OCCURRENCE OF LEAF AND POD DISEASES OF SISSOO *(DALBERGIA SISSOO ROXB)* IN BANGLADESH

Shamim Shamsi[1], Razia Sultana[2] and Rumana Azad[3]

[1]Professor, [2]M.Phil Student and [3]MS Student, Department of Botany, University of Dhaka, Dhaka-1000, Bangladesh.
Email: prof.shamsi@gmail.com

ABSTRACT

Shamim Shamsi, Razia Sultana and Rumana Azad. 2012. Occurrence of leaf and pod diseases of sissoo (*Dalbergia sissoo Roxb)* in Bangladesh. Bangladesh J. Plant Pathol. 28(1&2):45-52.

A study was conducted to identify fungi associated with diseased leaves and pods of sissoo tree (*Dalbergia. sissoo* Roxb (Sisam). Associated fungi were isolated and identified following standard methods. The fungi associated with leaves were *Alternaria alternata* (Fries) Keissler, *Pseudocercospora dalbergiae* (Sun) Yen, *Chalara* sp., *Colletotrichum gloeosporioides* (Penz.) Sacc., *Cylindrocladium* sp., *Fusarium solani* (Mort.) Sacc., *Gebberella* sp., *Lasiodiplodia theobromae* (Pat.) Griffon and Maubol, *Memnoniella* sp., *Phyllactinia dalbergiae* Piroz. and its anamorph *Ovulariopsis sissoo* Shamsi, Sultana and Azad sp. nov, *Tetraploa* sp. and a rust fungus. From diseased pods, *Colletotrichum gloeosporioides* was isolated. This is the first report of association of *Chalara* sp., *Memnoniella* sp. and *Tetraploa* sp. with Sissoo from Bangladesh.

Keywords: Mycoflora**,** diseases, *Dalbergia sissoo*

INTRODUCTION

Dalbergia sissoo Roxb. (Sisam) is an important timber tree with high timber value. The plants are attacked by a number of diseases such as powdery mildew, leaf rust, leaf blight, collar rot, wilt, die-back and *Ganoderma* root rot of the tree are reported by various researchers. The plant is susceptible to dieback, wilt and several other soil borne pathogens (Sah *et al.* 2003). Mukerji and Bhasin (1986) reported leaf spots caused by *Cercospora sissoo, Cochliobolus lunatus, Colletotrichum sissoo, Cylindrocladium scoparium, Phomopsis dalbergiae, Phyllachora spissa, Phyllosticta sissoo*; leaf blight caused by *Colletotrichum gloeosporioides*; leaf rust caused by *Maravalia achora, Uredo sissoo* and powdery mildew caused by *Phyllactinia dalbergiae* from India. Pod was infected by *Catenulaster batistae, Glomerella cingulata* and *Septothyrella dalbergiae.* Bakshi (1974) isolated *Phellinus gilvus* from roots of trees affected by dieback. Richardson (1990) reported several species of *Aspergillus, Penicillium, Rhizopus, Alternaria, Fusarium, Chaetomium, Drechslera* and *Curvularia* from forest tree seeds. Parajuli *et al.* (1999) reported *Fusarium oxysporum* from *Dalbergia sissoo* on water-logged soils in Nepal. Manadhar *et al.* (2000) isolated *Botryodiplodia* sp. and *Fusarium solani* from five diseased samples of *D. sissoo.* Khan *et al.* (2001) detected *Aspergillus niger, A. flavus, A. terreus, Aspergillus* sp., *Alternaria alternata, Chaetomium* sp., *Drechslera australiensis, Fusarium pallidoroseum, F. solani, Fusarium* sp., *Penicillium* sp., *Rhizopus* sp., and *Geotrichum* sp. from seeds of shisham trees. Rajput *et al.* (2008) isolated *F. solani, Rhizoctonia solani* and *Curvularia lunata* as predominant fungi from shisham trees infected with dieback. From Bangladesh, Muehback *et al.* (2010) isolated *F. oxysporum* and *Lasiodiplodia theobromae* from dieback symptom of sissoo. Shamsi *et al.* (2008) reported *Phyllactinia dalbergiae* and *Ovulariopsis sissoo* from powdery mildew infected plant parts. Information about fungi associated with diseased leves and pods of Sisso tree is limited in Bangladesh (Shamsi *et al.* 2008). The present study was conducted to identify fungi associated with diseased leaves and pods of Sisso trees.

MATERIALS AND METHODS

Diseased leaf and pod samples of Sisso were collected from Dhaka, Chittagong and Pabna districts during October 2008 to January 2010. Associated symptoms were recorded. The severity of disease on leaves was estimated visually using a 0-9 subjective scale, where 0= no infection, 1= up to 10% leaf area infected, 2= 10 – 20% leaf area infected, 3=20 – 30% leaf area infected, 4= 30 – 40% leaf area infected, 5= 40 – 50% leaf area infected, 6= 50 – 60% leaf area infected, 7= 60 – 70% leaf area infected 8= 70 – 80% leaf area infected and 9= 80% and above leaf area infected (Ghos *et al.* 2009).

Fungi associated with diseased samples were isolated following “tissue planting method" and "blotter method” (Anon. 1968). In case of “tissue planting method” fifty inocula, each measuring 2 mm^2 was cut from a particular specimen. The inocula were washed in sterile water and surface sterilized by dipping in 10.0%

Chlorox for 3-5 minutes. Three inocula were placed in each Petri plate containing sterilized potato dextrose agar (PDA) medium and incubated for 5-7 days at 25±2C. In "blotter method" moist chambers were made by placing two layers of filter paper on the bottom of the Petri plates. In each Petri plate, 5 surface sterilized inocula were placed and 10 plates were used. The inoculated plates were incubated at room temperature. The fungi growing out of the inocula were transferred to separate PDA plates and slants, and stored in a refrigerator for further studies. Prevalence of fungi associated with the specimens was expressed in percentage based on total number of leaf and pod samples checked. Identification of the isolated fungi was done using standard literature (Ellis 1971, 1976, Ellis and Ellis 1982, Sutton 1980). All the specimens were preserved in the Herbarium, Mycology and Plant Pathology Section, Department of Botany, University of Dhaka, Bangladesh.

RESULTS AND DISCUSSION

Different types of symptoms representing seven diseases were found on diseased leaves of *D. sissoo*. These were anthracnose, powdery mildew, angular leaf spot, leaf blight, leaf spot and leaf rust. Anthracnose symptom was also noticed on infected pods (Table 1 and Plate I-VI). Their prevalence is shown in Figure 1.

Anthracnose: Anthracnose was found in all leaf samples (Plate I A) collected from Savar and Pabna. The disease also appeared on pod samples (Plate I B & C) collected from only Pabna (Table 1). The highest disease severity index of 8 was recorded in the month of March and the index value was 6 during April to December 2009 (Fig. 1). *Colletotrichum gloeosporioides* was associated with leaf and pod samples infected with anthracnose (Plate I D).

Powdery mildew: Symptoms of powdery mildew caused by imperfect stage of the pathogen (*Ovulariopsis sissoo* Shamsi, Sultana and Azad) (Plate II A & B) were recorded from five leaf samples collected from Dhaka (Table 1). Powdery mildew symptoms developed by perfect stage of the fungus (*Phyllactinia dalbergiae*) (Plate III A & B) were found on two leaf samples collected from Dhaka and two from Savar (Table 1). The infection starts in the middle of October 2008 with the formation of a white mycelial growth mostly on the lower surface of the leaves. With the age, the mycelium and conidiophores bearing conidia become grayish-white to pale yellow. By the end of December most of the leaves on the trees are covered with white colony growth of the fungus, perithecia start to form, which were initially orange in colour. The ascocarps turn into brown with the progress of the disease and ultimately become black at maturity. The powdery mildew causes severe defoliation but never kills the tree. New leaves develop with the advent of spring. The highest severity index of 8 was recorded in the month of January and 7 in November and December, 2009. Perithecia formed during February to March. Perithecia were found in the samples collected from Dhaka (Fig. 1 and Table 1).

Angular leaf spot: Angular leaf spot symptoms (Plate IV A) were frequently noticed on leaves collected from Chittagong (Table 1). The causal fungus of angular leaf spot was identified as *Gibberella* sp. (Plate IV B).

Leaf spot: The disease appears as small circular spots on leaves. The size of the spots increases with the progress of times. Larger spots develop due to coalescence of closure spots (Plate IV C). The causal pathogen, *Pseudocercospora dalbergiae* (Plate IV D) attacks the leaves mostly on the lower surface producing yellowish to grayish-green discoloration. The mycelium is brown and intra-epidermal. The fungus produces asexual fruiting structure in July and August 2009. In the month of January, its severity index was 4. The highest disease index of 7 was recorded in the month of October and 5 in the month of November 2009 (Fig. 1 and 2 and Table 1).

Leaf blight: The leaf blight symptom was associated with leaf samples collected from Savar (Plate IV A and Table 1). Several fungi namely *Alternaria alternata*, *Chalara* sp., *Cylindrocladium* sp., *Fusarium solani*, *Lasiodiplodia theobromae*, *Memnoniella* sp. and *Tetraploa* sp. were found to be associated with leaf blight infected samples (Plate V B-H). The fungi were associated with leaf samples during June to October 2009 and their prevalence ranged 5.88-16.67% (Fig. 1).

Rust: The rust disease appeared during January to March on leaves (Plate VI) and young twigs. Uredinial sori are yellowish and formed on the lower surface of the leaves (Plate V). The fungus was found in the samples collected from Savar (Table 1) It severity varied with months (Fig. 1). Present report is slightly differing from the observation of Bakshi (1967). The author reported that the rust disease appeared in January to March on leaves and juvenile twigs and continued attacking the foliage and young twigs up to July and August. The infection declines following monsoon rains. The affected parts are killed resulting in die-back and subsequent death of affected seedlings. *Maravalia achroa* is recorded on seedling in nurseries from Uttar Pradesh, Bihar, Maharashtra and Assam. The disease also occurs on young plantations but not in as severe form as in the nurseries.

Table 1. Fungi associated with leaf and pod samples of *Dalbergia sissoo* having different types of symptoms collected from various locations of Bangladesh during December 2008 to January 2010

Sample No	Date of collectio	Locality	Diseases	Plant parts	Identified fungi
SS 2136	08-12-2008	Pabna	Anthracnose	Leaf	*Colletotrichum gloeosporioides*
SS 2138	27-01-2009	Pabna	Anthracnose	Pod	*Colletotrichum gloeosporioides*
SS 2164	10-03-2009	Savar	Anthracnose	Leaf	*Colletotrichum gloeosporioides*
SS 2171	17-06-2009	Savar	Anthracnose	Leaf	*Colletotrichum gloeosporioides*
SS 2174	22-07-2009	Savar	Anthracnose	Leaf	*Colletotrichum gloeosporioides*
SS 2184	04-07-2009	Savar	Anthracnose	Leaf	*Colletotrichum gloeosporioides*
SS 2152	22-01-2009	Dhaka	Anthracnose	Leaf	*Ovulariopsis sissoo*
SS 2157	17-02-2009	Dhaka	Powdery mildew	Leaf	*Ovulariopsis sissoo*
SS 2183	15-11-2009	Dhaka	Powdery mildew	Leaf	*Ovulariopsis sissoo*
SS 2185	06-12-2009	Dhaka	Powdery mildew	Leaf	*Ovulariopsis sissoo*
SS 2158	19-02-2009	Dhaka	Powdery mildew	Leaf	*Ovulariopsis sissoo*
SS 2160	02-03-2009	Dhaka	Powdery mildew	Leaf	*P. dalbergiae*
SS 2163	05-03-2009	Dhaka	Powdery mildiew with perithicia	Leaf	*Phyllactinia dalbergiae*
SS 2184	22-11-2009	Savar	Powdery mildiew with perithicia	Leaf	*P. dalbergiae*
SS 2172	08-07-2009	Savar	Powdery mildiew with perithicia	Leaf	*P. dalbergiae*
SS 2170	17-06-2009	Savar	Blight	Leaf	*Fusarium solani*
SS 2175	22-07-2009	Savar	Blight	Leaf	*Alternaria alternata*
SS 2177	05-08-2009	Savar	Blight	Leaf	*Tetraploa* sp.
SS 2179	19-08-2009	Savar	Blight	Leaf	*L. theobromae*
SS 2180	26-08-2009	Savar	Blight	Leaf	*Memnoniella* sp.
SS 2182	07-10-2009	Savar	Blight	Leaf	*Cylindrocladium* sp.
SS 2181	23-11-2009	Chittagong	Angular spot	Leaf	*Gibberella* sp.
SS 2186	12-12-2009	Savar	Rust	Leaf	Urediospor
SS 2207	12-01-2010	Savar	Rust	Leaf	Urediospor

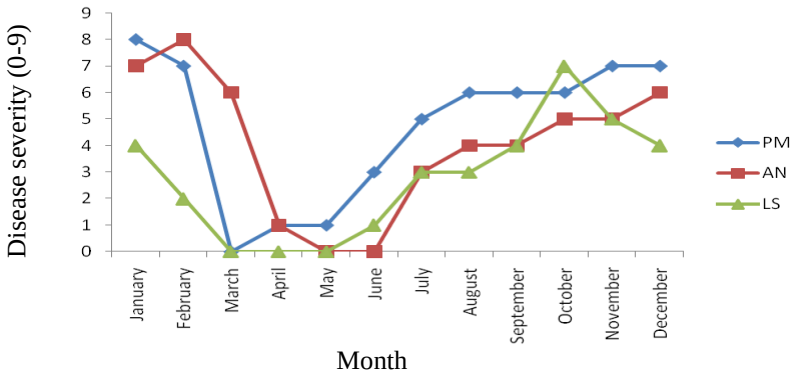


Fig. 1. Disease progress curve of powdery mildew (PM), anthracnose (AN) and leaf spot (LS) symptoms recorded on *Dalbergia sissoo* from January to December 2009.

Fungi associated with diseased leaves and fruits: A total of 13 fungal species namely, *Alternaria alternata*, *Pseudocercospora dalbergiae*, *Chalara* sp., *Colletotrichum gloeosporioides*, *Cylindrocladium* sp., *Fusarium solani*, *Gibberella* sp., *Lasiodiplodia theobromae*, *Memnoniella* sp., *Ovulariopsis sissoo*, *Phyllactinia dalbergiae*, *Tetraploa* sp. and an unidentified rust fungus were found associated with infected leaves of *D. sissoo*. Prevalenc of *P. dalbergiae* was the highest followed by *C. gloeosporioides*, *O. sissoo*, and *A. alternata* showing the prevalence of 52.94, 46.67 and 16.67%. Prevalence of *F solani*, *P. dalbergiae* and *Gibberella* sp. was 11.76, 11.76 and 11.11%, respectively. The most prevalence of 5.88 was recorded in *Chalara* sp., *Cylindrocladium* sp., *Memnoniella* sp., rust fungus and *Tetraploa* sp. *Colletotrichum gloeosporioides* was isolated from infected fruits (Fig. 2).

Results of the present study reveal that at least 13 species of fungi are associated with diseased leves of Sisso tree. The leaf spot, anthracnose and powdery mildew are the major diseases of *D. sissoo* in Bangladesh. The environment of Savar is favorable for growth and development of most the fungi than Chittagong, Dhaka and Pabna. Association of *Chalara* sp., *Memnoniella* sp. and *Tetraploa* sp. with *D. sissoo* is new records in Bangladesh.

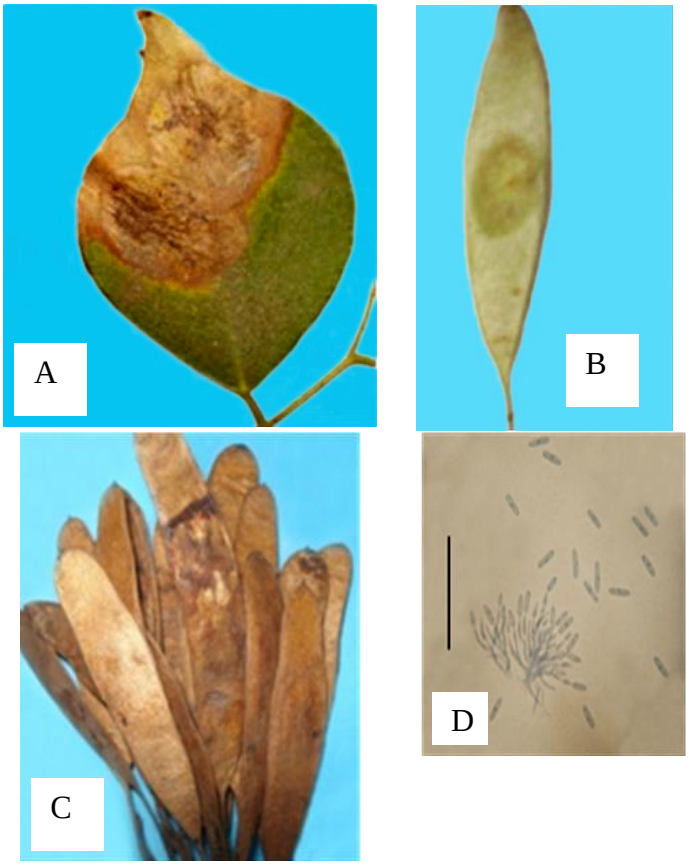


Plate I. Photographs showing symptoms of anthracnose on leaf (A) and on pod (B&C) of *Dalbergia sissoo* caused by *Colletotrichum gloeosporioides* (D)

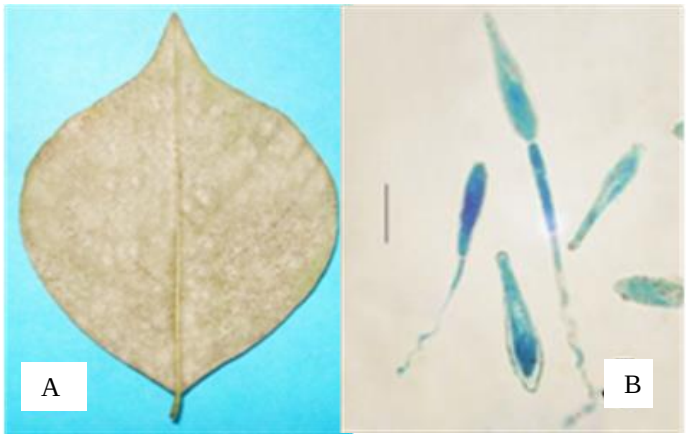


Plate II. Photographs showing symptoms of powdery mildew on leaf of *Dalbergia sissoo* caused by *Ovulariopsis sissoo* ((A & B) [Bar = 50 µm].

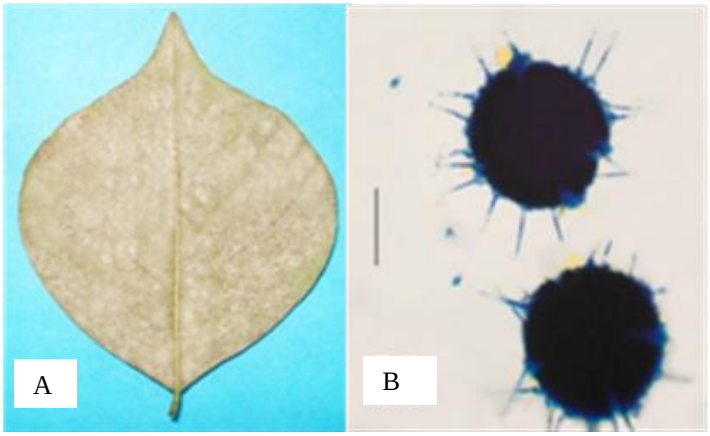


Plate III. Photographs showing symptoms of powdery mildew on leaf of *Dalbergia sissoo* caused by *Phyllactinia dalbergiae* (A & B) [Bar = 50 µm].

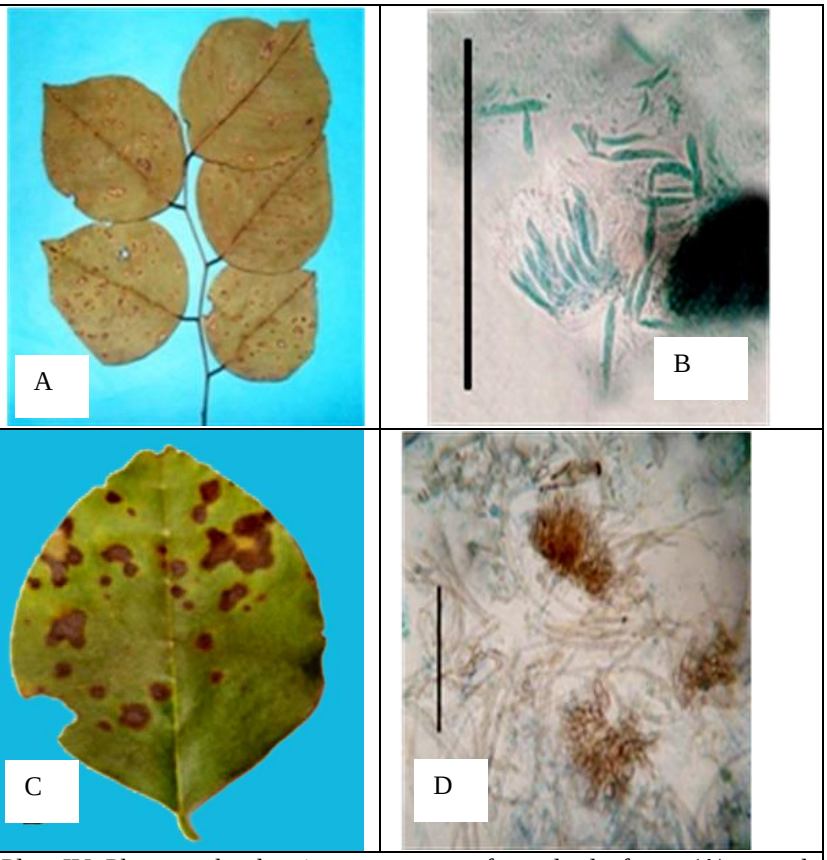
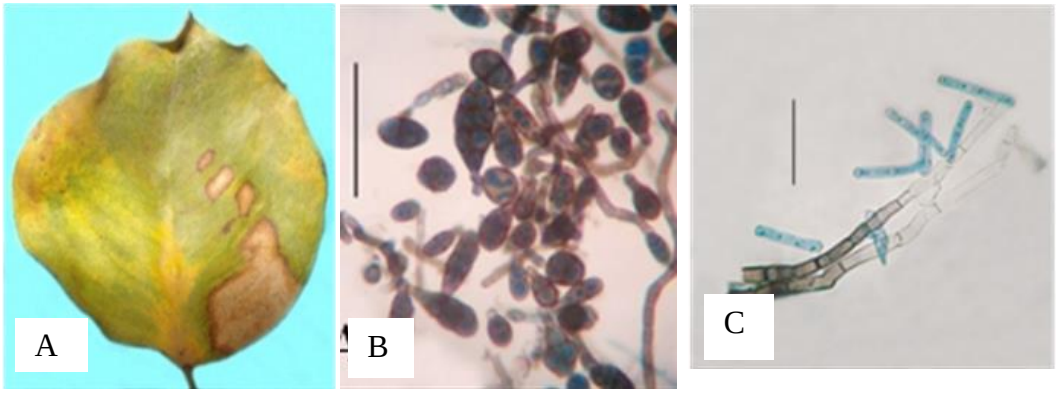
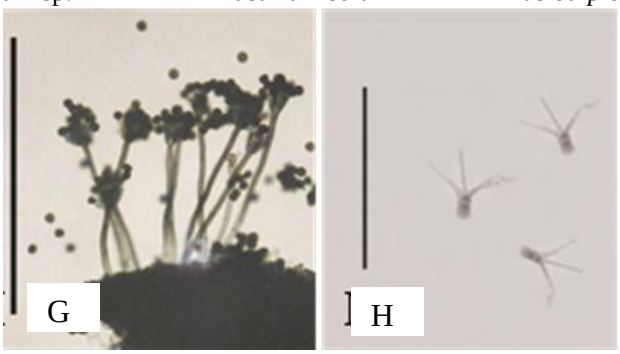


Plate IV. Photographs showing symptoms of angular leaf spot (A) caused by *Gibberella* sp. (B) and leaf spot (C) caused by *Pseudo-cercospora dalbergiae* (D).



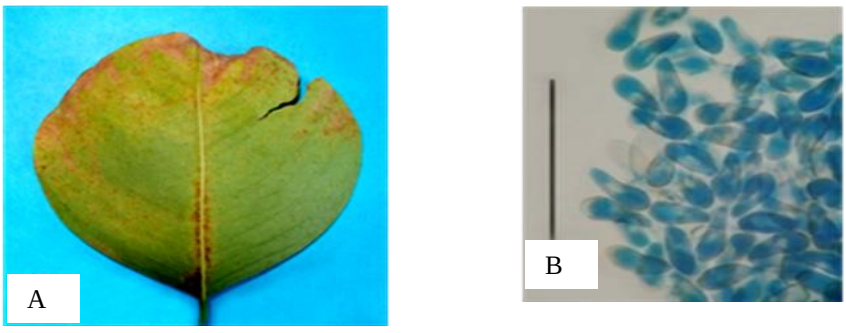
Leaf blight symptoms *Alternaria alternata* *Chalara* sp.

Cylindrocladium sp. *Fusarium solani* *Lasiodiplodia theobromae*.



Memnoniella sp. *Tetraploa* sp.

Plate V. Photographs showing symptoms of leaf blight symptoms (A) of *Dalbergia sissoo* and fungi associated with the blighted leaves(B-H) (Bar = 50 µm)



Rust disease An unidentified species of rust fungus

Plate VI. Symptoms of rust disease on leaf (A) of *Dalbergia sissoo* caused by an unknown species of rust fungus (B) (Bar = 50 µm)

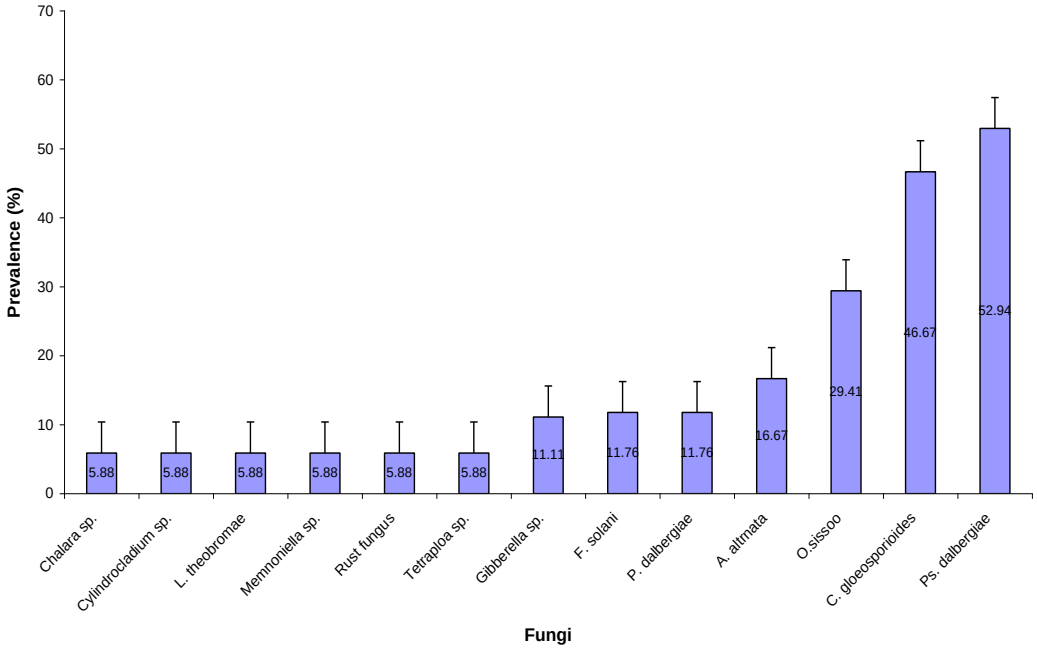


Fig. 1. Prevalence of fungi association with infected leaf samples of *Dalbergia sisso* grown in Bangladesh

LITERATURE CITED

Anonymous. 1968. Plant Pathologist's pocket Book. Commonwealth Agricultural Bureau (CAB), The Commonwealth Mycological Institute, Kew, Surrey, England. pp. 1-267.

Bakshi, B. K. and Sing, S. 1967. Rusts on Indian forest trees. Indian Forest Res. (N.S.). Forest Pathol. 2:139-198.

Bakshi, B. K. 1974. Control of root disease in plantation in reforested stands. *Indian Forester*. 100: 77-78. Booth, C. 1971. The Genus *Fusarium*. The commonwealth Mycological Institute, England. 273 p.

Ellis, M. B. 1971. Dematiaceous Hyphomycetes. CMI, England. 608 p.

Ellis, M. B. 1976. More Dematiaceous Hyphomycetes. CMI,England. 507 p.

Ellis, M. B. and Ellis, J. P. 1985. *Microfungi on Land Plants*. Biddles Ltd., Guildford and Kings Lynn, Great Britain. 818 p.

Ghosh, P. P., Mandal, D., Laha, S. and Dasgupta, M. K. 2009. Dynamics and severity model in managing fungal diseases. J. Pl. Ptotec. Sci. **1**(1):55-59.

Khan, S. M., Shakir, A. S., Tabssum, M. A. and Rehman, A. 2001. Isolation and identification of different fungi from diseased shisham tree. Proc. 3rd Natl. Conf. of Pl. Pathol. Oct. 1-3, 2001. NARC, Islamabad. pp. 44-46.

Manadhar, G., Shrestha, S. K., Appanah, S., Allard, G. and Amatya, S. M. 2000. Fungi associated with dieback of Sissoo. Proc. Intl. Sem., Nepal (18): 27-29.

Muehlback, H. P., Tantau, H., Renk, S., Schults, D., Woelki, S., Meyer, H., Schulze, J., Palm, D. Stubee, A., Fennemann, M., Valdez, N., Sarker, R. H., Alam, Sk. S, Saha, M. L., Khan, M. S and Haque, M. I. 2010. Molecular detection and characterization of biotic agents associated with dieback disease of *Dalbergia sissoo* Roxb. in Bangladesh. *In*: Role of biotechnology in food security and climate change. Proc. Sixth Intl. Pl. Tiss. Cult. Biotech. Conf. Decmber 3-5, 2010. pp.131-143.

Mukerji, K. G. and Bhasin, J. 1986. Plant diseases in India. A source Book. Tatta Mc.Grew-Hill Publishig Company Ltd. New Delhi. 467 pp.

Parajuli, A.V., Bhatta, B. M., Adhikary, K., Tuladhar, J. and Thapa, B. 1999. Causal agents responsible for the dieback of *Dalbergia sissoo* Roxb., in the eastern Nepal Terai. Ban Ko Jankari. 9: 7-14.

Rajput, N. A., Pathan, M. A., Jiskani, M. M., Rajput, A. Q., and Arain, R. R. 2008. Pathogenicity and host range of *Fusarium solani* (Mart.) Sacc., causing

dieback of Sisham (*Dalbergia sissoo* Roxb.). Pak. J. Bot., 40(6): 2631-2639.

Richardson, M. J. 1990. An Annotated List of Seed-borne Diseases. 4th ed. ISTA, Zurich.

Sah, S. P., Sharma, C. K. and Sehested, F. 2003. Possible role of the soil in the Sissoo forest (*Dalbergia sissoo* Roxb.) decline in the Nepal Terai. Pl. Soil Environ. 49: 378-385.

Shamsi, S., Razia Sultana and Rumana Azad. 2008. New record of *Phyllactenia dalbergae* Piroz. and its anamorph *Ovulariopsis sissoo* sp. nov. on *Dalbergia sissoo* Roxb. from Bangladesh. Bangladeh J. Plant Pathol. 24 (1&2): 87-89.

Sutton, B. C. 1980. The Coelomycetes, Fungi Imperfect with pycnidia Acervuli and Stroma. CMI Kew Surrey, England. pp. 525-537.