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Fungal diseases of Oak Tasar host plants (*Quercus* spp.) in Manipur

T. CHANU NG. AND G. K. N. CHHETRY
Department of Life Sciences, Manipur University, Canchipur 795003, Imphal, Manipur

Quercus serrata and *Q. grifitti* are the two common food plants for Oak Tasar silkworm (*Anthereae proylei* J.). These plants are occasionally attacked by fungal diseases. In the present investigation three fungal diseases namely sooty mould (causal organism : *Chactophoma quercifolia*), rust disease (causal organism : *Cronartium quercum*) and powdery mildew (causal organism : *Phyllactinia corylea*) were found to attack these plantation mostly from March to November during the year. Another fungal disease namely leaf blister is also found to occur during the year.

One year survey data on plantation revealed that disease incidence and severity increased from May to November and gradually decreased in the winter month due to abnormal sprouting and leaf fall. These diseases were mostly air borne.

Effect of epidemiological factors on the development of these diseases on Oak Tasar host plant plantation farm was also investigated.

Key words : *Anthereae proylei, Chactophoma quercifolia, Cronartium quercum, Phyllactinia corylea*

INTRODUCTION

Various fungal diseases are found to occur in various oak species commonly in *Quercus serrata* and *Quercus grifitti* in Manipur (Ghosh *et al.*, 1992). *Quercus* species are important food plants for oak tasar silkworm (*Antherea proylei* Jolly). Fungal disease on plants affect the nutritive value of leaves thereby rendering them unfit for silkworm consumption during summer and autumn season.

Another fungal disease called anthracnose may causes defoliation of most maple, oak, elm etc. Damage of this type usually occurs after unusually cool, wet weather during bud break. Microscopic species of most anthracnose fungi are produced in inflected tissue during April and March. Long rainy period helps the fungus to spread rapidly. There are also many information regarding the mortality of oak trees caused by *Raffalea quercivora* and infection by some hyphomycetes fungi in Nepal (Adhikari and Manandhar, 1990). Bagchee and Ujagan (1954) have also reported a serious heart rot disease of oak.

MATERIALS AND METHODS

For the isolation of internally seed borne fungi the seeds were surface sterilized with 0.1% mercuric chloride solution for 2 to 3 minutes followed by washing with sterilized distilled water and the sterilized seeds were placed in double layer moist blotting paper and PDA medium separately and incubated at 27±1°C for 6 days. After 6 days, the microbial growth coming out of the seeds were isolated, purified and maintained in PDA medium.

The mycoflora of leaf were isolated by using leaf impression method. Leaf was cut into many pieces and these pieces were pressed against the PDA in Petri plates at 5-6 places. Plates were incubated at 26°C in an inverted position for 7 days. The fungal growth was transferred to PDA slants, purified and maintained in PDA.

Roving survey was conducted for the occurrence and identification of fungal diseases of the *Quercus* spp. in two particular places namely Regional Tasar Research Station (RTRS) Mantripukhri and State farm Khonghampat (SFK) for the year 2005. Monthly roving survey data on disease incidence and diseases severity were recorded. Besides roving survey, a field experiment was conducted at Khabam, 6 km away from Imphal under Imphal East district of Manipur where *Quercus serrata* and *Quercus graffiti* were laid out in a randomized block design (RBD) experiment. Nursery of these varieties were raised during the month of December of previous year of plantation (i.e. 2004). Disease parameters of fungal diseases of nursery were also recorded. Transplantation of nurseries to readily prepared plots of randomized block design (RBD) were done during February of each of plantation. Field lay out was prepared without any fertilizers. Data on disease incidence and disease severity were recorded at monthly interval corresponding to the various growth stages of the *Quercus* spp.

Data on environmental factors such as temperature, rainfall and humidity were recorded on the sampling dates of fungal disease of *Quercus* spp. from the experimental site.

Percentage data on disease parameters were transformed using angular transformation (Sharma, 1996) and statistical analysis such as correlation coefficient was worked out using the following standard formula :

$$\text{Correlation coefficient (r)} = \frac{\sum xy}{\sqrt{\sum x^2 y^2}}$$

Where $x = (\bar{X} - \bar{X})$, $Y = (Y - \bar{Y})$, $x^2 = (X - \bar{X})^2$, $y^2 = (y - \bar{Y})^2$

Disease incidence and disease severity were recorded at monthly interval coinciding the growth stages of the plants and disease incidence (DI) and disease severity (DS) were recorded using the following equations.

$$\% \text{ Disease incidence (DI)} = \frac{\text{Number of leaves infected by a particular disease}}{\text{Total number of leaves under observation}} \times 100$$

$$\% \text{ Disease severity (DS)} = \frac{\text{Sum of all numeral rating}}{\text{Total number of leaves observed} \times \text{maximum scale (i.e. 9)}} \times 100$$

Here, disease rating was done using 0-9 scale i.e, 0,1,3,5,7,9 as used in the International Institute of disease scoring with certain modification (Mayee and Datar, 1986).

Small portion of pure culture so obtained were mounted on a sterilized slide using cotton blue and observed under microscope. Identification of pathogen was made by consulting the standard literature (Barnett and Hunter, 1972 ; Gilman *et al.*, 1959 ; Ghosh *et al.*, 1992).

Isolates of pathogen were used for pathogenicity test on two varieties of *Quercus* spp. using pot culture plants.

RESULTS AND DISCUSSION

A total of 14 fungal species were associated with the seeds of *Quercus serrata* and *Quercus grifitti*. Maximum numbers of fungi were found to be associated with uncoated seed placed in PDA medium. *Aspergillus niger* and *Rhizopus* species were found to be associated both with coated as well as uncoated seeds.

Percentage frequency of fungi associated with uncoated seeds was much higher than percentage frequency of fungi associated with coated seeds of *Quercus serrata* and *Q. grifitti*.

The percentage of fungi associated with uncoated seeds in summer season by Blotter (method) showed highest value i.e. 166 and Blotter (coated) : 100.13 than other PDA (uncoated): 87.78, PDA (coated) : 81.56, for *Quercus serrata* and Blotter (uncoated) : 128.68, Blotter (coated) : 98.02, PDA (uncoated) : 87.78 and PDA (coated) : 78.58 for *Quercus grifitti* (Table 1).

The percentage of fungi grown in rainy season at Blotter (uncoated) is 100 and Blotter (coated) : 99.91 than other PDA (uncoated) : 128.95, PDA

Table 1 : Percentage frequency of Coated and Uncoated mycoflora of seeds of two varieties of *Quercus* spp. namely *Quercus serrata* and *Quercus grifitti* using PDA and Blotter method during summer in the year 2005.

Fungi	*Quercus serrata* (V_1)				*Quercus grifitti* (V_2)			
	PDA/ Uncoated	PDA/ Coated	Blotter/ Uncoated	Blotter/ Coated	PDA/ Uncoated	PDA/ Coated	Blotter/ Uncoated	Blotter/ Coated
Alternaria alternata	3.17	-	-	-	3.17	-	-	9.52
Alternaria longipe	1.55	-	4.00	-	1.55	-	-	-
Aspergillus niger	12.69	17.60	12.00	23.07	12.69	10.07	16.07	4.76
A. flavus	6.51	-	-	-	6.51	12.50	12.07	5.52
A. fumigatus	7.21	-	8.00	7.77	7.21	19.65	19.50	-
A. oseus	6.34	-	-	15.38	6.34	-	-	-
Cladosporium cladosporoides	3.17	29.82	13.00	-	13.17	7.14	9.64	18.14
Fusarium fusaroides	6.34	-	-	-	6.34	3.57	-	7.76
F. semitectum	3.17	-	-	-	3.17	-	6.45	-
Mucor spp.	6.34	5.89	12.00	30.16	63.34	5.37	10.14	18.14
Penicillium notatum	7.21	10.60	20.00	15.38	7.21	14.28	19.14	23.66
Rhizopus spp.	11.11	11.760	14.00	7.77	17.11	-	29.03	9.52
Trichoderma album	7.21	-	-	-	7.21	-	-	-
Trichoderma lingnorum	5.76	-	-	-	5.76	-	-	-
Total	87.78	81.56	166.00	100.13	87.78	78.58	128.68	98.02

Table 2 : Percentage frequency of Coated and Uncoated mycoflora of seeds *Quercus serrata* and *Quercus grifitti* using PDA and Blotter method during rainy in the year 2005.

Fungi	*Quercus serrata* (V_1)				*Quercus grifitti* (V_2)			
	PDA/ Uncoated	PDA/ Coated	Blotter/ Uncoated	Blotter/ Coated	PDA/ Uncoated	PDA/ Coated	Blotter/ Uncoated	Blotter/ Coated
Alternaria alternata	1.55	4.00	20	-	3.17	-	4.71	20.00
Alternaria longipe	3.17	-	30	-	1.55	-	-	-
Aspergillus niger	17.39	12.00	-	33.30	6.51	-	23.09	30.00
A. flavus	8.69	-	-	-	7.21	16.07	4.76	-
A. fumigatus	6.51	-	-	22.2	6.34	-	-	-
A. oseus	7.21	-	20	-	3.17	12.50	-	20.00
Cladosporium cladosporoides	21.70	-	-	-	6.34	-	-	-
Fusarium fusaroides	6.34	8.00	-	-	6.34	3.57	4.28	-
F. semitectum	4.34	-	1.00	-	6.34	3.57	-	-
Mucor spp.	34.30	13.00	-	-	7.21	5.37	4.28	-
Penicillium notatum	8.69	12.00	-	11.11	11.11	10.28	19.04	20
Rhizopus spp.	4.34	20.00	20.00	33.3	7.21	21.42	28.3	-
Trichoderma album	1.55	14.00	-	-	4.76	-	-	-
Trichoderma lingnorum	3.17	-	-	-	1.55	-	-	-
Total	128.95	83.00	100.00	99.91	78.81	44.21	88.73	73.0

(coated) : 83, for *Quercus serrata* and Blotter (uncoated) : 88.73, Blotter (coated) : 78.81, PDA (uncoated) : 88.73 and PDA (coated) : 73.0 for *Quercus grifitti* (Table 2).

The percentage of fungi grown in winter season at Blotter (uncoated) is 34.84 and Blotter (coated) : 7.69 than other PDA (uncoated) : 43.79, PDA (coated) : 12.77, for *Quercus serrata* and Blotter (uncoated) : 11.03, Blotter (coated) : 6.05, PDA (uncoated) : 33.64 and PDA (coated) : 18.55 for *Quercus grifitti* (Table 3).

One year roving survey in two places viz. Regional

Table 3 : Percentage frequency of Coated and Uncoated mycoflora of seeds of *Quercus serrata* and *Quercus grifitti* using PDA and Blotter method during winter in the year 2005.

Fungi	*Quercus serrata* (V_1)				*Quercus grifitti* (V_2)			
	PDA/ Uncoated	PDA/ Coated	Blotter/ Uncoated	Blotter/ Coated	PDA/ Uncoated	PDA/ Coated	Blotter/ Uncoated	Blotter/ Coated
Alternaria alternata	1.55	-	-	-	3.17	-	-	-
Alternaria longipe	-	-	-	-	1.55	-	-	-
Aspergillus niger.	3.17	2.45	10.82	5.62	-	-	3.17	1.55
A. flavus	6.51	-	2.45	1.62	5.62	3.17	1.55	-
A. fumigatus	3.17	1.67	1.22	0.45	1.62	6.51	1.62	-
A. oseaus	-	-	-	-	4.21	1.26	-	-
Cladosporium cladosporoides	5.62	-	0.42	-	1.26	4.21	-	3.45
Fusarium fusaroides	1.84	2.67	-	-	3.14	-	3.14	-
F. semitectum	7.21	-	-	-	3.17	-	1.55	-
Mucor spp.	4.16	1.22	8.45	-	1.55	-	-	1.05
Penicillum notatum	10.45	1.28	5.21	-	1.84	-	-	-
Rhizopus spp.	11.11	3.48	6.27	-	6.51	3.4	-	-
Trichoderma album	1.56	-	-	-	-	-	-	-
Trichoderma lingnorum	1.84	-	-	-	-	-	-	-
Total	43.79	12.77	34.84	7.69	33.64	18.55	11.03	6.05

Tasar Research Station and State farm Khonghampat and field experimental site at Khabam under Imphal East district revealed the occurrence of three common fungal diseases namely Rust (causal organism : *Cronartium quercum*), Powdery mildew (causal organism : *Phyllactinia corylea*), Sooty mould (causal organism : *Chactophoma quercifolia*) and other fungal disease namely leaf blister (causal organism : *Taphrina cacrulescens*). Diseases incidence and disease severity for four diseases were recorded at monthly interval during roving survey and experimental sites were presented in the Figs. 1-11 showing the progress of diseases. These diseases were invariably found associated with two common varieties of *Quercus* spp. i.e. *Q. serrata* and *Q. grifitti*.

Rust diseases showed highest disease incidence and disease severity compared to other disease at all the three places. Most of the diseases showed higher disease incidence and severity in the month of June to September and disease incidence and severity

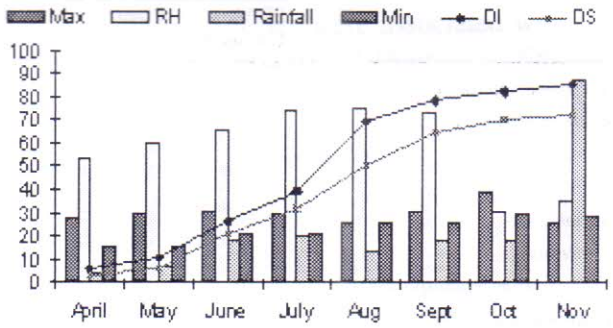

Fig. 1 : Epidemiology of disease parameters (DI and DS) of rust affected by environmental factors (Temp., RH, and Rainfall) at state farm, Khonghampat.

Disease Incidence (DI) and Disease Severity (DS) at State Farm Khonghampat

Disease incidence and severity for rust disease ranged from 3.40 to 70.85 and 0.54 to 40.40, DI and DS for Powdery mildew ranged from 0.06 to 19.22 and 0.02 to 9.32, DI and DS for Leaf blister ranged from 1.45 to 9.84 and 0.63 to 3.45, DI and DS for sooty mould ranged from 5.46 to 15.63 and 2.41 to 9.44.

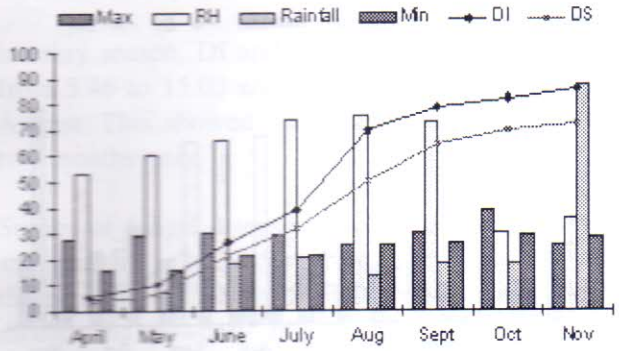

Fig. 2 : Epidemiology of disease parameters (DI and DS) of powdery mildew affected by environmental factors (Temp., RH, and Rainfall) at state farm, Khonghampat.

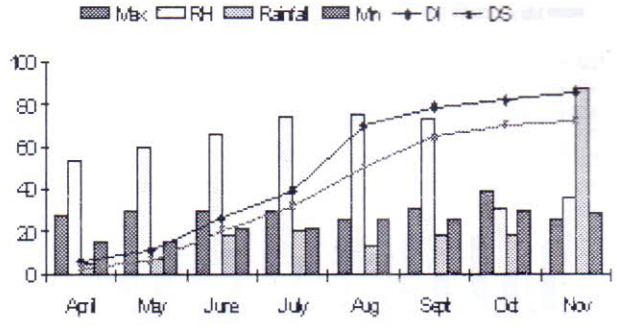

Fig. 5 : Epidemiology of disease parameters (DI and DS) of rust affected by environmental factors (Temp., RH, and Rainfall) at experimental site, Khabam.

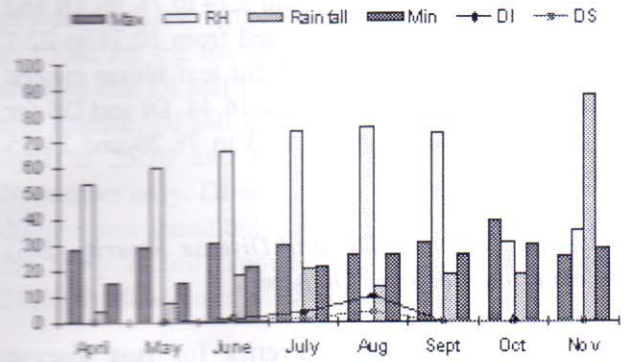

Fig. 3 : Epidemiology of disease parameters (DI and DS) of Leaf blister affected by environmental factors (Temp., RH, and Rainfall) at state farm, Khonghampat.

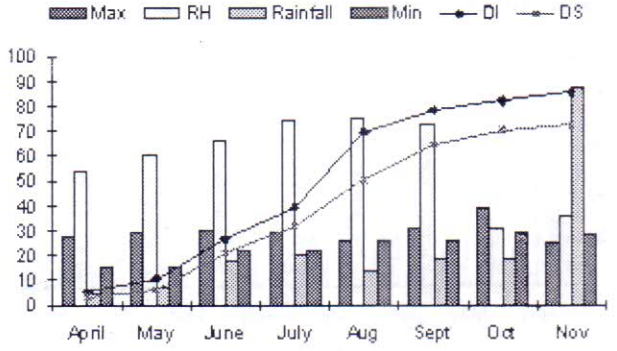

Fig. 6 : Epidemiology of disease parameters (DI and DS) of Powdery mildew affected by environmental factors (Temp., RH, and Rainfall) at experimental site, Khabam.

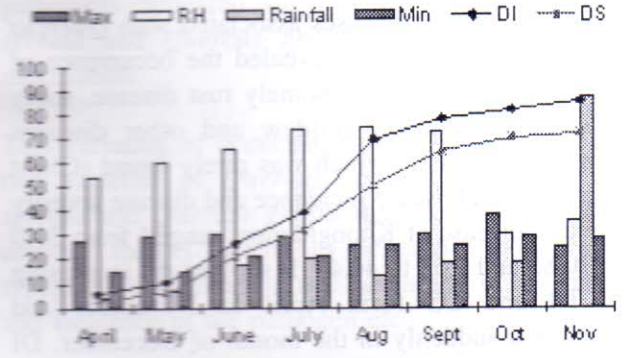

Fig. 4 : Epidemiology of disease parameters (DI and DS) of Sooty mould affected by environmental factors (Temp., RH, and Rainfall) at state farm, Khonghampat.

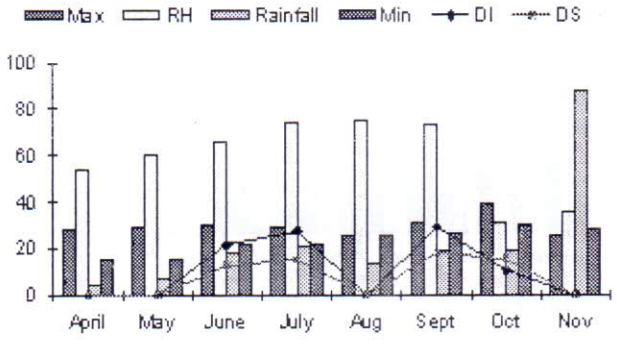

Fig. 7 : Epidemiology of disease parameters (DI and DS) of Leaf blister affected by environmental factors (Temp., RH, and Rainfall) at experimental site, Khabam.

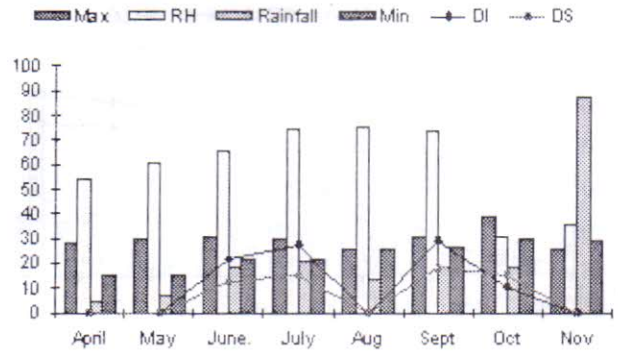

Fig. 8 : Epidemiology of disease parameters (DI and DS) of rust affected by environmental factors (Temp., RH, and Rainfall) at Regional Tasar Research Station (RTRS), Mantripukhri.

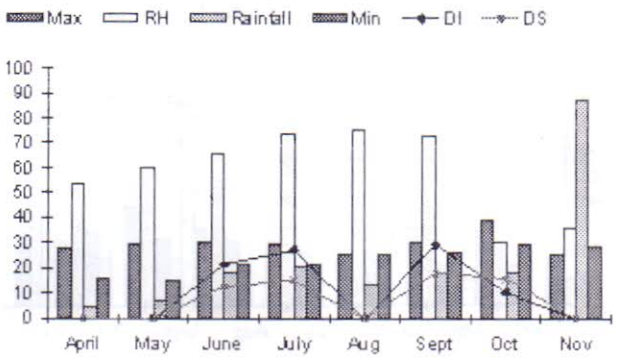

Fig. 11 : Epidemiology of disease parameters (DI and DS) of sooty mould affected by environmental factors (Temp., RH, and Rainfall) at Regional Tasar Research Station (RTRS), Mantripukhri.

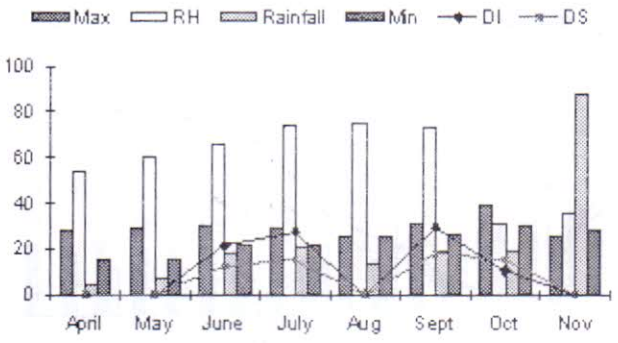

Fig. 9 : Epidemiology of disease parameters (DI and DS) of powdery mildew affected by environmental factors (Temp., RH, and Rainfall) at Regional Tasar Research Station (RTRS), Mantripukhri.

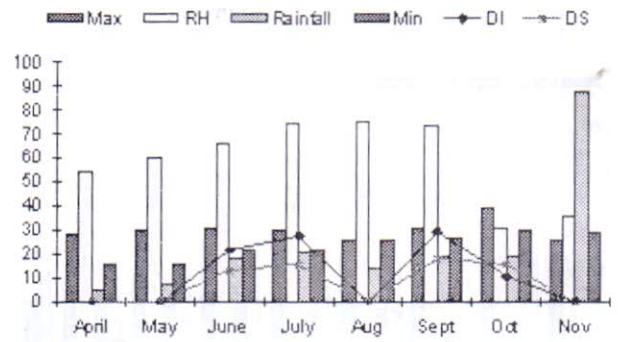

Fig. 10 : Epidemiology of disease parameters (DI and DS) of leaf blister affected by environmental factors (Temp., RH, and Rainfall) at Regional Tasar Research Station (RTRS), Mantripukhri.

Disease Incidence (DI) and Disease Severity (DS) at RTRS, Mantripukhri

Disease incidence and severity for rust disease ranged from 5.26 to 93.72 and 2.14 to 78.36, DI and DS for powdery mildew ranged from 10.71 to 22.1 and 6.4 to 17.40, DI and DS for leaf blister ranged from 0.60 to 25.10 and 0.12 to 16.44, DI and DS for sooty mould ranged from 53.3 to 78.20 and 21.35 to 50.44.

Disease Incidence (DI) and Disease Severity (DS) at experimental site, Khabam

Disease incidence and severity for rust disease ranged from 5.60 to 85.66 and 3.26 to 72.45, DI and DS for powdery mildew ranged from 2.33 to 22.10 and 1.24 to 18, DI and DS for leaf blister ranged from 21.44 to 10.30 and 22.61 to 15.40, DI and DS for sooty mould ranged from 12.61 to 15.40.

Survey of fungal diseases associated with *Quercus* spp. for the year 2005 revealed the occurrence of three common diseases namely rust disease, sooty mould and powdery mildew and other diseases namely leaf blister which was rarely found (Ghost *et al.*, 1992). Disease incidence and disease severity for rust disease at Khonghampat ranged from 3.40 to 70.85 and 0.54 to 40.44. It showed the increasing of DI and DS form April to November and decreased suddenly in the month of December. DI and DS for powdery mildew ranged from 0.06 to 19.22 and 0.02 to 9.32 for the month of April to November. This showed that DI and DS were very low compared to rust disease. DI and DS for leaf blister ranged from 1.45 to 9.84 and 0.03 to 3.45 from June to August only. This showed that DI and DS were very low and this disease was found only

in rainy season. DI and DS for sooty mould range from 5.46 to 15.03 and 2.41 to 9.44 from May to August. This showed the occurrence of disease in two months only.

Survey of fungal diseases associated with *Quercus spp.* for the year 2005 revealed the occurrence of three common diseases namely rust disease, sooty mould and powdery mildew and other diseases namely leaf blister which was rarely found (Ghost *et al.*, 1992). Disease incidence and disease severity for rust disease at RTRS ranged from 5.2 to 93.72 and 2.14 to 78.36. It showed the increasing of DI and DS form April to November and decreased suddenly in the month of December. DI and DS for powdery mildew ranged from 10.71 to 22.1 and 6.4 to 17.40 for the month of July to September. This showed that DI and DS were very low compared to rust disease. DI and DS for leaf blister ranged from 0.60 to 25.10 and 0.1 to 16.44 from April to November only. DI and DS were very low and this disease was found only in rainy season. DI and DS for sooty mould ranged from 53.3 to 78.20 and 21.35 to 50.44 from May to October.

The fungi were pathogenic to the test cultivars and symptoms were compared with the experimental field infected plant by fungal pathogens. The test satisfied the Koch postulate in the isolates of pathogens (*Chactophoma quercifolia*, *Cronartium quercum, Phyllactinia corylea*). Typical lesions of pathogens appeared on the leaves of *Quercus serrata* and *Quercus grifitti* after 8-12 days of inoculation.

This variation of occurrence of fungal diseases in two varieties of *Quercus* spp. namely *Quercus serrata* and *Quercus grifitti* may be due to many abiotic factors such as climatic condition, topographical condition and landscape of the land and virulence of the pathogen etc.

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