Macrophungi of Küre Mountains National Park in Bartın region of Turkey

Nuri Kaan Özkanç* (İletişim yazarı): nkaano@gmail.com, Yeşilbaş Keleş**

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 Macrofungal 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 macrocymota flora and biological diversity within the national park.

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

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 (Barutçyan, 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 Yildiz 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 (Falandyysz and Borowicka, 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 Özkanç 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. Özkanç 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 provience. 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).
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 (Arıt)      | Ören      | 1a   | 41°39’53”N  | 32°32’25”E  | 228 m    |
|                     | Soğütlü   | 1b   | 41°39’53”N  | 32°31’21”E  | 316 m    |
|                     | Çöpbey    | 1c   | 41°39’32”N  | 32°31’23”E  | 287 m    |
| 2. Site (Ulus)      | Drahna Valley | 2a  | 41°42’90”N  | 32°48’49”E  | 519 m    |
|                     | Kemerli Cave | 2b  | 41°42’24”N  | 32°49’23”E  | 535 m    |
|                     | Ulukaya    | 2c   | 41°40’31”N  | 32°46’28”E  | 398 m    |
| 3. Site (Sipahiler)| Sipahiler Cave | 3a  | 41°39’12”N  | 32°31’23”E  | 300 m    |
|                     | Dönüzren  | 3b   | 41°39’31”N  | 32°31’23”E  | 295 m    |
|                     | Çöme Gorge | 3c   | 41°39’33”N  | 32°31’24”E  | 264 m    |
| 4. Site (Amasra)    | Karadere Valley | 4a  | 41°43’53”N  | 32°34’22”E  | 487 m    |
|                     | Yukanşal   | 4b   | 41°43’33”N  | 32°34’26”E  | 666 m    |
|                     | Sarıdere   | 4c   | 41°43’40”N  | 32°34’25”E  | 594 m    |
| 5. Site (Kurucaşile)| Meryemler  | 5a   | 41°43’56”N  | 32°34’21”E  | 470 m    |
|                     | Başköy     | 5b   | 41°43’58”N  | 32°34’24”E  | 550 m    |
|                     | Kömeç      | 5c   | 41°43’60”N  | 32°34’26”E  | 651 m    |

Figure 1. Family-based distribution of the identified species
### Tablo 3. The list of identified macrofungi species of Küre Mountains National Park in Bartın

| Division | Family | Species | Substrate | Width (cm) | Height (cm) | Site |
|----------|--------|---------|-----------|------------|-------------|------|
| Basidiomycota | Discinaceae | *Gyromitra esculenta* (Pers.) (Fr.) | soil | 4-10 | 5-10 | 4a |
| | Helvellaceae | *Helvella crispa* Bull. | soil | 3-7 | 6-15 | 2b |
| | Helotiaceae | *Hymenochaetus calyctus* (Sowerby) W. Phil. | trunk | 2 | 4 | 3b |
| | Agariceae | *Bovista aerata* (Bonord.) Demoulin | soil | 4 | 4 | 1b-4c |
| | | *Bovista piambea* Pers. | soil | 1-3 | 1-3 | 1b |
| | | *Coprinus comatus* (O.F. Mill.) Pers. | soil | 6-15 | 4-7 | 2c |
| | | *Lycoperdon perlatum* Pers. | soil | 4-5 | 4-5 | 1b-1c-4a |
| | | *Lycoperdon pyriforme* Willd. | soil | 4-5 | 4-5 | 1b |
| | | *Amanita muscaria* (L.) Lam. | soil | 10-20 | 10-20 | 2c |
| | | *Amanita phalloides* (Fr.) Link. | soil | 6-12 | 5-8 | 4b |
| | | *Amanita pantherina* (DC.) Krombh. | soil | 6-10 | 6-10 | 1b |
| | | *Amanita rubescens* Pers. | soil | 6-10 | 10-20 | 1b |
| | | *Amanita velosa* (Peck) Lloyd | soil | 5-11 | 4-11 | 4b |
| | | *Entoloma grisescens* (Fr.) P. Kumm. | soil | 2-5 | 4-7 | 3a |
| | | *Entoloma sericeum* (Fr.) P. Kumm | soil | 1-2 | 2-5 | 3b |
| | | *Fistulina hepatica* (Schaeff.) With. | trunk | 10-12 | 3-5 | 4b |
| | | *Hyphoderma* (Fr.) Fr. | soil | 3-7 | 5-6 | 4c |
| | | *Inocybe asteropus* Quel | soil | 7 | 5-10 | 4a |
| | | *Marasmius androusosus* (L.) Fr. | soil | 0,5-1 | 5-6 | 4c |
| | | *Marasmius oreades* (Bolton) Fr. | soil | 5-6 | 5-6 | 3a |
| | | *Mycena crocata* (Schrad.) P. Kumm. | on litter | 4-7 | 10-15 | 3c-4c |
| | Physalacriaceae | *Armillaria mellea* (Vahl) P. Kumm. | bottom of trunk and on soil | 4-7 cm | 10-15 | 1c-4c |
| | | *Pluteus cervinus* (Schaeff.) P. Kumm. | on soil | 5-10 | 2-7 | 4a |
| | Psathyrellaceae | *Coprinellus disseminatus* (Pers.) J.E. Lange | on dead wood | 1-2 | 2-4 | 3a |
| | Schizophyllaceae | *Schizophyllum commune* Fr. | on dead wood block | 4 | 0,3-0,5 | 1a-1b-2c |
| | Strophariaceae | *Pholiotasquamosa* (Oeder) P. Kumm | on wood | 4-10 | 1-2 | 2c |
| | | *Collybia cirrata* (Schumach.) Quel | dead foliage | 1-5 | 3c |
| | | *Collybia conigena* (Pers.) P. Kumm. | on litter and dead foliage | 1-3 | 2-4 | 4b |
| | | *Collybia octor* (Pers.) Vilgalys & O.K. Mill. | on litter and dead foliage | 1,5-5 | 2c |
| | Boletaceae | *Boletus erythropus* Pers. | soil | 10-13 | 12-18 | 3a-4b |
| | | *Boletus luridus* Schaeff. | soil | 6-15 | 5-14 | 4c |
| | | *Boletus smithii* Thiers | soil | 10-16 | 5-17 | 4c |
| | Paxillaceae | *Paxillusrubicundus* P.D. Orton | soil | 10 | 4c |
| | Suillusaceae | *Suillus laetus* (L.) Roussel | soil | 8-10 | 5-8 | 3a |
| | Hydnaceae | *Hydnellum repandum* L. | soil | 8-20 | 5-15 | 4c |
| | | *Clavariadelphus occidentalis* Methven | soil | 3-5 | 5-20 | 4c |
| | | *Clavariadelphus pistillaris* L. (Donk) | soil | 2-6 | 8-20 | 4c |
| | | *Clavariadelphus sachalinensis* (S. Imai) Comer | soil | 7 | 4c |
| | Gomphaceae | *Clavariadelphus truncatus* (Quel.) Donk. | soil | 10-13 | 4c |
| | | *Ramaria aurea* (Schaeff.) Quel | soil | 7-14 | 4c |
| | | *Ramaria flava* (Schaeff.) Quel | soil | 7-15 | 10-20 | 4a |
| | | *Ramaria formosa* (Pers.) Quel | soil | 8-20 | 4a |
| | | *Ramaria stricta* (Pers.) Quel | soil | 5-10 | 2c |
| | Phallaceae | *Clathrus ruber* P. Micheli ex Pers. | soil | 3-5 | 10-15 | 3a |
| | | *Dendalea quercina* (L.) Pers. | trunk | 3-12 | 4-5 | 1a |
| | | *Lentinus strigosus* Fr. | wood | 2-10 | 1-4 | 2b |
| | | *Lepidiota bidentata* (L.) Fr. | trunk | 10 | 1-2 | 2c |
| | | *Polyporus montis (Polissi) Fr.* | trunk | 2-6 | 2-6 | 2a |
| | | *Trametes hirsuta* (Wulfen) Pilat | trunk | 10 | 6 | 2a |
| | | *Trametes ochracea* (Pers.) Gilb. & Ryvarden | trunk | 1,5-5 | 4a |
| | | *Trametes versicolor* (L.) Lloyd | trunk | 2-8 | 2-8 | 2c-4b |
| | Hericiaceae | *Crestiphas cirrhatus* (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 | *Lactarius barrowsii* Hesler & A.H. Sm. | soil | 5-10 | | 5b |
| | | *Lactarius controversus* Pers. | soil | 10-20 | 8-18 | 3a |
| | | *Lactarius delicious* (L.) Gray | soil | 10-15 | 3-6 | 1b |
| | | *Lactarius sanguifluus* (Paullet) Fr. | soil | 10-15 | 5-7 | 4a |
| | | *Lactarius vellereus* (Fr.) Fr. | soil | 10-25 | 10-20 | 1b |
| | Stereaceae | *Russula aquosa* Leclair, Bull. | soil | 5-15 | 3-7 | 3a |
| | | *Russula cyanoxantha* (Schaeff.) Fr. | soil | 5-15 | 6-10 | 4c |
| | | *Russula delica* Fr. (1838) | soil | 2-20 | 2-5 | 1b |
| | | *Russula drimeia* Cooke | soil | 5-12 | 4-10 | 4a |
| | | *Russula emetica* (Schaeff.) Pers. | soil | 5-10 | 4-8 | 4a |
| | | *Russula fageticola* (Romagn.) Bon | soil | 6-10 | 4-10 | 4a |
| | | *Russula lepida* Fr. | soil | 10-12 | 5-10 | 1a-1b-1c |
| | | *Russula sanguinea* (Bull.) Fr. | soil | 4-10 | 4-10 | 4a |
| | | *Russula turci* Bres. | soil | 4-8 | 4-10 | 1b |

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. deliciousus, 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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