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Jute Leaf Mosaic and its Effects on Jute Production

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Abstract: Growing on test was conducted in aluminum trays and photographic cassette holders to determine the germination and seed transmission of jute leaf mosaic agent using five *Corchorus capsularis* cultivars. The test cultivars (D-154 and CVL-1) were grown in successive two years in a net house. Seeds collected from early-infected plants were used in the second year. Significantly higher percentage of seed transmission was obtained in the second year. Among the five test cultivars grown in two agro-ecological zones CVL-1 performed the best but none of the cultivars was free from leaf mosaic disease infection. Agro-ecological factors influenced the occurrence of the disease.

Key words: Jute leaf mosaic, transmission, agro-ecological zone

Introduction

Leaf mosaic is one of the most important diseases resulting in loss of yield and quality of jute fiber. The infected plants raised from infected seeds gave 16.8-65.9% less fiber yield and had lower percentage of cellulose (46.02), Lignin (12.0) and Pectin (1.82) indicating weaker strength of fiber (Biswas *et al.*, 1989). The causal agent is seed-borne. Sowing of infected seeds may cause early death of the seedlings and often the plants escaping death act as source of inoculum for secondary spread through its vector in the field. Thus, the disease can spread very easily through infected seeds and vector *Bemisia tabaci* to cause epidemic resulting in loss of crop production in the subsequent seasons. Thus sowing of infected seeds spreads disease in the field and reduces the planting value of seed. In view of the above facts the research work was undertaken to study the seed to plant to seed transmission and its effect on the development of disease and yield in different agro-ecology.

Materials and Methods

The field experiments were conducted at the experimental fields of substations of Bangladesh Jute Research Institute (BJRI) at Kishoreganj (L₁) and Manikganj (L₂) during the period of March to October, 1999. The experimental area was under the subtropical climate characterized by heavy rainfall during April to September and scanty rainfall during October to March (Anonymous, 1960). The experimental fields were medium high land with sandy loam soil pH 6.5. Two experimental sites viz. Kishoreganj and Manikganj were under the AEZ of Upper Brahmaputra flood plain and Low Jamuna flood plain respectively (SRDI, 1990). For research seeds were collected from the Breeding Division of Bangladesh Jute Research Institute (BJRI), Dhaka. Two hundred seeds of each five varieties were taken at random from the working samples and sown in five (45 X 45 cm²) trays. The trays were supplied with water, 12/12 light / darkness, 30 °C / 21 °C ambient temperature at day / night in green house. The first reading of symptoms that developed on the cotyledonous leaves and counting of germination were done on 3 to 10 days after sowing. Number of seedlings with yellow dot marks on the cotyledons was counted.

Cassette holder method (Shakya and Chung, 1983) was also used for germination test and to observe the early seedling symptoms. Two fold blotting paper strips were put in the compartments of a photographic slide cassette holder. One seed, taken at random, was placed in between each paper folding. The loaded cassette holder was placed in a suitable

tray in which enough water was supplied to keep the papers wet. The cassette with trays was then placed in the growth room in the same environmental conditions as the trays received. Observation was made and counting was done 3-6 days after sowing.

Seed to plant to seed transmission of leaf mosaic of jute was studied in the screen house of the Seed Pathology Laboratory (SPL) under insect proof condition. Cultivars D-154 (susceptible) and CVL-1 (moderately resistant) were used. Four hundred seeds were sown in 16 pots with 25 seeds /pot initially. Symptom bearing seedling and plants were taken out carefully and transplanted individually in new pots. Mosaic affected plants were tagged for identification. Seeds were collected from those plants when matured for the next year sowing. In the following year 400 seeds of each variety collected from the mosaic-affected plants were sown. Data were recorded on the basis of symptoms expressed.

% Mosaic-expressing plants and % mosaic-expressing leaves were calculated as follows:

$$\% \text{ Mosaic expressing plants} = \frac{\text{No. of infected plants}}{\text{Total no. of plants}} \times 100$$

$$\% \text{ Mosaic infected plants} = \frac{\text{Infected leaves}}{\text{Total no. of leaves}} \times 100$$

These two parameters were recorded at the age of 45 days by the above formula.

Results and Discussion

To determine the percent germination and percent seed-borne infection, growing on test was conducted differently in aluminum trays and cassette holders. Little higher percentage of germination was observed in cassette holder than that of aluminum trays (Table 1). Earliest symptoms of jute mosaic infection appeared on very young seedlings as sharp or diffused chlorotic spots on cotyledon. This could be seen within days after emergence. Seeds belonging to the cultivar V₁ (D-154) showed the highest seed to plant transmission of the causal agent, whereas the cultivar V₄ (CVL-1) showed the least in both media. The V₁ expressed highest percent of symptom bearing seedlings, 10% and 8%, respectively in the aluminum and cassette holder experiments. V₄ expressed the lowest percent of symptom bearing seedlings, 6% in aluminum and cassette holder method. V₂ and V₃, in both

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Table 1: Germination of jute seed samples in aluminum tray and slide cassette holders expressing chlorotic symptoms in seedlings

Variety	Aluminum tray		Slide cassette holder	
	%germination	% symptom bearing seedlings at 5 days	%germination	% symptom bearing seedlings at 5 days
V ₁	75	10	82	8
V ₂	72	7	80	7
V ₃	74	7	83	7
V ₄	70	6	81	5
V ₅	73	8	80	6

Legends: V₁ : D-154, V₂ : BJC-7370, V₃ : BJC-83, V₄ : CVL-1, V₅ : CC-45

Table 2: Seed to plant transmission of jute leaf mosaic in two cultivars of jute grown in the net house and respective yield in 1998 and 1999

Variety	Transmission of jute leaf mosaic in 1998			Transmission of jute leaf mosaic in 1999		
	% germination	% mosaic expressing plants	% mosaic expressing leaf	% germination	% mosaic expressing plants	% mosaic expressing leaf
D-154	55	1.5	37.7	73.5	59.29	93.25
CVL-1	60	0.7	25.0	59.75	38.69	87.6

Table 3: The effect of two locations on the expression of leaf mosaic of jute in five test cultivars

Location	% Leaf mosaic plant	%Leaf mosaic leaf	Plant height (cm)	Base diameter (mm)	Green weight (g)	Leaf weight (g)	Fiber weight (Kg)
L ₁	63.125	77.989	177.27	13.93	2024	119.2	2.36
L ₂	19.617	12.803	263.19	16.43	2016.67	116.8	2.956
LSD 0.01	5.58	11.86	31.95	2.27	NS	NS	0.39
0.05	3.51	7.15	19.26	1.37	NS	NS	0.23
CV %	4.88	4.16	4.07	8.74	5.70	10.21	6.56

Legends: L₁- Kishoreganj Region L₂- Manikganj Region

Table 4: Average effect of leaf mosaic disease on different growth and yield parameters among different varieties of jute considering Kishoreganj (L₁) and Manikganj (L₂) together

Location	% Leaf mosaic plant	%Leaf mosaic leaf	Plant height (cm)	Base diameter (mm)	Green weight (g)	Leaf weight (g)	Fiber weight (Kg)
V ₁	39.40b	46.88b	216.95ab	14.03b	2167.5a	109.50	2.63b
V ₂	52.66a	52.16a	225.73ab	16.7a	2140.0a	116.67	2.41b
V ₃	40.47b	44.11bc	217.4ab	15.26ab	1881.6b	129.17	2.55b
V ₄	22.24b	35.69d	211.15b	14.43b	2062.5a	114.16	3.25a
V ₅	52.08a	48.12b	229.92a	15.48ab	1850.0b	120.50	2.44b
LSD 0.01	3.41	3.65	15.09	2.24	194.05	NS	0.29
0.05	2.47	2.65	10.95	1.62	140.83	NS	0.21
CV %	4.88	4.76	4.07	8.74	5.70	10.21	6.56

Legends: V₁ : D-154, V₂ : BJC-7370, V₃ : BJC-83, V₄ : CVL-1, V₅ : CC-45 NS = non significant

Table 5: Effect of leaf mosaic disease on different growth parameters of jute in Kishoreganj (L₁) and Manikganj (L₂) district

Variety		District Kishoreganj				District Manikganj			
		Base diameter (mm)	Plant height (cm)	Green weight (gm)	Leaf weight (gm)	Base diameter (mm)	Plant height (cm)	Green weight (gm)	Leaf weight (gm)
V ₁	Healthy	17.3	218.13	2430.00	146.00	18.5	309.50	2616.67	146.67
	Diseased	11.4	164.9	2185.00	111.67	16.65	269.00	2150.00	107.33
	Calculated t-value	4.23	8.14	1.56	6.90*	4.11	3.48	3.88	7.55*
V ₂	Healthy	19.8	218.3	2490.00	144.67	18.41	302.57	2466.67	133.30
	Diseased	16.7	188.1	2080.00	116.67	17.71	263.30	2200.00	116.67
	Calculated t-value	2.61	7.12	23.35	3.44	1.93	4.45*	1.84	5.00
V ₃	Healthy	19.8	221.8	2300.00	165.00	18.81	305.50	2366.67	143.30
	Diseased	16.7	176.5	1980.00	128.33	14.83	258.30	1783.33	130.00
	Calculated t-value	2.61	7.58*	4.25	4.16	14.51*	4.05	35.00	4.00
V ₄	Healthy	19.7	208.9	2500.00	154.67	17.8	301.47	2416.67	121.67
	Diseased	12.8	144.9	2075.00	115.00	16.05	277.33	2050.00	113.33
	Calculated t-value	6.08*	10.93	6.76*	8.25*	1.58	26.31	5.50	1.15
V ₅	Healthy	19.4	255.17	2150.00	159.67	17.91	306.00	2350.00	150.00
	Diseased	14.0	211.9	1800.00	124.33	16.96	247.93	1900.00	114.67
	Calculated t-value	2.23	4.68*	24.25*	3.64	2.00	3.93	3.58	5.00

* Significant at P=0.05 level of probability,

Legends: V₁: D-154, V₂: BJC-7370, V₃: BJC-83, V₄: CVL-1, V₅: CC-45

techniques had expressed 7% of symptom bearing seedlings (Table 1).

Out of five jute cultivars none was found free from mosaic disease. Cultivar V₁ (D-154) was found as the most sensitive whereas V₄ (CVL-1) was the least sensitive to the leaf mosaic disease. The symptoms appeared on the cotyledon are in agreement with the report of Lange (1980). It was revealed that the slide cassette holder method for germination and seedling symptom test has the possibility to replace other

growing on test techniques.

The transmission of leaf mosaic disease of jute from seed to plant to seed has been studied for two years. First mosaic symptom appeared on the plants of both varieties just about a month after sowing the seeds. In the first year, D-154 had 1.5% of mosaic plant with 37.7% of mosaic leaf in mosaic plants. Whereas CVL-1 had 0.7% of mosaic plants with 25% of mosaic leaves in each mosaic plant (Table 2).

In the second year also mosaic symptoms prominently

appeared on the plants, more or less one month after sowing. Both varieties produced the symptom-bearing plants abundantly in the second year. D-154 produced 59.29% symptom bearing plants having 93.25% symptom bearing leaves in each infected plant. Whereas CVL-1 produced 38.69% symptom bearing plants with 87.60% symptom bearing leaves (Table 2). It was found that seeds obtained from the infected plants gave higher percentage of infected plants in the following year. The result confirms the findings of Ghosh and Basak (1951).

It was found that different agro-ecological zones induced different degree of leaf mosaic disease in the five cultivars tested. It is revealed that occurrence and the effect of the disease are significantly more in Kishoreganj region (63.12%) than that of Manikganj region (19.62%). The fiber weight was significantly lower (2.36 Kg) at Kishoreganj than that of Manikganj (2.96 Kg) region (Table 3). This finding is also very much in conformity with earlier reports of Haque *et al.* (1998). Five cultivars were tested at both locations against leaf mosaic disease. Significant genetic variation and reaction were found. The cultivar V₄ (CVL-1) had the least occurrence of disease (22.24%) and gave the highest yield (3.25 Kg). Cultivar V₁ (D-154) produced the least amount of fiber with moderate occurrence of disease.

Significant genetic variations of reaction were also apparent, when the results of five cultivars tested in both locations against leaf mosaic disease were considered together (Tables 4 and 5). The cultivar V₄ had the least occurrence of disease but produced the highest yield. Cultivar V₂ produced the least amount of fiber with moderate occurrence of the disease with moderate fiber yield. The results are in conformity with the previous report of Azad and Wahab (1984). In Kishoreganj and Manikganj regions, different growth parameters were affected by the disease, though little variation has been observed among the cultivars for two locations in expressing

tolerance or susceptibility to the disease for different growth parameters. In every case plant height, base diameter, green weight and leaf weight were higher in healthy plants than those of affected plants. The results confirm the findings of Haque *et al.* (1998). Out of five *Corchorus capsularis* cultivars none was found free from the infection of the leaf mosaic disease. Of these V₄ (CVL-1) was found to be the best in terms of less occurrence of the disease as well as the higher production of the fiber.

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