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Macrofungal biodiversity of Kop Mount (Bayburt-Erzurum)

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Kop Dağı (Bayburt-Erzurum)'nın makromantar biyoçeşitliliği

Abstract: The study was mainly based on macrofungi samples collected from Kop Mount within the boundaries of Bayburt and Erzurum province between 2010 and 2011. Together with some previously presented taxa, a total of 88 macrofungi species belonging to 63 genera, 30 families, eight orders within classes *Agaricomycetes*, *Leotiomycetes* and *Pezizomycetes* have been compiled. The list of the determined taxa were presented together with their habitats, substrates, collection localities and personel voucher numbers.

Key words: Biodiversity, macrofungi, mycota, Turkiye

Özet: Çalışma temel olarak 2010 ve 2011 yıllarında Bayburt ve Erzurum sınırları içinde yer alan Kop Dağı'ndan toplanan makromantar örnekleri üzerinde gerçekleştirilmiştir. Önceden yayınlanmış bazı taksonlarla birlikte, *Agaricomycetes*, *Leotiomycetes* ve *Pezizomycetes* sınıfları içinde yer alan sekiz takım, 30 familya ve 63 cinse ait 88 tür derlenmiştir. Belirlenen taksonlar, habitatları, substratları, toplanma yerleri ve toplayıcı numaraları ile birlikte listelenmiştir.

Anahtar Kelimeler: Biyoçeşitlilik, makromantar, mikota, Türkiye

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1. Introduction

Fungi is a diverse kingdom and estimated to contain more than 1.5 million species (Hawksworth et al., 1995). Members of the kingdom can grow almost everywhere in the world. Some of them form fruiting bodies that can be seen by the naked eye, and are known as macrofungi. Wild edible mushrooms are used in many countries as delicious and nutritional foods and medicine (Saiqa et al. 2008). About 27.000 fungal species have been reported worldwide (Chang and Miles, 2004).

Many studies have also been carried out on the macromycetes of Türkiye. Most of these studies have been conducted during the last five decades. The latest checklist include about 2.500 macrofungi species (Sesli et al., 2020). New contributions were also made to this list either as regional lists (Çetinkaya et al., 2021; Çevik et al., 2021; Doğan et al., 2021; Kesici and Uzun, 2021; Oruç et al., 2021; Sadullahoğlu et al., 2021) or as new records (Acar et al., 2021; Kaplan et al., 2021; Kaygusuz et al., 2021; Sesli, 2021a,b).

Kop Mount is located at the intersection of the borders of three provinces, Bayburt, Erzincan and Erzurum, as a part of the eastern Black Sea Mountain system. It has an altitude of 2918 m. The region has an annual average temperature of 6.85°C, and a rainfall of 906.3 mm. Steppes are the main vegetation type in the region. Forest vegetation is resembled mainly by scarce *Quercus* L. sp. and *Pinus* L. sp. populations. *Salix* L. and *Populus* L. populations also exist in the region.

Some studies were carried out within the boundaries of Bayburt (Uzun et al., 2004), Erzincan (Keleş and Demirel, 2010; Allı, 2011) and Erzurum (Demirel et al., 2003; Keleş et al., 2017; Sadullahoğlu et al., 2021). Edible taxa determined in the region were also presented in 10th Congress of Turkey Edible Mushrooms, and published as a special issue (Keleş et al., 2016).

The study aims to determine the macrofungal biodiversity of the region and make a contribution to the mycobiota of Türkiye.

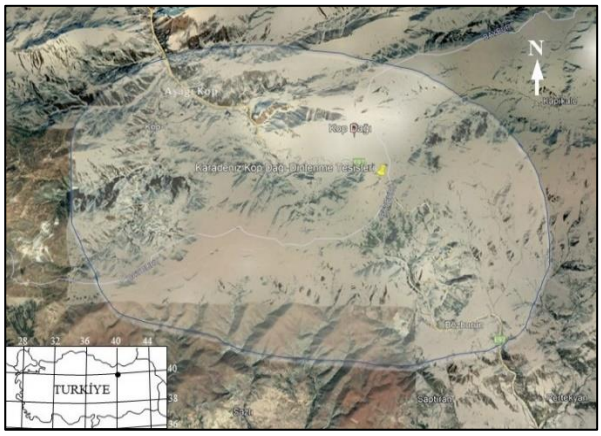

Figure 1. Macrofungi collection region (adopted from Google Earth)

2. Material and Method

Macrofungi samples were collected from Kop Mount within the boundaries of Bayburt and Erzurum provinces during field studies performed between 2010 and 2011. Fruit bodies were photographed at their natural habitats and notes were taken about their morphology, ecology and geography. Then the fruit bodies were collected and put in paper boxes. Then they were transferred to the fungarium.

The samples were dried in an air conditioned room and kept as fungarium materials in polyethylene bags. Further investigations were carried out in the fungarium on dried samples. Microscopic investigations were performed under a compound microscope. The specimens were identified with the help of the relevant literature (Philips, 1981; Moser, 1983; Breitenbach and Kränzlin, 1984, 1986, 1991, 1995, 2000; Buczacki, 1989; Bresinsky and Besl, 1990; Hansen and Knudsen, 1992, 1997; Jordan, 1995; Pegler et al., 1995; Abbott and Currah, 1997; Bessette et al., 1997; Dähncke, 2004; Hausknecht, 2009). The determined macrofungi samples are kept in the fungarium of Biology Department, Science Faculty, Van Yüzüncü Yıl Üniversity(VANF).

3. Results

The determined taxa are listed in alphabetical order. Kirk et al. (2008) and Index Fungorum (accessed on 20 August 2022) were followed for the systematics of taxa. Previously reported taxon was given with the citation.

Fungi R.T. Moore

Ascomycota Caval.-Sm.

Leotiomycetes O.E. Erikss. & Winka

Helotiales Nannf.

Helotiaceae Rehm

1. ***Hymenoscyphus calyculus*** (Fr.) W. Phillips: Erzurum, eastern foothills of Kop Mount around stone pit, on decaying *Salix* sp. branches, 39°59'435"N, 40°31'969"E, 1536 m, 28.10.2010, P.72.

Pezizomycetes O.E.Erikss. & Winka

Pezizales J. Schröt.

Helvellaceae Fr.

2. ***Helvella acetabulum*** (L.) Quél.: (Keleş et al., 2016).

3. ***Helvella lacunosa*** Afzel.: (Keleş et al., 2016).

4. ***Paxina queletii*** (Bres.) Stangl: (Keleş et al., 2016).

Morchellaceae Rchb.

5. ***Morchella elata*** Fr.: (Keleş et al., 2016).

6. ***Morchella esculenta*** (L.) Pers.: (Keleş et al., 2016).

7. ***Morchella semilibera*** DC.: (Keleş et al., 2016).

Pezizaceae Dumort.

8. ***Peziza repanda*** Wahlenb. ex Fr.: Erzurum, Bozburun village, on *Salix* sp. stump, 39°58'056"N, 40°34'154"E, 1660 m, 04.06.2011, P.221.

Pyronemataceae Corda

9. ***Cheilymenia granulata*** (Bull.) J. Moravec: Erzurum, Bozburun village, under *Quercus* L. sp., 39°59'516"N, 40°32'676"E, 1850 m, 04.06.2011, P.231.

10. ***Geopora arenicola*** (Lév.) Kers: Erzurum, eastern foothills of Kop Mount, under Salix sp., 39°59'516"N, 40°32'676"E, 1850 m, 04.06.2011, P.243.

Basidiomycota R.T. Moore

Agaricomycetes Doweld

Agaricales Underw.

Agaricaceae Chevall.

11. ***Agaricus arvensis*** Schaeff.: (Keleş et al., 2016).

12. ***Agaricus bitorquis*** (Quél.) Sacc.: (Keleş et al., 2016).

13. ***Agaricus comtulus*** Fr.: (Keleş et al., 2016).

14. ***Agaricus heimii*** Bon: (Keleş et al., 2016).

15. ***Agaricus pampeanus*** Speg.: (Keleş et al., 2016).

16. ***Coprinus comatus*** (O.F. Müll.) Pers.: (Keleş et al., 2016).

17. ***Cystolepiota seminuda*** (Lasch) Bon: Bayburt, western foothills of Kop Mount, under coniferous trees, 39°59'541"N, 40°32'658"E, 2078 m, 28.10.2010, P.106.

18. ***Lepiota clypeolaria*** (Bull.) P. Kumm.: Bayburt, western foothills of Kop Mount, under coniferous trees, 40°01'884"N, 40°25'245"E, 2117 m, 04.06.2011, P.274.

19. ***Lepiota cristata*** (Bolton) P. Kumm.: Erzurum, eastern foothills of Kop Mount around stone pit, under *Populus* sp., 39°59'435”N, 40°31'969”E, 1536 m, 28.10.2010, P. 63.

20. ***Leucoagaricus leucothites*** (Vittad.) Wasser: (Keleş et al., 2016).

21. ***Macrolepiota excoriata*** (Schaeff.) Wasser: (Keleş et al., 2016).

22. ***Tulostoma brumale*** Pers.: Erzurum, southern foothills of Kop Mount, among grass, 40°03'262”N, 40°26'528”E, 1838 m, 31.10.2010, P.167

Bolbitiaceae Singer

23. ***Conocybe aporos*** Kits van Wav.: Erzurum, eastern foothills of Kop Mount, among grass under *Salix* sp., 39°57'705”N, 40°34'635”E, 1612 m, 06.05.2011, P.180,

24. ***Conocybe pulchella*** (Velen.) Hauskn. & Svrček: Bayburt, Aşağı Kop village, roadside, 40°04'050”N, 40°25'970”E, 1841 m, 04.06.2011, P.296.

Crepidotaceae Singer

25. ***Crepidotus caspari*** Velen.: Erzurum, Kop Dağı eteği, daş ocağı cıvarı, on dead *Salix* sp. branches, 39°59'435”N, 40°31'969”E, 1539 m, 28.10.2010, P.71.

Hygrophoraceae Lotsy

26. ***Arrhenia obscurata*** (D.A. Reid) Redhead, Lutzoni, Moncalvo & Vilgalys: Bayburt, western foothills of Kop Mount, under coniferous trees, 39°59'541”N, 40°32'658”E, 2078 m, 28.10.2010, P. 118.

27. ***Hygrocybe calciphila*** Arnolds: (Keleş et al., 2017)

28. ***Hygrophorus gliocyclus*** Fr.: (Keleş et al., 2016).

Hymenogastraceae Vittad.

29. ***Galerina sideroides*** (Bull.) Kühner: Erzurum, eastern foothills of Kop Mount, around stone pit, around *Salix* sp. stump, 39°59'435”N, 40°31'969”E, 1536 m, 28.10.2010, P.58.

30. ***Hebeloma laterinum*** (Batsch) Vesterh.: Erzurum, eastern foothills of Kop Mount, under deciduous trees, 40°03'262”N, 40°26'528”E, 1838 m, 31.10.2010, P.161.

31. ***Psilocybe coronilla*** (Bull.) Noordel.: (Keleş et al., 2016).

Incertae sedis

32. ***Clitocybe rivulosa*** (Pers.) P. Kumm.: Erzurum, eastern foothills of Kop Mount, under shrubs, 39°57'707”N, 40°34'633”E, 1625 m, 04.06.2011, P.212.

33. ***Crucibulum laeve*** (Huds.) Kambly: Bayburt, western foothills of Kop Mount, on remains of coniferous trees, 39°59'541”N, 40°32'658”E, 2078 m, 28.10.2010, P.115.

34. ***Lepista nuda*** (Bull.) Cooke: (Keleş et al., 2016).

35. ***Lepista personata*** (Fr.) Cooke: (Keleş et al., 2016).

36. ***Melanoleuca cognata*** (Fr.) Konrad & Maubl.: (Keleş et al., 2016).

37. ***Melanoleuca exscissa*** (Fr.) Singer: Bayburt, Aşağı Kop village, under *Salix* sp., 40°03'618”N, 40°26'460”E, 1866 m, 29.10.2010, P.99.; under coniferous trees, 39°59'541”N, 40°32'658”E, 2078 m, 28.10.2010, P.301; Erzurum, Bozburun village, under *Salix* sp., 38°30'359”N, 43°23'159”E, 1615 m, 09.05.2010, P.8.

38. ***Melanoleuca stridula*** (Fr.) Singer: (Keleş et al., 2016).

Inocybaceae Jülich

39. ***Inocybe dulcamara*** (Pers.) P. Kumm.: Bayburt, Aşağı Kop village, under *Populus* sp., 40°03'618”N, 40°26'460”E, 1866 m, 04.06.2011, P.258,

40. ***Inocybe hystrix*** (Fr.) P. Karst.: Erzurum, eastern foothills of Kop Mount, around *Quercus* sp., 39°59'477”N, 40°32'642”E, 1840 m, 09.05.2010, P.27.

41. ***Pleurocybella porrigens*** (Pers.) Singer: Erzurum, eastern slopes around peak of Kop Mount, on dead branches, 40°01'335”N, 40°32'370”E, 2335 m, 08.10.2010, P.48.

Lycoperdaceae F. Berchtold & J. Presl

42. ***Apioperdon pyriforme*** (Schaeff.) Vizzini: (Keleş et al., 2016)..

43. ***Bovista pila*** Berk. & M.A. Curtis: Erzurum, Bozburun village, Hasbek place, meadow, 39°59'442”N, 40°31'978”E, 1880 m, 01.06.2011, P.315,

44. ***Bovistella utriformis*** (Bull.) Demoulin & Rebriev: (Keleş et al., 2016).

45. ***Lycoperdon perlatum*** Pers.: (Keleş et al., 2016).

Marasmiaceae Roze ex Kühner

46. ***Marasmius rotula*** (Scop.) Fr.: Bayburt, Aşağı Kop village, on remains of *Salix* sp. leaves, 40°03'618”N, 40°26'460”E, 1866 m, 29.10.2010, P.102.

Mycenaceae Overeem

47. ***Mycena epipterygia*** (Scop.) Gray: Bayburt, western slopes of Kop Mount, among needle litter under coniferous trees, 40°01'780”N, 40°24'595”E, 2090 m, 29.10.2010, P.122.

48. ***Mycena mirata*** (Peck) Sacc.: Bayburt, western slopes of Kop Mount, under coniferous trees, 39°59'541”N, 40°32'658”E, 2078 m, 28.10.2010, P.110.

Omphalotaceae Bresinsky

49. ***Gymnopus fusipes*** (Bull.) Gray: Bayburt, western slopes of Kop Mount, around hotels, under *Quercus* sp., 40°03'263”N, 40°26'546”E, 2018 m, 30.10.2010, P.149.

Pleurotaceae Kühner

50. ***Pleurotus eryngii*** (DC.) Quél.: (Keleş et al., 2016).

51. ***Pleurotus ostreatus*** (Jacq.) P. Kumm.: (Keleş et al., 2016).

52. ***Pleurotus populinus*** O. Hilber & O.K. Mill.: (Keleş et al., 2016).

Pluteaceae Kotl. & Pouzar

53. ***Volvopluteus gloiocephalus*** (DC.) Vizzini, Contu & Justo: (Keleş et al., 2016).

Psathyrellaceae Vilgalys, Moncalvo & Redhead

54. ***Candolleomyces candolleanus*** (Fr.) D. Wächt. & A. Melzer: (Keleş et al., 2016).

55. ***Coprinellus disseminatus*** (Pers.) J.E. Lange: (Keleş et al., 2016).

56. ***Coprinellus micaceus*** (Bull.) Vilgalys, Hopple & Jacq. Johnson: (Keleş et al., 2016).

57. ***Coprinellus xanthothrix*** (Romagn.) Vilgalys, Hopple & Jacq. Johnson: Erzurum, eastern foothills of Kop Mount, among decaying wood chips, 39°59'627”N, 40°32'702”E, 1807 m, 07.10.2010, P.36.; 40°03'262”N, 40°26'528”E, 1838 m, 31.10.2010, P.171.

58. ***Coprinopsis atramentaria*** (Bull.) Redhead, Vilgalys & Moncalvo: Bayburt, Aşağı Kop village, around *Salix* sp. stump, 40°03'618”N, 40°26'460”E, 1866 m, 04.06.2011, P.223; Erzurum, eastern foothills of Kop Mount, around stone pit, around *Salix* sp. stump, 39°59'435”N, 40°31'969”E, 1536 m, 28.10.2010, P.53; Bozburun village, 39°58'043”N, 40°34'154”E, 1623 m, 28.10.2010, P.78.

59. ***Coprinopsis nivea*** (Pers.) Redhead, Vilgalys & Moncalvo: Erzurum, eastern foothills of Kop Mount, on cow dung, 39°57'707”N, 40°34'633”E, 1625 m, 04.06.2011, P.207.

60. ***Parasola plicatilis*** (Curtis) Redhead, Vilgalys & Hopple: (Keleş et al., 2016).

61. ***Tulosesus impatiens*** (Fr.) D. Wächt. & A. Melzer: Bayburt, western foothills of Kop Mount, under Quercus sp., 40°03'263”N, 40°26'546”E, 2018 m, 30.10.2010, P.144.

Strophariaceae Singer & A.H. Sm.

62. ***Agrocybe dura*** (Bolton) Singer: (Keleş et al., 2016).

63. ***Hypholoma acutum*** (Sacc.) E. Horak: Bayburt, Aşağı Kop village, around *Salix* sp. stump, 40°04'049”N, 40°25'978”E, 1840 m, 08.10.2010, P.42.

64. ***Pholiota aurivella*** (Batsch) P. Kumm.: (Keleş et al., 2016).

65. ***Pholiota populnea*** (Pers.) Kuyper & Tjall.-Beuk.: Bayburt, western slopes of Kop Mount, on *Populus* sp. trunk, 40°01'780”N, 40°24'595”E, 2090 m, 29.10.2010, P.140; Erzurum, Bozburun village, Hasbek place, on *Populus* sp. trunk, 39°59'437”N, 40°31'970”E, 1901 m, 30.10.2010, P.49.

Tricholomataceae Lotsy

66. ***Tricholoma atrosquamosum*** Sacc.: (Keleş et al., 2016).

67. ***Tricholoma portentosum*** (Fr.) Quél.: (Keleş et al., 2016).

Tubariaceae Vizzini

68. ***Cyclocybe cylindracea*** (DC.) Vizzini & Angelini: (Keleş et al., 2016).

69. ***Tubaria furfuracea*** (Pers.) Gillet: (Keleş et al., 2016).

Boletales E.-J. Girbert

Boletaceae Chevall.

70. ***Boletus edulis*** Bull.: (Keleş et al., 2016).

71. ***Butyriboletus appendiculatus*** (Schaeff.) D. Arora & J.L. Frank: (Keleş et al., 2016).

72. ***Rubroboletus satanas*** (Lenz) Kuan Zhao & Zhu L. Yang: Erzurum, eastern foothills of Kop Mount, under *Quercus* sp., 39°59'627"N, 40°32'702"E, 1807 m, 15.08.2010, P.31.

Paxillaceae Lotsy

73. ***Paxillus involutus*** (Batsch) Fr.: Bayburt, Yukarı Kop village, under *Populus* sp., 40°02'938"N, 40°25'650"E, 1922 m, 04.06.2011, P.294.

Sclerodermataceae Corda

74. ***Pisolithus arhizus*** (Scop.) Rauschert: Erzurum, eastern foothills of Kop Mount, under *Quercus* sp., 39°59'542"N, 40°32'657"E, 1856 m, 28.10.2010, P.87.

Suillaceae Besl & Bresinsky

75. ***Suillus bovinus*** (L.) Roussel: (Keleş et al., 2016).

76. ***Suillus luteus*** (L.) Roussel: (Keleş et al., 2016).

Geastrales K. Hosaka & Castellano

Geastraceae Corda

77. ***Geastrum coronatum*** Pers.: Erzurum, eastern foothills of Kop Mount, around stone pit, under coniferous trees, 39°25'870"N, 40°05'221"E, 1920 m, 08.10.2010, P.47.

78. ***Geastrum quadrifidum*** Pers.: Bayburt, western slopes of Kop Mount, around hotels, under *Malus* L. sp., 40°03'263"N, 40°26'546"E, 2018 m, 30.10.2010, P.141.

Hymenochaetales Oberw.

Hymenochaetaceae Donk

79. ***Phellinus igniarius*** (L.) Quél.: Bayburt, Aşağı Kop village, on *Salix* sp. stump, 40°04'049"N, 40°25'978"E, 1840 m, 08.10.2010, P.50; Erzurum, Bozburun village, 38°30'359"N, 43°23'159"E, 1615 m, 09.05.2010, P.34.

Polyporales Gäum.

Polyporaceae Fr. ex Corda

80. ***Cerioporus squamosus*** (Huds.) Quél.: (Keleş et al., 2016).

81. ***Ganoderma resinaceum*** Boud.: (Uzun et al., 2004).

82. ***Lentinus brumalis*** (Pers.) Zmitr.: Bayburt, western slopes of Kop Mount, around hotels, on decaying *Quercus* sp. branches, 40°03'263"N, 40°26'546"E, 2018 m, 30.10.2010, P.143; Erzurum, eastern foothills of Kop Mount, 39°59'477"N, 40°32'642"E, 1840 m, 09.05.2010, P.25.

83. ***Pycnoporus cinnabarinus*** (Jacq.) P. Karst.: Bayburt, western slopes of Kop Mount, around hotels, on decaying *Quercus* sp. stump, 40°03'263"N, 40°26'546"E, 2018 m, 30.10.2010, P.146; Erzurum, eastern foothills of Kop Mount, 39°59'477"N, 40°32'642"E, 1840 m, 09.05.2010, P.24.

84. ***Trametes hirsuta*** (Wulfen) Lloyd: Bayburt, eastern foothills of Kop Mount, on *Quercus* sp. stump, 40°01'780"N, 40°24'595"E, 2090 m, 29.10.2010, P.126.

85. ***Trametes trogii*** Berk.: Erzurum, southern foothills of Kop Mount, on *Salix* sp. stump, 39°57'707"N, 40°34'633"E, 1625 m, 04.06.2011, P.205.

Russulales K. Hosaka & Castellano

Russulaceae Lotsy

86. ***Lactarius acerrimus*** Britzelm.: Erzurum, eastern foothills of Kop Mount, eastern foothills of Kop Mount, under *Quercus* sp. 39°59'477"N, 40°32'642"E, 1840 m, 15.08.2010, P.32.

87. ***Lactarius deliciosus*** (L.) Gray: (Keleş et al., 2016).

88. ***Russula delica*** Fr.: (Keleş et al., 2016).

4. Discussions

Eighty eight macrofungi species belonging to 63 genera, 30 families, eight orders and three classes were compiled from Kop Mount. Ten of the determined taxa belong to *Ascomycota* (*Leotiomycetes* 1, *Pezizomycetes* 9) while 78 belong to *Basidiomycota* (*Agaricomycetes* 78). Fourty three of the determined taxa are new for the region (Demirel et al., 2003; Uzun et al., 2004; Keleş, 2010; Allı, 2011; Keleş et al., 2016; Sadullahoğlu et al., 2021).

The taxa, determined in the region, are distributed in eight orders (Fig. 2) and 30 families. *Agaricaceae* was found to be the most crowded family in the region with 12 taxa. It is followed by *Psathyrellaceae* and *Polyporaceae* with eight and six taxa respectively. *Lycoperdaceae* and *Strophariaceae* were found to be represented by four taxa each. Seven (*Boletaceae, Helvellaceae, Hygrophoraceae, Hymenogastraceae, Morchellaceae, Pleurotaceae, Russulaceae*) of the families are represented with three taxa, and eight (*Bolbitiaceae, Geastraceae, Inocybaceae, Mycenaceae, Pyronemataceae, Suillaceae, Tricholomataceae, Tubariaceae*) of them are represented with two taxa. The rest of nine families are represented with only one taxon in the region (Fig. 3).

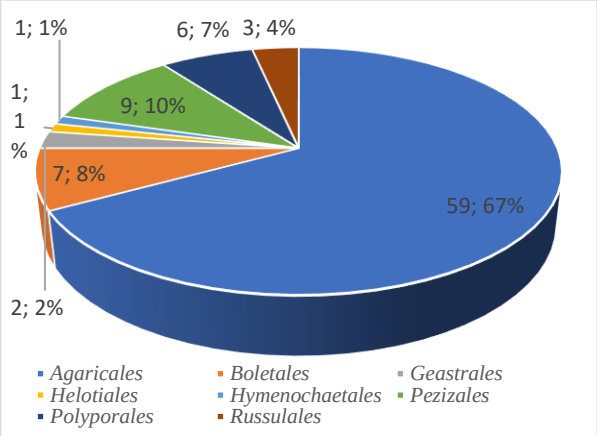

Figure 2. Ditribution of the determined taxa within orders.

The compiled taxa are distributed in 63 genera. The most crowded one is *Agaricus*. *Coprinellus, Melanoleuca, Morchella* and *Pleurotus* follow it with 3 taxa. *Conocybe, Coprinopsis, Geastrum, Helvella, Inocybe, Lactarius, Lepiota, Lepista, Mycena, Pholiota, Suillus, Trametes* and *Tricholoma* come next each with 2 taxa, while the rest of the genera are represented with only one taxon in the region. Fourty four (%55.00) of the determined taxa are edible. Among them *Pleurotus eryngii* and *Agaricus* sp. are collected and consumed in the region (Keleş et al., 2016).

Table 1. Similarity percentages of neighbouring studies with Kop Mount.

Neighbouring study	# of identical taxa	Total taxa	Similarity (%)
Ağrı (Demirel et al., 2002)	22	44	50.00
Bayburt (Uzun et al., 2004)	23	51	45.10
Erzincan (Keleş and Demirel, 2010)	40	193	20.73
Erzurum (Demirel et al., 2003)	23	114	20.18
Gümüşhane (Uzun et al., 2006)	22	105	20.95
Kemaliye (Allı, 2011)	25	106	23.58
Zigana Mount (Akata et al., 2016)	19	182	10.44

The rest of the taxa are regarded as inedible or poisonous by local public. Thirty eight (%47.50) of them are inedible and six (%7.50) of them (*Coprinopsis atramentaria, Inocybe dulcamara, Inocybe hystrix, Lepiota cristata, Paxillus involutus, Rubroboletus satanas*) are more or less poisonous.

The determined taxa were compared with those presented by the studies carried out in neighbouring regions and some similarities were observed. These studies and the similarity percentages are given in Table 1.

Conflict of Interest

Authors have declared no conflict of interest.

Authors' Contribution

The authors contributed equally.

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