

# Macrofungal diversity of Hasandağı Mountain and Göreme District in Turkey

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**Abstract.** The present study reports on specimens of macrofungi collected in different localities of Hasandağı Mountain and Göreme District, in the period 1999-2001. The field and laboratory studies resulted in the identification of 66 taxa, belonging to two classes and 22 families. Among them, eight taxa belong to Ascomycota and 62 to Basidiomycota. Moreover, two taxa, *Peziza moravecii* and *Coprinus leiocephalus*, are recorded for the first time for the Turkish mycota.

**Key words:** fungal diversity, Göreme District, Hasandağı Mountain, new records, Turkey

## Introduction

Numerous studies on Turkish macrofungi have been conducted and further summarized and published as lists by Sesli & Denchev (2005) and Doğan *et al.* (2005). According to these literature sources, the registered macrofungi in Turkey represent about 1600 species. In these studies, the Mediterranean, Marmara, and Black Sea region of Turkey have been investigated. These regions consist of coniferous, deciduous or mixed forests; for example, cedar, pine, fir, oak, beech, and spruce, which are very favourable habitats for macrofungi. Nevertheless, the studies on macromycota in Central Anatolia are insufficient and there are still a lot of regions, waiting to be investigated. Currently, no data on the fungal diversity of Hasandağı Mountain and Göreme District are available. For this reason both of these regions were chosen as a research area (Fig. 1).

Hasandağı Mountain, which is 3268 m high, represents a volcanic area formed 30 million years ago. The mountain is bordered by Aksaray to the north and west, Niğde to the south, and Nevşehir to the east. The climate of Hasandağı is dry and semi-dry terrestrial type. The annual rainfall in the region is 400 mm. The annual average temperature is 11.5 °C.

Göreme District is a tourist resort with fantastic fairy chimneys, formed by the wind and water erosion in the course

of thousands of years. There are old churches, built by the first Christian people. The climate of Göreme is also dry and semi-dry terrestrial type.

Dominant plants in both places of investigation are *Pinus nigra* J.F. Arnold subsp. *nigra* var. *caramanica* (Loudon) Rehder, *Quercus petraea* (Mattuschka) Liebl., *Q. pubescens* Willd., *Q. cerris* L., *Salix alba* L., *Populus* spp., and *Elaeagnus* spp.

The aim of this study was to determine species of macrofungi in the research area and, thus, to provide more data on the Turkish macrofungi.

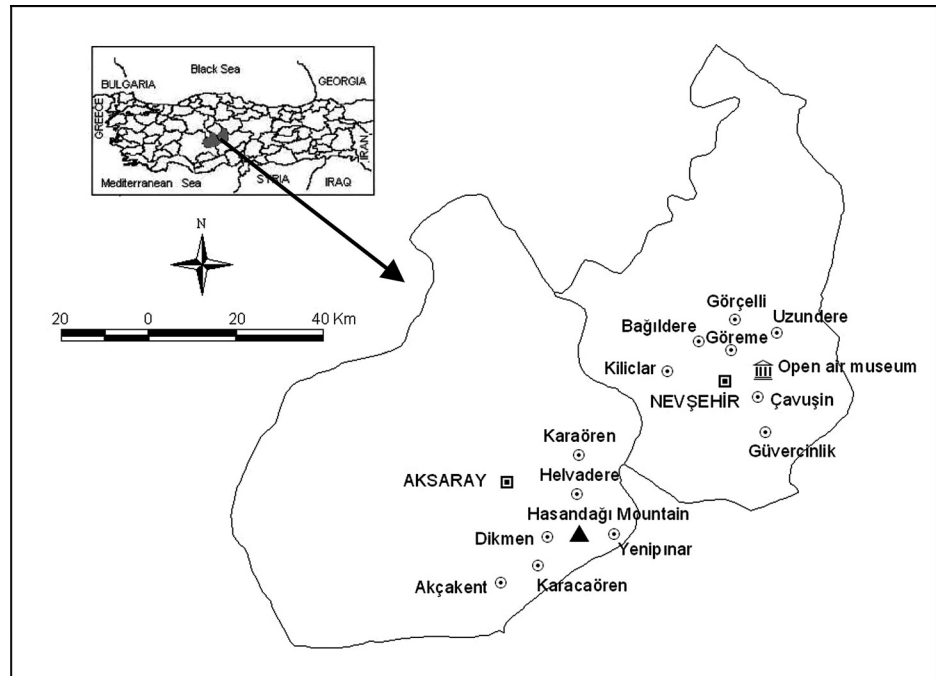
## Materials and Methods

Field studies have been carried out mainly in the autumn and spring, since the climatic conditions in these periods are the most suitable for carpophore formation.

Collected samples were placed in separate wicker containers to avoid mixing. The colour, locality, and characteristics of the habitats, etc. were noted during the collection. The morphological features, the spore properties of dry and fresh macrofungal specimens were studied in the laboratory using reagents, such as Melzer reagent, 5 % KOH, cotton blue, sulphovanilin, etc. The collected materials were identified

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Fig. 1. Collection areas



using the following references: Watling (1973, 1982), Phillips (1981), Michael *et al.* (1983-1987), Moser (1983), Grünert & Grünert (1984, 1991), Breitenbach & Kränzlin (1984-2000), Pegler (1987), Dähncke (1988, 1993), Watling & Gregory (1989), Bresinsky & Besl (1990), Ellis & Ellis (1990), Pacioni (1993), Smith & Smith (1996), Gerhardt (1997), and Pace (1998). After identification, the fungi were dried and preserved in polythene bags, containing 5 g of thymol crystals. All specimens are kept in the collection of the Department of Science Education, Pamukkale University, Denizli, Turkey.

## Results

The families and species are listed in alphabetical order. The new records of fungi are marked with an asterisk (\*) and short descriptions are provided in the text.

### Ascomycota

#### Discinaceae

##### *Gyromitra esculenta* (Pers. : Fr.) Fr.

Hasandağı – Bozkurt plateau, on grass in pine forest, alt. 1500 m, 9 Apr 2001, Türkoğlu & Doğan (370); Göreme – Uzundere valley, on grass in black pine, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (850).

#### Helvellaceae

##### *Helvella lacunosa* Afzel. : Fr.

Hasandağı – Helvadere, on grass, alt. 1100 m, 21 May 2001, Türkoğlu & Doğan (807); Göreme – Bağıldere valley, on grass in black pine forest, alt. 1100 m, 23 Apr 2002, Türkoğlu & Doğan (835).

##### *H. spadicea* Schaeff.

Hasandağı – Helvadere; in sandy soil on a poplar plantation, alt. 1100, 21 May 2001, Türkoğlu & Doğan (799); Göreme – Kılıçlar valley, in

sandy soil in a poplar plantation near the bank, alt. 1100 m, 29 May 2001, Türkoğlu (826).

#### Humariaceae

##### *Caloscypha fulgens* (Pers. : Fr.) Boud.

Göremem – Bağıldere valley, in black pine trees, alt. 1100 m, 29 May 2002, Türkoğlu & Doğan (842).

#### Pyronemataceae

##### *Geopora sumneriana* (Cooke) M. Torrey

Göreme – Görçelli valley, on needle litter in black pine forest, alt. 1100 m, 29 May 2001, Türkoğlu (825).

#### Morchellaceae

##### *Mitrophora semilibera* (DC. : Fr.) Lév.

Göreme – Uzundere valley, on grass and plants' remnants from poplar plantation, alt. 1100 m, 24 May 2002, Türkoğlu & Doğan (856).

##### *Morchella esculenta* (L. : Fr.) Pers.

Hasandağı – Bozkurt plateau, in black pine forest, alt. 1500 m, 23 Apr 2001, Türkoğlu & Doğan (556).

#### Pezizaceae

##### \**Peziza moravecii* (Svrček) Svrček

Fruit body 1-5 cm, hemispherical to saucer shaped (Fig. 2). Hymenium ochre when young, then light to hazel-brown. Flesh thin and fragile. Spores hyaline, smooth, elliptical, 14-15 × 7-9 μm.

Hasandağı – 3 km from Bozkurt plateau, on sandy soil in black pine forest, alt. 500 m, 21 May 2001, Türkoğlu & Doğan (787).

#### Basidiomycota

#### Agaricaceae

##### *Agaricus bitorquis* (Quél.) Sacc.



Fig. 2. *Peziza moravecii*. Scale bar: 1 cm

Göreme – Love Valley, on meadow, alt. 1100 m, 23 Apr 2002, Türkoğlu & Doğan (836).

*A. campestris* L. : Fr.

Hasandağı – Helvadere, on grass and meadow, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (557).

*A. vaporarius* (Pers.) Cappelli

Hasandağı – Akcakent village, on grass, alt. 1300 m, 23 Apr 2001, Türkoğlu & Doğan (542).

**Amanitaceae**

*Amanita citrina* (Schaeff.) Pers. var. *citrina*

Hasandağı – Bozkurt plateau, in mixed oak and black pine forest, alt. 1500 m, 9 Apr 2001, Türkoğlu & Doğan (365).

*A. phalloides* (Fr. : Fr.) Link

Hasandağı – Bozkurt plateau, in oak and black pine forest, alt. 1500 m, 21 May 2001, Türkoğlu & Doğan (812).

**Bolbitiaceae**

*Agrocybe dura* (Bolton : Fr.) Singer

Hasandağı – Dikmen village, on grass, 1250 m, 21 May 2001, Türkoğlu & Doğan (801).

*A. paludosa* (J.E. Lange) Kühner & Romagn.

Hasandağı – Yenipınar village, on grass, alt. 1200 m, 21 May 2001, Türkoğlu & Doğan (788).

*A. praecox* (Pers. : Fr.) Fayod

Hasandağı – Yenipınar village, on poplar trunks, alt. 1200 m, 21 May 2001, Türkoğlu & Doğan (789).

*A. vervacti* (Fr. : Fr.) Singer

Göreme – Bağıldere valley, on grass, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (843).

**Boletaceae**

*Boletus edulis* Bull. : Fr.

Hasandağı – Bozkurt plateau, on grass in mixed oak and black pine forest, alt. 1500 m, 23 Apr 2001, Türkoğlu & Doğan (558).

*Leccinum holopus* (Rostk.) Wätling

Hasandağı – Karacaören village, in oak forest, alt. 1150 m, 21 May 2001, Türkoğlu & Doğan (819). Göreme – Güvercinlik valley, in oak forest, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (854).



Fig. 3. *Coprinus leiocephalus*. Scale bar: 1 cm

**Coprinaceae**

*Coprinus atramentarius* (Bull. : Fr.) Fr.

Hasandağı – Bozkurt plateau, on grass near the bank and poplar trunks, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (353); Göreme – Kılıçlar valley, on grass near the bank and poplar trunks, alt. 1100 m, 29 May 2001, Türkoğlu (822).

*C. comatus* (O.F. Müll. : Fr.) Pers.

Göreme – Uzundere valley, on meadow, alt. 1100 m, 23 Apr 2002, Türkoğlu & Doğan (837).

\**Coprinus leiocephalus* P.D. Orton

**Pileus** 1-2.5 cm, ovoid when young, then turns to cylindrical-campanulate, and finally becomes plane, red-brown to orange-brown with a darker centre (Fig. 3). **Lamellae** whitish when young, then gray-black. **Stipe** 5-7 × 0.1-0.3 cm, cylindrical, hollow, white when young, then light brown. **Spores** elliptical, smooth, dark red-brown, 9-12 × 5-7.5 μm.

Hasandağı – Helvadere, on grass, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (559).

*C. micaceus* (Bull. : Fr.) Fr.

Hasandağı – Helvadere, on poplar trunks and barks, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (555).

*Panaeolus fimicola* (Pers.) Gillet

Göreme – Uzundere valley, on grass, alt. 1100 m, 23 Apr 2002, Türkoğlu & Doğan (838).

*P. olivaceus* F.H. Møller

Hasandağı – Helvadere, on grass, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (549).

*Psathyrella candolleana* (Fr. : Fr.) Maire

Hasandağı – Karacaören village, in sandy soil near the bank, alt. 1150 m, 21 May 2001, Türkoğlu & Doğan (798).

*P. cotonea* (Quél.) Konrad & Maubl.

Hasandağı – Karacaören village, on grass near the bank, alt. 1150 m, 21 May 2001, Türkoğlu & Doğan (813); Göreme – Uzundere valley, on grass near the bank, alt. 1100 m, 24 May 2002, Türkoğlu & Doğan (855).

*P. tephrophylla* (Romagn.) M.M. Moser

Göreme – Bağıldere valley, on grass near the bank, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (841).

**Cortinariaceae*****Cortinarius orellanus* Fr.**

Hasandağı – Bozkurt plateau, in black pine forest, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (346).

***Hebeloma eburneum* Malençon**

Hasandağı – Bozkurt plateau, in black pine forest, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (352); Hasandağı – Helvadere, in black pine forest, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (545); Göreme – Uzundere valley, in black pine forest, alt. 1100 m, 29 May 2001, Türkoğlu (821).

***H. mesophaeum* (Pers.) Fr. var. *mesophaeum***

Hasandağı – Karacaören village, in black pine forest, alt. 1150 m, 21 May 2001, Türkoğlu & Doğan (818); Göreme – Çavuşin, in black pine forest, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (853).

***Inocybe dulcamara* (Alb. & Schwein.) P. Kumm.**

Göreme – Çavuşin, on grass particularly in sandy soil near the bank, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (847).

**Entolomataceae*****Entoloma hirtipes* (Schumach. : Fr.) M.M. Moser**

Hasandağı – Helvadere, in black pine forest, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (548); Göreme – Görçelli valley, in black pine forest, alt. 1100 m, 19 Apr 2002, Türkoğlu & Doğan (852).

***E. sericeoides* (J.E. Lange) Noordel.**

Hasandağı – Yenipınar village, in black pine forest, alt. 1200 m, 21 May 2001, Türkoğlu & Doğan (785); Göreme – Görçelli valley, in black pine forest, alt. 1100 m, 19 Apr 2002, Türkoğlu & Doğan (851).

***E. sinuatum* (Bull. : Fr.) P. Kumm.**

Hasandağı – Dikmen village, in black pine region, alt. 1250 m, 21 May 2001, Türkoğlu & Doğan (806); Göreme – Open Air Museum, on grass near the bank, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (846).

**Geastraceae*****Geastrum pectinatum* Pers. : Pers.**

Göreme – Open Air Museum, in black pine forest, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (844).

**Lepiotaceae*****Lepiota clypeolaria* (Bull. : Fr.) Quél.**

Hasandağı – Bozkurt plateau, on grass, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (347).

***L. ignivolvata* Bousset & Joss. ex Joss.**

Hasandağı – Yenipınar village, on grass, alt. 1200 m, 9 Apr 2001, Türkoğlu & Doğan (802).

***L. erminea* (Fr. : Fr.) P. Kumm.**

Hasandağı – Bozkurt plateau, on grass in oak forest, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (351).

***Macrolepiota procera* (Scop. : Fr.) Singer var. *procera***

Hasandağı – Bozkurt plateau, in black pine forest, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (350).

**Lycoperdaceae*****Lycoperdon nigrescens* Wahlenb.**

Hasandağı – Karacaören village, on grass in black pine forest, alt. 1150 m, 21 Apr 2001, Türkoğlu & Doğan (803).

***L. pedicellatum* Peck.**

Hasandağı – Karacaören village, on grass in black pine forest, alt. 1150 m, 21 Apr 2001, Türkoğlu & Doğan (804).

**Paxillaceae*****Paxillus involutus* (Batsch : Fr.) Fr.**

Göreme, Görçelli valley, on grass near the bank, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (849).

**Pleurotaceae*****Pleurotus ostreatus* (Jacq. : Fr.) P.Kumm.**

Hasandağı – Bozkurt plateau, on poplar trees, alt. 1500 m, 9 Apr 2001, Türkoğlu & Doğan (378); Göreme – Uzundere valley, on stumps of poplar trees, alt. 1100 m, 29 May 2001, Türkoğlu (824).

**Pluteaceae*****Pluteus plautus* (Weinm.) Gillet**

Göreme – Çavuşin, on black pine stumps, alt. 1100 m, 24 Apr 2002, Türkoğlu & Doğan (840).

***Volvariella speciosa* (Fr. : Fr.) Singer**

Göreme – Bağlıdere valley, on grass, alt. 1100 m, 19 May 2002, Türkoğlu & Doğan (848).

**Polyporaceae*****Fomes fomentarius* (L. : Fr.) J.J. Kickx**

Göreme – Kılıçlar valley, on poplar trees, alt. 1100 m, 23 Apr 2002, Türkoğlu & Doğan (833).

***Polyporus brumalis* (Pers. : Fr.) Fr.**

Göreme – Uzundere valley, on poplar trees, alt. 1100 m, 29 May 2001, Türkoğlu (827).

**Strophariaceae*****Hypholoma fasciculare* (Huds. : Fr.) P. Kumm.**

Hasandağı – Bozkurt plateau, on poplar trunks, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (355).

***Stropharia coronilla* (Bull. : Fr.) Fr.**

Göreme – Uzundere valley, on grass, alt. 1100 m, 29 May 2001, Türkoğlu (830).

**Tricholomataceae*****Armillaria mellea* (Vahl : Fr.) P. Kumm.**

Göreme – Open Air Museum, on stumps of poplar trees, alt. 1100 m, 23 Apr 2002, Türkoğlu & Doğan (834).

***Clitocybe foetens* Melot**

Hasandağı – Karacaören village, on grass in black pine forest, alt. 1150 m, 21 May 2001, Türkoğlu & Doğan (818).

***Gymnopus dryophilus* (Bull. : Fr.) Murrill**

Hasandağı – Karacaören village, in mixed oak and black pine forest, alt. 1150 m, 21 May 2001, Türkoğlu & Doğan (815); Göreme – Kılıçlar valley, in mixed oak and black pine forest, alt. 1100 m, 29 May 2001, Türkoğlu (820).

***Lepista nuda* (Bull. : Fr.) Cooke**

Göreme – Uzundere valley, in black pine forest, alt. 1100 m, 29 May 2001, Türkoğlu (828).

***L. personata* (Fr. : Fr.) Cooke**

Hasandağı – Helvadere, on grass in black pine forest, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (546).



*Lyophyllum decastes* (Fr. : Fr.) Singer

Göreme – Çavuşin, in black pine forest, alt. 1100 m, 23 Apr 2002, Türkoğlu & Doğan (839).

*Melanoleuca cognata* (Fr.) Konrad & Maubl. var. *cognata*

Hasandağı – Helvadere, in black pine forest, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (550, 554); Göreme – Kılıçlar valley, in black pine forest, alt. 1100 m, 29 May 2001, Türkoğlu (823).

*M. graminicola* (Velen.) Kühner & Maire

Göreme – Kılıçlar valley, in black pine forest, alt. 1100 m, 29 May 2001, Türkoğlu (829).

*M. paedida* (Fr.) Kühner & Maire

Hasandağı – Akçakent village, in black pine forest, alt. 1300 m, 23 Apr 2001, Türkoğlu & Doğan (544).

*M. stridula* (Fr.) Singer

Hasandağı – Bozkurt düzlüğü, in black pine forest, alt. 1500 m, 9 Apr 2001, Türkoğlu & Doğan (372).

*M. subalpina* (Britzelm.) Bresinsky & Stangl

Hasandağı – Helvadere on meadow in black pine forest, alt. 1100 m, 23 Apr 2001, Türkoğlu & Doğan (553).

*Mycena pelliculosa* (Fr. : Fr.) Quél.

Hasandağı – Dikmen village, on pine branch remnants, alt. 1250 m, 21 May 2001, Türkoğlu & Doğan (800).

*Tricholoma stans* (Fr.) Sacc.

Hasandağı – Karacaören village, in black pine forest, alt. 1150 m, 21 May 2001, Türkoğlu & Doğan (805).

## Tulostomataceae

*Tulostoma brumale* Pers. : Pers.

Göreme – Güvercinlik valley, on grass, alt. 1100 m, 23 Apr 2002, Türkoğlu & Doğan (832).

## Russulaceae

*Russula emetica* (Schaeff. : Fr.) Pers.

Hasandağı – Bozkurt plateau, in black pine forest, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (349).

*R. vesca* Fr.

Hasandağı – Bozkurt plateau, in black pine forest, alt. 1500 m, 10 Jul 2000, Türkoğlu & Doğan (354).

## Discussion

In this study, 66 species, belonging to 22 families, were collected in Hasandağı Mountain and Göreme District and identified. Among them, 12 % belong to Ascomycota and 88 % to Basidiomycota. These figures are similar to those, reported in earlier studies conducted in other areas. For instance, in the Mediterranean region of Turkey, macrofungi consist of 7.5 % Ascomycota and 92.5 % Basidiomycota (İşiloğlu & Watling 1992), 8.7 % and 91.3 % in the Antalya region (Gezer 2000), and 5.85 % and 94.15 % in the Alanya region (Öztürk *et al.* 2003).

*Peziza moravecii* and *Coprinus leiocephalus* are recorded for the first time for Turkey, while *Clitocybe foetens*, *Leccinum holopus*, *Lycoperdon nigrescens*, and *Russula emetica* are collected for the second time in Turkey.

Families that are the richest in species in the region are Tricholomataceae (19.6 %) and Coprinaceae (13.6 %).

Twenty-two of the 66 species, found in the area, are considered edible; however, *Agaricus bitorquis*, *A. campestris*, *A. vaporarius*, *Agrocybe dura*, *Amanita citrina* var. *citrina*, *Helvella spadicea*, *Lepista personata*, *Macrolepiota procera*, *Melanoleuca cognata* var. *cognata*, *M. subalpina*, *Mitrophora semilibera*, *Morchella esculenta* var. *rotunda*, and *Pleurotus ostreatus* are commonly used for food by the people. Five species, *Amanita phalloides*, *Cortinarius orellanus*, *Entoloma hirtipes*, *E. sinuatum*, and *Gyromitra esculenta*, are poisonous.

The distribution of species as habitats is as follows; the most spread habitats are Pine trees with 28 species and Grasses with 19 species. These habitats are followed by Poplar trees with 9 species, mixed oak and Pine trees with 6 species, and Sandy soil with 4 species, respectively. The species distribution is parallel to the habitat, because the most spread plants in Turkey are pine, oak, and other deciduous trees.

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