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INCIDENCE OF BLIGHT AND ROT DISEASES OF *BAMBUSA TULDA* ROXB. GROVES IN DIMAPUR DISTRICT OF NAGALAND STATE

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ABSTRACT
Bambusa tulda, one of the most important commercial bamboo species of Nagaland, are found to be infected by blight and rot diseases and pose a potential threat to the plantations. The objective of this paper is to study the symptomatology, isolation of the causal organism and per cent disease incidence of blight and rot in *B. tulda* plantations in Dimapur district of Nagaland state. Bamboo groves under fifteen villages of Dimapur districts of Nagaland were selected for study and occurrence and symptoms of the disease was recorded during the year 2009-1010. Four fungal pathogens have been isolated from the diseased samples where same *Fusarium semitectum* Roxb. was responsible for both blight and rot diseases. The pathogenecity test also confirmed *Fusarium semitectum* is responsible for blight and rot diseases on *Bambusa tulda* in study area. Further studies needed to be undertaken for effective management and control of blight and rot diseases and to prevent from invasion into new areas.

KEY WORDS: Dimapur district, bamboo, *Fusarium semitectum*, rural economy, management and control

INTRODUCTION

Bamboo is an indispensible timber substitute plant resource for the rural people of Asia for their diverse uses in day-to-day life and will continue to be the mainstay of rural economy in the region. In India, there are about 128 species of this arborescent grass belonging to 23 genera and cover an area of 10.3 million hectares. Of these, the Northeastern region has 15 genera and 90 species covering 29,396 sq km which comprises of about 28% of total bamboo growing area in the country (Anonymous, 2005). Bamboo and its products are central to the economy of people of Northeast India for different purposes such as constructions, food, fuel, crafts and almost indefinite other cultural and traditional uses. There are more than 1,500 documented uses of bamboo and for this reason bamboo is regarded as 'emperor' among the grasses and also 'poor man's timber'.The Dimapur district ($25^0$54'45"N and 93^0E) represents one of the important bamboo growing regions of Nagaland state. Of the different species of bamboo, *Bambusa tulda* Roxb. is usually preferred for domestic and commercial purposes. Besides, bamboo plantations can be used for maintaining ecological balance and soil erosion. However, the production potential of this grass species is reducing day by day mainly due to biotic factors such as pest and diseases. Bamboo is affected by many diseases and among these rot and blight diseases are most serious ones which were first reported from Bangladesh (Gibson, 1975; Rahman, 1978). In India, blight disease was reported from the state of Kerala and Orissa (Mohanan, 1997; Jamaludin et al. 1992). Gogoi et al (2010) reported the occurrence of leaf blight on *Bambusa tulda* Roxb. and branch necrosis in *B. balcooa* Roxb. in Assam. Groves of *B. tulda*, one of the most important commercial bamboo species of Nagaland, are found to be infected by blight and rot diseases and pose potential threat to the plantations. In view of the importance of bamboo in Northeast India, this paper investigates the incidence, symptomatology and causal organism of blight and rot incidence of *B. tulda* in village bamboo groves of fifteen localities in Dimapur district of Nagaland state.

MATERIALS AND METHODS

The village bamboo grooves in Dimapur district, Nagaland state is infected by rot and blight disease which are at various stages of infection. Investigation of different bamboo groves to study the incidence and symptomatology of blight and rot diseases on *B. tulda* was undertaken during 2009-2010 at the following villages- Ghowato, Sovima, Seithekema, Dipupar, Thilixu, Darogapathar, Zani, Shikavi, Chumukedima, Urra, Murise, Thahekhu, Rangapahar, Santamila and Senjum (Fig. 1). Selected clumps of healthy, blighted and rotted bamboos from the groves were marked for all the new culms that appeared in 2009-2010. The marked current year culms were monitored throughout the growing season and symptomatology of the disease was observed. The last evaluation of blight and rot incidence is counted using the following formula-

Percent incidence = **nd**/N x 100

Where, '**nd'** is the total number of culms/clump affected and 'N' is the total number of culms/clump observed in all the clumps of studied area (Mohanan, 1994a).

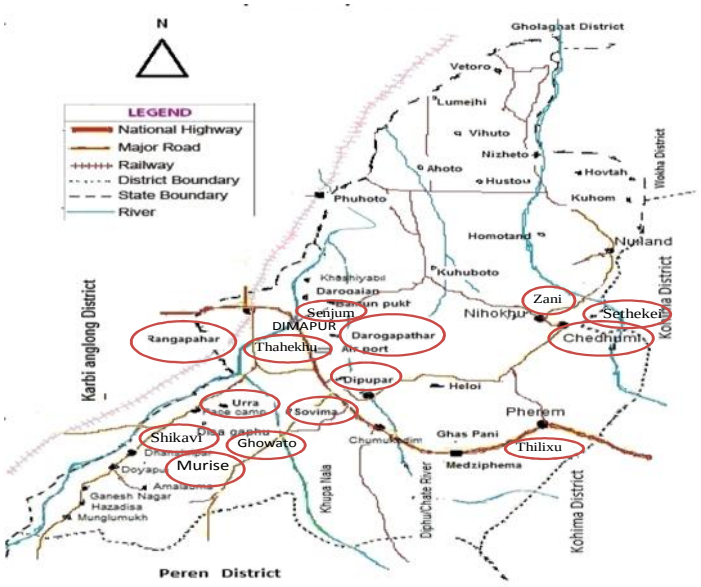

FIGURE 1. Map of Dimapur district, Nagaland. Circles show villages where filed study was undertaken.

Diseased samples of blight and rot were collected from *Bambusa tulda* plantations and bought to laboratory for isolation of the causal organism. Samples were surface sterilised by 0.35 percent Sodium Hypochlorite and washed thoroughly with distilled water. After sterilization, samples were cut into small pieces and transferred to Potato Dextrose Agar Media (PDA) for culturing the endophytic pathogen. Bacterial contamination were prevented by adding Streptomycin just before pouring PDA medium in the plates and then incubated at 27^0 C and periodically observed till 10^{th} day. The pure cultures so obtained were transferred to slants containing PDA medium and maintained in refrigerator for further study. The pathogenecity test of the isolated fungus was conducted through Koch postulates (1882).

RESULTS

Incidence of rot and blight diseases, from low to high intensity, has been observed in bamboo groves in Dimapur district, Nagaland. *Fusarium semitectum* Berkeley and Ravenel is the causal organism of both blight and rot disease of *B. tulda*; the pathogenecity tests also confirmed *F. semitectum* as the casual organism. The cultures of *F. semitectum* showed cottony white mycelia, circular, slightly raised-centre and at maturity colony became brown in colour. Reproductive parts like microconida, macroconidia and chlamydospores were also observed. The highest percent infection of blight was observed at Thilixu (31.74%) and least infection was observed in Rangapahar (12.90%), while highest percent incidence of rot was observed at Gowotao (12.01%) and least was 2.56% in Shikavi (Table 1). Though severity of the diseases are not alarming, yet the continuous damage of new culms due to blight and rot diseases has affected the economy of the rural people.

TABLE 1. Status of blight and rot of *Bambusa tulda* in different localities of Dimapur district, Nagaland.

Localities Villages	Total numbers of new culms observed	Number of infected culms		Average infection % of new culms	
		blight	rot	blight	rot
Gowotao	258	67	31	25.01	12.01
Sovima	92	14	09	15.21	9.78
Seithekema	77	20	05	25.97	6.49
Diphupar	89	11	14	12.35	15.73
Thilixu	65	18	07	31.74	10.76
Darogapathar	95	21	11	22.10	11.57
Zami	97	17	06	17.52	6.18
Shikavi	78	12	02	15.38	2.56
Chumukedima	65	9	12	13.84	13.84
Urra	72	16	07	22.23	9.72
Murise	78	18	04	23.07	5.55
Thahekhu	55	13	04	23.63	7.27
Rangapahar	62	8	06	12.90	9.67
Sangtamtila	77	14	03	18.18	3.89
Senjum	93	20	09	27.69	9.67

DISCUSSION

Symptoms of blight disease

Blight symptoms was first noticed in the month of July when culms attains a height of about 10 m and could be easily identifiable in the field by the presence of truncated and deformed culms showing varying degrees of die back. Generally, symptoms became distinct during August to October in case of 2-4 months old culms. The culm ceases growth on the appearance of the blight symptoms. Withering of young tissues and cessation of growth leading to partial or complete death articulated by the growing culms is referred to as blight of bamboos. Initially, the blight symptom appeared on the edge of the apical culm sheath with some greyish necrotic spots. Further, these spots increased in number and size, and became water soaked spreading over the entire leaf sheath. After few days, spots coalesced and resulted premature death of culm sheath. Affected sheaths were easily removable and showed decay symptoms and loosely hanged or fell down. Subsequently, infection spread to the culm tissue from the culm sheath. Infected zone became distinct from healthy zone due to the change of colour (Fig. 2). Newly infected region turned into brown but in some cases, reddish orange colour was also noticed. The drying of culms initiated from apices and progress downwards, either with '**V**' shape of reddish brown colour (Fig. 2) or uniformly of light orange to brown colour.

FIGURE 2. 'V' shaped blight symptom on culm

FIGURE 3. Downward bending of blighted culm

FIGURE 4. Spindle shaped lesion on culm

FIGURE 5. Rotted areas at the base of infected internode

Two types of blight have been observed based on age and height of growing culms. In one type of infection, the entire culm died when it attained a height of about 12 m. In another type, fully grown culms generally of 14-16 m height showed die back symptoms but the extension of die back is confined in two different heights. In one group the infection spread up to 7-9 m length from the apices and the lowermost portion remained alive. The dead and decayed infected part remained hanged for sometime and then broke off. In the other group, infection was found to confine to 3-5 m length only and affected culm curved downwards (Fig. 3).

Symptoms of Rot disease

Generally, rot symptom was observed on emerging fleshy culms during the month of June and July which appeared as light brown to dark brown spindle shaped lesions on the outermost sheath of emerging culms near the ground level. As the infection increases, the infected culm sheath became soft and died. Gradually the infection also spread to soft culm tissue and spindle-shaped dark brown centered lesions appeared on internodes (Fig. 4). The growth of the infected culm is completely retarded and infected tissues became light orange colour, water soaked and rotted which emits bad odour. Severely rotted spots have been seen above the node when infected culm sheaths were removed (Fig. 5).

The causal organism

Four pathogen taxa designated as type A, B, C and D were isolated from blight and rot diseased samples, among which A and B were from blight and C and D from the rot samples. Table 2 shows that 77.35 percent pathogen produced type A whereas only 12.46 percent was of type B. Total 88.23 percent of isolated pathogen was type C and 11.76 percent was of type D. Type A was isolated from seven type of samples whereas B from six types. In case of rot, most of the samples yielded type C and D was isolated from three samples only. Types A and C has been identified as *Fusarium semitectum*, B as *Mucor* sp. and

D as *Aspergillus niger* based on mycelial characters and spores morphology. Among the isolates, *Fusarium semitectum* could be predominantly isolated from both blight and rot diseased samples. The pathogenecity tests also confirmed that the *Fusarium semitectum* is the casual organism of blight and rot diseases of *Bambusa tulda*. The cultures of *Fusarium semitectum* (Fig. 6) shows cottony white mycelia, circular, slightly raised centre and at maturity colony became brown in colour.

TABLE 2. Fungal pathogen isolated from blight and rot samples of *Bambusa tulda*

Localities	No. of samples		No. of inoculums		No. of pure culture		Type of fungi		No. of colony of each fungus		Percent of each type of fungus	
	Blight	Rot	Blight	Rot	Blight	Rot	Blight	Rot	Blight	Rot	Blight	Rot
Gowotao	15	3	135	27	94	15	A	C	84	11		
							B	D	10	04		
Sovima	4	2	36	18	15	8	B	C	15	08		
Seithekema	7	5	63	45	37	21	A	C	37	17		
								D		04		
Diphupar	12	1	108	09	76	3	A	C	76	03	A=77.35	C=
Thilixu	6	4	54	36	27	13	A	C	24	13	B=12.46	88.23
							B		03			D=
Darogapathar	2	1	18	09	07	2	B	C	07	02		11.76
Zami	8	4	72	36	52	14	A	C	42	14		
							B		10			
Thahekhu	10	2	90	18	65	6	A	C	65	04		
								D		02		
Senjum	6	1	54	09	20	3	A	C	16	03		
							B		04			

FIGURE 6. *Fusarium semitectum* colony on PDA medium

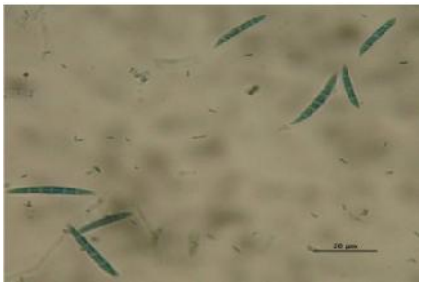

FIGURE 7. Conidia of *Fusarium semitectum*

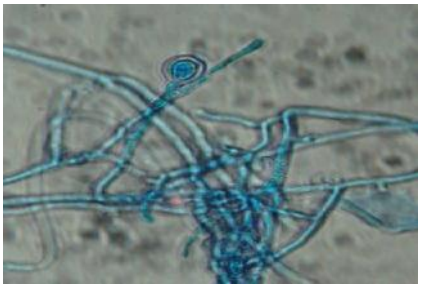

FIGURE 8. Chlymydospore of *Fusarium semitectum*

Microconida, macroconidia and chlamydospores were observed in the culture. Macroconidia were 4 to 6 septate and measured 15 to 30 µm in length (Fig. 7). Chlamydospores were oval shaped, terminal, darkly stained centre with transparent margins (Fig. 8). Although, the diseases were not causing widespread damage, blight and rot was observed in all the localities of the studied area with varying degrees of infection. Perusal of data (Table 1) showed that the per cent of blight incidence in culms ranges from 12.35 to 27.69%. The highest per cent infection of blight was observed at Thilixu (31.74%) followed by Seithekema (25.97%) and least infection was observed in Rangapahar (12.90%). Comparatively, the study recorded rot per cent incidences lower than blight. From the data compiled in Table 1 it is obvious that highest per cent incidence of rot was at Gowotao (12.01%) and least was 2.56% found in Shikavi. The higher incidence of the blight disease observed in Thilixu village might be attributed to the presence of natural courses of water canal near the bamboo groves that have created high temperature and humidity favouring the environment for blight infection. Jamaludin et al (1992) also reported about the high incidence of blight in *B. nutans* caused by *Sacrocladium oryzae* along water cannel during monsoon season. The highest disease incidence of leaf blight in case of *B. tulda* and *B. pallida* caused by *Bipolaris* sp. in water stagnant areas are due to high humidity in the area was reported from Assam by Gogoi et al (2010). *Fusarium semitectum* caused both blight and rot diseases in *B. tulda*; the fungus was earlier reported in branch necrosis of *B. balcoa* in Assam (Gogoi et al, 2010)

CONCLUSION

Bambusa tulda is the most common and widely used species of bamboo and is considered the mainstay of the socio-cultural fabric of people of Dimapur district of Nagaland state. However, the productivity of the village bamboo groves is affected by the occurrence of blight and rot diseases. The result of roving survey conducted in the village bamboo groves of Dimapur showed the presence of varying degrees of blight and rot diseases in all the villages studied. Though severity of the diseases is not alarming, yet the continuous damage of new culms due to blight and rot diseases has affected the economy of rural people. Further studies needed to be undertaken for effective management and control of blight and rot diseases in order to prevent from invasion into new areas.

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