Journal of Biological Sciences 3 (12): 1070-1075, 2003
ISSN 1727-3048

Survey and Evaluation of Leaf Spot Disease in Six Varieties of Mulberry (*Morus* sp).

Lipika Ghosh, N. Ahsan, S. Parvez, A.M. Swaraz, M.R. Khan, [1]M.R. Ali and M.F. Alam
Department of Botany, University of Rajshahi, Rajshahi -6205
[1]BSRTI, Rajshahi, Bangladesh

Abstract: Leaf spot disease incidence caused by *Cercospora moricola* Cooke was studied on five high yielding and a local variety of mulberry during the months of May to September in 2000, 2001 and 2002. Leaf infection was observed in those years. Percentage of disease incidence was calculated against *Cercospora* leaf spot disease in five high yielding and one local varieties. Among the six varieties the local one was found to be highly susceptible to *Cercospora* where the highest disease incidence (55.60%) around three years was recorded. BM-4 (16.97%) and BM-5 (18.46%) were found to be moderately resistant. On the other hand BM-1 (27.83%), BM-2 (29.82%) and BM-3 (36.99%) were identified as moderately susceptible to leaf spot disease.

Key words: Mulberry, leaf spot disease, survey, *Cercospora moricola*

Introduction

Mulberry (*Morus* sp.) is one of the basic material for sericulture. It is the only source of nutrition for silkworm (*Bombyx mori* L). The nutritional quality of mulberry has been predominating influence on the growth and development of the larvae of *Bombyx mori* L. and subsequent cocoon crop production (Krishnaswami, 1978). Nutrition quality and quantity also varys from variety to variety and for this reason six different mulberry varieties of different origin, different genetical nature and different moisture, protein percentage has been considered for this study to evaluate leaf spot disease incidence for better selection of mulberry variety in future for commercial exploitation.

Mulberry is attacked by a number of diseases (Teotia and Sen, 1994). Amongst them, leaf spot a fungal disease caused by *Cercospora moricola* Cooke is the most common and major disease of all the diseases in mulberry which severely affects the foliage yield by increasing leaf fall prematurely and impairs leaf quality (Sikdar and Krishnaswami, 1980; Rao *et al.*, 1981; Sukumar and Ramalingam, 1986) in rainy season. Sikder *et al.* (1975) found that 65-80% atmospheric humidity and a temperature averaging 24°C were found to favour leaf spot disease development. In Bangladesh Ali (1995) reported the leaf spot disease as the second major leaf disease of mulberry.

Siddaramaiah and Krisnaprasad (1978) reported that leaf spot disease causes extensive damage to the foliage resulting in defoliation and reducing the feeding value of the leaves to the silkworms. Ullal and Narasimhanna (1978) and Siddaramaiah *et al.* (1980) detected that production of toxins by *Cercospora moricola* is the cause of premature defoliation.

The diseased leaves are not poisonous to silkworm but are poor in nutritive value owing to the absorption of leaf nutrients by the fungus. Growth of silkworms fed with these infected leaves become stunted, prolong larval period and cocoon formation is poor (Suryanarayan and Ganesh, 1969; Nomani ***et al.***, 1970).

In Bangladesh during the growth period of mulberry plant in rainy season (April to September), fungal pathogen ***Cercospora moricola*** Cooke comes in contact with mulberry leaves under existing environmental condition and causes the leaf spot disease which fed to silkworm cannot produce good quality cocoons and thus causing a serious set back to the Sericulture Industry (Annual Research Report, BSRTI, 1980-1981). Therefore, the present investigation was undertaken to select and evaluate the high yielding mulberry varieties ($HYMV_s$) relatively less susceptible to leaf spot disease.

Materials and Methods

The experiment was conducted during 2000 to 2002 with five high yielding and one local mulberry varieties i.e. BM-1, BM-2, BM-3, BM-4 and Telia evolved at Bangladesh Sericultural Research and Training Institute, Rajshahi. Varieties were cultivated as low cut form and were considered for the study. Plantations for this study were done during September-November (1996-97). Plot size and spacings were 8.5 × 7.5 m and 1.20 × 1.25 cm, respectively.

In this study data on number of infected leaves, infection(%), percent of disease incidence(PDI) and reaction of high yielding mulberry varieties (HYMV) against leaf spot disease were studied every month from May to September around three years. Total numbers of diseased and healthy leaves were recorded in three long branches of each plant to calculate the percentage of disease incidence (PDI) using 0 to 5 scales (Mc Kinney, 1923) in the following different grades.

0=No infection
I=1-10%
II=11-25%
III=26-50%
IV=51-75%
V=76-100%

$$PDI = \frac{\text{Total number of leaves observed} \times 5 \text{ (max. grade)}}{\text{Sum of ratings of leaves observed}} \times 100$$

Varieties were categorized as immune (PDI=0), resistant (PDI upto 10), moderately resistant (11-25), moderately susceptible (26-50), susceptible (51-75) and highly susceptible (75 and above) according to Teotia ***et al.*** (1997).

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 (Snedecor and Cochran, 1980).

Results and Discussion

Percentage of infection and mean infection of leaf spot disease recorded in different months over three years are presented in Table 1. Significant differences due to disease amongst the varieties were evident. It could be seen from Table 1 that the mean infection of 27.70% was observed in BM-4 followed by BM-5 (32.85%), BM-1 (47.21%), BM-2 (49.53%) and BM-3 (67.67%). The highest infection rate was observed 81.23% in the local variety (Telia). The mean value showed the minimum infection (22.20%) in May followed by June (40.44%), July (53.37%), while the maximum infection was observed in August (64.80%) and September (74.22%). Among all the varieties BM-4 was found to be the less susceptible and local variety (Telia) was found to be highly susceptible varieties in all the months over three years (Table 1-3 and Fig. 1-3).

Ghosh (1996) reported that in general *Cercospora* infection of 47-67% with 15-23% disease severity in mulberry leaf crop was noticed in Bangladesh. Pasha and Barman (1988) reported that out break of leaf spot disease first appears in May -June and continued up to 5-6 months before winter pruning in Bangladesh climate. Ali and Qaiyyum (1993) also showed that the percentage of leaf infection from May onwards with a peak during August in favourable environmental conditions. Pathogen becomes strong to infect the host plant and environment influences directly for the spread of leaf spot disease.

Incidence of leaf spot disease of six varieties in different years are shown in Table 2. The lowest infection was observed 28.93% in variety BM-4 during 2000 while the highest infection was 89.21% in local variety Telia in the same year. Variety BM-4 was found to show less infection in all the three years of experimentation (Table 2 and Fig. 2). F-test reveals a highly significant variation among the tested varieties.

Percent of disease incidence (PDI) of leaf spot disease and reaction of HYMV against the leaf spot disease of Bangladesh in 2000, 2001 and 2002 are shown in Table 3 and Fig. 3.

The result of three years evaluation showed that the lowest PDI was recorded in BM-4 (15.75%) in 2002 while the highest PDI 58.28% was noted in Telia in the same year. The results of different varieties over the three years show only BM-4 and BM-5 were found to be moderately resistant to leaf spot disease.

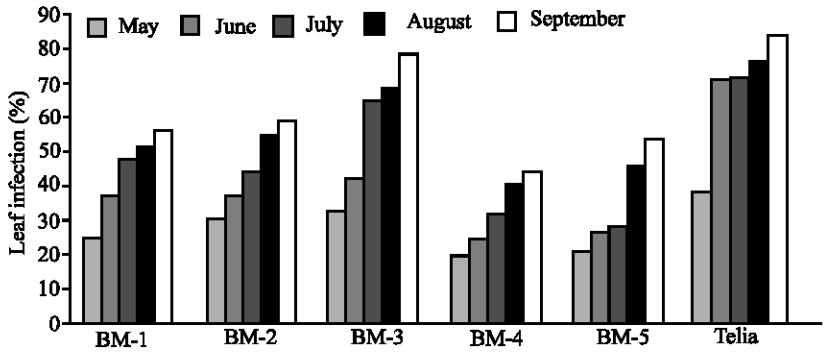

Fig. 1: Leaf infection (%) of six varieties of mulberry due to leaf spot disease

Table 1: Incidence of leaf spot disease in six varieties of mulberry during the months of May to September in three years

Observations(%)												
Variety	May	Mean± SE	June	Mean±SE	July	Mean±SE	Aug.	Mean±SE	Sep.	Mean±SE	Total	Mean
BM -1	17.44*	24.64±1.16	35.82	36.75±0.69	50.92	47.44±1.38	64.33	53.33±0.70	67.52	55.25±0.70	236.05	47.21
BM -2	24.6	29.67±1.42	36.52	37.16±0.35	48.23	43.97±0.99	65.33	53.91±0.69	72.97	58.66±0.76	247.65	49.53
BM -3	29.92	33.08±2.17	45.88	42.61±0.66	81.92	64.82±0.43	84.89	67.16±0.92	95.75	78.26±1.68	338.35	67.67
BM -4	11.38	19.69±0.54	17.33	24.56±0.87	27.21	31.43±0.74	36.28	37.03±0.36	46.3	42.88±0.33	138.5	27.7
BM -5	12.25	20.44±0.90	19.2	25.97±0.84	22.75	28.46±0.81	45.04	42.13±0.66	65.01	53.73±0.69	164.25	32.85
Telia (Control)												
	38.25	38.18±1.46	87.91	69.68±1.01	89.23	70.90±1.09	92.94	74.65±1.30	97.82	82.45±2.79	406.15	81.23
Mean	22.2		40.44		53.37		64.8		74.22			
C.D. at												
5% level	4.73		2.64		3.28		2.84		4.93			
C.D. at												
1% level	6.73		3.76		4.68		4.04		7.01			

• Mean of three years.

Table 2: Infection percentage data of leaf spot disease in six varieties of mulberry (2000, 2001 and 2002)

	2000				2001				2002			
Variety	TL	IL	I (%)	Mean±SE	TL	IL	I (%)	Mean±SE	TL	IL	I (%)	Mean±SE
BM-1	1034	507	49.03	44.43±1.75	1024	483	47.16	43.35±0.89	998	515	51.60	45.92±0.33
BM-2	1022	574	56.16	48.51±0.87	1013	533	52.61	46.49±0.88	1005	503	50.04	45.00±0.66
BM-3	1012	683	67.49	55.44±3.84	1015	653	64.33	53.33±1.38	1031	734	71.19	57.54±0.37
BM-4	1075	311	28.93	32.48±1.61	1080	315	29.16	32.65±1.68	1071	268	25.02	29.99±0.77
BM-5	1064	375	35.24	36.40±0.91	1062	350	32.95	34.99±0.70	1067	324	30.36	33.44±0.74
Telia (Control)												
	1020	910	89.21	72.81±6.33	1021	901	88.24	69.98±1.03	1019	784	76.93	61.28±0.40
C.D. at												
5% level	-	-	11.05	-	-	-	3.93	-	-	-	1.95	-
C.D. at												
1% level	-	-	15.74	-	-	-	5.59	-	-	-	2.78	-

TL=Total no. of leaves studied, IL= No. of Infected leaves, I (%) =Infection (%)

Table 3: Reaction of HYMV against leaf spot

	Percentage of Disease incidence (PDI)				
Variety	2000	2001	2002	Mean	Reaction
BM-1	28.04	27.13	28.32	27.83	MS
BM-2	31.12	30.32	28.04	29.82	MS
BM-3	37.33	35.43	38.23	36.99	MS
BM-4	17.49	17.69	15.75	16.97	MR
BM-5	18.21	19.52	17.66	18.46	MR
Telia (Control)	57.38	51.16	58.28	55.60	S

MS = Moderately susceptible

MR = Moderately resistant

S = Susceptible

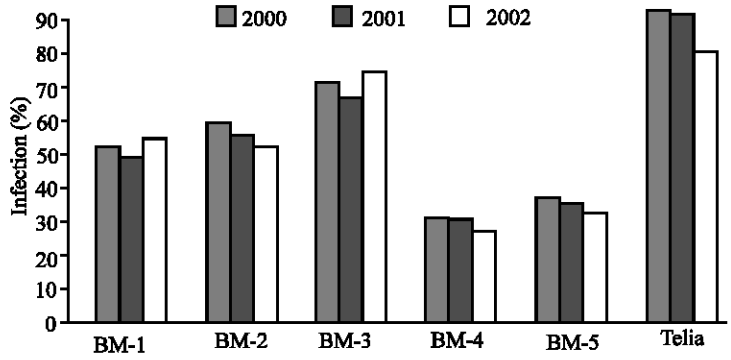

Fig. 2: Infection (%) of six mulberry varieties due to leaf spot disease in different years

F-test Due to variety -- -- -- --- ---- --- ---- --- ---- 127.53**

Due to year -- -- -- --- --- ---- --- ---- --- --- 2.84 N.S

Due to interaction (year × variety) -- -- -- 1.79N.S

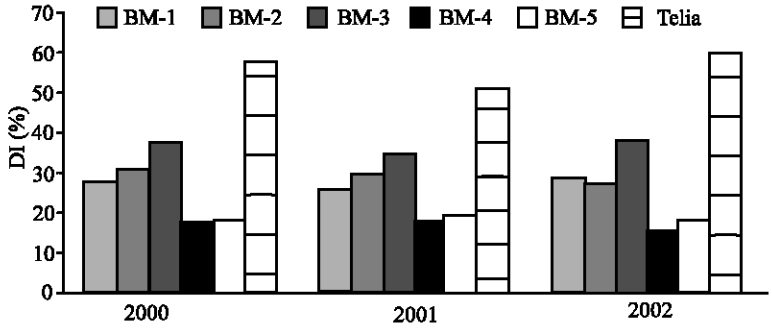

Fig.3: Disease incidence (%) of leaf spot disease in six varieties of mulberry (2000, 2001 and 2002)

Govindaiah ***et al.*** (1989) also found variety S_{799} as moderately resistant to leaf spot under South Indian conditions. Further 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 spot. Remaining varieties were found under the category of moderately susceptible.

The observation on the percentage of disease incidence (PDI) and percent of infection of leaf spot disease in five high yielding and one local variety over a period of three years clearly indicate that there exists a significant variation among the tested varieties. The variety BM-4 always showed least susceptibility and local variety (Telia) showed highest susceptibility to genetical and acclimatization in \the local atmospheric environment. Therefore variety BM-4 may be selected for commercial propagation in respect of leaf spot disease under stress condition.

References

Ali, M.R. and M.A. Qaiyyum, 1993. Incidence of leaf spot disease in different varieties of Mulberry. Bull. Sericult. Res., 4: 74-76.

Ali, M.R., 1995. Studies on important fungal diseases of mulberry (***Morus sp.***) leaf in Bangladesh and their control. Ph.D. Thesis, Univ. Rajshahi, Bangladesh.

Annual Research Report, 1980-81. Bangladesh Sericulture Research and Training Institute, Rajshahi, Bangladesh.

Ghosh, L., 1996. Studies on the ***Cercospora*** leaf spot disease of mulberry (***Morus sp.***) and its control. M. Phil. Thesis, Univ. Rajshahi, Bangladesh.

Govindaiah, P., D.D. Sharma, K. Sengupta, V.M. Gunasekhar, N. Suryanarayan and Madhav Rao, 1989. Screening of mulberry varieties against major fungal diseases. Indian J. Seric., 28: 207-213.

MC Kinney, H.H., 1923. Influence of soil temperature and moisture on infection of wheat seedlings by ***Helminthosporium ativum***. J. Agric. Res., 26: 195-210.

Nomani, M.K.R., P.K. Mukerjee and S. Krishnaswami, 1970. Studies on the effect of feeding multivoltine silkworm (***Bombyx mori*** L.) larvae with mildew affected mulberry leaves. Ind. J. Seric., 9: 49-52.

Pasha, K. and A.C. Barman, 1988. Selection of mulberry (***Morus alba***) variety resistant to leaf spot disease. Bang. J. Agric., 13: 103-108.

Rao, M.Y.R., M.S. Kodandaram and E.B. Srinivasan, 1981. Effect of leaf spot disease on the composition of food content mulberry (***Morus alba*** L.) leaves. J. Mysore Res., 28: 21-33.

Siddaramaiah, A.L., K.S. Krisnaprasad and R.K. Hedge, 1978. Epidemiological studies of mulberry leaf spot caused by ***Cercospora moricola*** Cooke. Ind. J. Seri., 17: 44-47.

Siddaramaiah, A.L., S. Lingaraju and R.K. Hedge, 1980. Toxic effect of the culture filtrate of ***Cercospora moricola*** Cooks, the causal organism of leaf spot of mulberry. Ind. J. Seri., 19: 32-33.

Sikdar, A.K. and S. Krishnaswami, 1980. Assessment of leaf yield loss of the two mulberry varieties due to leaf spot. Indian J. Seric., 19: 9-12.

Sikdar, A.K. and P.C. Bose, 1975. The influence of environment on mulberry growth. Indian silk, 30: 27-30.

Snedecor, G.W. and W.G. Cochran, 1980. Statistical Methods. 7th Ed. Iowa State Univ. Press, Amer, Towa, U.S.A., pp: 507.

Sukumar, J. and A. Ramalingam, 1986. Epidemiology of ***Cercospora*** leaf spot disease of mulberry, I. stage of infection spot and conidial production. Sericologia, 26: 549-533.

Suryanarayan, S.K. and N.K. Ganesh, 1969. Preliminary observations on the effect of feeding silkworm with mildew affected leaves. Silkworm Information Bull., 1: 62-67.

Teotia, R.S., S.K. Mandal, S.K. Sen and T. Pavan Kumar, 1997. Evaluation of some high yielding mulberry varieties against leaf spot (***Cercospora moricola*** Cooke) in West Bengal. Bull. Sericult., 8: 83-84.

Teotia, R.S. and S.K. Sen, 1994. Mulberry diseases in India and their control. Sericologia, 34: 1-18.

Ullal, S.R. and M.N. Narasimhanna, 1978. Handbook of Practical Sericulture. Central Silk Board, Bombay, India, pp: 43.