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Determination of fungal diseases, site and stand characteristics in mixed stands in Ilgaz-Yenice forest district, Cankiri, Turkey

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Abstract: *Fungal diseases, site and stand characteristics were investigated in Yenice forest sub-district headquarters belonging to Ilgaz forest enterprise. Diseases and wood decaying fungi on fallen and cut tree stumps were determined on scots pine (Pinus sylvestris), crimean pine (P. nigra subsp. nigra var.caramanica), and uludag fir (Abies nordmanniana subsp. bornmulleriana). Altitude (m), exposure, slope (%), relief, rate of mixture (%) and anthropogenic effects were noted for 56 sample plots which have various stand compositions. Age, breast height diameter (cm), top height (m), crown and bole quality, regeneration quality and development of representative tree species were also recorded into vegetation forms. Yellow witches' broom (Melampsorella caryophyllacearum), which caused drying of uludag fir trees, was determined. Besides, 53 macrofungi species belonging to 3 divisions, 10 orders, 25 families and 36 genera were determined. Some of them cause white and brown decay on living and core wood. The most common parasitic and saprobe fungi are Galerina Ganoderma, Gloeophyllum, Gymnopilus, Hypholoma, Lentinus, Phellinus, Pleurotus, Polyporus and Stereum species in the research area. Trichaptum abietinum is also typical wood decay fungi for living or cut fir trees and it is very common in the research area.*

Key words: *Fungal diseases, Ilgaz-Yenice, Macrofungi, Mixed stand, Site, Stand characteristics*
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Introduction

Plants constitute plant communities by existing together with their own species or other plant species. These plant communities do not come together randomly. The effects of various competition conditions are important in their coming together. In other words, these communities are composed of individuals (plants) that can adjust themselves to competition conditions (Aksoy, 1978; Ozalp, 1993; Pacala, 1997; Freckleton and Watkinson, 2001).

Generally, forests show heterogenic structure. The partnership consisting of plant communities and animals associated with the plants is called biocenosis. Trees, shrubs, herbs, ferns, mosses, lichens, algae, micro-organisms also join the living partnership. These plants form a multi dimensional relation complex among themselves under the effects of growing factors that constitutes the environment of the plants (Tilman, 1988; Callaway, 2007).

An intervention that will be applied in a forest with such stability should not damage the stability in the long run. In order to protect stability, it is necessary to know the basic features of forest communities and stands (Kijtewachakul *et al*., 2004; Seppela, 2005).

Fungi damaging forest trees live as a parasite and/or a saprobe on leaf, branch, and stem or stump. Fungi living on wood are in ascomycota, basidiomycota and fungi imperfecti. Some fungi do not directly decay the wood but they can cause damage to the natural colour of the wood and some other pigmentation. Therefore, these fungi can negatively change the appearance of the wood. Some other fungi cause white or brown rots on sapwood and heartwood. Logs rotted by activities of fungi are damaged heavily and they cannot be used any more. Some fungi lead to infection by contagion of planted trees. These kinds of fungi are generally harmful parasites causing infection by penetrating to trees through wounds in the stem or branch of the tree (Sinclair and Lyon, 2005; Dai *et al*., 2007).

Wood material infected by fungi can macroscopically be recognized with its colour changes. Wood-rotting fungi cause strength and weight losses for the trees. If the rot is at the beginning level, cell walls may not be damaged. However, the material loss is more in the cell wall than other places and the rot can be recognized from the morphologic appearance of the wood. Some tree species have extractive materials in their dark-coloured heartwood. These materials show toxic effect against micro-organisms, so this tree species is more resistant to rot fungi. However, sapwood can be rotted by the micro-organisms since it does not include this kind of materials from all species (Heijari *et al*., 2005; Guglielmo *et al*., 2007).

The aim of this paper is to determine the fungal diseases, site and stand characteristics in Ilgaz-Yenice Forest Sub district Headquarters Cankiri, Turkey.

Materials and Methods

Site and stand characteristics of 56 sample plots have been determined in Yenice forest sub district headquarters

Table - 1: Site and stand characteristics of sample plots

Sample Plot No.	Compar-tment No.	Altitude (m)	Exposure	Slope (%)	Relief	Tree species	Rate of mixture (%)	Age (Years)	Breast height diameter (cm)	Top height (m)
1	83	1480	SW	40	MH[1]	SP[4]	70	138	55	27
						UF[5]	10	18	21	5
						CP[6]	20	61	35	20
2	107	1650	ES	70	MH	SP	60	80	42	19
						CP	30	70	38	18
						UF	10	20	21	5
3	61	1430	SE	31	MH	SP	60	110	55	31
						CP	30	100	50	30
						UF	10	30	21	15
4	73	1380	NW	70	MH	CP	80	110	43	24
						SP	10	60	30	19
						UF	10	45	32	16
5	77	1345	NE	51	MH	CP	80	104	43	23
						UF	10	48	24	18
						SP	10	40	27	17
6	49	1480	S	38	MH	CP	70	99	51	26
						UF	20	81	49	24
						SP	10	87	46	23
7	56	1670	SE	45	MH	CP	30	76	43	24
						UF	10	75	41	18
						SP	60	70	40	23
8	59	1660	S	19	MH	CP	10	70	42	24
						UF	30	60	40	19
						SP	60	120	58	33
9	24	1670	E	50	UpH[2]	UF	90	105	46	23
						SP	10	72	40	19
10	25	1560	E	55	UnH[3]	UF	90	107	49	31
						SP	10	97	48	23
11	20	1830	ES	30	UpH	UF	80	108	41	27
						SP	20	82	48	23
12	21	1750	WS	60	MH	UF	70	107	47	27
						SP	30	78	41	24
13	22	1710	WS	60	UpH	UF	70	110	42	19
						SP	30	106	49	20
14	26	1630	WS	40	UpH	UF	70	109	49	31
						SP	30	98	43	22
15	80	1560	NE	40	UpH	UF	50	90	39	21
						SP	50	120	45	26
16	6	1950	N	84	UpH	UF	40	72	40	21
						SP	60	108	48	27
17	7	1870	NW	67	MH	UF	40	74	42	22
						SP	60	104	45	25
18	79	1540	NW	60	UpH	UF	40	80	39	19
						SP	60	122	46	26
19	52	1660	SW	55	UpH	UF	30	86	46	19
						SP	70	106	49	24
20	55	1760	W	45	MH	UF	30	96	49	22
						SP	70	109	61	32
21	65	1510	S	32	UpH	UF	10	30	23	12
						SP	90	100	50	28
22	48	1420	SE	58	MH	SP	90	108	51	27
						UF	10	60	40	19
23	13	1715	SW	19	UpH	SP	90	140	60	32
						UF	10	60	30	20
24	102	1670	NE	30	UnH	SP	90	90	42	28
						UF	10	30	18	7

25	72	1570	N	30	UpH	SP	90	120	50	27
						UF	10	70	36	17
26	96	1610	N	20	UpH	SP	90	93	48	26
						UF	10	40	23	13
27	45	1850	S	50	UpH	SP	90	106	43	27
						UF	10	17	17	5
28	78	1550	NW	51	UpH	SP	80	117	49	27
						UF	20	80	36	18
29	51	1660	WS	55	UpH	SP	80	106	49	24
						UF	20	86	46	19
30	97	1640	NW	40	MH	SP	80	110	47	26
						UF	20	80	39	21
31	98	1660	S	30	MH	SP	80	111	59	30
						UF	20	70	43	18
32	91	1970	W	70	UpH	SP	80	10	50	29
						UF	20	50	33	20
33	40	2020	S	40	MH	SP	70	97	39	27
						UF	30	73	44	26
34	38	1810	SW	30	UnH	SP	60	97	41	28
						UF	40	82	38	24
35	67	1820	N	30	UnH	SP	60	97	46	29
						UF	40	89	42	26
36	63	1550	NE	58	MH	SP	60	96	49	30
						UF	40	67	41	21
37	41	1940	S	40	UnH	SP	60	102	41	28
						UF	40	87	40	26
38	106	1550	NW	40	UnH	SP	60	128	83	31
						UF	40	110	56	28
39	23	1610	W	55	MH	SP	60	96	44	24
						UF	40	82	39	18
40	2	1720	SE	49	MH	SP	60	107	46	26
						UF	40	70	39	20
41	1	1900	SW	49	UpH	SP	30	60	36	20
						UF	70	70	32	25
42	47	1760	ES	60	MH	CP	80	110	45	24
						SP	20	90	41	20
43	58	1430	SE	11	MH	CP	60	120	57	27
						SP	40	80	39	26
44	75	1365	NE	50	MH	CP	90	110	48	26
						UF	10	40	28	16
45	46	1710	SW	47	MH	CP	60	94	48	26
						UF	40	71	44	21
46	128	1740	W	23	MH	SP	100	106	48	29
47	8	1920	N	70	UpH	SP	100	106	49	28
48	9	1760	NE	62	MH	SP	100	96	48	28
49	10	1770	NE	60	MH	SP	100	97	47	27
50	11	1800	NE	31	UpH	SP	100	100	50	29
51	50	1475	S	36	MH	CP	100	98	50	25
52	43	1750	W	42	MH	CP	100	97	49	24
53	44	1760	SW	38	UpH	CP	100	90	47	24
54	3	1780	NW	81	MH	UF	100	93	51	25
55	4	1770	NW	65	MH	UF	100	91	49	24
56	5	1720	NE	60	UpH	UF	100	90	47	24

[1]MH = Mid-hillside, [2]UpH = Upper-hillside, [3]UnH = Under-hillside, [4]SP = Scots pine, [5]UF = Uludag fir, [6]CP = Crimean pine, E= East, W = West, N= North, S = South

including a part of Ilgaz Mountain National Park between 2000 and 2002. In addition, fungi species causing wood decay on living trees, stumps or other cut places were studied.

Generally, the forest vegetation of the area consists of conifer trees. *Pinus nigra* Arnold. subsp. *nigra* var. *caramanica* (Loudon) Rehder., *P. sylvestris* L. and *Abies nordmanniana* (Steven) Spach.

subsp. *bornmulleriana* (Mattf.) Coode and Cullen are dominant tree species in the area. Additionally, these species constitute mixed stands. The research area is situated between steppe and humid forest regions.

Yenice forest sub-district covers 11,585 ha that 4,441 ha of which are not forested; 5,201 ha of the forest areas are productive high forests, and the rest is unproductive high forests (OGM, 1996). The altitude of the area varies between 790 m (Dede place) and 2,546 m (Kucukhacet hill). It is situated in Euxine province of Euro-Siberian floristic region and in the A4 square in Davis' grid system (Davis *et al.*, 1988). The average temperature is 10.1°C, and the annual rainfall is 484.4 mm (Met. Office, 2006). The vegetation period is 7 months, between April and October (Rubner, 1949). According to Thornthwaite method, the research area is characterized by the climate type of arid-semi humid, mesothermal, with water excess to the medium degree in winter. It is similar to the oceanic type of climate (Ozyuvaci, 1998). The geological structure of the region mainly consists of Neogen, serpentine, magnasite, sandy clay and loamy soils (Blumenthal, 1948).

Research was conducted in 56 sample plots having a different stand in the study area. Sample plots (400 m^2) with homogeny distribution were selected from the least human affected compartments. Vegetation forms belonging to these areas were arranged. Topographic features of the areas, stand properties and canopies of the stand were separately defined in the vegetation forms. Site and stand characteristics were determined for each sample plot such as altitude (m), exposure, slope (%), relief, tree species participating in the mixture, rate of mixture based on species (%), maximum tree age (years), breast height diameter (cm) and top height (m) (Wenger, 1984; Kent and Coker, 1994).

Stems, branches and root collar were examined with respect to diseases with crimean pine, scots pine and uludag fir. Basidiocarps and ascocarps of the wood decaying fungi were collected from fallen branches or stumps. Then, they were packed and labelled in different plastic bags. Later they were brought to the laboratory. The photos of fungi were taken in their habitats. Their morphologic and growth location features were recorded in a notebook.

A microscope and reagents (Melzer reagent, 5% KOH, cotton blue, sulphovanilin *etc.*) were used for fungi identification. The determination of the recorded species was accomplished during the field trips or afterwards, in the Mycological Laboratory. Drying and diagnosis processes of fungi were executed in Selcuk University Mushroom Application and Research Centre Laboratory, Konya.

For the identification of macrofungi samples, the following reference Books were used: Moser (1983), Julich (1984), Breitenbach and Kränzlin (1984-2000), Riffle and Peterson (1986), Skelly et al. (1987), Riva (1988), Ellis and Ellis (1990), Ryvarden and Gilbertson (1994), Stephenson and Stempen (1994), Strouts and Winter (1994) and Hansen and Lewis (1997).

Results and Discussion

Site and stand characteristics of the 56 sample plots are given in Table 1. In the sample plots (16, 17, 40, 41, 47-50 and 54-56), which is above Kadincayiri locality, there are vertical cracks on the stem and sampling stages of the uludag firs. There are also resin flows in these cracks. In addition, bark dumps and dryings were determined in these trees. Deformations, folds and brown colourizations were determined in the ends of new shoots of the uludag firs between 1 and 5 years of age from the area closer to Cankiri-Kastamonu motorway of the same sample plots. It was thought that the reason for such conditions might be spring frost, which is not the case with uludag firs. Needle cast diseases *(Lophodermium* sp) in scots pine and witches' brooms *(Melampsorella caryophyllacearum* Link. Schoter) in uludag firs were identified.

In the sample plots of 1, 2, 4, 6-8, 19, 20 and 51, uludag fir and scots pine are in the first site class, and the crown rate of uludag fir is 2/3. There is abundant regeneration of fir under canopy. It was determined that scots pine and crimean pine have qualitative, straight and full balled, few knotty cylindrical bodies. They have crown with the rate of 1/3.

Needle cast diseases (*Lophodermium* sp), and needle rust *(Coleosporium* sp) diseases were determined in scots pine. The symptoms of the witches' brooms in the Uludag firs were determined as swelled branches and that is an appearance of witches' brooms on the ground. Also, in that region, swelling in the stems of the firs was observed as a symptom of the diseases. It was thought that colour change towards brown in new shoots of the uludag firs in the high altitudes might be caused by winter cold.

Overgrown individuals with their thick branches and large tops were observed among the uludag fir trees in the examined sample plots of 9-14, 22, 23, 27, 29, 33-36, 39, 42, 45, 52 and 53. The lower branches are totally dry and most of them are covered with lichens. Uludag firs had knotty and poor quality body. The symptoms of witches' brooms were seen on branches that had fallen to the ground due to the diseases. Crimean pine stems are of high quality and the rate of crown is 1/3. In the mixed stands of scots pine plus uludag fir, the scots pine have straight and full balled, quality stems and symmetrical crowns. The stand canopy ratios change between 60% and 100%.

Needle cast diseases (*Lophodermium* sp.) on the needle of the scots pine and *Cytospora friesii* on the needle of firs were determined in the sample plots of crimean pine, scots pine and Uludag fir (5, 15, 18, 24, 28, 32, 37 and 46). Any phytopathologic agent was observed in crimean pine.

Crimean pine and scots pine took place generally in top, medium and bottom tree layer and they have straight and full balled and qualitative stems. Their crowns are generally symmetric, with sprigs and have crown ratio of 1/3. There are only uludag firs in the shrubs and herb layer of the stand. The individuals of uludag fir have crown ratio of 2/3 and they show

Table - 2: Identified macrofungal agents and their disease on the trees

Division	Orders	Families	Genera and species	Collection number	Substracts	Diseases
Myxomycota	Physarales	Didymiaceae	*Diderma meyerae* H. Singer, G. Moreno, Illana & A. Sánchez	87,99	Scots pine, on dry branch, Uludag fir, on stump	Weak lignicolous
		Stemonitaceae	*Stemonitis* Gled., sp.	72	Scots pine, on stump	Weak lignicolous
Ascomycota	Diaporthales	Melanconidaceae	*Melogramma spiniferum* (Wallr.) De Not.	45,74	Uludag fir, on branch and on stem	Weak lignicolous
	Hypocreales	Hypocreaceae	*Trichoderma viride* Pers.	89	Uludag fir, on dry stem	Weak lignicolous
		Nectriaceae	*Nectria* (Fr.) Fr., sp.	90	Scots pine, on stump	Weak lignicolous
			Nectria cinnabarina (Tode) Fr.	70,81	Scots pine, on stump	Weak lignicolous
	Helotiales	Hyaloscyphaceae	*Lachnellula occidentalis* (G.G. Hahn & Ayers) Dharne	47,52,76, 77,90	Uludag fir, on branch	Weak lignicolous
			Lachnellula subtilissima (Cooke) Dennis	61	Uludag fir, on branch	Weak lignicolous
			Lachnellula suecica (de Bary ex Fuckel) Nannf.	46	Uludag fir, on dry stem	Weak lignicolous
Basidiomycota	Dacrymycetales	Dacrymycetaceae	*Dacrymyces stillatus* Nees	100	Scots pine, on dry branch	Weak lignicolous
	Agaricales	Agaricaceae	*Agaricus augustus* Fr.	80	Uludag fir, on root collar, in soil	Terricolous
		Cortinariaceae	*Galerina marginata* (Batsch) Kuhner	86	Uludag fir, on branch	Lignicolous
			Gymnopilus stabilis (Weinm.) Kuhner and Romagn	63	Uludag fir, on dry stem	Lignicolous
			Pleurotellus chioneus (Pers.) Kühner	15	Uludag fir, on stump	Lignicolous
		Entolomatacea	*Entoloma cuspidiferum* Noordel.	02,21	Uludag fir, on root collar	Terricolous
		Lepiotace	*Macrolepiota mastoidea* (Fr.) Singer	05	Uludag fir, on remnant in soil	Terricolous
		Lycoperdaceae	*Handkea utriformis* (Bull.) Pers.	01,55, 56,57	Scots pine, on root collar, Uludag fir, on soil	Terricolous
			Lycoperdon pyriforme Schaeff.	106	Uludag fir, on tree remnant	Terricolous
			Lycoperdon molle Pers.	109	Uludag fir, on soil, in groups	Terricolous
		Pleurotaceae	*Pleurotus ostreatus* (Jacq.) P. Kumm.	121	Scots pine, on stump	Wood decay
		Strophariaceae	*Hypholoma capnoides* (Fr.)P. Kumm.	118	Ilgaz, Uludag fir, on stem	Wood decay
			Pholiota lucifera (Lasch) Quel.	116	Uludag fir, on stem	Wood decay
		Tricholomataceae	*Mycena polygramma* (Bull.) Gray	43	Uludag fir, on stem	Lignicolous
			Mycena sanguinolenta (Alb. and Schwein.) P. Kumm.	39	Uludag fir, on decayed stump	Lignicolous
			Mycena stipata Maas Geest. and Schwobel	42	Uludag fir, on branch	Lignicolous
	Hymenochaetales	Hymenochaetaceae	*Hymenochaete cruenta* (Pers.) Donk	60	Uludag fir, on bark	Lignicolous
			Inonotus P. Karst., sp.	49	Uludag fir, on stump	White root
			Inonotus dryadeus (Pers.) Murr.	119,120	on living oak tree	White root

		Inonotus hispidus (Bull.) P. Karst.	69	on living oak tree	White root
		Phellinus igniarius (L.) Quél.	79	on living oak tree	White root
		Phellinus nigricans (Fr.) P. Karst.	41	on living oak tree	White root
		Phellinus hartigii (Allesch. & Schnabl) Pat.	75,112	Uludag fir, on stem	White root
	Schizoporaceae	*Basidioradulum radula* (Fr.) Nobles	98	Uludag fir, on stem	Wood decay
	Fomitopsidaceae	*Fomitopsis pinicola* (Sw.) P. Karst.	36	Uludag fir, on trunk	Brown cubical root
Polyporales	Ganodermataceae	*Ganoderma applanatum* (Pers.) Pat.	18	Uludag fir, on stump	White root
		Ganoderma pfeifferi Bres.	54,68	Uludag fir, on root collar	White root
		Ganoderma resinaceum Boud.	04	Uludag fir, on stump	White root
	Gloeophyllaceae	*Gloeophyllum abietinum* (Bull.) P. Karst.	16,17	Scots pine, on stump	Brown root
Polyporales	Hapalopilaceae	*Ischnoderma benzoinum* (Wahlenb.) P. Karst.	88	Uludag fir, on stump-root collar	White root
		Ceriporia purpurea (Fr.) Komarova	97	Scots pine, on branch	Wood decay
	Poylporaceae	*Lentinus cyathiformis* (Schaeff.) Bres.	82	Uludag fir, on stump-root collar	Wood decay
		Neolentinus lepideus (Fr.) Redhead and Ginns	92	Scots pine, on stump	Wood decay
		Perenniporia medulla-panis (Jacq.) Donk	48,83,107, 110,115	Scots pine, on stump, Uludag fir, on stump-root collar	White root
		Polyporus squamosus (Huds.) Fr.	20	Scots pine, on stump	White heart root
		Trichaptum abietinum (Dicks.) Ryvarden	38,50,51, 53,59,71	Uludag fir, on stem	White pocket root
		Trichaptum fuscoviolaceum (Ehrenb.) Ryvarden	63,64,65, 73,84	Scots pine, on stem	White pocket root
Russulales	Russulaceae	*Russula brunneoviolacea* Crawshay	101,102,103	Uludag fir, on soil, in groups	Terricolous
		Russula cuprea (Krombh.) J.E. Lange	111	Uludag fir, on soil, in groups	Terricolous
		Russula pallidospora J. Blum ex Romagn	91	Scots pine, on soil	Terricolous
		Lactarius salmonicolor R. Heim and Leclair	114	Uludag fir, on soil, in groups	Terricolous
	Stereaceae	*Stereum rameale* (Schwein.) Burt	40,45	Uludag fir, on stem	Lignicolous
		Stereum sanguinolentum (Alb. & Schwein.) Fr.	37	Uludag fir, on stem	Lignicolous
Thelephorales	Bankeraceae	*Phellodon niger* (Fr.) P. Karst	78	Scots pine and Crimean pine, on soil	Lignicolous

tendency to branch down to the bottom. When the tree stems were observed, the knot ratio was found low. Lichens were found in the branches of individuals of the uludag firs. Uludag firs accompany the scots pine with the ratio of 20% in sample plot 28. This ratio is 40% in sample plot 18, and 50% in sample plot 15. As evident from these ratios, uludag firs are becoming dominant in the stand. When these stands are investigated with respect to age, scots pines are between 117 and 122; uludag firs are between 80 and 90 years of age. In other words, these stands have only scots pine in the first stage of their development phase and uludag fir partakes in the stands later. It will be reasonable that silvicultural process should be performed to increase scots pine regeneration in these stands.

Crimean pine and scots pine individuals in sample plots 3, 21, 25, 26, 30, 31, 38, 43 and 44 have straight, full balled and quality stems. These tree species occur in all vegetation layers. Uludag fir individuals have a crown ratio of 2/3 and they demonstrate tendency for branching down to the bottom. Few knots were observed on the tree stems. Needle cast diseases *(Lophodermium* sp) and needle rust (*Coleospohum* sp) diseases were determined in the needles of the scots pines. *Cytospora friesii* was identified in the needles of the

Table - 3: Distribution of macrofungi according to families in the research area

Families	Number of taxa	Percentage (%)
Hymenochaetaceae	7	13,20
Polyporaceae	6	11,30
Russulaceae	4	7,55
Cortinariaceae	3	5,66
Ganodermataceae	3	5,66
Hyaloscyphaceae	3	5,66
Lycoperdaceae	3	5,66
Tricholomataceae	3	5,66
Hapalopilaceae	2	3,77
Nectriaceae	2	3,77
Stereaceae	2	3,77
Strophariaceae	2	3,77
Agaricaceae	1	1,89
Bankeraceae	1	1,89
Dacrymycetaceae	1	1,89
Didymiaceae	1	1,89
Entolomataceae	1	1,89
Fomitopsidaceae	1	1,89
Gloeophyllaceae	1	1,89
Hypocreacea	1	1,89
Lepiotaceae	1	1,89
Melanconidaceae	1	1,89
Pleurotaceae	1	1,89
Schizophoraceae	1	1,89
Stemonitaceae	1	1,89
Total	**53**	**100**

15 years old uludag firs. However, the disease characterized by vertical black shuttle shape signs could not be identified yet. In these compartments, there are vertical cracks covered with the tissue of callus in the stems of uludag firs, and scots pines between 60 and 80 ages. These cracks do not occur due to any pathologic reason but rather it was thought due to physiological reasons.

Wood decay agents were identified on the trunks on the ground and tree stumps of scots pines, crimean pines and uludag firs in the study area. A list of 3 divisions, 10 orders, 25 families, 36 genera and 53 taxa of macro fungi are presented in Table 2. Their distributions according to families are given in Table 3.

The most common habitat for macrofungi is uludag fir. Among the fungi species in the region, *Trichaptum abietinum* is specific for uludag fir. Since the stems of uludag fir trees are soft, this fungus could easily grow on the tree and it is common in the research area. Consequently, it is an important lignicolous fungal type for uludag firs. *Galerina Ganoderma, Gloeophyllum, Gymnopilus, Hypholoma, Lentinus, Phellinus, Pleurotus, Polyporus* and *Stereum* species live as parasites and lignicolous. They are very harmful to trees. These fungi can spread their mycelium inside the transmission bunches of trees from the wounded and cut part of the trees. As a result, the trees (especially young and wounded old ones) become dry in a very short time. Beside their direct damage, there is also certain indirect damage. Wood decaying on the tree bark and transmission bunches by the fungal pathogens may encourage the other pathogen organisms and they also damage the trees. In addition, these species cause deterioration of the quality of wood by causing white and brown rots and decomposing the cellulose and lignin.

The second common habitat for macrofungi species is scots pine, while the third habitat is crimean pine. The typical fungal species found in scots pine trees are *Gloeophyllum, Inonotus, Neolentinus, Perenniporia Pleurotus* and *Polyporus.* These species grow on bark, stump and branch of scots pine. They are also very harmful and reduce the quality of trees. We only found *Inonotus* species on crimean pine. We can say that crimean pine is more resistant and in better health condition than scots pine and uludag fir. However, some species are not lignicolous fungi in the area. These saprobic species are *Agaricus, Entoloma, Handkea, Lactarius, Lycoperdon, Macrolepiota* and *Russula*.

In the examination done on the planted trees, *(Melampsorella caryophyllacearum* (Link) Schroter witches' brooms were determined on uludag firs. The existence of this disease was reported for the first time with this work in the Ilgaz Mountain National Park. This rust disease fungus infects firs' bud and attacks young shoots in spring. This goes on throughout the year and shoots start to appear as witches' brooms. The symptoms start to appear slowly. At the end of the first year, a small vertical swelling occurs on the infected shoots. In the spring of next year, infected branches give thicker and shorter shoots. The needles on such shoots are shorter, thicker and light green. This abnormal development goes on for a few years and at the end, witches' brooms shape occurs. Witches' brooms can be observed only on needles of that year. Initially they are light green but they turn into yellow in summer. The needles shed in autumn and the tree remains without any leafs in winter. Light green needles occur in spring. Circular or spindle shaped galls may occur in the infected branch on the bottom of this formation. The trees having many witches' brooms become weakened and then die. This kind of trees cannot maintain their liveliness. Alternate hosts of the pathogen are shrubs such as *Cerastium* spp and *Stellaria* spp. The aecidiospores of the fungi infect the leaves of the plants and cause burns in leafs and shoots (Butin, 1995).

It was observed from management plans that scots pine and crimean pine were dominant in the forest area of Yenice forest subdistrict headquarters in the past. However, the area has been narrowed as a result of pasturage, unlawful cutting and improper technical interventions. Their canopy is damaged and their quality has been reduced. Then, as a result of these, the area of Uludag firs has enlarged and they have become dominant in other areas. Crimean pines are dominant in the southwest at the lower altitudes. Stands of scots pine+Uludag fir take place in rather large areas. Stands of crimean pine+Uludag fir are fewer. The former silvicultural interventions were made in a wrong manner in favour of Uludag firs. If it is maintained in the same way, Yenice forest will turn into pure Uludag firs (Oner *et al*., 2006; Kondur *et al*., 2006; Simsek *et al*.,2006)

Pure stand formation in the research area would be an important factor; it can facilitate witches' brooms *(Melampsorella caryophyllacearum* Link Schroter) and other fungal diseases in these

areas. Most of the wood decay fungi were collected from cut fir trunks and fallen trees (Filip and Goheen, 1984; Mcfee and Stone, 1996; Mireille *et al*., 2004).

Among the determined species in the area, *Phellinus hartigii* and *Fomitopsis pinicola* species are especially an important parasite for Uludağ firs. *Ganoderma, Gloeophyllum, Phellinus, Polyporus, Stereum* and *Trichaptum abietinum*, species lead to diminishing of the wood quality by causing white and brown rots on the wood (Gordienko and Gorlenko, 1987; Yupina, 1987; Karen, 1993; Ryvarden and Gilbertson, 1994; Isikhuemhen *et al*., 2000; Whitney *et al*., 2002).

Silvicultural interventions are very important in order to prevent this situation. Applications in favour of Scots pine and Crimean pine can contribute to formation of mixed stands. It is also understood that this mixed stands have great importance for the study area for a sensitive ecosystem (Kile *et al*., 1991; Holah *et al*., 1993; Salo, 1993; Rouhier and Read, 1998; Misir *et al*., 2007).

Ilgaz mountain is located at the border of Ilgaz mountain National park. The park is an important place with respect to national mountaineering and forming water resources for the residential area around it (Kaya *et al*., 1997; Kaya and Raynal, 2001).

At the same time, it is located on the motorway of Cankiri-Ilgaz-Kastamonu. The slope of the motorway is so high and there is a possibility for landslide. In addition, there are several folded Uludag firs in the forest due to wind and snow. Thus, increasing scots pine and Crimean pine in the forest will be beneficial for the motorway and for winter tourism in this region (Konukcu,1998).

This study seems important in aspect of maintaining natural balance and forest ecosystems healthy. Forest are indicators of biological richness and could be protected by means of application of findings obtained as the result of this study with evaluation of currect literature, within localities that have similar ecological conditions.

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References

Akman, Y., E. Yurdakulol and M. Demirors: The vegetation of the Ilgaz mountains. *Ecologia Mediterranea*, **9**, 137-165 (1983).

Akman, Y., P. Quezel, E. Yurdakulol, O. Ketenoglu and M. Demirors: The vegetation of the summits of the Ilgaz Mountains. Ecologia Mediterranea,13, 119-129 (1987).

Aksoy, H.: Researches on Forest Communities of Karabuk-Buyukduz Research Forest and Their Silvicultural Properties. Istanbul University Publication No: 2332, Faculty of Forestry Publication No: 237, Istanbul (1978).

Avci, M.: Plant geography of Ilgaz mountains and surrounding areas I: Geographic distribution of plant cover. Istanbul University, *J. Geography Institute*, **7**, 137-216 (1998).

Blumenthal, M.: Geology of North Anatolian Series Between Bolu and Lower Kizilirmak. M.T.A Publication, Ankara (1948).

Breitenbach, J. and F. Kranzlin: Fungi of Switzerland I-V. Verlag Mykologia, Lucerne (1984-2000).

Butin, H.: Tree Diseases and Disorders. Oxford University Press, England (1995).

Callaway, R.M.: Positive Interactions and Interdependence in Plant Communities. Springer, Dordrecht (2007).

Dai, Y.C., B.K. Cui, H.S. Yuan and B.D. Li: Pathogenic wood-decaying fungi in China. *For. Pathol.*, **37**, 105-120 (2007).

Davis, P.H., R.R. Mill and K. Tan: Flora of Turkey and The East Aegean Islands (supplement). Vol. 10, Edinburgh University Press, Edinburgh (1988).

Ellis, M.B. and J.P. Ellis.: Fungi Without Gills (Hymenomycetes and Gasteromycetes). Chapman and Hill, London (1990).

Filip, G.M. and D.J. Goheen: Root diseases cause severe mortality in white and grand fir stands of the Pacific Northwest. *Forest Sci.*, **30**, 138-142 (1984).

Freckleton, R.P. and A.R. Watkinson: Nonmanipulative determination of plant community dynamics. *Trends Ecology Evolution*, **16**, 301-307 (2001).

Gordienko, P.V. and M.V. Gorlenko: Anthropogenic effects on the development of forest fungal diseases. *Mikol. Fitopatol.*, **21**, 377-387 (1987).

Guglielmo, F., S.E. Bergemann, P. Gonthier, G. Nicolotti and M. Garbelotto: A multiplex PCR-based method for the detection and early identification of wood rotting fungi in standing trees. *J. Applied Microbiology*, **103**, 1490-1507 (2007).

Hansen, E.M. and K.J. Lewis: Compendium of Conifer Diseases. APS Press (1997).

Heijari, J., A.M. Nerg, S. Kaakinen, E. Vapaavuori, H. Raitio, T. Levula, H. Viitanen, J.K. Holopainen and P. Kainulainen: Resistance of scots pine wood to brown-rot fungi after long-term forest fertilization. *Trees-Structure and Function*, **19**, 729-734 (2005).

Holah, J.C., M.V. Wilson and E.M. Hansen: Effects of a native forest pathogen *Phellinus weirii* on Douglas-fir forest composition in western Oregon. *Can. J. For. Res.,* **23**, 2473-2480 (1993).

Isikhuemhen, O.S, J.M. Moncalvo, F. Nerud and R. Vilgalys: Mating compatibility and phylogeography in *Pleurotus tuberregium*. *Mycol. Res*., **104**, 732-737 (2000).

Julich, W.: Aphyllophorales, Heterobasidiomycetes and Gastromycetes. Kleine Kryptogamenflora IIb/1. Gustav Fischer Verlag, Stuttgart-New York. (1984).

Karen, K.N.: Diversity of lignicolous basidiomycetes in coarse woody debris (*Eds*.: J.W. McMinn and D.A. Crossley). Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. p. 146 (1993).

Kaya, Z. and D.J. Raynal: Biodiversity and conservation of Turkish forest. *Biological Conservation*, **97**, 131-141 (2001).

Kaya, Z., E. Kun and A. Guner: National Plan for *In Situ* Conservation of Plant Genetic Diversity in Turkey. Report Submitted to the Ministry of Environment (MOE), The Republic of Turkey, Ankara (1997).

Kent, M. and P. Coker: Vegetation Description and Analysis a Practical Approach. John Wiley and Sons Ltd., England (1994).

Kijtewachakul, N., G.P. Shivakoti and E.L. Webb: Forest health, collective behaviors and management. *Environ. Manage*., **33**, 620-636 (2004).

Kile, G.A., G.I. McDonald and J.W. Byler: Ecology and disease in natural forests. Armillaria root disease. Agricultural Handbook No: 691, Forest Service, United States Department of Agriculture, 102-121, Washington DC (1991).

Kondur, Y., N. Oner and Z. Simsek: Harmful insects and relationships between certain tree properties in scots pine (*Pinus sylvestris* L.) of Ilgaz mountain, Cankiri, Turkey. *J. Biological Sciences*, **6**, 1065-1070 (2006).

Konukcu, M.: Nature Conservation and Protected Areas in Turkey. The State of Planning Organization (DPT), Ankara (1998).

McFee, W.W. and E.L. Stone: The persistence of decaying wood in the humus layers of northern forests. *Proc. Soil Sci. Am*., **30**, 513-516 (1996).

Meller, A.: The low - medium and montane forest communities on the northern aspect of Ilgaz Mountains in Northern Anatolia. Institute of Botany, University of Bodenkultur, Vienna (1993).

Met. Office: DMI Ilgaz Meteorology Station, Ilgaz (2006).

Mireille, D., B. Genevieve, B. Louis and B. Mathieu: The eastern boreal old-growth balsam fir forest: A distinct ecosystem. *Can. J. Botany*, **82**, 830-849 (2004).

Misir, M., N. Misir, N. and H. Yavuz: Modeling individual tree mortality for crimean pine plantations. *J. Environ. Biol*., **28**, 167-172 (2007).

Moser, M.: Keys to Agarics and Boleti. Gustav Fisher Verlag, Stuttgart (1983).

OGM: Management Plan for Yenice Forest District. Ankara Regional Forest Headquarters, Ilgaz Forest Subdistrict Headquarters, Ankara (1996).

Oner, N., Z. Simsek and Y. Kondur: The relationship between different growth parameters and damage of harmful insects in crimean pine of Ilgaz mountain, Cankiri, Turkey. *J. Biological Sci*., **6**, 1071-1076 (2006).

Ozalp, G.: Silvicultural evaluation of forest communities in Citdere (Yenice-Zonguldak) region. *Istanbul University Faculty of Forestry Journal*, A, **42**, 119-157 (1993).

Ozyuvaci, N.: Meteorology and Climatology. Istanbul University Publication No: 4196, Faculty of Forestry Publication: 460, Istanbul (1998).

Pacala, S.W.: Dynamics of plant communities. *In*: Plant ecology (*Ed*.: M.J. Crawley). Blackwell Scientific. pp. 532-555 (1997).

Riffle, J.W. and G.W. Peterson: Diseases of Trees in The Great Plains. USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-129, USA (1986).

Riva, A.: Tricholoma. Liberia Editrica Giovanna Biella I-21047, Saronno-Milano (1988).

Rouhier, H. and D.J. Read: Plant and fungal responses to elevated atmospheric carbon dioxide in mycorrhizal seedlings of *Pinus sylvestris*. *Environ. Exp. Bot.,* **40-3**, 237-246 (1998).

Rubner, K.: The Forest in Bavaria Forestry Practice. 4, Munich (1949).

Ryvarden, L. and R.L. Gilbertson: European Polypores Fungiflora, Oslo, Norway (1994).

Salo, K.: The composition and structure of macrofungus communities in boreal upland type forests and peatlands in North Karelia, Finland. *Karstenia*, **33**, 61-99 (1993).

Seppala, R.: The future of forest research in a changing world. *J. For. Res*., **9**, 313-316 (2005).

Simsek, Z., Y. Kondur and N. Oner: The damage of bark beetles and the relations between certain tree properties in Uludag fir (*Abies nordmanniana* subsp. *bornmulleriana* Mattf.) at Ilgaz mountain, Cankiri, Turkey, *J. Biological Sciences*, **6-6**, 1017-1022 (2006).

Sinclair, W. and H.H. Lyon: Diseases of Trees and Shrubs, 2nd Edn., Ithaca, NY: Cornell University Press (2005).

Skelly, J.M., D.D. Davis, W. Merrill, E.A. Cameron, H.D. Brown, D.B. Drummond and L.S. Dochinger: Diagnosing Injury to Eastern Forest Trees. Penn State College of Agricultural Sciences (1987).

Stephenson, S.L. and H. Stempen: Myxomycetes. A Handbook of Slime Molds, Timber Press (1994).

Strouts, R.G. and T.G. Winter.: Diagnosis of Ill-Health in Trees. Forestry Commission HMSO (1994).

Tilman, D.: Plant Strategies and the Dynamics and Structure of Plant Communities. Princeton University Press, Princeton, NJ (1988).

Volk, G.: The High subalpine and montane forest on the Northern Aspects of the Ilgaz Mountains in Northwest Anatolia. Thesis at the Institute of Botany, University of Bodenkultur, Vienna (1993).

Wenger, K.F.: Forestry Handbook. 2nd Edn., A Wiley-Interscience Publication, John Wiley and Sons, USA (1984).

Whitney, R.D., R.L. Fleming, K. Zhou and D.S. Mossa: Relationship of root rot to black spruce windfall and mortality following strip clear-cutting. *Can. J. For. Res*., **32**, 283-294 (2002).

Yupina, G.A.: Wood-attacking fungi of anthropogenic territories. *Mikol. Fitopatol.*, **21**, 224-225 (1987).