

Macrofungi of Küre Mountains National Park in Bartın region of Turkey

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Abstract: In this study, Küre Mountains National Park, Bartın Province in the rest of the border must macrofungi flora areas and buffer zones between the years 2013 to 2015 inclusive were searched. The results of the field work space Macrofungi 284 samples were collected. A total of 284 macrofungi samples were collected. Laboratory analysis identified 68 species within 11 orders and 29 families. Of these, 3 taxa belong to Ascomycota, and 65 to Basidiomycota. Determined taxa were found to be growing on four types of substrates: 51 from soil, 11 from branches or trunks, 4 from logs, and 2 from leaves. This study can lay the groundwork for further biodiversity studies in the area, providing a basis for ensuring the continuity of the macrofungi flora and biological diversity within the national park.

Keywords: Macrofungi, Küre Mountains National Park, Bartın, Mycota

Türkiye’de Küre Dağları Milli Parkının Bartın Bölgesindeki Makrofungusları

Özet: Bu çalışma ile 2013-2015 yılları arasında Küre Dağları Milli Parkı’nın Bartın İli Sınırlarında kalan bölümünde mutlak ve tampon zon dâhilindeki alanlarda makrofungus türleri araştırılmıştır. Yapılan arazi çalışmaları sonucunda alandan 284 adet makrofungus örneği toplanmıştır. Toplamda sahadan 284 makrofungus örneği toplanmıştır. Labotatuvar ve teşhis çalışmaları sonucunda 10 takım ve 29 familyaya ait toplam 68 tür tanımlanmıştır. Bu türlerden 3 tanesi Ascomycota, 65 tanesi ise Basidiomycota bölümüne dahildir. Toplanan makro funguslardan 51 tanesi topraktan, 11 tanesi dal ve gövdelerden, 4 tanesi kütüklerden ve 2 tanesi de yapraklardan olmak üzere 4 farklı substrat üzerinde toplanmıştır. Bu çalışma, bölgede yapılacak olan daha fazla biyolojik çeşitlilik çalışması için zemin hazırlayabilir ve milli parkta makromikota ve biyolojik çeşitliliğin sürekliliğini sağlamak için bir temel oluşturabilir.

Anahtar kelimeler: Makrofungus, Küre Dağları Milli Parkı, Bartın, Mikota

1. Introduction

Like all the living things in nature, fungi have certain functions and importance within their life-time. For example, 95% of soil formation is made up of saprophytic fungi (Barutçıyan, 2012). Such as parasitic plants the fungi in a forest, they weed out weaker plants and provide room for the growth of higher quality plants. Some fungi act as nets for various insect species, and mycorrhizal fungi help plants gain mineral matter and water from soil (Palta et al. 2010), and other fungi have been used in medicine and pharmaceuticals (Turp Yıldız and Boylu 2018).

Certain fungi, however, can threaten the economy and also be lethal to humans. Eating poisonous fungi is one of the most common health risks (Mat, 1998). Fungi also cause disease in various species, agricultural and forest products, humans and animals alike, which can lead to pecuniary and non-pecuniary losses.

In 1991, a landmark paper estimated that there are 1.5 million fungi on the Earth. Because only 70000 fungi had been described at that time, the estimate has been the impetus to search for previously unknown fungi (Falandysz and Borovicka, 2013). Today, the total number of species is thought to be approximately 5.1 million (Blackwell, 2010). In Turkey, this number is known to be about more than 2500 (Kaya ve Uzun, 2018).

Many mycological studies have been done on macrofungi species in Turkey. Some examples of these studies were presented in Table 1.

Despite the number of studies conducted on macrofungi in Turkey, there is no research on the fungi at Küre Mountains National Park, other than Özkazanç and Yılmaz (2017). Only Afyon et al. (2000), Afyon and Konuk (2002) and Afyon et al. (2005) conducted research on the province of Bartın and its vicinity, but did not focus in particular on Küre Mountains National Park. Özkazanç and Oğuz (2017) identified 45 species in the Kastamonu part of the national park. The selection of Küre Mountains National Park is important for fulling this research gap and contributes to creating a comprehensive inventory of macrofungi distribution in Turkey.

Küre Mountains National Park has a total floor area of 37.753 hectares, 52% of which (19.500 hectares) are located within the boundaries of Bartın province. Küre Mountains National Park hosts the best wildlife samples of the endangered “Black Sea Humid Karstic Forest” and is among the 100 forest ‘hot spots’ in need of protection in Europe. In terms of forest birds, it hosts as many as 129 bird species, the park has also been listed in the “Important Bird Areas” (IBA), and due to the 1050 plant species hosted by the park, it has also been listed as one of the “Important Plant Areas in Turkey” (IPA). Furthermore, Küre Mountains National Park is the only place in the world where 43 plant species live endemically (Görmüş et al. 2015).

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Table 1. Some examples of macrofungi studies in Turkey

Authors	Year	Site	Total Species count	New species count
Sesli	1993	Maçka-Trabzon	40	23
Demirel and Işiloğlu	1993	Ardanuç-Artvin	56	11
Baydar and Sesli	1994	Akçaabat-Trabzon	40	14
Aşkun and Işiloğlu	1997	Balya-Balikesir	56	9
Uzun and Demirel	1998	Şenkaya-Erzurum	50	-
Stojchev et al.	1998	Thrace region	67	-
Demirel and Uzun	1999	Sankamış-Kars	-	4
Gezer	2000	Antalya	81	-
Afyon et al.	2000	Bartın	62	15
Işiloğlu	2001	Sandras Mountain-Muğla	76	-
Kaya	2001	Bitlis	60	4
Demirel et.	2002	Ağrı	45	-
Afyon and Konuk	2002	Zonguldak	77	23
Solak and Yılmaz Ersel	2002	Manisa	36	-
Yabanlı et al.	2004	Ula-Muğla	61	-
Afyon et al.	2004	Sinop	170	32
Yılmaz Ersel and Solak	2004	Izmir	55	3
Afyon et al.	2005	Black Sea region	80	7
Kaya	2005	Gölbasi- Adıyaman	77	5
Doğan and Öztürk	2006	Karaman	202	-
Uzun et al.	2006	Gümüşhane	105	14
Aktaş et al.	2006	Akseki-Antalya	85	-
Oskay and Kalyoncu	2006	Sultan Mountains	34	-
Köse et al.	2006	Bekilli-Denizli	61	-
Demir et al.	2007	Batman	50	3
Türkoğlu and Gezer	2007	Hacer Forest-Kayseri	69	-
Allı and Işiloğlu	2007	Aydın	19	-
Yüksel et al.	2007	Düzce	31	-
Kaya et al.	2009	Göksun-Kahramanmaraş	110	-
Türkecul and Zulfikaroğlu	2010	Çamlıbel-Tokat	51	-
Demirel et al.	2010	Hatila Valley National Park	126	-
Küçük et al.	2010	Bozyazı-Mersin	104	-
Kaşık et al.	2010	Gevne Valley-Konya	34	-
Akçay et al.	2010	Malazgirt-Muş	50	-
Alkan et al.	2010	Derebucak-Konya	134	6
Gezer et al.	2011a	Çamlık-Denizli	42	-
Gezer et al.	2011b	Campus of Pamukkale University	52	-
Kaşık et al.	2011	İskilip-Çorum	54	-
Allı	2011	Kemaliye-Erzincan	106	3
Doğan et al.	2012	Cocakdere Valley-Mersin	186	4
Solak et al.	2013	Burdur	35	-
Şen et al.	2014	Bigadiç	48	-
Keleş et al.	2014	Ayder	127	-
Güngör et al.	2015	Adan and Mersin	38	-
Demirel et al.	2015	Van	122	-
Dengiz and Demirel	2016	Şiravn-Siirt	53	-
Keleş et al.	2016	Kop Mountain	44	-
Ünal et al.	2016	Muğla	30	-
Demirel et al.	2016	Lice-Diyarbakır	55	-
Akata et al.	2016	Zigana Mountain-Gümüşhan	182	6
Demirel ve Koçak	2016	Zilan Valley (Erzinca-Van)	96	-
Akata	2017	Belgrat Forest	280	-
Öztürk et al.	2017	Nallıhan	68	-
Allı et al.	2017	Yalova	91	-
Akata and Uzun	2017	Uzungöl Nature	215	-
Altuntaş et al.	2017	Kazdağı National Park	207	-

2. Materials and methods

In the fieldwork a polyethylene sack for collecting species, knives, gloves, GPS for recording areas, camera, field book for writing the data and sample field cards was used. Stereo and binocular microscopes were used for macro/micro examinations of species which that were collected through field work under proper climate conditions between the years 2013-2015. Photos of the macrofungus species were taken, and their GPS location coordinates were noted, before collected. Geographical

properties, morphological structure and ecological properties of the specimens were recorded into the field cards. The specimens were brought into the laboratory and identified via macro/micro examinations. Species identification draw upon previous publications from Petersen 1999, Montag 2000, Seo and Kikr 2000, Williams 2001, Huffman et al. 2008, Lamaison and Polese 2011, and Laux 2012.

Study sites

In order to monitor the project and coordinate sample collection, the study field was divided into five main sites and each site as divided into sub-sites based on geographical properties. Table 2 provides GPS data of the five main sites and their sub-sites.

3. Results

The identified species are given in Table 3 according to mycobank systematic criteria.

The study identified the following: 68 macrofungus species from two phyla (Ascomycota, Basidiomycota), 11

orders and 29 families. Figure 1 provides species distribution based on their families.

Identified macrofungi were collected from four different substrates: 51 from the soil, 11 from branches or trunks, 4 from logs, and 2 from leaves. The macrofungi were collected from trunks, branches and logs of generally dead or fallen trees, thus imposing no economic loss.

The fourth site (Amasra) yielded the highest number of macrofungus species. Since this area has a large number of broad-leaved forest trees, the moisture and temperature values necessary for the growth and development of macro-mushrooms are very suitable in this field. Figure 2 provides the number of identified macrofungi species in the research field sites.

Table 2. GPS data of the main and sub-sites of the study field

Site Names	Sub-Sites	Sign	North	East	Altitude
1. Site (Art)	Ören	1a	41°39'53"	32°32'25"	228 m
	Sögütlü	1b	41°39'53"	32°31'21"	316 m
	Çöpbey	1c	41°39'32"	32°31'23"	287 m
2. Site (Ulus)	Drahna Valley	2a	41°42'90"	32°48'49"	519 m
	Kemerli Cave	2b	41°42'24"	32°49'23"	535 m
	Ulukaya	2c	41°40'31"	32°46'28"	398 m
3. Site (Sipahiler)	Sipahiler Cave	3a	41°39'32"	32°31'23"	300 m
	Darıören	3b	41°39'31"	32°31'22"	295 m
	Çöme Gorge	3c	41°39'33"	32°31'24"	264 m
4. Site (Amasra)	Karadere Valley	4a	41°43'53"	32°34'22"	487 m
	Yukarışal	4b	41°43'33"	32°34'26"	666 m
	Sarıdere	4c	41°43'40"	32°34'25"	594 m
5. Site (Kurucaşile)	Meryemler	5a	41°43'56"	32°34'21"	470 m
	Başköy	5b	41°43'58"	32°34'24"	550 m
	Kömeç	5c	41°43'60"	32°34'26"	651 m

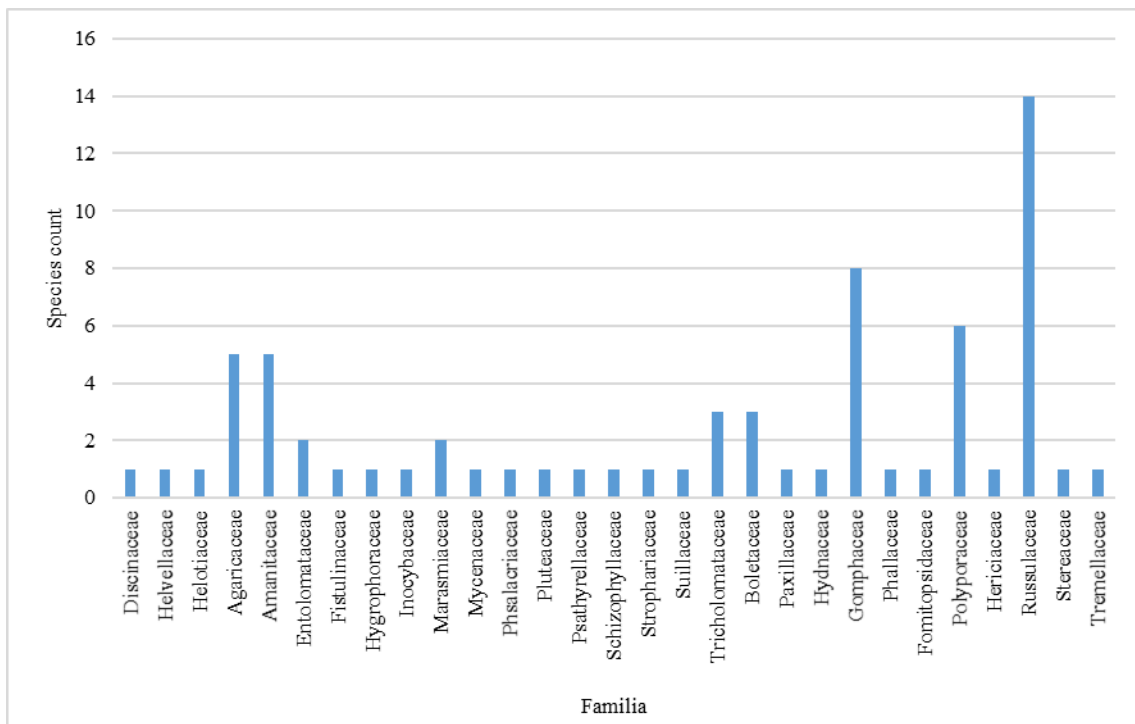


Figure 1. Family-based distribution of the identified species

Table 3. The list of identified macrofungi species of Küre Mountains National Park in Bartın

Division	Family	Species	Substrate	Width (cm)	Height (cm)	Site
Ascomycota	Discinaceae	<i>Gyromitra esculenta</i> (Pers.) (Fr.)	soil	4-10	5-10	4a
	Helvellaceae	<i>Helvella crispa</i> Bull.	soil	3-7	6-15	2b
	Helotiaceae	<i>Hymenoscyphus calyculus</i> (Sowerby) W. Phil.	trunk	2	4	3b
Basidiomycota	Agaricaceae	<i>Bovista aestivalis</i> (Bonord.) Demoulin	soil	4	4	1b-4c
		<i>Bovista plumbea</i> Pers.	soil	1-3	1-3	1b
		<i>Coprinus comatus</i> (O.F. Müll.) Pers.	soil	6-15	4-7	2c
		<i>Lycoperdon perlatum</i> Pers.	soil	4-5	4-5	1b-1c-4a
		<i>Lycoperdon pyriforme</i> Willd.	soil	4-5	4-5	1b
	Amanitaceae	<i>Amanita muscaria</i> (L.) Lam.	soil	10-20	10-20	2c
		<i>Amanita phalloides</i> (Fr.) Link.	soil	6-12	5-8	4b
		<i>Amanita pantherina</i> (DC.) Krombh.	soil	6-10	6-10	1b
		<i>Amanita rubescens</i> Pers.	soil	10-20	10-20	1b
		<i>Amanita velosa</i> (Peck) Lloyd	soil	5-11	4-11	4b
	Entolomataceae	<i>Entoloma griseocyaneum</i> (Fr.) P. Kumm.	soil	2-5	4-7	3a
		<i>Entoloma sericellum</i> (Fr.) P. Kumm	soil	1-2	2-6	3b
	Fistulinaceae	<i>Fistulina hepatica</i> (Schaeff.) With.	trunk	10-12	3-5	4b
	Hygrophoraceae	<i>Hygrophorus agathosmus</i> (Fr.) Fr.	soil	5-7	3-7	4c
	Inocybaceae	<i>Inocybe asterospora</i> Quel	soil	7	5	4a
	Marasmiaceae	<i>Marasmius androsaceus</i> (L.) Fr.	soil	0,5-1	5-6	4c
		<i>Marasmius oreades</i> (Bolton) Fr.	soil	3-7	6-7	3a
	Mycenaceae	<i>Mycena crocata</i> (Schrad.) P. Kumm.	on litter	1-2	10-12	4a
	Physalacriaceae	<i>Armillaria mellea</i> (Vahl) P. Kumm.	bottom of trunk and on soil	4-7 cm	10-15	1c-4c
	Pluteaceae	<i>Pluteus cervinus</i> (Schaeff.) P. Kumm.	on soil	5-10	2-7	4a
	Psathyrellaceae	<i>Coprinellus disseminatus</i> (Pers.) J.E. Lange	on dead wood	1-2	2-4	3a
	Schizophyllaceae	<i>Schizophyllum commune</i> Fr.	on dead wood block	4	0,3-0,5	1a-1b-2c
	Strophariaceae	<i>Pholiota squarrosa</i> (Oeder) P. Kumm	on wood	4-10	1-2	2c
		<i>Collybia cirrhata</i> (Schumach.) Quel.	dead foliage	1-5		3c
	Tricholomataceae	<i>Collybia conigena</i> (Pers.) P. Kumm.	on litter and dead foliage	1-3	2-4	4b
		<i>Collybia oclor</i> (Pers.) Vilgalys & O.K. Mill.	on litter and dead foliage	1,5-5		2c
	Boletaceae	<i>Boletus erythropus</i> Pers.	soil	10-13	12-18	3a-4b
<i>Boletus luridus</i> Schaeff.		soil	6-15	5-14	4c	
<i>Boletus smithii</i> Thiers		soil	10-16	5-17	4c	
Paxillaceae	<i>Paxillus rubicundulus</i> P.D. Orton	soil	10		4c	
Suillaceae	<i>Suillus luteus</i> (L.) Roussel	soil	8-10	5-8	3a	
Hydnaceae	<i>Hydnum repandum</i> L.	soil	8-20	5-15	4c	
	<i>Clavariadelphus occidentalis</i> Methven	soil	3-5	5-20	4c	
	<i>Clavariadelphus pistillaris</i> L. (Donk)	soil	2-6	8-20	4c	
	<i>Clavariadelphus sachalinensis</i> (S. Imai) Corner	soil		7	4c	
	Gomphaceae	<i>Clavariadelphus truncatus</i> (Quel.) Donk.	soil		10-13	4c
		<i>Ramaria aurea</i> (Schaeff.) Quel	soil		7-14	4b
<i>Ramaria flava</i> (Schaeff.) Quel		soil	7-15	10-20	4a	
<i>Ramaria formosa</i> (Pers.) Quel		soil		8-20	4a	
<i>Ramaria stricta</i> (Pers.) Quel		soil		5-10	2c	
Phallaceae	<i>Clathrus ruber</i> P. Micheli ex Pers.	soil	3-5	10-15	3a	
Fomitopsidaceae	<i>Daedalea quercina</i> (L.) Pers.	trunk	3-12	4-5	1a	
	<i>Lentinus strigosus</i> Fr.	wood	2-10	1-4	2b	
	<i>Lenzites betulina</i> (L.) Fr.	trunk	10	1-2	2c	
	<i>Polyporus mori</i> (Pollini) Fr.	trunk	2-6	2-6	2a	
	Polyporaceae	<i>Trametes hirsuta</i> (Wulfen) Pilat	trunk	10	6	2a
<i>Trametes ochracea</i> (Pers.) Gilb. & Ryvarden		trunk	1,5-5		4a	
<i>Trametes versicolor</i> (L.) Lloyd		trunk	2-8	2-8	2c-4b	
<i>Creolophus cirrhatus</i> (Pers.) P. Karst.		trunk	6-8	5-13	2a	

Table 3. Continues The list of identified macrofungi species of Küre Mountains National Park in Bartın

Division	Family	Species	Substrate	Width (cm)	Height (cm)	Site		
Basidiomycota	Russulaceae	<i>Lactarius barrowsii</i> Hesler & A.H. Sm.	soil	5-10		5b		
		<i>Lactarius controversus</i> Pers.	soil	10-20	8-18	3a		
		<i>Lactarius deliciosus</i> (L.) Gray	soil	10-15	3-6	1b		
		<i>Lactarius sanguifluus</i> (Paulet) Fr.	soil	10-15	5-7	4a		
		<i>Lactarius vellereus</i> (Fr.) Fr.	soil	10-25	10-20	1b		
		<i>Russula aquosa</i> Leclair, Bull.	soil	5-15	3-7	3a		
		<i>Russula cyanoxantha</i> (Schaeff.) Fr.	soil	5-15	6-10	4c		
		<i>Russula delica</i> Fr. (1838)	soil	2-20	2-5	1b		
		<i>Russula drimeia</i> Cooke	soil	5-12	4-10	4a		
		<i>Russula emetica</i> (Schaeff.) Pers.;	soil	5-10	4-8	4a		
		<i>Russula fageticola</i> (Romagn.) Bon	soil	6-10	4-10	4a		
		<i>Russula lepida</i> Fr.	soil	10-12	5-10	1a-1b-1c		
		<i>Russula sanguinea</i> (Bull.) Fr.	soil	4-10	4-10	4a		
		<i>Russula turci</i> Bres.	soil	4-8	4-10	1b		
		Stereaceae	<i>Stereum hirsutum</i> (Willd.) Pers.	trunk		2-5	4b	
		Tremellaceae	<i>Tremella mesenterica</i> (Schaeff.) Retz.	dead; trunk		3-12	3-12	2a

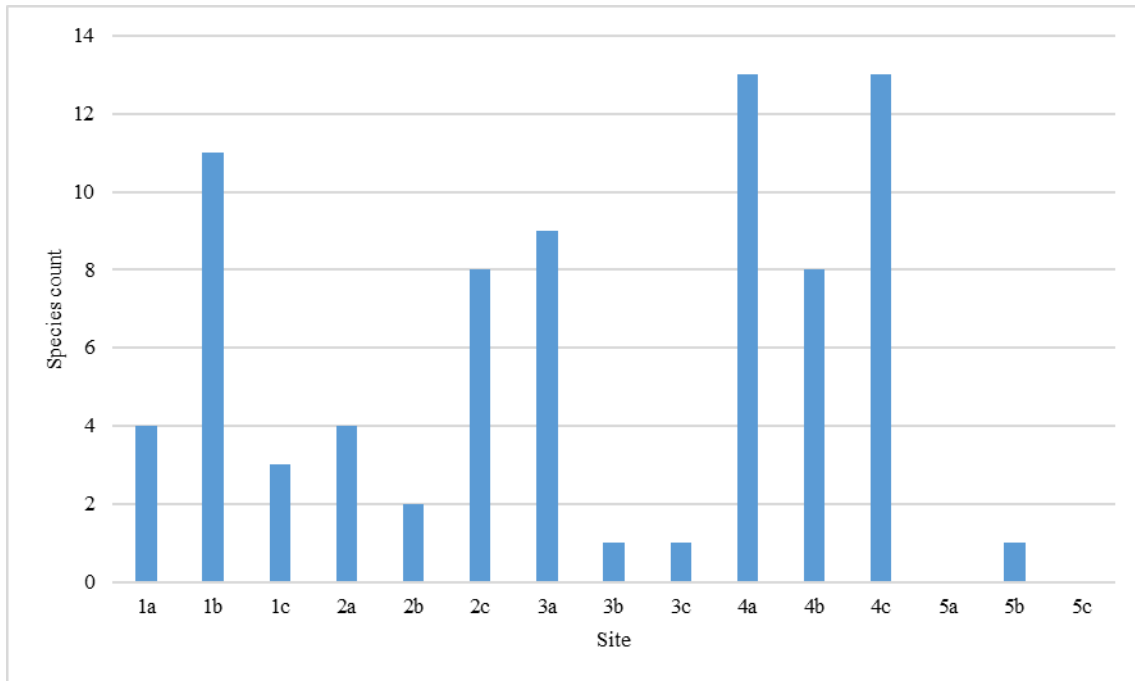


Figure 2. Distribution of the determined taxa to the assigned sites

4. Discussion

Afyon et al. (2000) identified 62 macrofungus taxa belonging to 19 families in a study they conducted in the province of Bartın, 15 of which were taxa newly recorded for the macrofungi of Turkey. In other research, Afyon et al. (2005) identified macrofungi of the western Black Sea region, including two sites from the Bartın region, which yielded two different species from their previous research. In our research, 69 macrofungus taxa were identified solely in Küre Mountains National Park and recorded for the province of Bartın. Afyon et al. (2000) identified only one species belonging to the class Ascomycetes. Our research increases this number to four. Only six of the species identified in the study that Afyon et al. (2000) conducted (*Suillus luteus*, *Trametes hirsuta*, *Ramaria aurea*, *Lactarius controversus*, *L. deliciosus*, *Schizophyllum commune*) were

also identified in our research. In comparison, the remaining 62 taxa were new recordings for the province of Bartın.

In light of the aforementioned information, it seems possible that new studies, whether in the province of Bartın or Küre Mountains National Park, can lead to an increase in the identified number of species and new recordings for the macrofungus flora of Turkey.

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