



SOME IMPORTANT SHOOT AND STEM FUNGI IN PINE (*Pinus* spp.) AND FIRS (*Abies* sp.) IN WESTERN BLACKSEA REGION, TURKEY

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ABSTRACT

This study was carried out to determine fungal diseases of pines and firs observed on the shoots and the stems in the Western Blacksea Region (Karabük, Ulus and Bartın State Forest Enterprises) between the years of 2001–2004. Five different fungi were determined on pines (*Pinus* sp.) and firs (*Abies* sp.) by this study. *Melampsora pinitorqua* and *Cronartium flaccidum* which cause rust diseases were determined only on pines. *Sphaeropsis sapinea* and *Gremmeniella abietina* were determined on pines and firs, while *Sirococcus strobilinus* was only found on firs. In this study, description of the disease agents, their symptoms, damages and distribution of the diseases are presented.

Keywords: Shoot, stem, fungi, pine, fire, western blacksea,

INTRODUCTION

Besides being raw material, wood is one of the most important materials which human race needs, since its sustainable characteristic is very important. Additionally, trees and forests which are sources of wood are valuable wealths for recreation. But shoot and stem fungi have great impact on trees growth like other diseases and pests, therefore valuable and effective output of wood decreased.

Vural and Tunçtaner (1971) determined that *Melampsora pinitorqua* caused different deformations on 2–5 years age pine shoots.

Nicholls and Robinson (1984) reported that *Sirococcus strobilinus* affected conifers in the Northern United States and Southern Canada, and the fungus infected the new shoots; diseased seedlings and saplings were especially affected.

Vural et. al. (1985) first time identified *Cronartium flaccidum* on pines in Turkey in 1969. The fungus caused drying, degeneration and death of saplings.

Peterson and Johnson (1986) determined that *Sphaeropsis sapinea* was a canker causing fungus killing new shoots, and causing severe infections that may lead to death of trees in all sizes.

Haugen (1997) said that *Gremmeniella abietina* was the most often observed in red and jack pine plantations in Michigan and Northern Wisconsin. According to Haugen there were two recognized strains of fungi. The North American strain usually causes damage primarily below six feet above ground. The European strain can cause damage throughout the crown of tree, and thus has the potential to be much more damaging.

Özkazanç (2007) observed that *Melampsora pinitorqua* was more dangerous for 1–10 years old pines.

The study aims at describing the disease agents, their symptoms, damages and distribution of the diseases.

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Introduction of The Fungus Species Identified

Five different fungi species causing disease on the shoots and stems of the pines and firs were identified by field and laboratory studies.

Melampsora pinitorqua Rostr.; At first it appears with aecidiums that can be seen among the pine shoots' barks turning into yellow (Butin, 1995). spring yellow blotchs of 3 cm height occur on the pine shoots. The fungus is diagnosed with orange-coloured urediums in poplar leaves and at the end of the growth period brown teliums appearing on the same poplar leaves in alternative host *Populus termula* (Apsen). The fungus causes C and S shaped twists on pine shoots (Hansen and Lewis 1997). The damage on poplars is limited by the decreased chlorophyll assimilation (Fig. 1) (Vural and Tunçtaner 1971, Özkazanç 2007).

Cronartium flaccidum (Alb. Ve Schw.) Winter; First appearing symptoms are pink coloured aecidiums, which have orange coloured aecidiospores, on pine shoots and stem (Vural et. al.1985; Hansen and Lewis 1997). Infections of pine and developing of aecidiums continue 3-4 years or more (Cummins and Hiratsuka 1983). Aecidiums of the fungus were determined as pink coloured, pyramidal shaped and of 2-3 mm height in area of the study. Aecidiospores are yellow-orange coloured, elipsoidal or oval shape. The fungus caused dieback, crown to die, hypertropies, open injuries and exudation of resin on pine shoots and stem (Fig. 2) (Vural et. al. 1985; Butin, 1995; Hansen and Lewis 1997).

Sphaeropsis sapinea (Fr.) Dylco&Juston; After the first symptoms that are sprout blight, shoots can't grow and their colors turn to yellow-brown and dwarf, needles turn to brown. Needles on the infected shoots change colour before budding. Exudation of resin occurs on infected shoots (Peterson and Johnson, 1986; Tisserat 2003). Dead grey-yellow-brown needles and twisted shoot sprouts, dwarfing and drying occur because of shoot infections (Hansen and Lewis 1997). While pycnidiums in fir needles, are oval shape and appear at the bottom surface of fir needles, They are long-spindle shaped and appear on the whole surface of pine needles. Conidiums are elipsoidal and 1 or 2 celled. The fungus causes cancer injuries on shoots and stem (Fig. 3)

Gremmeniella abietina (Largerberg) Morelet; ; The disease have started by drying of needles from bottom to top and after needles have casted, green spots have been seen under the barks of shoot (Haugen, 1997). The fungus has two different races of Europe and North America (Hansen and Lewis, 1997; Haugen, 1997). It causes death of seedlings and saplings, losses of growth, cancer of stem, death of crown, deformations and losses of wood quality (Sinclair et. al. 1996). The top parts of the apotheciums on top side of fir needles are bored and blistered shaped at the beginning stages. Apothecium dehiscences like a goblet in future periods. The fungus causes drying and diebacks of shoots (Fig. 4).

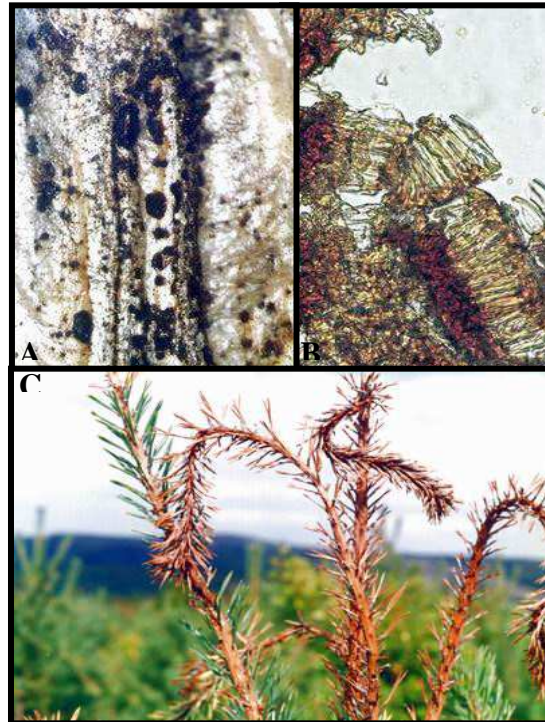


Figure 1. *Melampsora pinitorqua* A) Aecidiums on pine shoot B) Telium in poplar leaf (x10) C) Damage on pine shoots.



Figure 2. *Cronartium flaccidum* A) Aecidium on pine shoot B) Aecidiospores (x20) C) Damage on pine shoots and stem

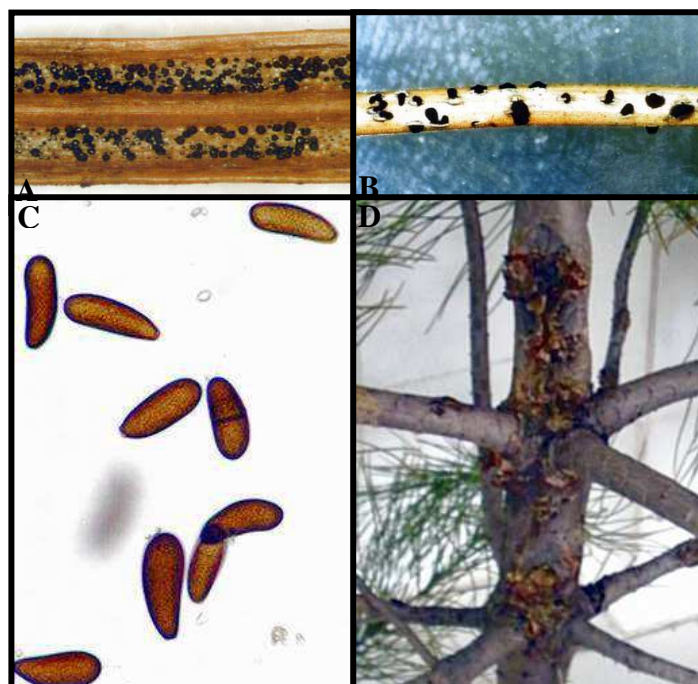


Figure 3. *Sphaeropsis sapinea* A) Pycnidiums un fir needles B) Pycnidiums un pine needles C) Conidiums (X 20) D) Damage on pine

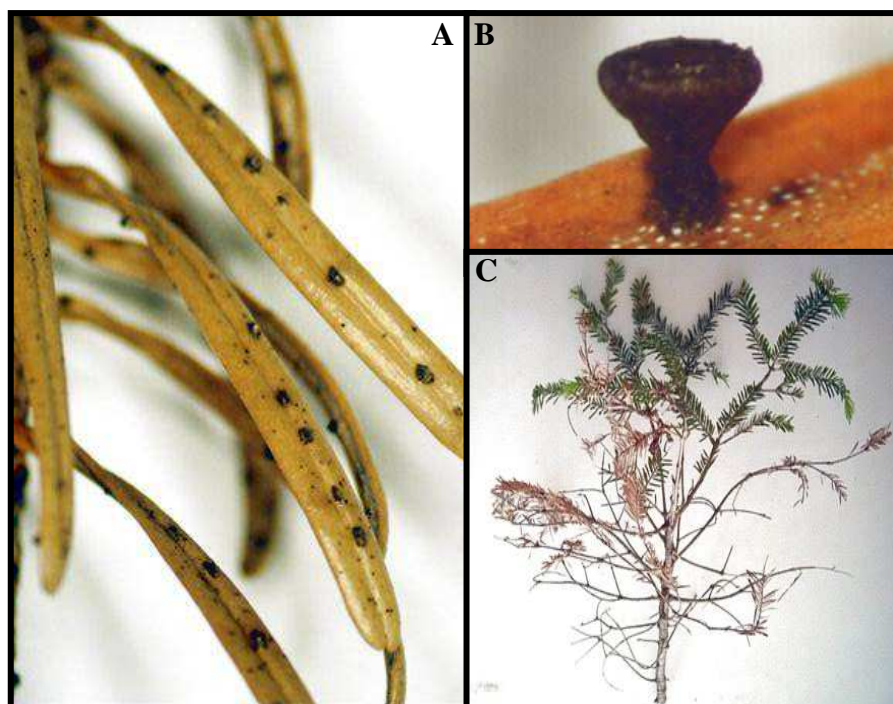


Figure 4. *Gremmeniella abietina* A) Apothecium of fir needles B) Mature apothecium (x7,5) C) Damage on fir
Sirococcus strobilinus (Preuss); The fungus causes exudation of resin, brown base of needles, chlorosis, twisted and dead shoots. Diebacks occur on shoots, cancer occurs on last year's shoots and the sprout parts of the shoots twist as cane (Nicholls ve Robinson, 1984; Butin, 1995). Pycnidiums which are of 0,5–1 mm diameter and blister shape occur on fir needles. The fungus causes twisted and dead shoots in area of the study (Fig. 5).

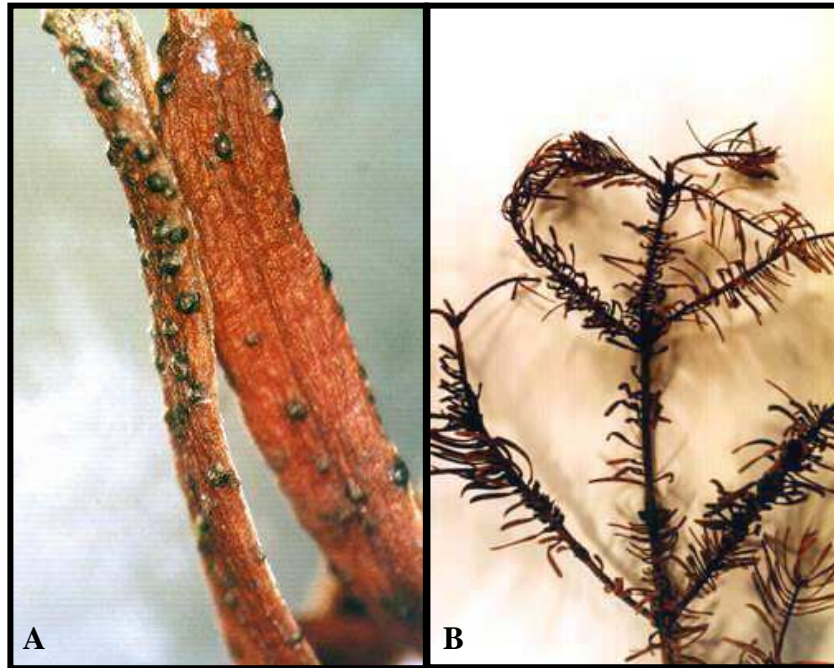


Figure 5. *Sirococcus strobilinus* A) Pycnidiums on fir needles B) Damage on fir

MATERIAL AND METHOD

Two different methods, field and laboratory studies were applied. The shoot, branch, needle and stem sections were collected from trees on which probable disease symptoms were observed through field studies. Specimens collected from land were classified in the laboratory and then preparats were prepared with curettage and section methods from parts of disease symptoms. The identification of the species was done by these preparats and land specimens were analysed by light and stereo microscope. To attain these aims in laboratory, Nikon ZMU stereo microscope and Nikon Eclipse E 400 light microscope were used to indentify fungi existing on shoot and stem of pines and firs. The preparats were prepared with water or saffron gelatine and then were analysed by x10, x20 and x40 focused. Butin (1995), Cummis and Hiratsuka (1983), Hansen and Lewis (1997) and Sinclair et. al (1996) are some of who which used it for indentifying the fungi.

RESULTS AND DISCUSSION

Pinus sylvestris L. (Scote pine), *Pinus nigra* Arnold (Austrian pine), *Pinus brutia* (Ten.) (Red pine), *Pinus pinea* L. (Stone pine), *Pinus pinaster* Ait. (Maritime pine), *Abies nordmanniana* supsp. *bornmülleriana* Mattf. (Caucasian fir) are the species have been observed in area of the study (Yaltırık, 1993).

The general imformation about determinated fungi by field and laboratory studies have been given at the Table 1.

Table 1. Identified fungi on pines and firs

Species	Host	Place	First Determination	Density
<i>Melampsora pinitorqua</i>	<i>Pinus sylvestris</i>	Karabük S.F.E. Dikmen F.S.H. number of 269,270,271 Forest division	1995	xxx
<i>Cronartium flaccidum</i>	<i>Pinus brutia</i>	Karabük S.F.E. Dikmen F.S.H. Kaplan plantation	02.05.2003	xx
<i>Sphaeropsis sapinea</i>	<i>Abies bornmülleriana</i> <i>Pinus sylvestris</i> <i>Pinus nigra</i>	Karabük S.F.E. Dikmen F.S.H. number of 269,270,271 Forest division	02.05.2003	xx
	<i>Pinus brutia</i>	Karabük S.F.E. Dikmen F.S.H. Kaplan plantation	09.04.2004	xx
<i>Gremmeniella abietina</i>	<i>Abies bornmülleriana</i> <i>Pinus sylvestris</i>	Ulus S.F.E. Uluyayla F.E.C. Location of Ahmet Usta	02.03.2003	xx
	<i>Pinus nigra</i>	Bartın F.E. Arıt F.S.H. Location of Cücübaşı	21.05.2004	x
<i>Sirococcus strobilinus</i>	<i>Abies bornmülleriana</i>	Ulus S.F.E. Merkez F.S.H Location of Güney Ören	18.10.2002	x

F.E.: State Forest Enterpris, F.E.C.: Forest Subdistric Headquarters xxx: high xx: midium, x: low

Melampsora pinitorqua on *Pinus sylvestris*, *Cronartium flaccidum* on *Pinus brutia*, *Sphaeropsis sapinea* on *Abies bornmülleriana*, *Pinus sylvestris*, *Pinus nigra*, *P. brutia*, *Gremmeniella abietina* on *Abies bornmülleriana*, *Pinus sylvestris*, *Pinus nigra* and *Sirococcus strobilinus* on *Abies bornmülleriana* were identified as a result of the investigations.

Sphaeropsis sapinea, *Gremmeniella abietina* and *Sirococcus strobilinus* are known the first records up to date in Turkey.

Melampsora pinitorqua, *Cronartium flaccidum*, *Sphaeropsis sapinea* were found in Karabük Forest Enterpris, *Gremmeniella abietina* was found in Ulus ve Bartın State Forest Enterprises, and *Sirococcus strobilinus* was identified in Ulus State Forest Enterpris.

Considering damage severity and distribution, *Melampsora pinitorqua* has been observed more intensively than the other fungus species in area of the study. However *Sirococcus strobilinus* was the species that appears the least and damage of which is the lowest. While damage of *Melampsora pinitorqua* has occurred on only shoots, damages of other fungi occur on needles, shoots and stem. Finally, *Melampsora pinitorqua* on 1-10 years old pines, *Cronartium flaccidum* more than 5 years old pines, *Sphaeropsis sapinea* and *Gremmeniella abietina* on stake age young pines and firs and *Sirococcus strobilinus* on mature firs have caused diseases in area of the study.

The following precautions can be applied for preventing to damage and distribution of these fungi.

- Infected saplings should not be in new plantations,
- The plantations must be established by native tree species,
- Alternative hosts of diseases can be eradicated in field,
- Dead and infected trees and pruning residues must be moved from area,

- Sanitation can be done to reduce the level of diseases available to infect new plantings on or adjacent to a site,
- Tree species which are resistant to diseases can be used for plantations,
- Effective fungicide programs must be developed for nurseries and plantations.

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