



Macrofungal Diversity of Yalova Province

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Abstract: Fungal samples were collected from different localities in the boundaries of Yalova province between 2010 and 2012. As a result of field and laboratory studies, 91 species within the 41 families and 14 orders were identified. 17 of them belong to the division *Ascomycota* and 74 to *Basidiomycota*. The species list is given with the informations on localities, habitats, collecting dates and collection numbers.

Key words: Macrofungal diversity, Yalova, Marmara region, Turkey.

Yalova İlinin Makrofungus Çeşitliliği

Öz: Mantar örnekleri 2010 ve 2012 yılları arasında Yalova il sınırları içerisinde farklı lokalitelerden toplanmıştır. Arazi ve laboratuvar çalışmaları sonucunda, 14 ordo ve 41 familya içerisinde yer alan 91 tür tespit edilmiştir. Bunlardan 17'si *Ascomycota*, 74'ü ise *Basidiomycota* bölümüne aittir. Tür listesi, lokaliteler, habitatlar, toplama tarihleri ve koleksiyon numaraları ile ilgili bilgilerle birlikte verilmiştir.

Anahtar kelimeler: Makrofungus çeşitliliği, Yalova, Marmara Bölgesi, Türkiye.

Introduction

Macrofungi are specific part of kingdom fungi that include the divisions *Ascomycota* and *Basidiomycota* with large and easily observed fruiting bodies (Servi et al., 2010). Most of them are saprobes or mycorrhizal symbionts, but some are parasitics on various plants or fungi species. A great deal of taxonomic studies have been carried out on Turkish macromycota for more than 100 years. The number of these investigations have been increased especially for the last decade and the collected data were presented as checklists by different research groups (Doğan et al., 2005; Sesli and Denchev, 2008). Recently, some new contributions were also added to list from different part of Turkey (Acar et al., 2015; Akata, 2017; Akata and Doğan, 2015; Akata and Uzun, 2017; Akata et al., 2015, 2016a;2016b; Akçay and Uzun, 2016; Alkan et al., 2016; Allı et al, 2016; Demirel and

Koçak, 2016; Doğan and Akata, 2015; Doğan and Kurt, 2016; Dülger and Akata, 2016; Kaya et al., 2016; Sesli and Topçu Sesli, 2016, 2017; Sesli and Vizzini, 2017; Sesli et al., 2016; Öztürk C. et al., 2017; Öztürk Ö. et al., 2016; Taşkın et al., 2016; Vizzini et al., 2016; Uzun et al., 2017). The taxonomic investigations around the study area are conducted by Akata (2017); Allı et al. (2016), Karamanoğlu and Öder (1973), Solak and Gücin (1992), but there is not any report of mycological investigation in Yalova province.

The purpose of this study is to determine the macrofungal diversity of Yalova province and to make a contribution to the mycobiota of Turkey.

Yalova is a province of Marmara Region, on the eastern coast of Marmara sea. The province, which is comprised of 6 districts and 58 villages, is surrounded by Marmara Sea in the north, and the west, Kocaeli province in the east,



Bursa province in the south (Figure 1). It has an area of 839 km² and its elevation varies from sea level to 926 m (Koçyiğit and Özhatay, 2006; Özdemir and Bahadır, 2007). The area, which falls in Euro-Siberian phytogeographical region, is situated in the A2 grid square (Davis, 1965). The climatic characteristics of the region shows transition between the Mediterranean and the Black Sea climates but continental climate features can be seen in some periods. Summers

are hot and relatively dry, winters are warm and rainy. The average annual mean temperature is 14.3 °C and the maximum average temperature is 23.7 °C while the minimum average temperature is 6.6 °C. The coldest months are January and February, the warmest month is July. The average annual precipitation is 1093.4 mm and the average annual humidity is 76%. Most rainfall is seen in November, December and January (Url. 1).



Figure 1. Map of the research area.

The floristic composition of the province is mainly consist of forest and maquis elements such as hairy hoary rock-rose, French lavender, hawthorn, mock privet, strawberry tree, laurel tree, sage-leaved rock-rose, tree heath, thorny broom, beech, oak, hornbeam, chesnut, cornelian cherry, linden and pine (Koçyiğit and Özhatay, 2006; Anonymus, 2016).

Materials and Methods

Macrofungi samples were collected in the boundaries of Yalova province between 2010 and 2012. Necessary morphological and ecological characteristics of the samples were noted and they were photographed in their natural habitats.



Fungal samples were further examined and micro-structural data were obtained by light microscopy. Some reagents such as distilled water, Melzer's reagent, 5% KOH, H₂SO₄, Cotton blue, Congo red etc. were used for microscopic investigations. Identification was performed according to Breitenbach and Kränzlin (1984–2000), Hansen and Knudsen (1992–2000), Ryvarden and Gilbertson (1993), Pegler et al. (1997), Calonge (1998), Kränzlin (2005) and Medardi (2006).

Results

The species list is given in alphabetical order with locality, notes on habitat, collection date and fungarium numbers. The systematics of the taxa are presented in accordance with Cannon and Kirk (2007), Kirk et al. (2008), and the Index Fungorum (Url. 2).

Fungi

Ascomycota

Helotiales

Helotiaceae

Hymenoscyphus calyculus (Fr.) W. Phillips: Yalova centre, Höyük hill, on linden branch, 600 m, 23.11.2011, Candar 250.

Pezizales

Helvellaceae

Helvella acetabulum (L.) Qué!.: Yalova centre, Güney village, mixed forest, 542 m, 25.04.2012, Candar 375.

Helvella cupuliformis Dissing & Nannf.: Armutlu district, beech forest, 553 m, 18.09.2012, Candar 515.

Morchellaceae

Morchella esculenta (L.) Pers.: Yalova centre, Research orchard, pine forest, sea level, 27.11.2012, Candar 651.

Pyronemataceae

Scutellinia scutellata (L.) Lambotte: Çınarcık district, İsmaildere area, on beech stump, 350 m, 24.04.2012, Candar 360.

Scutellinia umbrorum (Fr.) Lambotte: Yalova centre, Güney village, on linden branch, 692 m, 09.05.2012, Candar 386.

Sarcoscyphaceae

Pithya vulgaris Fuckel: Yalova centre, Paşakent

area, on pine branch, 60 m, 27.12.2012, Candar 646.

Xylariales

Diatrypaceae

Diatrype disciformis (Hoffm.) Fr.: Yalova centre, Sugören village, on linden branch, 635 m, 27.12.2011, Candar 311.

Diatrype stigma (Hoffm.) Fr.: Altınova district, Laledere area, on oak branch, 350 m, 17.07.2012, Candar 477.

Diatrypella quercina (Pers.) Cooke: Yalova centre, Mezarlıktepe area, on oak branch, 542 m, 25.04.2012, Candar 379.

Xylariaceae

Biscogniauxia nummularia (Bull.) Kuntze: Yalova centre, Mezarlıktepe area, on linden branch, 542 m, 25.04.2012, Candar 373.

Daldinia concentrica (Bolton) Ces. & De Not.: Termal district, on linden branch, 400 m, 21.11.2011, Candar 176.

Hypoxylon fragiforme (Pers.) J. Kickx f.: Çınarcık district, İsmaildere area, on beech stump, 350 m, 24.04.2012, Candar 356.

Hypoxylon fuscum (Pers.) Fr.: Yalova centre, Güney village, on common hazel branch, 550 m, 09.05.2012, Candar 399.

Kretzschmaria deusta (Hoffm.) P.M.D. Martin: Çınarcık district, İsmaildere area, on beech stump, 350 m, 24.04.2012, Candar 358.

Xylaria hypoxylon (L.) Grev.: Yalova centre, Kurt village, on chestnut stump, 362 m, 25.10.2010, Candar 142; Altınova district, Taşköprü area, on beech stump, 271 m, 24.11.2011, Candar 259.

Xylaria longipes Nitschke: Altınova district, Laledere area, on linden branch, 600 m, 09.07.2012, Candar 454.

Basidiomycota

Agaricales

Agaricaceae

Crucibulum laeve (Huds.) Kambly: Armutlu district, on fern stem, 250 m, 31.10.2012, Candar 582.

Lycoperdon atropurpureum Vittad.: Yalova centre, Güney village, in meadow, 42 m, 20.06.2011, Candar 119; Altınova district, Taşköprü, pine forest, 271 m, 29.11.2011, Candar 274.



Lycoperdon echinatum Pers.: Yalova centre, Sugören village, linden forest, 635 m, 27.12.2011, Candar 630.

Lycoperdon perlatum Pers.: Yalova centre, Paşakent area, pine forest, 60 m, 23.11.2011, Candar 201; Armutlu district, Mecidiye village, pine forest, 250 m, 23.11.2011, Candar 238;

Lycoperdon pyriforme Schaeff.: Yalova centre, Kurt village, on chestnut stump, 362 m, 25.10.2010, Candar 150.

Macrolepiota excoriata (Schaeff.) Wasser: Yalova centre, Güney village, in meadow, 42 m, 24.10.2011, Candar 114.

Macrolepiota procera (Scop.) Singer: Yalova centre, Güney village, in meadow, 42 m, 24.10.2011, Candar 115; Termal district, in meadow, 100 m, 21.11.2011, Candar 193.

Amanitaceae

Amanita argentea Huijsman: Çınarcık district, Kent forest, in meadow, 530 m, 18.09.2012, Candar 519.

Amanita caesarea (Scop.) Pers.: Termal district, mixed forest, 100 m, 21.11.2011, Candar 188.

Amanita pantherina (DC.) Krombh.: Çınarcık district, Teşvikiye area, in meadow, 106 m, 05.06.2012, Candar 444.

Fistulinaceae

Fistulina hepatica (Schaeff.) With.: Çınarcık district, Hasanbaba area, on oak, 30 m, 29.11.2011, Candar 294.

Hydnangiaceae

Laccaria tortilis (Bolton) Cooke: Altınova district, Gacik area, mixed forest, 177 m, 16.07.2012, Candar 470.

Hygrophoraceae

Hygrocybe conica (Schaeff.) P. Kumm.: Yalova centre, Sugören village, linden forest, 635 m, 27.12.2011, Candar 639.

Hygrophorus unicolor Gröger: Termal district, mixed forest, 400 m, 21.11.2011, Candar 170.

Inocybaceae

Crepidotus mollis (Schaeff.) Staude: Çınarcık district, Hasanbaba area, on oak branch, 30 m, 29.11.2011, Candar 298.

Inocybe geophylla (Bull.) P. Kumm.: Yalova centre, Kurt village, chestnut forest, 360 m, 24.10.2011, Candar 148.

Mycenaceae

Mycena crocata (Schrad.) P. Kumm.: Yalova centre, Kurt village, on chestnut stump, 360 m, 24.10.2011, Candar 140; Yalova centre, Höyük hill, on beech stump, 600 m, 23.11.2011, Candar 257.

Omphalotaceae

Omphalotus olearius (DC.) Singer: Yalova centre, Kurt village, on chestnut stump, 360 m, 24.10.2011, Candar 151; Çınarcık district, Hasanbaba area, on oak stump, 30 m, 29.11.2011, Candar 281.

Physalaciaceae

Armillaria mellea (Vahl) P. Kumm.: Altınova district, İstihdam hill, on beech root, 530 m, 24.11.2011, Candar 260; Çınarcık district, Hasanbaba area, on oak root, 30 m, 29.11.2011, Candar 291.

Mucidula mucida (Schrad.) Pat.: Termal district, on beech stump, 100 m, 21.11.2011, Candar 185.

Pleurotaceae

Pleurotus ostreatus (Jacq.) P. Kumm.: Çınarcık district, Hasanbaba area, on oak stump, 30 m, 29.11.2011, Candar 301.

Psathyrellaceae

Coprinellus disseminatus (Pers.) J.E. Lange: Çınarcık district, Kent forest, on plane stump, 530 m, 25.09.2012, Candar 538.

Coprinopsis picacea (Bull.) Redhead, Vilgalys & Moncalvo: Yalova centre, Güney village, oak forest, 42 m, 24.10.2011, Candar 111; Yalova centre, Höyük hill, in meadow, 600 m, 23.11.2011, Candar 247; Çınarcık district, Hasanbaba area, in meadow, 30 m, 29.11.2011, Candar 287.

Schizophyllaceae

Schizophyllum commune Fr.: Termal district, on common hazel, 100 m, 21.11.2011, Candar 189.

Strophariaceae

Cyclocybe cylindracea (DC.) Vizzini & Angelini: Yalova centre, Research orchard, chestnut stump, sea level, 26.09.2012, Candar 543.

Hypholoma fasciculare (Huds.) P. Kumm.: Armutlu district, Mecidiye village, on pine stump, 495 m, 23.11.2011, Candar 213.

Stropharia aeruginosa (Curtis) Quéél.: Altınova district, Gacik area, near pine forest, 177 m, 16.07.2012, Candar 635.



Tricholomataceae

Clitocybe odora (Bull.) P. Kumm.: Yalova centre, Kurt village, chestnut forest, 362 m, 25.10.2010, Candar 157.

Lepista nuda (Bull.) Cooke: Çınarcık district, Kent forest, mixed forest, 530 m, 25.09.2012, Candar 539.

Tricholoma terreum (Schaeff.) P. Kumm.: Yalova centre, Research orchard, pine forest, sea level, 23.11.2011, Candar 205; Armutlu district, Mecidiye village, pine forest, 250 m, 23.11.2011, Candar 233.

Auriculariales

Auriculariaceae

Auricularia auricula-judae (Bull.) QuéL.: Yalova centre, Kurt village, on oak branch, 362 m, 27.12.2011, Candar 306; Yalova centre, Sugören village, on linden stump, 635 m, 27.12.2011, Candar 313;

Exidia nigricans (With.) P. Roberts: Çınarcık district, İsmaildere area, on beech stump, 350 m, 24.04.2012, Candar 355.

Exidia glandulosa (Bull.) Fr.: Yalova centre, Güney village, on oak branch, 30 m, 21.03.2012, Candar 343.

Boletales

Boletaceae

Hortiboletus rubellus (Krombh.) Simonini, Vizzini & Gelardi: Yalova centre, Güney village, oak forest, 42 m, 24.10.2011, Candar 127.

Gomphidiaceae

Chroogomphus helveticus (Singer) M.M. Moser: Armutlu district, pine forest, 250 m, 20.06.2012, Candar 542.

Chroogomphus rutilus (Schaeff.) O.K. Mill.: Yalova centre, Güney village, pine forest, 42 m, 20.06.2011, Candar 129; Armutlu district, Mecidiye village, pine forest, 250 m, 23.11.2011, Candar 241.

Paxillaceae

Paxillus involutus (Batsch) Fr.: Çınarcık district, Kent forest, in meadow, 530 m, 18.09.2012, Candar 508.

Rhizopogonaceae

Rhizopogon ochraceorubens A.H. Sm.: Armutlu district, Anittepe area, pine forest, 250 m,

23.11.2011, Candar 240.

Sclerodermataceae

Pisolithus arhizus (Scop.) Rauschert: Yalova centre, Research orchard, pine forest, sea level, 24.10.2011, Candar 127.

Scleroderma polyrhizum (J.F. Gmel.) Pers.: Yalova centre, Research orchard, pine forest, sea level, 27.11.2012, Candar 650.

Suillaceae

Suillus collinitus (Fr.) Kuntze: Yalova centre, Paşakent area, under stone pine, 60 m, 23.11.2011, Candar 197; Yalova centre, Research orchard, pine forest, 12 m, 23.11.2011, Candar 203; Armutlu district, Mecidiye village, pine forest, 250 m, 23.11.2011, Candar 242.

Cantharellales

Cantharellaceae

Cantharellus cibarius Fr.: Armutlu district, Mecidiye village, pine forest, 250 m, 23.11.2011, Candar 245.

Craterellus cornucopioides (L.) Pers.: Yalova centre, Sugören village, near linden forest, 635 m, 27.12.2011, Candar 319.

Dacrymycetales

Dacrymycetaceae

Calocera cornea (Batsch) Fr.: Çınarcık district, Hasanbaba area, on oak branch, 30 m, 07.10.2016, Candar 612.

Hymenochaetales

Hymenochaetaceae

Fuscoporia torulosa (Pers.) T. Wagner & M. Fisch.: Çınarcık district, Hasanbaba area, on chestnut stump, 30 m, 18.09.2012, Candar 523.

Inonotus hispidus (Bull.) P. Karst.: Yalova centre, on apple tree, sea level, 24.10.2011, Candar 109.

Phallales

Phallaceae

Clathrus ruber P. Micheli ex Pers.: Armutlu district, Anittepe area, pine forest, 495 m, 23.11.2011, Candar 211.

Mutinus caninus (Huds.) Fr.: Armutlu district, Mecidiye village, pine forest, 250 m, 20.06.2012, Candar 545.



Polyporales

Fomitopsidaceae

Daedalea quercina (L.) Pers.: Yalova centre, Kurt village, on chestnut stump, 362 m, 25.10.2010, Candar 158.

Laetiporus sulphureus (Bull.) Murrill: Termal district, on chestnut stump, 100 m, 21.11.2011, Candar 194; Çınarcık district, İsmaildere area, on beech stump, 350 m, 24.04.2012, Candar 366.

Ganodermataceae

Ganoderma applanatum (Pers.) Pat.: Yalova centre, Research orchard, chestnut stump, sea level, 29.02.2012, Candar 336.

Ganoderma lucidum (Curtis) P. Karst.: Çınarcık district, Hasanbaba area, on oak stump, 30 m, 29.11.2011, Candar 294; Çınarcık district, İsmaildere area, on beech stump, 350 m, 24.04.2012, Candar 359.

Ganoderma resinaceum Boud.: Altınova district, Laledere area, on oak stump, 350 m, 17.07.2012, Candar 476.

Meripilaceae

Rigidoporus ulmarius (Sowerby) Imazeki: Çınarcık district, Teşvikiye area, on plane stump, 106 m, 20.03.2012, Candar 341.

Polyporaceae

Fomes fomentarius (L.) Fr.: Yalova centre, Güney village, on chestnut stump, 542 m, 25.04.2012, Candar 376.

Lentinus tigrinus (Bull.) Fr.: Çınarcık district, Kent forest, on plane stump, 530 m, 18.09.2012, Candar 512.

Lentinus substrictus (Bolton) Zmitr. & Kovalenko: Çınarcık district, İsmaildere area, on beech stump, 350 m, 24.04.2012, Candar 362.

Lenzites betulina (L.) Fr.: Yalova centre, Güney village, on oak stump, 30 m, 19.09.2012, Candar 526.

Picipes melanopus (Pers.) Zmitr. & Kovalenko: Yalova centre, Kurt village, on chestnut stump, 490 m, 05.06.2012, Candar 423.

Trametes hirsuta (Wulfen) Lloyd: Armutlu district, mixed forest, on beech branch, 177 m, 20.06.2012, Candar 541.

Trametes ochracea (Pers.) Gilb. & Ryvardeen: Çiftlikköy district, on linden stump, 500 m,

24.04.2012, Candar 370.

Trametes versicolor (L.) Lloyd: Termal district, on common hazel, 400 m, 21.11.2011, Candar 177; Yalova centre, Altınova district, Höyük hill, on beech, 600 m, 23.11.2011, Candar 256 ; Çınarcık district, Hasanbaba area, on oak stump, 30 m, 29.11.2011, Candar 292; Yalova centre, Sugören village, on beech, 635 m, 27.12.2011, Candar 310.

Trametes pubescens (Schumach.) Pilát: Yalova centre, Güney village, on oak branch, 42 m, 24.10.2011, Candar 117.

Russulales

Peniophoraceae

Peniophora quercina (Pers.) Cooke: Çınarcık district, Hasanbaba area, on oak branch, 30 m, 29.11.2011, Candar 284.

Russulaceae

Lactarius aurantiacus (Pers.) Gray: Altınova district, Laledere area, linden-oak mixed forest, 350 m, 15.07.2012, Candar 473.

Lactarius deliciosus (L.) Gray: Yalova centre, Paşakent area, pine forest, 60 m, 23.11.2011, Candar 199; Armutlu district, Mecidiye village, pine forest, 495 m, 23.11.2011, Candar 209.

Lactarius deterrimus Gröger: Armutlu district, Mecidiye village, pine forest, 495 m, 23.11.2011, Candar 210.

Lactarius sanguifluus (Paulet) Fr.: Yalova centre, Research orchard, pine forest, 12 m, 23.11.2011, Candar 202.

Russula acrifolia Romagn.: Çınarcık district, Delmece area, linden forest, 610 m, 10.07.2012, Candar 463.

Russula anatina Romagn.: Yalova centre, Güney village, mixed forest, 62 m, 04.06.2012, Candar 413.

Stereaceae

Stereum gausapatum (Fr.) Fr.: Termal district, on chestnut branch, 400 m, 21.11.2011, Candar 167; Yalova centre, Kurt village, on oak stump, 362 m, 27.12.2011, Candar 303.

Stereum hirsutum (Willd.) Pers.: Yalova centre, Höyük hill, on oak branch, 600 m, 23.11.2011, Candar 249; Yalova centre, Kurt village, on oak stump, 362 m, 27.12.2011, Candar 304;



Thelephorales

Bankeraceae

Sarcodon fuligineoviolaceus (Kalchbr.) Pat.: Yalova Centre, Armutlu district, pine forest, 250 m, 23.11.2011, Candar 215.

Tremellales

Tremellaceae

Tremella mesenterica Retz.: Yalova centre, Güney village, on oak branch, 42 m, 24.10.2011, Candar 124.

Discussion

In this study, Ninety-one macrofungi species belong to 41 families and 14 orders were presented. All species are new for Yalova province. The list contains 17 *Ascomycota* (1 *Helotiales*, 6 *Pezizales* and 10 *Xylariales*), and 74 *Basidiomycota* (30 *Agaricales*, 3 *Auriculariales*, 8 *Boletales*, 2 *Cantharellales*, 1 *Dacrymycetales*, 2 *Hymenochaetales*, 2 *Phallales*, 15 *Polyporales*, 9 *Russulales*, 1 *Thelephorales* and 1 *Tremellales*). Four orders (*Agaricales*, *Polyporales*, *Russulales*, *Boletales*) are the most crowded that contain 68.4% of total species.

Fifty-one species are lignicolous and forty are terricolous. The most common lignicolous species in the research area are; *Xylaria hypoxylon*, *Armillaria mellea*, *Auricularia auricula-judae*, *Laetiporus sulphureus*, *Trametes versicolor*, *Stereum gausapatum* and *S. hirsutum*. Eight terricolous species

(*Lycoperdon perlatum*, *Macrolepiota procera*, *Coprinopsis picacea*, *Tricholoma terreum*, *Pisolithus arhizus*, *Suillus collinitus*, *Chroogomphus rutilus* and *Lactarius deliciosus*) are widely distributed in the research area.

Twenty-two of ninety-one macrofungi are edible but *Amanita caesarea* (Yumurta mantarı), *Lycoperdon perlatum* (Puf mantarı), *Lactarius deliciosus* (Kanlıca), *Macrolepiota procera* (Şemsiye mantarı) and *Pleurotus ostreatus* (Kayın mantarı) are consumed by local people.

Seven species (*Amanita pantherina*, *Clitocybe odora*, *Hypholoma fasciculare*, *Inocybe geophylla*, *Omphalotus olearius* and *Paxillus involutus*) are also reported as poisonous in the research area but there is not any report of mushroom poisoning because the local people collect and consume only well-known edible mushrooms.

With the present study, 91 macrofungi species were determined and an important contribution to Turkish mycobiota has been made by determining the most of the macrofungi species in the boundaries of Yalova province.

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