomycota (3 classes, 11 orders, 45 families, 87 genera). The most species-rich families are Xylariaceae (3) among the ascomycetes and Polyporaceae (16) from the Basidiomycetes. The greatest diversity of fungi was found in oak forests and in mixed oak and beech forests in the higher parts of the mountain ridge, as well as from meadow and pastures. The predominant participation of lignicolous fungi (95 species) on dead and living wood (saprotrophs and parasites) is characteristic of old forests (Parmasto & Parmasto, 1997; Natcheva & Gyosheva, 2016).

Lignicolous species were collected on fallen branches, trunks, logs and living trees on the following substrates: *Fagus sylvatica* (29), *Quercus* spp. (21), on the two substrates (*Fagus* and *Quercus* spp.) – 22, and 23 species were registered on other wood substrates (*Abies alba, Carpinus betulus, C. orienthalis, Corylus avellana, Pinus nigra, Populus tremula, Sambucus nigra, Salix* spp., *Tillia* spp., etc.). From lignicolous species, there are 15 wood parasites and 80 saprobionts (Fig. 2). Five wood parasites: *Armillaria mellea, Fistulina hepatica, Fomes fomentaris, Ganoderma lucidum*, and *Phellinus igniarius* are of high economic importance in terms of the sanitary status of the forest ecosystems (Natcheva & Gyosheva, 2016; Gospodinov et al., 2018).

The most frequent lignicolous species are: *Armillaria mellea, Fistulina hepatica, Fomes fomentarius, Ganoderma applanatum, G. lucidum, Inonotus hispidus, Laetiporus sulphureus, Oudemansiella radicata, Panellus stypticus, Phellinus igniarius, Schizophyllum commune, Schizopora paradoxa, Stereum hirsutum, Trametes hirsuta*, and *Vuilleminia comedens.* Rare lignicolous species are: *Hericium coralloides, Ganoderma lucidum, Laxitextum bicolor*, and *Vuilleminia cystidiata*. Characteristic species of *Abies* are: *Gloeophyllum abietinum, Ischnoderma benzoinum, Phellinus hartigii* and *Phlebia tremellosa*; for *Fagus: Calocera cornea, Cerrena unicolor, Fomes fomentarius, Phellinus igniarius* and *Laxitextum bicolor*; for *Quercus: Daedalea quercina, Peniophora quercina, Phellinus ferruginosus, Tremella mesenterica*, and *Vuilleminia comedens*.

The terricolous species are presented by 44 mycorrhizal and 30 saprobionts (Fig. 2). The most frequent terricolous species are *Agaricus arvensis, A. campestris, Amanita rubescens, Boletus edulis, Bovista plumbea, Cantharellus cibarius, Cortinarius torvus, Laccaria laccata, Lactarius piperatus, Lycoperdon perlatum, Micetinis alliaceus, Marasmius oreades, Rhodocollybia butyracea, Russula cyanoxantha, Vascellum pratense*, etc.

Some of the species such as *Clavaria fumosa, Geastrum schmidelii, Discina ancilis, Hygrocybe punicea, Lepiota erminea, Mycena aetites, M. bulbosa* and *Vuilleminia cystidiata* could be highlighted as rare.

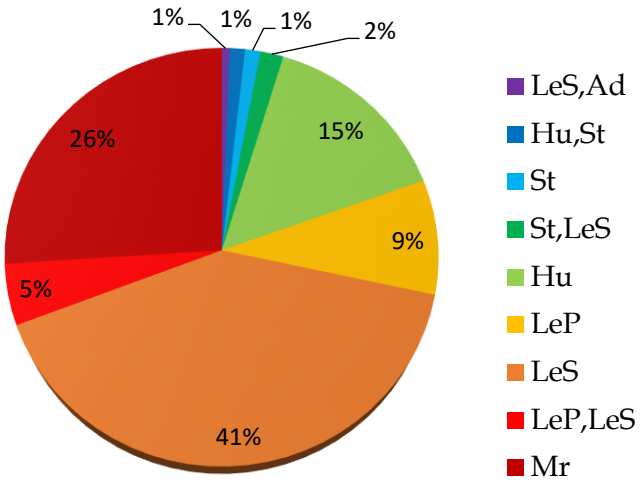

Fig. 2. Arrangement of fungal species in ecological-trophic groups.

Fig. 3 shows the most frequent ectomycorrhizal genera on Dragoica mountain ridge, where the genera *Amanita, Boletus, Cortinarius, Clitocybe, Lactarius, Tricholoma* and *Russula*, are present with a larger number of species, while the others are present with a smaller number of species. The larger number of species was recorded in oak associations and mixed oak and beech (Fig. 4), a smaller number was recorded in beech forests with a mixture of Fir, Black pine, Hornbeam and other broadleaved trees, as well as and beech-fir forests, while the rest of the investigated associations (meadows, pastures, etc.) are characterised by a few numbers of species. Of the registered species, 45 are edible fungi, most of them from the genera *Agaricus, Boletus, Calocybe, Clitocybe, Cantharellus, Lactarius, Lepista, Macrolepiota, Russula*, etc.: *Agaricus arvensis, A. bitorquis, A campestris, A. macrocarpus, A. sylvaticus, A. sylvicola, A. urinascens, Amanita rubescens, Armillaria mellea, Boletus appendiculatus, Boletus calopus, Boletus edulis, Boletus fehtneri, Boletus chrisenteron, Bovista plumbea, Calocybe gambosa, Calvatia excipuliformis, C. gigantea, C. utriformis, Cantharellus cibarius, Clitocibe gibba, C. nebularis, C. odora, Coprinus comatus, Craterellus cornucopioides, Lactarius piperatus, Laetiporus sulphureus, Leccinum aurantiacum, L. quercinum, L. scabrum, Lycoperdon perlatum, Macrolepiota mastoidea, M. procera, Chlorophillum rhacodes, Marasmius oreades, Oudemansiella radicata, Pleurotus ostreatus, Polyporus squamosus, Russula vesca, R. cyanoxantha, R. virescens, R. xerampelina, Suillellus queletii, Suillus luteus, S. granulatus*.

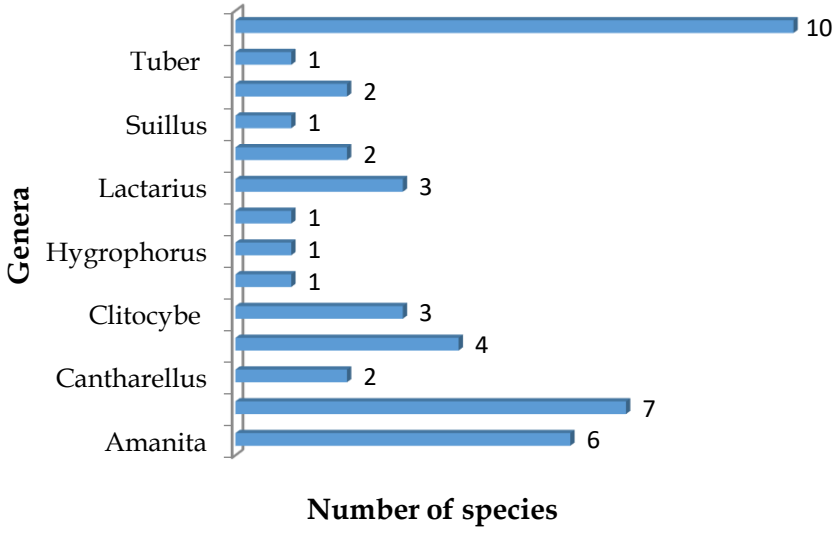

Fig. 3. The most frequent ectomycorrhizal genera.

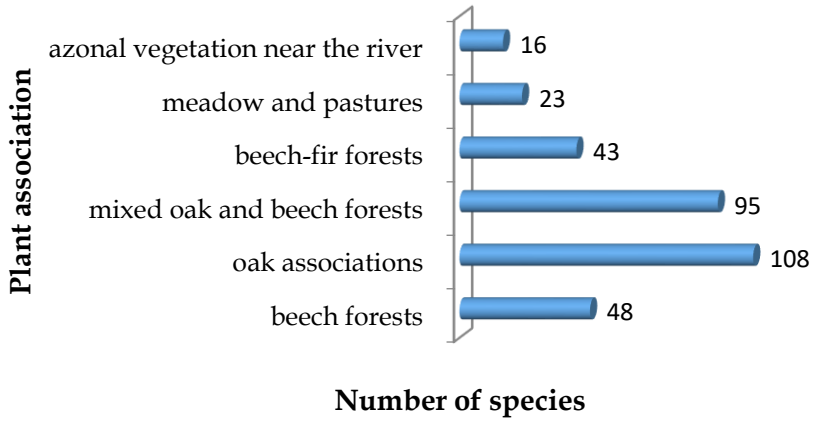

Fig. 4. Number of species in researched plant communities.

The species *Amanita crocea, A. battarre, Clavaria fumosa, Geasrum schmidelii, Hygrocybe punicea, Ischnoderma benzoinum, Leccinum quercinum, Mycena aetites* and *M. bulbosa* may be highlighted as especially rare for the area. The fungi *Vuilleminia cystidiata* and *Neolentinus schaefferi* grow in rare or difficult to access habitats.

Eight (8) species of conservation value (*Agaricus macrocarpus, Amanita caesarea, A. vittadinii, Discina ancilis, Hericium coralloides, Lenzites warnieri, Tuber aestivum* and *Tulostoma fimbriatum*), included in the Red List of Fungi in Bulgaria (Gyosheva et al., 2006) and Red Data Book of the Republic Bulgaria Volume 1 (Peev et al., 2015), are established. *Agaricus macrocarpus, Amanita caesarea* and *Tuber aestivum* are endangered by excessive exploitation, which is the reason why these species are in the Red List and Red Data Book. The fungi *Amanita caesarea, Hericium coralloides* and *Lenzites warnieri* possibly are not rare species. The earlier records for each of these species are in 10 floristic regions (Nacheva & Gyosheva, 2016; Denchev & Assyov, 2010; Voykov et al., 2017).

The edible fungi *Agaricus arvensis, A. campestris, A. urinascens, Boletus aereus, B. edulis, B. reticulatus, Calocybe gambosa, Cantharellus cibarius, Craterellus cornucopioides, Lepista personata, Macrolepiota excoriata, M. procera, Marasmius oreades, Ramaria flava*, etc., are subjected to intensive exploitation by the population in nearby settlements. The truffle *Tuber aestivum* is an ectomycorrhizal edible truffle, which has a high commercial value. *T. aestivum* is one of the most widespread truffle species which is found on the territory of Bulgaria. Its natural habitats include a wide range of soil units and a wide spectrum of ectomycorrhizal host tree species (Petrova et al., 2024).

The list of all fungal species, their ecological-trophic structure, substrates and conservation value (CV) are presented in Table 1.

Table 1. Species composition, localities, ecological-trophic structure, substrates and conservation status of the lignicolous and tericolous larger fungi recorded on the territory of Dragoica Mountain Ridge (families and species listed alphabetically). Legend: (EN) Endangered, (VU) Vulnerable, (NT) Near Threatened; the species reported for the first time from Forebalkan are marked with (1) and for second time with (2).

Species composition	Localities/plant communities						*ETG/ Substrate or host
	1	2	3	4	5	6	
Ascomycota **Leotiomycetes** **Helotiales** ***Helotiaceae***							
(2) *Ascocoryne sarcoides* (Jacq. ex S.F. Gray)	+						LeS/Fs; dead wood
(2) *Bisporella citrina* (Batsch) Korf & S.E. Carp.	+	+					LeS/Fs; dead wood
Pezizomycetes ***Pezizales***							
Discinaceae							
(VU) (1) *Discina ancilis* (Pers.) Sacc.			+				Hu/on soil
Morchellaceae							
(1) *Morchella esculenta* (L.) Pers.			+	+			Hu/on soil
Pyronemataceae							
(2) *Scutellinia scutellata* (L.) Lambotte					+		St/dead wood
Sarcoscyphaceae							
(1) *Sarcoscypha coccinea* (Jacq.) Sacc.					+	+	St/dead wood
Tuberaceae							
(EN) (1) *Tuber aestivum* Vittad.		+		+	+		Mr/ Cb, Tp, Qc, Qp
Xylariales ***Diatrypaceae***							
(2) *Diatrype disciformis* (Hoffm. : Fr.) Fr.	+		+				LeS/Fs; dead wood
Xylariaceae							
(2) *Hypoxylon fragiforme* (Pers. : Fr.) J. Kickx f.	+	+	+		+		LeS/Fs, Qp; dead wood

(2) *Hypoxylon multiforme* (Fr. : Fr) Fr.		+	+				LeS/Qc; dead beech wood
(2) *Xylaria polymorpha* (Pers. : Fr.) Grev.				+	+	+	LeS/Fs, Qc; dead wood
Basidiomycota **Agaricomycetes** **Agaricales** ***Agaricaceae***							
Agaricus arvensis Schäeff.						+	Hu/on soil
(1) *Agaricus bitorquis* (Quél.) Sacc.						+	Hu/on soil
Agaricus campestris L. : Fr.						+	Hu/on soil
(EN) (1) *Agaricus macrocarpus (F.H. Moller) F.H. Moller*						+	Hu/on soil
(1) *Agaricus urinascens* (Jul. Schäeff. & F.H. Moller) Singer						+	Hu/on soil
Agaricus sylvaticus Schäeff.		+	+				Hu/on soil
(1) *Agaricus sylvicola* Vittad. Lév.	+	+					Hu/on soil
(1) *Coprinus comatus* (O.F. Müll. : Fr.) Pers.						+	Hu/on soil
(1) *Chlorophyllum rachodes* (Vittad.) Velinga						+	Hu/on soil
(2) *Cyathus striatus* (Huds. Pers.) Willd.			+	+			LeS/Aa, dead fir wood
(1) *Lepiota clypeolaria* (Bull. : Fr.) P. Kumm.					+		Hu/on soil
(1) *Lepiota erminea* (Fr. : Fr.) P. Kum.						+	Hu/on soil
Macrolepiota excoriate (Schäeff. : Fr.) Wasser		+				+	Hu/on soil
(1) *Macrolepiota procera* (Scop. : Fr.) Singer						+	Hu/on soil
(1) *Macrolepiota mastoidea* (Fr. : Fr.) Singer			+	+	+		Hu/on soil
(1) *Phlebia tremellosa* (Schrad. : Fr.) Burds. & Nakasone			+	+	+		LeS/Aa; dead fir wood
Amanitaceae							
(VU) *Amanita caesarea* (Scop. : Fr.) Pers.		+		+	+		Mr/on soil
(1) *Amanita rubescens* Pers. : Fr.				+	+		Mr/on soil
(1) *Amanita phalloides* (Vail. : Fr.) Link		+		+			Mr/on soil
(1) *Amanita crocea* (Quel.) Singer					+		Mr/on soil
(1) *Amanta battarre* (Bout.) Bon.		+			+		Mr/on soil
(VU) 1*Amanta vittadinii* (Moretti) Vittad.						+	Mr/on soil
Clavariaceae							
(1) *Clavaria fragillis* Holmsk.		+	+				Hu, Ls/forest litter
(1) *Clavaria fumosa* Pers. : Fr.			+				Hu, Ls/forest litter
Clitocybaceae							
(1) *Clitocibe gibba* (Pers. : Fr.) P. Kumm.		+		+	+		Mr/on soil
(1) *Clitocybe nebularis* (Batsch) P. Kumm.		+		+	+		Mr/on soil
(1) *Clitocybe odora* (Bull. : Fr.) P. Kumm.		+			+		Mr/on soil
(1) *Lepista nuda* (Bull. : Fr.) Cooke				+	+		Hu/on soil
(1) *Lepista flaccida* (Sowerby : Fr.) Pat.		+		+	+		Hu/on soil
(1) *Lepista personata* (Fr. : Fr.) Cooke						+	Hu/on soil
Cortinariaceae							
(1)*Cortinarius trivialis* J.E. Lange		+			+		Mr/on soil
(1) *Cortinarius croceus* (Schaeff. : Fr.) Gray			+		+		Mr/on soil
(1) *Cortinarius glaucopus* (Schaeff. : Fr.) Fr.		+			+		Mr/on soil
(1) *Cortinarius torvus* (Fr. : Fr.) Fr.		+			+		Mr/on soil
Crepidotaceae							
(2) *Crepidotus mollis* (Schaeff.) Staude		+		+	+		LeS/Qc, Qp, dead oak wood
Hygrophoraceae							
(1) *Hygrocybe punicea* (Fr. : Fr.) P. Kumm.	+		+				Mr/on soil

Hydnangiaceae							
(1) *Laccaria laccata* (Scop.) Cooke	+	+	+				Mr/on soil, among mosses
Fistulinaceae							
Fistulina hepatica (Schäeff. : Fr.) With.		+		+	+		LeP/Qc, living and dead oak wood
Lycoperdaceae							
Bovista plumbea Pers.						+	Hu/on soil
(1)*Calvatia excipuliformis* (Scop. : Pers.) Perdeck						+	Hu/on soil
(1) *Calvatia giganthea (*Batsc. : Pers.) Lloyd						+	Hu/on soil
Lycoperdon perlatum Pers.		+		+	+		LeS/Qc; dead wood
(2) *Lycoperdon pyriforme* Schaeff. : Pers.		+	+	+			LeS/Aa, dead wood
(1) *Vascellum pratense* (Pers. : Pers.) Kreisel						+	Hu/on soil
Lyophyllaceae							
Calocybe gambosa (Fr. : Fr.) Donk					+	+	Mr/on soil
Marasmiaceae							
Gymnopus dryophilus (Bull. : Fr.) Murrill		+		+			St, LeS/on soil
Gymnopus fusipes (Bull. : Fr.) Gray				+	+		St, LeS/on soil
Marasmius oreades (Bolton) Fr.						+	Mr/on soil
(2) *Marasmius rotula* (Scop. : Fr.) Fr.	+	+	+	+	+		LeS/Fs, Qp; dead wood
(2) *Megacollybia platyphylla* (Pers. : Fr.) Kotl. & Pouzar		+	+	+			St, LeS/Fs, Aa; dead wood
(1) *Micetinis alliaceus* (Jacq. : Fr.) Earle	+	+					LeS/Fs; dead wood
(1) *Omphalotus olearius* (DC. : Fr.) Singer	+	+			+		LeP/Fs, Cb; living wood
(2) *Setulipes androsaceus* (L. : Fr.) Antonín			+		+		LeS, Ad/Aa, Ps; dead wood
Mycenaceae							
(2) *Mycena acicula* (Schäeff.) P. Kumm.	+	+			+		LeS/Fs; dead wood
(1) *Mycena aetites* (Fr.) Quel.					+		LeS/Qc; dead wood
(1) *Mycena bulbosa* (Cejp.) Kuhner		+		+			LeS/Fs; dead wood
(2) *Mycena crocata* (Schrad. : Fr.) P. Kumm.				+			LeS/Aa; dead wood
Mycena epipterigia (Scop. : Fr.) Gray		+			+		LeS/Qc; dead wood
(1) *Mycena galericulata* (Scop.: Fr.) Gray	+	+	+		+		LeS/Fs, Pn; dead wood
(2) *Mycena polygramma* (Bull. : Fr.) Gray	+	+		+			LeS/Fs; dead wood
(1) *Mycena pura* (Pers. : Fr.) P. Kumm.		+		+	+		LeS/Qc, dead wood
(1) *Mycena rorida* (Fr. : Fr.) Quel.		+		+	+		LeS/Fs, Qc, dead wood
Omphalotaceae							
(1) *Rhodocollybia butyracea* (Bull.) Lennox			+	+			LeS/Pn, dead pine wood
Physalacriaceae							
(2) *Armillaria mellea* (Vahl : Fr.) P. Kumm.	+	+		+			LeS, LeP/Fs, living and dead wood
(2) *Armillaria socialis* (D.C. : Fr.) Fayod		+			+		LeS/Fs, dead wood
(1) *Xerulla radicata* (Relhan : Fr.) Dörfelt		+		+			LeS/Qp; dead wood
Pleurotaceae							
(2) *Pleurotus ostreatus* (Jacq. : Fr.) P. Kumm.		+		+	+		LeS, LeP/Fs, Pt; dead wood
(1) *Pleurotus cornucopiae* (Paulet) Rolland		+	+				LeS, LeP/Fs, Qc; living wood
Pluteaceae							
(2) *Pluteus atromarginatus* (Conrad) Kuhner.		+	+	+			LeS/Ps, Aa; dead wood
(2) *Pluteus cervinus* (Schaeff.) P. Kumm.	+	+					LeS/Fs, Cb, Qc; dead wood
(2) *Volvariella bombycina* (Schäeff. : Fr.) Singer	+	+					LeS, LeP/Fs; living wood

Psathyrellaceae							
(2) *Coprinellus disseminatus* (Pers. : Fr.) J.E. Lange				+	+		LeS/Qc; dead wood
(2) *Coprinellus micaceus* (Bull. : Fr.) Vilgalys	+	+					LeS/Fs; dead wood
(2) *Coprinopsis atramentaria* (Bull. : Fr.) Redhead, Vilgalys & Moncalvo	+	+					LeS/Fs; dead wood
(2) *Psathyrella candolleana* (Fr. : Fr.) Maire	+	+	+		+		LeS/Fs, Pt; dead wood
Schizophyllaceae							
Schizophyllum commune Fr. : Fr.	+	+		+	+		LeS/Fs, Aa, dead wood
Strophariaceae							
(2) *Hypholoma fasciculare* (Huds. : Fr.) P. Kumm.		+	+	+			LeS/Aa, Ps; dead wood
(2) *Hypholoma sublateritium* (Schäeff. : Fr.) P. Kumm.	+	+					LeS/Fs; dead wood
(1) *Pholiota populnea* (Pers.) Kuyper & Tjall.-Beuk.					+		LeS/Pt; dead wood
Tricholomataceae							
(1) *Tricholoma saponaceum* (Fr. : Fr.) P. Kum.		+		+			Mr/on soil
Tricholoma album (Schaef. : Fr.) P. Kum		+		+			Mr/on soil
Tulostomataceae							
(NT) (1) *Tulostoma fimbriatum* Fr.						+	Hu/on soil
Auriculariales ***Auriculariaceae***							
Auricularia auricula-judae (Bull. : Fr.) Quél.	+	+			+		LeS/Fs, dead wood
Exidia glandulosa (Bull. : Fr.) Fr.	+	+	+				LeS/Fs, dead wood
Hydnaceae							
Cantharellus cibarius Fr. : Fr.		+	+	+	+		Mr/ on soil, among mosses
(1) *Cantharellus cinereus* (Pers. : Fr.) Fr.		+	+				Mr/ on soil, among mosses
(1) *Craterellus cornucopioides* (L. : Fr.) Pers.	+	+	+				Mr/ on soil, among mosses
Boletales ***Boletaceae***							
Boletus aereus Bul. : Fr.					+		Mr/on soil
Boletus appendiculatus Schäeff.		+			+		Mr/on soil
Boletus chrysenteron Bull.		+			+		Mr/on soil
(1) *Boletus calopus* Pers. : Fr.		+	+				Mr/on soil
Boletus edulis Bull. : Fr. s lat.		+		+	+		Mr/on soil
(1) *Boletus fehtneri* Velen.		+					Mr/on soil
(1) *Boletus reticulatus* Schäeff.	+			+	+		Mr/on soil
(1) *Leccinum quercinum* Pilat					+		Mr/on soil
Leccinum scabrum (Bull.) Gray					+		Mr/on soil
Suillellus queletii Schulzer	+	+	+	+	+		Mr/on soil
Sclerodermataceae							
Scleroderma verrucosum (Bull. : Pers.) Pers.					+		Hu/on soil
Suillaceae							
(1) *Suillus luteus* (L. : Fr.) Roussel			+				Mr/on soil
Corticiales ***Vuilleminiaceae***							
Vuilleminia comedens (Nees) Maire				+	+		LeS/Qc, dead wood
(1) *Vuilleminia cystidiata* Parmasto					+		LeS/Qc, dead wood
Geastrales ***Geastraceae***							
(1) *Geastrum schmidelii* Vittad.					+		Hu/on soil
(1) *Geastrum fimbriatum* Fr.					+		Hu/on soil
Gloeophyllales ***Gloeophyllaceae***							

Gloeophyllum abietinum (Bull. : Fr.) P. Karst.			+	+			LeS/Aa, dead fir wood
(1) *Neolentinus schaefferi* Redhead & Ginns					+		LeS/Pt, dead wood
Hymenochaetales ***Hymenochaetaceae***							
Inonotus cuticularis (Bull. : Fr.) P. Karst.	+	+	+				LeP/Fs; living beech wood
(2) *Inonotus hastifer* Pouzar	+						LeP/Fs; living beech wood
Inonotus hispidus (Bull. : Fr.) P. Karst.	+	+					LeP/Fs; living beech wood
(2) *Phellinus ferruginosus* (Schrad. : Fr.) Pat.					+		LeP/Qc; living oak wood
(1)*Phellinus hartigii* (Alesch. & Schnabl) Pat.			+				LeP/Aa; living fir wood
Phellinus igniarius (L.: Fr.) Quél.	+	+					LeP/Fs; living beech wood
Phellinus torulosus (Pers. : Fr.) Bourdot & Galzin	+			+			LeP/Fs; living beech wood
(2) *Phylloporia ribis* (Schumach.: Fr.) Ryvarden.	+		+				LeP/Fs, Aa; living beech and fir wood
(2)*Pseudoinonotus dryadeus* (Pers. : Fr.) T. Wagner & M. Fisch.		+		+			LeS, LeP/Qc; living and dead oak wood
Schizoporaceae							
(2) *Schizopora paradoxa* (Schrad.) Donk				+	+		LeS, LeP /Fs, Qc; living and dead wood
Polyporales ***Cyphellaceae***							
(2) *Chondrostereum purpureum* (Pers. : Fr.) Pouzar		+			+		LeS/Qc; dead oak wood
(2)*Panellus stipticus* (Bull. : Fr.) P. Karst.		+		+	+		LeS/Fs; dead wood
Fomitopsidaceae							
Daedalea quercina (L. : Fr.) Pers.				+	+		LeS, LeP/Qc; dead oak wood
Ischnodermataceae							
(1) *Ischnoderma benzoinum* (Wahlenb.) P. Karst.			+				LeS/Aa; dead fir wood
Laetiporaceae							
Laetiporus sulphureus (Bull. : Fr.) Murrill		+	+	+	+	+	LeP/Ac, Qc; living wood
(2) *Postia stiptica* (Pers. : Fr.) Jülich			+	+			LeS/Aa, Ps
Meruliaceae							
Bjerkandera adusta (Willd.: Fr.) P. Karst.		+			+		LeS/Cb, Fs; dead wood
(2) *Phlebia tremellosa* (Schrad. : Fr.) Burds. & Nakasone	+	+					LeS/Fs, Qc; dead wood
Polyporaceae							
(2) *Cerrena unicolor* (Bull. : Fr.) Murrill		+					LeS/Fs; dead beech wood
Coriolopsis gallica (Fr. : Fr.) Ryvarden					+		LeS/Pt; dead wood
Daedaleopsis tricolor (Bull. : Fr.) Bondartsev & Singer		+		+	+		LeS/Cb, Fs, Qc; dead wood
(2) *Datronia mollis* (Sommerf. : Fr.) Donk		+		+			LeS/Fs; dead wood
Fomes fomentarius (L. : Fr.) J.J. Kickx	+	+		+	+		LeP/Fs; living and dead beech wood
(2) *Ganoderma applanatum* (Pers.) Pat.	+	+					LeP/Fs; dead oak wood
(1) *Ganoderma lucidum* (Kurtis : Fr.) P. Karst.					+		LeP/Qc; dead oak wood
(2) *Ganoderma resinaceum* Boud.		+			+		LeS, LeP/Qc; dead oak wood
Lenzites betulina (L.: Fr.) Fr.	+		+		+		LeS/Fs, Qc, dead wood

(NT) (1) *Lenzites warnieri* Durieu & Mont.		+		+			LeS/Fs, Qc, dead oak wood
(2) *Polyporus arcularius* (Batsch: Fr.) Fr.	+	+					LeS/Fs, Qc; dead wood
(2) *Polyporus leptocephalus* (Jacq. : Fr.) Fr.	+	+			+		LeS/Fs; dead wood
Polyporus squamosus (Huds. : Fr.) Fr.	+	+			+		LeP/Fs; dead wood
(2) *Pycnoporus cinnabarinus* (Jacq. : Fr.) P. Karst.		+			+		LeS/Cb; dead wood
Trametes hirsuta (Wulfen : Fr.) Pilát	+	+	+		+		LeS/Ca; dead wood
Trametes versicolor (L. : Fr.) Lloyd	+	+	+	+	+		LeS/Fs, Qc; dead wood
Russulales							
Auriscalpiaceae							
(1) *Lentinellus cochleatus* (Pers.) P. Karst.					+		LeS/Qc; dead wood
Hericiaceae							
(NT) (1) *Hericium coralloides* (Scop. : Fr.) Pers.	+	+					LeS/Qc; dead oak wood
(1) *Laxitextum bicolor* (Pers. : Fr.) Lentz.	+	+					LeS/Fs, Qc; dead oak and beech wood
Peniophoraceae							
(2) *Peniophora quercina* (Pers. : Fr.) Cooke					+		LeS/Fs, Qp; dead oak wood
Stereaceae							
(2) *Stereum hirsutum* (Willd. : Fr.) Gray	+	+		+	+		LeS/Ca, Fs, Qc; dead wood
(2) *Stereum gausapatum* (Fr. : Fr.) Fr.	+	+		+	+		LeS/Fs, Bp, Qc; dead wood
Stereum rugosum (Pers. : Fr.) Fr.				+	+		LeS/Fs; dead wood
Russulaceae							
Lactarius deliciosus (L. : Fr.) Gray			+				Mr/on soil
Lactarius piperatus (L. : Fr) Pers.		+	+	+	+		Mr/on soil
Lactarius volemus (Fr. : Fr.) Fr.		+			+		Mr/on soil
Russula cyanoxantha (Schaeff.) Fr				+	+		Mr/on soil
(1) *Russula vesca* Fr.		+		+	+		Mr/on soil
(1) *Russula virescens* (Schaeff.) Fr		+			+		Mr/on soil
(1) *Russula ochroleuca* (Pers.) Fr.		+					Mr/on soil
(1) *Russula xerampelina* (Schaeff.) Fr		+			+		Mr/on soil
(1) *Russula foetens* (Pers. : Fr.) Fr.				+			Mr/on soil
(1) *Russula delica* Fr. s. lat.	+	+		+	+		Mr/on soil
Dacrymycetes							
Dacrymycetales							
Dacrymycetaceae							
(1) *Calocera cornea* (Batsch : Fr.) Fr.	+	+					LeS/Fs; dead beech wood
Tremellomycetes							
Tremellales							
Tremellaceae							
(1) *Tremella mesenterica* Retz. : Fr.	+	+			+	+	LeS/Fs, Qc; dead oak wood

Abbreviation of ecological-trophic groups (*ETG) and wood-substrate: Ad – needle-debris saprotrophs, Br – moss saprotrophs, Fd – saprotrophs of fallen leaves of deciduous trees, Hu – soil saprotrophs, LeS – wood saprotrophs, LeP – wood parasites, Mr – ectomycorrhizal fungi, St – litter saprotrophs; wood-substrate and host: Aa – *Abies alba* Mill.; Ac – *Acer campestre* L.; Bp – *Betula pendula* Roth; Ca – *Corylus avellana* L., Cb – *Carpinus betulus* L.; Co – *Carpinus orientalis* Mill.; Fs – *Fagus sylvatica* L.; Pn – *Pinus nigra* Arn.; Ps – *Pinus sylvestris* L.; Pt – *Populus tremula* L.; Qc – *Quercus cerris* L.; Qd – *Quercus dalechampii* Ten.; Qf – *Quercus frainetto* Ten.; Qp – *Quercus petraea* (Matt.) Liebl.; Tc – *Tilia cordata* Mill.; Tp – *Tilia platyphyllos* Scop.; Tt – *Tilia tomentosa* Moench; Sn – *Sambucus nigra* L.

The predominant part of the fungi in the territory of the Dragoica mountain ridge has been reported in locations from beech, oak, and mixed forests, as well as in meadows and pastures in neighboring and European countries, as: Macedonia (Karadelev, 2000, 2002, 2018; Ivančević, 2009; Karadelev & Rusevska, 2013a,b; Ivancevic & Karadelev, 2013), Serbia and Kosovo (Lukić, 2008; Ivančević & Karadelev, 2009; Katanić et al., 2015; Vukojević et al., 2016; Akata, 2017; Ramshaj et al., 2021), Greece (Zervakis et al., 2004); Romania (Tănase & Pop, 2005), Turkey (Afyon et al., 2005; Yagiz et al., 2006 a,b; Akata et al., 2010, Sesli & Denchev, 2005, 2010, 2014; Solak et al., 2015), Hungary (Siller et al., 2013), Italy (Venturella et al., 2011), with a number of species being of high conservation value (Sesli & Denchev, 2005, 2010; Zervakis et al., 2004); Venturella et al., 2011; Karadelev & Rusevska, 2013a,b), etc.

Conclusions

A total of 169 species of fungi are represented here – 95 lignicolous and 74 terricolous. Forty-two (42) are mycorrhizal, 110 are saprobionts and 15 are parasitic, 76 species have been added as new data for the Forebalkan floristic region, and 47 species have been reported for the second time from this floristic region. New localities of about forty-six (46) macrofungi have also been reported.

A larger number of species was recorded in oak communities (108) and mixed oak-beech forests with (95), a smaller number in beech-fir forests (48) with a mixture of black pine and hornbeam (43), while in the other studied communities (meadows, pastures, azonal vegetation, etc.) 23 and 16 species are characteristic, respectively. The predominant part of the lignicolous fungi are widespread in the beech and oak forests of Europe and Bulgaria. Some species such as: *Amanita crocea, A. battarre, A. vittadinii, Boletus fehtneri, Clavaria fumosa, Geastrum schmidelii, Hericium coralloides, Hygrocybe punicea, Leccinum quercinum, Lepiota erminea, Lepista personata, Mycena aetites, M. bulbosa, Phyllotopsis nidulans, Tulostoma fimbriatum* and *Vuilleminia cystidiata* can be highlighted as rare for this region.

Lignicolous macromycetes (*Laetiporus sulphureus, Pleurotus ostreatus, Polyporus squamosus*), as well as terricolous mushrooms (*Agaricus arvensis, A. campestris, A. urinascens, Boletus aereus, B. edulis, B. reticulatus, Cantharellus cibarius, Calocybe gambosa, Craterellus cornucopioides, Lepista personata, Macrolepiota excoriata, M. procera, Marasmius oreades* and *Tuber aestivum*) are known as edible mushrooms that are collected for consumption and trade by local people. Other edible wood-decomposing and saprotrophic species are not recognized or valued locally.

From the systematic analysis made, it is obvious that the mountain ridge is of interest in mycological terms, as well as for the conservation of mushrooms. The following species are included in the Red List of Mushrooms in Bulgaria: *Agaricus macrocarpus, Amanita caesarea, A. vittadinii, Discina ancilis, Hericium coralloides, Lenzites warnieri, Tuber aestivum* and *Tulostoma fimbriatum*.

The results of this study enrich the information on the diversity of lignicolous and terricolous larger mushrooms from the Dragoica Mountain Ridge (Forebalkan floristic region), as well as on the fungal diversity in Bulgaria in general.

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