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Field evaluation of High Yielding Mulberry Varieties for Susceptibility to Leaf Blight Disease Caused by *Phyllosticta* sp. in Bangladesh

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Abstract

The study was carried out to find the peak disease incidence period of leaf blight disease in five high yielding mulberry varieties (BM-1, BM-2, BM-3, BM-4 and BM-5) and a local variety named Telia caused by *Phyllosticta* sp. for better selection in future for commercial exploitation. The incidence and severity of leaf blight disease in six mulberry varieties were evaluated under field conditions in Bangladesh Sericulture Research and Training Institute (BSTRI), Rajshahi. The plants were rated for disease incidence and severity over a period of July to November in three years (2010 to 2012). A high incidence of 31.57% disease prevalence was recorded on BM-2 followed by BM-3 (26.75%), BM-4 (22.66%), BM-1 (13.72%) and BM-5 (12.37%). Among the varieties, the local one was found to be highly susceptible (52.75%) to *Phyllosticta* sp. whereas BM-5 was resistant to leaf blight disease. The peak incidence period of the disease was higher in August and September than the other months of the year. Results suggest that BM-5 can be utilized in future to confer disease resistant trait in high yielding mulberry varieties.

Keywords: Leaf blight, Disease incidence, Mulberry, *Phyllostica* sp.

INTRODUCTION

The sericulture industry is an upcoming enterprise that is increasingly being perceived as a promising alternative source of income in Bangladesh (Annual Research Report, 1980-81). Mulberry (*Morus* sp.) is the only source of nutrition for silkworm (Aggarwal *et al*. 2004). The growth rate of silkworm larvae and subsequent silk production is largely depened on the good quality of leaf (Ghosh *et al*. 2010 & 2012). However, diseases are some of the limiting factors for successful mulberry cultivation. Like other plants, different fungal pathogens cause a variety of diseases to mulberry foliage (Reddy *et al*. 2009). Our earlier reports showed that the leaf spot and leaf blight disease caused by *Cercospora moricola* Cook and *Phyllosticta* sp., respectively are serious diseases in mulberry plant in Bangladesh (Ghosh, 1996; Ghosh *et al*. 2003; Ghosh *et al*. 2010). Moreover, leaf blight infection changes the amino acids and chlorophyll a and b contain may be the cause of yield and quality reduction of mulberry leaves (Ghosh *et al*., 2010). So the damage of these leaves positively affect the food source of silkworm which ultimately reduces the silk production. Screening of mulberry varieties against leaf spot disease has been done previously (Ghosh *et al*. 2003). However, evaluation

of high yielding mulberry varieties for susceptibility to leaf blight disease in Bangladesh is limited.

Leaf blight disease of mulberry plant caused by *Phyllosticta* sp. positively affects on mulberry leaves (Shree and Nataraj, 1993). During the growth period of mulberry plant in rainy season, fungal pathogen *Phyllosticta* sp. comes in contact with mulberry leaves under existing environmental condition and causes the leaf blight disease. Rainy weather favours the development of this disease and allows them to spread rapidly (Agrios, 2005). Growth of silkworms fed with these infected leaves become stunted, prolong larval period and cocoon formation occur poorly, thus causing a serious setback to the Sericulture Industry in Bangladesh (Annual Research Report, 1980-81).

In Bangladesh, Rajshahi region is famous for mulberry-based sericulture. However, based on the plant morphology, disease resistance, biochemical properties and performances in rearing silkworm races in different agro-climatic conditions is essential to select and exploit promising varieties for better sericulture practices. This study reports the performance of some high yielding mulberry varieties (HYMVs) against leaf blight disease, where this activity is increasingly perceived as a promising alternative source of income.

MATERIALS AND METHODS

A field study of leaf blight disease of mulberry was carried out at the experimental plot located in Bangladesh Sericulture Research and Training Institute (BSTRI), Rajshahi during 2010, 2011 and 2012. The experiments were undertaken to evaluate the following items: (i) % of monthly leaf infection, (ii) % of yearly disease incidence and (iii) reaction of HYMVs against leaf blight disease. The tested varieties were BM-1, BM-2, BM-3, BM-4, BM-5 and a local variety named Telia. The varieties were cultivated as low-cut form and the experiments were laid out in Randomized Complete Block Design (RCBD) with three replications. A plantation was done during September to November. The plot size was (20 × 20) m and plant to plant spacing was 120 cm. Disease development in normal environmental conditions was studied.

Isolation of the pathogen

The mulberry leaves showing symptoms of infections were taken to the Plant Pathology, Mycology and Microbiology Laboratory, Department of Botany, Rajshahi University, Bangladesh for laboratory observation of the causative pathogen. The pathogen was identified by microscopic examination and compared with a standard (Hanlin, 1990). Pathogenicity test was done according to Baiyewu *et al*. (2005).

Disease assessment

Disease incidence and severity was studied for each year starting from July to November. Disease reading was recorded by randomly selecting 12 plants of each variety. The total numbers of diseased and healthy leaves were recorded in three long branches on the six top fully matured leaves of each plant. Disease severity was recorded using a visual rating scale (McKinney, 1996). In this scale,

0= No symptoms (Immune).
1= Lesions covering about 1-10% of the leaf (Resistant).
2= Few scattered lesions covering about 11-25% of the leaf (Moderately resistant).
3= Spots covering about 26-50% of the leaf (Moderately susceptible).
4= Spots coalescing and covering about 51-75% of the leaf (Susceptible).
5= Severe infection with coalescing and covering more than 75% of the leaf (Highly susceptible).

Percentage of disease incidence (PDI) was scored using one to six scales modified from Mc Kinney (1923) and Teotia *et al*. (1997).

$$PDI = \frac{\text{Sum of numerical values}}{\text{Total no. of leaves} \times 5 \text{ (maximum grading)}} \times 100$$

Statistical analysis of data given as percentage was carried out from angular transformed values and performed using Microsoft Excel software. LSD was determined, whenever the calculated 'F' values were significant at 5% level (Snedcor and Cochran, 1982).

RESULTS AND DISCUSSION

The results indicate that all the mulberry varieties were affected by leaf blight disease. However, disease severity varied across the mulberry variety screened. Percentage of mean infection of leaf blight disease recorded in different months over three years are presented in Figure 1. Significant differences due to disease among the varieties were evident. It could be seen in Figure 1 that the mean infection of 20.67% was observed in BM-5 followed by BM-1 (27.67%), BM-4 (40.57%), BM-3 (44.35%) and BM-2 (61.58%). The highest infection rate was observed 75.76% in the local variety (Telia). The mean value of each month showed the minimum (16.71%) in July which was followed by September

(58.74%), October (47.92%) and November (34.18%). The highest infection was shown in the month of August (67.95%). Among all the varieties, BM-5 was found to be less susceptible than the other varieties. Local variety Telia was found to be highly susceptible variety in all the months. Ali and Qaiyyum (1993) also showed that the percentage of leaf blight infection from May onwards with a peak during August is favourable environmental condition. Pathogen becomes strong to infect the host plant and environmental influences directly for the spread of the leaf blight disease. Gunasekhar *et al.* (1994) studied on the incidence and severity of foliar fungal and bacterial diseases of mulberry in South India and found that the incidence and severity of leaf blight disease was more during the rainy season followed by winter.

The percentages of leaf infection by *Phyllosticta* sp. of six varieties in 2010, 2011 and 2012 are shown in Table 1. Among the HYMVs, lowest infection was observed 19.89% in variety BM-5 and highest was 66.77% in BM-2 during 2012. Local variety Telia showed 84.12% in the same year. Variety BM-5 was found to show less infection in all the three years of experimentation. F-test reveals a highly significant variation among the tested varieties.

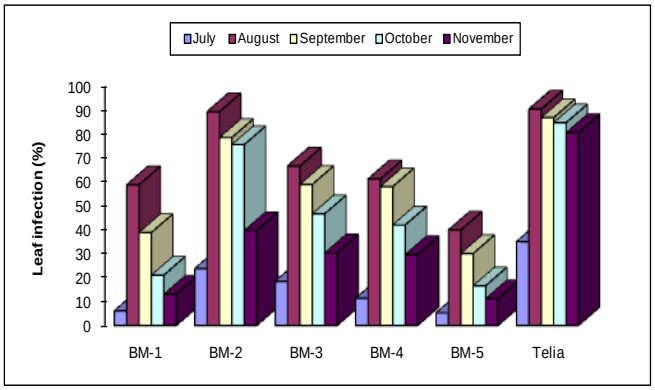

Fig. 1. Incidence of leaf blight disease in six varieties of mulberry during the month of July to November.

Rating of mulberry varieties against leaf blight disease was taken using the PDI means (Table 2). The results of different varieties over the three years showed that BM-5 (12.37%), BM-1 (13.72%) and BM-4 (22. 66%) were found to be moderately resistant to leaf blight disease. Variety BM-5 showed least susceptibility than the other varieties. The difference in infection rate of different mulberry varieties can be attributed to varietal characteristics ascribed to genetic inheritance (Jindal and Bhavani, 2002). Environmental factors, leaf age and host susceptibility influence disease progress (Biswas *et al.*, 1995). Govindaiah *et al.* (1989) also found in mulberry variety S_{779} as moderately resistant to South Indian leaf spot under South Indian environmental conditions. Furthermore, Teotia *et al*. (1997) found that variety C_{1726} was highly susceptible among 10 HYV_s of mulberry against leaf spot disease in West Bengal. In the present study the local variety was observed susceptible with highest intensity of leaf blight disease.

Table 1: Incidence of leaf blight disease of mulberry varieties in three years

Variety	Year								
	2010			2011			2012		
	TL	IL	I(%)	TL	IL	I(%)	TL	IL	I(%)
BM-1	1012	291	27.93	1044	316	30.27	1041	265	25.46
BM-2	995	594	59.70	992	624	62.90	1011	675	66.77
BM-3	993	474	47.73	1002	515	51.40	985	444	45.08
BM-4	1004	424	42.23	1014	448	44.18	978	456	46.63
BM-5	1060	256	24.15	1055	252	23.89	1051	209	19.89
Telia (Control)	1001	842	84.12	1001	851	85.01	999	764	76.48
C.D. at 5% level			1.120			2.076			1.120
C.D. at 1% level			1.592			2.953			1.592

TL, Total No. of leaves studied; IL, No. of infected leaves; I, Infection

Table 2. Reaction of HYMVs against leaf blight disease

Variety	Mean PDI	Reaction
BM-1	13.72	MR
BM-2	31.57	MS
BM-3	26.75	MS
BM-4	22.66	MR
BM-5	12.37	MR
Telia (control)	52.72	S

MS, Moderately susceptible; MR, Moderately resistant; S, Susceptible

In conclusion, the present study on the disease severity of leaf blight disease caused by *Phyllosticta* sp. in five high yielding and one local variety over a period of three years clearly indicates that there exists a significant variation among the tested varieties. The variety BM-5 always showed least susceptibility and local variety (Telia) showed highest susceptibility to local atmospheric environment. Therefore, the variety BM-5 may be selected for commercial propagation in respect of leaf blight disease.

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