

*Full Length Research Paper*

# Edible macrofungi of Edremit Gulf (Balıkesir) in Turkey

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**Gulf of Edremit is an important center of trade, coupled with its sandy beaches, shores and towns that are surrounded by green olive trees (Ayvalık, Edremit, Burhaniye and Havran). It is also one of the largest districts of Balıkesir Province. Macrofungi are ideal food for people because they have a fairly high content of protein which contains all of the essential amino acids. They are also a source of dietary fibre, and are virtually free of cholesterol. The edible native fungi are cultivated and exported to the markets by many countries. This study was done based on the edible macrofungi specimens collected from Edremit Gulf (Edremit, Havran, Burhaniye) between 2007 and 2009. The collected fungi samples were photographed and their morphological and ecological properties and information gathered from the rural people were noted in the field notebook. Fungi were investigated morphologically in the laboratory, and then samples were dried in the oven to preserve them as herbarium samples. 10 edible fungi species belonging to nine families were identified. Six of them are consumed by local people and sold in local markets.**

**Key words:** Edible macrofungi, Edremit Bay, Balıkesir, Turkey.

## INTRODUCTION

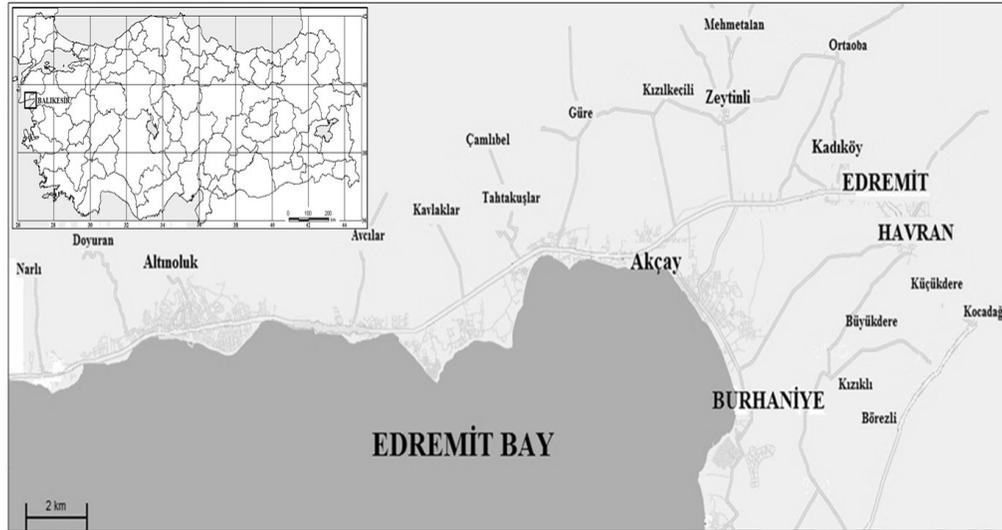
Fungi are ideal food because they have a fairly high content of protein (typically 20-30% dry matter as crude protein) which contains all of the essential amino acids. Fungal biomass is also a source of dietary fibre, and is virtually free of cholesterol. Mushrooms are cultivated around the world, global annual production being in the region of 8 million metric tonnes (Moore and Chiu, 2001). Macrofungi studies have long been of interest to scientists as well as the public due to their important roles in human life, such as their beneficial and harmful effects on forests, their use in the pharmacology industry, and the mass production of cultivated fungi in the food industry, as well as their vital role in biodegradation (Stojchev et al., 1998). Macrofungi have a potential of being used as both nutritive and medicinal food stuff. Macrofungi are not only sources of nutrients but also could be used to prevent diseases such as hypertension, hypercholesterolemia and cancer (Altuner and Akata, 2010).

Climate and vegetation in Turkey, especially in the

Western, Northern and Southern regions are suitable for wild mushrooms to grow. The vegetations of the regions show a great variation and complexity. They range from coniferous to broad leaves tree forests. The Black sea region is rainy throughout the year. Aegean and Mediterranean regions have a mild and rainy climate in coastal parts and cooler in the inner parts of the regions. The dominant vegetation of Balıkesir Province reflects typical characteristics of Mediterranean plant community and climate. In addition, *Pinus* sp. and *Quercus* sp. trees are very common in the region. Since climatic and vegetational characteristics of the region are suitable, it has a rich macromycota population (Yılmaz Ersel and Solak, 2005).

The research area covered Edremit, Havran and Burhaniye (Balıkesir) districts (Figure 1). The local geography is within the Mediterranean phytogeographic region, although it contains elements of the Europe-Siberia and Iran-Turan phytogeographic regions (Sütgibi, 2003). Many studies have been carried out on the macromycota of Turkey between 1932 and 2010. About 1936 macrofungi taxa have thus far been reported from Turkey (Servi et al., 2010). From a review of the relevant literature, it appears that no previous studies of the macromycota have been carried out in Edremit Bay.

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**Figure 1.** The map of the Gulf of Edremit and its surroundings.

However, some research has been carried out around Balıkesir (Aşkun and Işiloğlu, 1997; Yılmaz and Işiloğlu, 1997).

This paper presents an overview of the more common edible macrofungi eaten by the Turkish people, of the Southern-East of Turkey. The aims of this study were to determine the macrofungi taxa of Edremit Bay, to identify edible, inedible and poisonous species and to make a contribution to the macrofungal flora of Turkey.

## MATERIALS AND METHODS

Macrofungi specimens were collected from different localities in Havran, Burhaniye and Edremit between 2007 and 2009, particularly during autumn and spring. The morphological and ecological characteristics of the specimens were recorded and photographed in their natural habitats, and then, brought to the laboratory. The local consumption of macrofungi and their local names were recorded by interviewing local people.

Specimens, dried in place without direct sunlight, were numbered and placed in sealed bags. In addition, they were put into a deep freezer for a week against internal and external parasite attacks (Yılmaz Ersel and Solak, 2005). The identification of taxa was carried out according to literature (Philips, 1981; Moser, 1983; Buczacki, 1989; Işiloğlu and Watling, 1992; Işiloğlu et al., 2008). Fungus' names, authors, locality numbers, habitats, collecting dates, collector's names and numbers were given in floristic list, respectively. All specimens collected were kept in the Herbarium of Balıkesir University, Department of Biology. The collection localities in the study area are shown in Figure 1.

## RESULTS

10 edible macrofungi taxa belonging to nine families were identified. The species and local names are given in Table 1. For each taxa, habitat, locality, collection date, altitude and herbarium registration numbers were given

also.

### Edible macrofungi of Edremit Gulf

#### Ascomycetes

##### *Discinaceae* Benedix

##### 1. *Gyromitra elata* Fr.

Balıkesir, Havran, Tepeoba village; 39° 37.938 N - 027° 06.168 E, 346 m April 2009 (RP 24, RP 25).

##### *Morchellaceae* Rchb.

##### 2. *Morchella elata* Fr.

Balıkesir, Havran, Çakırdere village, Dişka taşı district; 39° 28.719 N - 027° 08.995 E, 470 m, April 2009 (RP 3, RP 4).

Balıkesir, Burhaniye, Sübeylidere village, 39° 24.418 N - 027° 01.397 E, 258 m, April 2009 (RP 5).

##### 3. *Morchella vulgaris* (Pers.) Boud.

Balıkesir, Burhaniye, Sübeylidere village; 39° 24.418 N - 027° 01.397 E, 258 m, April 2009 (RP 8, RP 9, RP 10).

#### Basidiomycetes

##### *Agaricaceae* Chevall.

##### 4. *Agaricus campestris* L.

Balıkesir, Havran, Kobaklar village; 39° 33.396 N - 027°

**Table 1.** Edible macrofungi of Edremit Gulf.

| Family           | Species name                                    | Local Name                              |
|------------------|---|---|
| Russulaceae      | <i>Russula delica</i> Fr.                       | Beyaz mantar, Beyaz melki               |
| Gomphaceae       | <i>Ramaria aurea</i> (Schaeff.) Quel.           | Tavuk ayağı, Tavuk purçu, Meşe purçu    |
| Agaricaceae      | <i>Agaricus campestris</i> L.                   | Çim mantarı, Çimen mantarı              |
| Physalacriaceae  | <i>Armillaria mellea</i> (Vahl) P. Kummer       | Kavak mantarı                           |
| Morchellaceae    | <i>Morchella vulgaris</i> (Pers.) Boud.         | Göbek mantarı, Beyaz göbek, Kuzu göbeği |
| Morchellaceae    | <i>Morchella elata</i> Fr.                      | Göbek mantarı, Esmer göbek, Kuzu göbeği |
| Discinaceae      | <i>Gyromitra elata</i> Fr.                      | Aygır mantarı, Oğlak göbeği             |
| Sparassidaceae   | <i>Sparassis crispa</i> (Wulfen) Fr.            | Çam purçu, Purç mantarı                 |
| Russulaceae      | <i>Lactarius deliciosus</i> (L.ex Fr.) S.F.Gray | Melki, Kırmızı melki                    |
| Tricholomataceae | <i>Tricholoma</i> sp.                           | Cincile, Cincana mantarı                |

18.278 E, 627 m, November 2009 (RP 17, RP 18).

### **Gomphaceae Donk**

#### **5. *Ramaria stricta* (Pers.) Quél.**

Balıkesir, Havran, Tepeoba village; 39° 37.938 N - 027° 06.168 E, 346 m, November 2009 (RP 15, RP 16).

### **Physalacriaceae Corner**

#### **6. *Armillaria mellea* (Vahl) P. Kumm.**

Balıkesir, Burhaniye, Kirtik village; 39° 21.900 N - 027° 03.343 E, 690 m, November 2009 (RP 6).  
Balıkesir, Burhaniye, Kirtik village; 39° 22.459 N - 027° 02.894 E, 545 m, November 2009 (RP 7).

### **Russulaceae Lotsy**

#### **7. *Lactarius deliciosus* (L.) Gray**

Balıkesir, Havran, Tepeoba village; 39° 37.938 N - 027° 06.168 E, 346 m, November 2009 (RP 11, RP 12).  
Balıkesir, Burhaniye, Kizikli village; 39° 28.627 N - 026° 59.577 E, 47 m, November 2009 (RP 13).  
Balıkesir, Burhaniye, Bahadinli village; 39° 26.533 N - 026° 02.599 E, 179 m, November 2009 (RP 14).

#### **8. *Russula delica* Fr.**

Balıkesir, Havran, Karaoğlanlar village; 39° 31.804 N - 027° 12.415 E, 467 m, November 2008 (RP 1).  
Balıkesir, Havran, Teaşarasi village, 39° 30.523 N - 027° 11.720 E, 458 m, November 2009 (RP 2).

### **Sparassidaceae Herter**

#### **9. *Sparassis crispa* (Wulfen) Fr.**

Balıkesir, Burhaniye, Kirtik village; 39° 22.459 N - 027°

02.894 E, 545 m, November 2009 (RP 19, RP 20).

### **Tricholomataceae R. Heim ex Pouzar**

#### **10. *Tricholoma* sp.**

Balıkesir, Havran, Kocaseyit village; 39° 35.822 N - 027° 10.860 E, 237 m, November 2008 (RP 22).  
Balıkesir, Havran, İnönü village, 39° 34.865 N - 027° 09.293 E, 235 m, November 2008 (RP 23).

### **DISCUSSION**

In this study, 10 edible macrofungi taxa belonging to nine families, collected from Edremit Bay were reported and identified. Three of these belonged to Ascomycetes and seven to Basidiomycetes. Of those edible macrofungi taxa, 30% belonged to Ascomycetes, while 70% belonged to Basidiomycetes.

Mushrooms are collected mainly at the mountain villages and are sold mainly at the local markets in the region. It is indeed a nutritional element and is a good income source for the local people. Identified species within this study were the *Morchella* sp. and *Gyromitra elata*; are the types which are collected during spring while there are other taxa collected during autumn. *Russula delica*, *Agaricus campestris*, *Morchella vulgaris*, *Morchella elata*, *Lactarius deliciosus*, *Tricholoma* sp. types are also collected at wide and sold at the local markets. Few people mentioned having identified *Ramaria aurea*, *Armillaria mellea*, *Gyromitra elata*, *Sparassis crispa* types in the region (Figure 2A to F). It was very rare that they were sold locally. According to the sources, *G. elata* is known as poisonous if consumed fresh, but still it was found that the locals consume it cooked.

Turkey has a large edible mushroom potential because it possesses favorable environmental conditions for the growth of mushrooms. Therefore, Turkey is becoming an important exporter for wild edible mushrooms (Demirbaş,



**Figure 2.** Photos of edible macrofungi of Edremit Gulf. A, *Russula delica*; B, *Agaricus campestris*; C, *Morchella vulgaris*; D, *Morchella elata*; E, *Lactarius deliciosus*; F, *Ramaria aurea*.

2002). Mushrooms have long been a popular food in Turkey. Local people collect mushrooms for their own table and for sale. They recognize the benefit of the additional food, added flavor and the income from local

sales and from export to Switzerland, Germany, and other countries. However, the nutritional value of these mushrooms has not been known and so that value has not been previously well appreciated (Çağlar İrmak et al.,

**Table 2.** Similarity percentages of neighboring studies.

| Study                      | Number of identical taxa | Total taxa | Similarity percentage (%) |
|----------------------------|--------------------------|------------|---------------------------|
| Güçin (1993)               | 2                        | 6          | 30                        |
| Solak et al. (1999)        | 7                        | 49         | 14                        |
| Yılmaz and Işıloğlu (2002) | 2                        | 33         | 6                         |
| Yüksel et al. (2006)       | 4                        | 31         | 13                        |
| Satıl et al. (2006)        | 4                        | 8          | 50                        |
| Gezer et al. (2007)        | 6                        | 35         | 17                        |

**Table 3.** Nutrient content of some wild edible mushrooms (g/100 g).

| Specimen  | Protein (%) | Crude fat (%) | Total carbohydrate (%) |
|---|-------------|---------------|------------------------|
| <i>Russula delica</i> Fr.                       | 27.69       | 3.15          | 63                     |
| <i>Armillaria mellea</i> (Vahl) P.              | 21.12       | 6.08          | 70                     |
| <i>Morchella vulgaris</i> (Pers.) Boud.         | 23.18       | 3.68          | 63                     |
| <i>Morchella elata</i> Fr.                      | 38.11       | 2.83          | 40.26                  |
| <i>Lactarius deliciosus</i> (L. ex Fr.) S. Gray | 28.2        | 6.17          | 57                     |
| <i>Tricholoma</i> sp                            | 20.3        | 5.04          | 36.67                  |

References: (Konuk et al., 2006; Colak et al., 2009; Liu et al., 2010; Kalyoncu et al., 2010).

2002). When compared, the results of this work showed similarities with the findings of the studies carried out in neighboring regions. The number of identical taxa and similarity percentages of neighboring studies are given in Table 2.

Edible mushrooms are sources of food and are delicious all over the world. They have a high nutritional value almost twice that of any vegetable or fruit. (Sivrikaya et al., 2002). Biochemical and statistical analyses showed that mushrooms have the crude protein, crude fibre, crude fat, carbohydrate, soluble sugars, ash and mineral elements (Moore and Chiu, 2001; Konuk et al., 2006; Liu et al., 2010). Edible mushrooms are highly valued as a good source of protein and their protein contents usually range from 14.0 to 44.3% of dry weight (Ragunathan et al., 2003; Sanmee et al., 2003; Konuk et al., 2006; Liu et al., 2010; Manjunathan and Kayiarasan, 2011). It was shown that the investigated mushrooms were rich sources of protein and carbohydrates and had low amounts of fat. (Konuk et al., 2006; Colak et al., 2009). The nutrient contents of the wild edible mushrooms are given in Table 3. In conclusion, wild edible mushrooms are an excellent food that can be used in a well-balanced diet for their low fat content, functional compounds and other nutritional values.

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