Macrofungal biodiversity of Gürpınar (Van) district

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Gürpınar (Van) yöresinin makromantar biyoçeşitliği

Abstract: The study was based on macrofungi samples collected from Gürpınar district of Van province between 2015 and 2017. As a result of field and laboratory studies 94 macrofungi species belonging to 49 genera, 27 families, orders and three classes within Ascomycota and Basidiomycota were determined. The list of the determined taxa were presented together with their habitats, substrates, collection localities and personnel voucher numbers.

Key words: Biodiversity, macrofungi, mycota, Turkey

Özet: Çalışma 2015 ve 2017 yıllarında Van’ın Gürpınar ilçesinden toplanan makromantar örnekleri üzerinde gerçekleştirilmiştir. Arazi ve laboratuar çalışmalar sonucunda Ascomycota ve Basidiomycota böümleri içinde yer alan üç sınıf, yedi tane, 27 familya ve 49 cine ait 94 tür belirlenmiştir. Belirlenen taksonlar, habitatları, substratlari, toplanma yerleri ve toplayıcı numaraları ile birlikte listelenmiştir.

Anahtar Kelimeler: Biyoçeşitlilik, makromantar, mikota, Türkiye

1. Introduction

The kingdom Fungi constitutes the second most diverse living group in the world with about more than 1.5 million species (Hawksworth et al., 1995). They can grow almost everywhere in the world as saprophytes, parasites and symbionts, and those with fruiting bodies that can be seen by naked eye are known as macrofungi. Besides being consumed as food, macrofungi are used in cosmetics and pharmacology and have high economic value (Adanacıoğlu et al., 2016; Süfer et al., 2016).

Studies on the macrofungal biodiversity of Turkey have been started in the first quarter of the 19th century, and lots of works have been conducted by many researchers (Alkan et al., 2010; Demirel et al., 2010; Doğan et al., 2012; Türkekul and İşık, 2016; Uzun et al., 2017; Yıldız et al., 2019; Acar et al., 2020). The specimens were identified by comparing the obtained data with the relevant literature (Moser, 1983; Breitenbach and Kränzlin, 1984, 1986, 1991, 1995, 2000; Buczacki, 1989; Bresinsky and Besl, 1990; Jordan, 1995; Pegler et al., 1995; Philips, 1991; Dahncke, 2004; Hausknecht, 2009; Uzun, 2010; Kuo and Methven, 2014). The determined macrofungi samples are kept in the fungarium of Biology Department, Science Faculty, Van Yüzüncü Yıl University(VANF).

Gürpınar is the largest district of Turkey with a surface area of 4.063 km² within the boundaries of Van province (Fig. 1), and located between 37°44'–28°29' north latitudes and 43°07'–44°07' east longitudes. The district lies within the Irano-Turanian phytogeographical flora sector. The climate of the research area is Mediterranean with an annual rainfall of 281 mm and an annual average temperature of 8.1 °C (Bani and Adugüzler, 2008). Though the list of naturally growing edible mushrooms was presented by Şelem et al. (2019), there isn’t a detailed study on the overall macrofungal biodiversity of Gürpınar district.

The study aims to determine naturally growing macrofungi of the district and make a contribution to the mycobiota of Turkey.

2. Materials and Method

Macrofungi samples were collected from the region within the boundaries of Gürpınar districts of Van province. During field studies, first of all the fruit bodies were photographed at their natural habitats. Then necessary notes about the ecological and morphological characteristics and the geographical positions of the the samples were recorded. The collected samples were in paper boxes and transferred to the fungarium. They 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 by comparing the obtained data with the relevant literature (Moser, 1983; Breitenbach and Kränzlin, 1984, 1986, 1991, 1995, 2000; Buczacki, 1989; Bresinsky and Besl, 1990; Jordan, 1995; Pegler et al., 1995; Philips, 1991; Dahncke, 2004; Hausknecht, 2009; Uzun, 2010; Kuo and Methven, 2014). The determined macrofungi samples are kept in the fungarium of Biology Department, Science Faculty, Van Yüzüncü Yıl University(VANF).

3. Results

The determined taxa are listed in alphabetical order. Index Fungorum (accessed on 20 December 2020) were followed for the systematics of taxa. Previously reported taxa were given with the citation.

Ascomycota Whittaker
Leotiomycetes O.E. Erikss. & Winka
Helotiales Nannf.
Helotiaceae Rehm
1. Hymenoscyphus calyculus (Fr.) W. Phillips: On decaying Populus sp., twigs, locality 17, 05.10.2016, Şelem 276.
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Figure 1. Map of the research area

Table 1. Collection localities of the macrofungi samples

| Loc. No. | Locality                                      | Coordinates                      | Altitude (m) |
|----------|-----------------------------------------------|----------------------------------|--------------|
| 1        | Akbulut village                               | 38°18´06″N; 43°41´02″E           | 2186         |
| 2        | Albenek village                               | 38°36´01″N; 43°17´01″E           | 2022         |
| 3        | Alnıak village                                | 38°13´12″N; 43°42´48″E           | 2502         |
| 4        | Bozyiğit Village                              | 38°22´57″N; 43°34´08″E           | 1845         |
| 5        | Çevizalan village                             | 38°24´19″N; 43°47´56″E           | 2172         |
| 6        | Çörekli village                               | 38°21´53″N; 43°47´54″E           | 2001         |
| 7        | Çevizalan village                             | 38°22´16″N; 43°47´34″E           | 2025         |
| 8        | Erkaldi quarter                               | 38°21´26″N; 43°33´04″E           | 1809         |
| 9        | Giyimli village                               | 38°12´16″N; 43°47´05″E           | 2322         |
| 10       | Günbaşı village                               | 38°18´46″N; 43°43´45″E           | 2168         |
| 11       | Gürpınar (entrance)                           | 38°19´27″N; 43°24´06″E           | 1745         |
| 12       | Gürpınar centre                               | 38°19´33″N; 43°24´24″E           | 1751         |
| 13       | Gürpınar-Hakkari highway 14th km              | 38°21´59″N; 43°34´02″E           | 2010         |
| 14       | Güzelsu village                               | 38°18´58″N; 43°48´04″E           | 1982         |
| 15       | Güzelsu village                               | 38°18´52″N; 43°48´25″E           | 1980         |
| 16       | Güzelsu village                               | 38°19´11″N; 43°48´07″E           | 1996         |
| 17       | Güzelsu village                               | 38°19´00″N; 43°47´58″E           | 1977         |
| 18       | Güzelsu village                               | 38°19´02″N; 43°48´12″E           | 1986         |
| 19       | Güzelsu village                               | 38°18´57″N; 43°48´00″E           | 1972         |
| 20       | Hacıköy village                               | 38°18´22″N; 43°38´23″E           | 2205         |
| 21       | Hamurkesen village                            | 38°20´38″N; 43°37´29″E           | 1948         |
| 22       | İşkınpar village                              | 38°19´16″N; 43°37´01″E           | 2134         |
| 23       | Kırgeçit village                              | 38°08´17″N; 43°29´43″E           | 2105         |
| 24       | Kırgeçit village                              | 38°08´35″N; 43°31´27″E           | 2147         |
| 25       | Kırgeçit village                              | 38°08´08″N; 43°31´17″E           | 2165         |
| 26       | Koçgüden village                              | 38°09´20″N; 43°38´33″E           | 2570         |
| 27       | Kuşdağı village                               | 38°14´35″N; 43°27´29″E           | 1905         |
| 28       | Muratalı village                              | 38°15´17″N; 43°51´08″E           | 2136         |
| 29       | Ortaköy village                               | 38°22´02″N; 43°38´04″E           | 1910         |
| 30       | Ortaköy village                               | 38°21´50″N; 43°37´55″E           | 1868         |
| 31       | Örmeli village                                | 38°07´05″N; 43°30´52″E           | 2231         |
| 32       | Sapakonak village                             | 38°12´46″N; 43°36´35″E           | 2537         |
| 33       | Sevindik village                              | 38°18´11″N; 43°52´51″E           | 2098         |
| 34       | Sevindik village                              | 38°18´22″N; 43°52´27″E           | 2038         |
| 35       | Taşdöndüren village                           | 38°16´01″N; 43°48´53″E           | 2031         |
| 36       | Tepeğören village                             | 38°21´35″N; 43°53´13″E           | 2107         |
| 37       | Tutmaç village                                | 38°15´08″N; 43°42´34″E           | 2401         |
| 38       | Üçgen village                                 | 38°22´31″N; 43°44´46″E           | 2141         |
Morchellaceae Rchb.
8. Mitrophora semilibera (DC.) Lév.: (Şelem et al., 2019).
9. Morchella elata Fr.: (Şelem et al., 2019).
10. Morchella esculenta (L.) Pers.: (Şelem et al., 2019).
11. Morchella esculentoides M. Kuo, Dewsbury, Moncalvo & S.L. Stephenson: (Şelem et al., 2019).
12. Morchella prava Dewsbury, Moncalvo, J.D. Moore & M. Kuo.: (Şelem et al., 2019).
13. Verpa conica (O.F. Müll.) Sw.: On soil under Populus and Salix sp., locality 13, 03.06.2016, Şelem 34.
14. Geopora arenicola (Lév.) Kers: In soil under Populus sp., locality 12, 05.10.2016, Şelem 101; locality 15, 05.10.2016, Şelem 310; locality 23, 03.06.2016, Şelem 254.
15. Geopora arenosa (Fuckel) S. Ahmad: On soil under Populus sp., locality 16, 18.05.2016, Şelem 23.
16. Geopora sepulka (Fr.) Korf & Burds.: On soil under Populus sp., locality 19, 05.10.2015, Şelem 74.
17. Pulvinula convexella (P. Karst.) Pfister.: On burned ground, locality 15, 05.10.2016, Şelem 289.
18. Scutellinia scutellata (L.) Lambotte: On damp soil among leaf litter, locality 15, 05.10.2016, Şelem 290.
19. Tricharina praecox (P. Karst.) Dennis: On damp soil, locality 17, 05.10.2016, Şelem 273.
20. Trichophlea pseudogregaria (Rick) Boud.: (Keleş and Şelem, 2017).
Pezizaceae Dumort.
21. Peziza succosa Berk.: On burned ground, locality 18, 18.05.2015, Şelem 30.
Basidiomycota R.T. Moore
Agaricomycetes Doweld
Agaricales Underw.
Agaricaeae Chevall.
22. Agaricus bisporus (J.E. Lange) Imbach: (Şelem et al., 2019).
23. Agaricus campestris L.: (Şelem et al., 2019).
24. Agaricus urinascens (Jull. Schäff. & F.H. Möller) Singer: (Şelem et al., 2019).
25. Boivista plumbea Pers.: (Şelem et al., 2019).
26. Coprinus comatus (O.F. Müll.) Pers.: (Şelem et al., 2019).
27. Cyathus olla (Batsch) Pers.: On soil near woody debris, locality 17, 18.05.2015, Şelem 59.
28. Lepiota cristata (Bolton) P. Kumm: On soil among leaf litter, locality 8, 05.06.2015, Şelem 171.
29. Lepiota subincarnata J.E. Lange: On soil under Salix sp., locality 15, 10.05.2016, Şelem 299.
Bolbitiaceae Singer
30. Conocybe aporos Kits van Wav.: On soil under Salix sp., locality 17, 05.06.2015, Şelem 137.
31. Conocybe fuscimarginata (Murrill) Singer: On soil under Salix sp., locality 14, 18.05.2015, Şelem 43; locality 17, 05.06.2015, Şelem 145.
32. Conocybe pygmaeoaaffinis (Fr.) Kühner: On soil under Salix sp., locality 17, 05.06.2015, Şelem 146.
33. Conocybe rickeniana P.D. Orton: On soil among grass, locality 17, 05.06.2015, Şelem 149.
34. Conocybe tenera (Schueff.) Fayod: On soil among grass, locality 17, 18.05.2015, Şelem 43.
35. Conocybe vestita (Fr.) Kühner: On soil among grass, locality 11, 05.18.2015, Şelem 27.
Cortinariaceae R. Heim ex Pouzar
36. Cortinarius decipiens (Pers.) Fr.: On soil under Salix sp., locality 8, 05.06.2015, Şelem 175.
37. Cortinarius vernus H. Lindstr. & Melot: On soil under Populus sp., locality 15, 05.10.2016, Şelem 297.
Cyphellaceae Lotsy
38. Chondrostereum purpureum (Pers.) Pouzar: On Populus sp. stump, locality 11, 18.11.2015, Şelem 297; locality 8, 05.06.2015, Şelem 167.
Entolomataceae Kotl. & Pouzar
39. Entoloma caccabas (Kühner) Noordel.: On soil under Salix sp., locality 11, 19.05.2016, Şelem 343.
40. Entoloma rusticooides (Gillet) Noordel: On soil under Malus sp., locality 11, 18.05.2015, Şelem 108.
Hymenogastraceae Vittad.
41. Hebeloma mesophaeum (Pers.) Quél.: On soil under Salix sp., locality 17, 05.06.2015, Şelem 139.
42. Hebeloma pusillum J.E. Lange: On soil under Salix sp., locality 17, 18.05.2015, Şelem 53; on soil under Populus sp., locality 17, 05.10.2016, Şelem 256.
43. Hypholoma Fasciculare (Huds.) P. Kumm.: On Populus sp. stump, locality 17, 05.06.2015, Şelem 165.
44. Psilocybe coronilla (Bull.) Noordel.: (Şelem et al., 2019).
Incertaes sedis
45. Panaeolus fimico (Pers.) Gillet: On decaying cow dung, locality 4, 18.11.2015, Şelem 201.
Inocybaceae Julich
46. Crepidotus vulgaris Hesler & A.H. Sm.: On decaying Salix sp. stump, locality 13, 03.06.2016, Şelem 222.
47. *Inesperma maculatum* (Boud.) Matheny & Esteve-Rav.: On soil under *Salix* sp., locality 28, 08.11.2015, Şelem 280.

48. *Inocybe cincinnata* (Fr.) Quél.: On soil under *Populus* sp., locality 30, 18.06.2016, Şelem 79.

49. *Inocybe dulcamara* (Pers.) P. Kumm.: On soil under *Populus* sp., locality 13, 18.05.2015, Şelem 81; on soil under *Salix* sp., locality 14, 05.06.2015, Şelem 119; locality 17, 18.11.2015, Şelem 235.

50. *Inocybe flocculosa* Sacc.: On soil under *Populus* sp., locality 14, 18.05.2015, Şelem 37.

51. *Inocybe fuscocmarginata* Kühner: On soil under *Salix* sp., locality 17, 05.06.2015, Şelem 145.

52. *Inocybe perbrevis* (Weim.) Gillet: On soil under *Salix* sp., locality 17, 18.10.2016, Şelem 121; on soil under *Populus* sp., locality 16, 05.06.2015, Şelem 278.

53. *Pseudosperma rimosum* (Bull.) Matheny & Esteve-Rav.: On soil under *Populus* sp., locality 8, 05.06.2015, Şelem 169; on soil under *Salix* sp., locality 4, 18.11.2015, Şelem 197.

54. *Pleurotus eryngii* (DC.) Quél.: (Şelem et al., 2019).

55. *Pleurotus ostreatus* (Jacq.) P. Kumm.: (Şelem et al., 2019).

56. *Pleurotus populinus* O. Hilber & O.K. Mill.: (Şelem et al., 2019).

57. *Pluteus aurantiocrusgus* (Trog) Sacc.: (Şelem et al., 2019).

58. *Pluteus romellii* (Britzelm.) Sacc.: (Şelem et al., 2019).

59. *Volvopluteus gloiocephalus* (DC.) Vizzini, Contu & Justo: (Şelem et al., 2019).

60. *Psathyrellaceae* Kühner

61. *Psathyrella candeldeana* (Fr.) Maire: (Şelem et al., 2019).

62. *Psathyrella fatua* (Fr.) P. Kumm. *Populus* sp. ağacları altı, 17, 18.05.2015, Şelem 56.

63. *Psathyrella panaeoloides* (Maire) Arnold: On soil under *Salix* sp., locality 17, 05.06.2015, Şelem 162; locality 15, 05.10.2016, Şelem 302.

64. *Psathyrella poteri* A.H. Sm.: On soil under *Populus* and *Salix* sp., locality 13, 18.05.2015, Şelem 103.

65. *Psathyrella pron* (Fr.) Gillet: On soil under *Populus* and *Salix* sp., locality 13, 18.05.2015, Şelem 204; locality 17, 05.10.2015, Şelem 263; locality 15, 05.10.2016, Şelem 301.

66. *Psathyrella pseudogracilis* (Romagn.) M.M. Moser: On decaying stump, locality 17, 18.05.2015. Şelem 58.

67. *Strophariaceae* Singer & A.H. Sm.

68. *Agrocybe dura* (Bolton) Singer: (Şelem et al., 2019).

69. *Agrocybe paludosa* (J.E. Lange) Kühner & Romagn. ex Bon: On soil among grass, locality 17, 05.06.2015. Şelem 148.

70. *Agrocybe pediades* (Fr.) Fayod: (Şelem et al., 2019).

71. *Agrocybe praecox* (Pers.) Fayod: (Şelem et al., 2019).

72. *Cyclocybe cylindracea* (DC.) Vizzini & Angelini: (Şelem et al., 2019). On *Populus* sp. stump, locality 13, 05.10.2016, Şelem 268.

73. *Pholiota aurivella* (Batsch) P. Kumm.: (Şelem et al., 2019).

74. *Tricholomataceae* Lotsy

75. *Melanoleuca angelesiana* A.H. Sm.: On soil among needle litter under *Pinus* sp., locality 29, 05.06.2015, Şelem 179.

76. *Melanoleuca brevipes* (Bull.) Pat.: (Şelem et al., 2019).

77. *Melanoleuca cognata* (Fr.) Konrad & Maubl.: (Şelem et al., 2019).

78. *Pseudoclitocybe cyathiformis* (Bull.) Singer: (Şelem et al., 2019).

79. *Lepista personata* (Fr.) Cooke: (Şelem et al., 2019).

80. *Tubariaceae* Vizzini

81. *Tubaria conspersa* (Pers.) Fayod: On damp soil among leaf litter under *Salix* sp., 17, 05.06.2015, Şelem 122.

82. *Tubaria furfuracea* (Pers.) Gillet: On woody debris, locality 30, 18.11.2015, Şelem 195

83. *Boletales* E.-J. Girbert

84. *Suillaceae* Besl & Bresinsky

85. *Suillus collinitus* (Fr.) Kuntze: (Şelem et al., 2019).

86. *Hymenochaetales* Oberw.

87. *Hymenochaetaceae* Donk

88. *Polyporales* Gäum.

89. *Polyporaceae* Fr. ex Corda
91. *Fomes fomentarius* (L.) Fr.: On *Populus* sp. stump, locality 20, 28.06.2017, Şelem 375; locality 5, 19.05.2016, Şelem 381.

92. *Cerioporus squamosus* (Huds.) Quël.: (Şelem et al., 2019).

93. *Trametes trogii* Berk.: On *Populus* sp. stump, locality 17, 05.06.2015, Şelem 118; locality 18, 19.05.2016, Şelem 332; locality 26, 13.06.2017, Şelem 375; locality 5, 13.11.2016, Şelem 381.

94. *Trametes versicolor* (L.) Lloyd: On *Populus* sp. stump, locality 19, 19.05.2016, Şelem 362.

4. Discussions

Ninety four macrofungi species belonging to 49 genera, 27 families, seven orders and three classes were determined from Gürpınar district. Twenty one of the determined taxa belong to Ascomycota (Leotiomycetes 2, Pezizomycetes 19) while 73 belong to Basidiomycota (Agaricomycetes 73). Except previously reported 36 edible species (Şelem et al., 2019), all the taxa are new for the region.

The taxa are distributed in 7 orders (Fig. 2) and 27 families. *Psathyrellaceae* and *Inocybaceae* were found to the most crowded first two families with 16 and 7 taxa respectively.

*Agaricales*, *Boletales*, *Incertae sedis*, *Morchellales* and *Strophariaceae* are the third crowded families each with 6 taxa. Then *Helvellaceae* and *Pyronemataceae* come each with 5 taxa. Two of the families (Hymenogasteraceae, *Polyporaceae*) comprise 4, Three of them (*Pluteaceae*, *Pluteaceae*, *Tubariaceae*) comprises 3, three of them (*Cortinariaceae*, *Entolomataceae*, *Pulvinulaeaceae*) comprises 2 taxa, and the rest of the 10 families comprises 1 taxon.

![Figure 2. Distribution of the determined taxa within orders.](image)

The determined taxa are distributed in 49 genera. The most crowded genera are *Conocybe* and *Psathyrella* each with 6 taxa. *Inocybe* and *Parasola* were found to be the second crowded two genera each with 5 taxa. Three of of the genera (*Agrocybe*, *Helvella*, *Morchella*) comprise 4 taxa, five of them (*Agaricus*, *Coprinellus*, *Geopora*, *Melanoleuca*, *Pleurotus*) comprise 3 taxa, eight of them (*Coprinopsis*, *Cortinarius*, *Entoloma*, *Hebeloma*, *Lepticia*, *Plateus*, *Trametes*, *Tubaria*) comprise 2 taxa, and the rest of the 29 taxa comprise one taxon.

*Coprinus comatus*, *Coprinellus disseminatus*, *C. micaceus*, *Coprinopsis atramentaria*, *Psathyrella candollea*, *Pleurotus ostreatus*, *P. eryngii*, *Inocybe dulcama* and *Pholiota aurivella* were found to be the most widespread species in the region.

Thirty six (%38.30) of the determined taxa are edible. Among them *Pleurotus eryngii* is collected and consumed in all villages of the district. This mushroom is known with the Turkish name “heliz mantarı” and also has regional economic importance. *Agaricus bisporus*, *A. campestris*, *A. urinascens* and *P. ostreatus* are regionally known in research area and they are also collected and consumed by some locals. Forty four (%46.81) of them are inedible and 14 (%14.89) of them are more or less poisonous.

The taxa determined in Gürpınar district were compared with the findings of the studies carried out in neighbouring regions and some similarities were observed. These studies and the similarity percentages are given in Table 2.

### Table 2. Similarity percentages of neighbouring studies with Gürpınar district.

| Neighbouring study | # of identical taxa | Total taxa | Similarity (%) |
|--------------------|---------------------|------------|----------------|
| Bütis (Kaya, 2001) | 17                  | 60         | 28.33          |
| Ağrı (Demirel et al., 2002) | 20              | 45         | 44.44          |
| Erzurum (Demirel et al., 2003) | 17              | 114        | 14.91          |
| Malazgirt (Akçay et al., 2010) | 16              | 50         | 32.00          |
| Van (Demirel et al., 2015) | 40              | 122        | 32.79          |
| Bingöl (Uzun et al., 2017) | 16              | 112        | 14.29          |
| Şemdinli and Yüksekova (Acar et al., 2020) | 40              | 197        | 20.30          |
| Muradiye (Çagli and Öztürk, 2020) | 38              | 86         | 44.19          |
| Karz Dağı (Sadullahoğlu and Uzun, 2020) | 25              | 95         | 26.32          |

Conflict of Interest

Authors have declared no conflict of interest.

### Authors’ Contributions

The authors contributed equally.

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