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Inoculation Times with Strains of *Macrophomina phaseolina* and *Colletotrichum corchori* on the Seed Yield Contributing Characters of Late Jute Seeds

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Abstract: An experiment was conducted to assess the effect of different inoculation times with MS-6, MS-9 strains of *Macrophomina phaseolina* and CS-1 strain of *Colletotrichum corchori* on the seed yield contributing characters and quality of late jute seeds (*Corchorus capsularis* L). Varieties were BJC-7370 and CVL-1. Results showed that inoculation with the pathogens was conducted on 45,55,65 days age of the jute plants. Variety BJC-7370 and CVL-1 of jute had reaction with strains MS-6, MS-9, and CS-1 at every inoculation times. The gradual increase of inoculation affected the plants. As the time of inoculation increases the lesion size on stem decreases, the number of pods plant^{-1}, seeds plant^{-1} and Seed germinations (%) increases and at the same time seed infections (%) decreases. MS-6 strain was found more virulent than MS-9 and CS-1 regarding pods plant^{-1} and seeds plant^{-1} production, as well as seed germinations and infections(%).

Key words: MS-6 and MS-9 strains, *Macrophomina phaseolina*, CS-1 strain, *Colletotrichum corchori*, Inoculation times, Late jute seeds (*Corchorus capsularis* L.)

Introduction

Jute is the main cash crop of Bangladesh. It suffers from a number of diseases of which 10 are known to be seed-borne (Fakir, 1987). Among the seed borne diseases, only leaf mosaic is caused by virus, rest all are caused by fungi. Fazli and Ahmed (1959) made a comprehensive list of pathogenic fungi which are *Macrophomina phaseolina*, *Botryodiplodia theobromae*, *Colletotrichum corchori*, *Glomerella cingulata* and *Fusarium* (semi-pathogenic). Among which *M. phaseolina* causes stem-rot at any stage from seedling to fruiting and *C. corchori* causes seedling blight and both lead to deterioration of yield of fibre and quality of seed. Stem-rot alone causes loss of fiber to the tune of 5 lakh bales (Ahmed, 1968). It also causes loss of fibre quality (Ahmed, 1968;

Biswas ***et al.***, 1980). Anthracnose is also most important disease of jute. Anthracnose affected plants yield poor quality fibre, mostly knotty in nature with adherent barks, which resist retting. The disease is seed-borne and thus seedling blight and pre-emergent death show gaps in the field (Ahmed, 1966). In mature stage, the plants do not die, but the disease badly affects the fibre quality. As a result, the market values of this fibre become 30-50% less than that from healthy plants (Khan and Strange, 1975). Such poor quality fibre is classed in the market as 'Crossbottom' (Ghosh, 1957). In nature, ***M. phaseolina*** has 19 physiological races of which MS-6 and MS-9 are most common virulent (Ahmed and Ahmed, 1969). On the other hand, ***C. corchori*** has 6 physiological races of which CS-1 is the virulent strain (Chaudhury and Ahmed, 1969). ***M. phaseolina*** and ***C. corchori*** has different degree of virulence on jute plants depending on the age of the plants (Anonymous, 1994). ***Macrophomina phaseolina,. and Colletotrichum corchori*** are major pathogens of jute and known to be the quite frequently transmitted from seed to plant to seeds (Akanda and Fakir, 1985). In Bangladesh, Loss due to seed-borne diseases of jute is 8% to 20% depending on the severity of diseases from year to year (Ahmed ***et al.***, 1985).

The objectives of this study was to know the reactions of BJC-7370 and CVL-1 variety of jute (***Corchorus capsularis*** L.) with MS-6, MS-9 strains of ***Macrophomina phaseolina*** and CS-1 strains of ***Colletotrichum corchori*** at different inoculation times and then observe their differences and effects on the production of pods plant^{-1}, seeds plant^{-1}, seed germinations and infections (%) in BJC-7370 and CVL-1variety of Jute.

Materials and Methods

The experiment was conducted in the green house and at laboratory of BJRI central station, Dhaka, with variety BJC-7370 and CVL-1 deshi jute. Seeds were sown in earthen pods (12 inches diameter) containing sterilized soil. Forty eight hours old culture MS-6 and MS-9 strains of ***M. phaseolina*** and CS-1 strain of ***C. corchori*** were used for inoculation. Circular blocks of cultures (2 mm diameter) were made with a block cutter and inoculated in the plants at two spots pricking with needle and placing one block on each spot and labelled. The inoculation was done at 45, 55 and 65 days after emergence of seedlings. Inoculated plants were kept inside the glass house with temperature ranging from 32 to 37°C and humidity from 90 to 100% for 48 hours. Lesions developed on the stems were measured after 8 days of inoculation.

Reaction of variety BJC-7370 and CVL-1 of jute (***Corchorus capsularis*** L.) with MS-6 and MS-9 Strains of ***M. phaseolina*** were recorded on the basis of lesion size developed on the stem after 8 days of inoculation and graded with the following scale (Ahmed and Ahmed, 1969).Resistant (R)= 0-15mm lesion size, Moderately susceptible (MS)=16-30mm lesion size, Susceptible (S)= Above 30 mm lesion size but plant not killed, Highly susceptible(HS) = Lesion size above 30mm or less, spread all around the stem and killing the plant.

Similar jute varieties reactions with CS-1 Strain of *C. corchori* were recorded on the basis of lesion size developed on the stem after 8 days of inoculation and graded with the following scale (Chaudhury and Ahmed, 1969). Resistant (R)= 0-5X0-2 mm lesion size, Moderately Resistant (MR)= 6-15X2.5-5 mm lesion size, Moderately Susceptible (MS) =16-25 X 5.5-7.5 mm lesion size, Susceptible (S)= Above 25 mm X Above 5.5-7.5 mm.

When the pods were about to ripened more than 60-70%, they were harvested, dried and seeds were extracted from the pods and labeled. All the seed samples were analyzed for seed germination and prevalence of the three strains in the collected seed samples by blotter method following International rules for Seed Testing Association (Anonymous, 1999). Fungal Pathogens associated with jute seeds were detected and identified by observing their growth characteristics on the incubated seeds in blotter under stereomicroscope at 25 X magnification.

The experiment was conducted following the complete randomized design (CRD) with 4 treatments and 3 replications. Analyses of variance were carried out and Duncan's multiple range test (DMRT) judged the response of the treatments (Gomez and Gomez, 1984).

Results and Discussions

Both BJC-7370 and CVL-1 had reactions with the strains MS-6, MS-9 and CS-1 at different inoculation times. Plants without inoculation were found disease free. Reactions with the varieties with the strains MS-6 and MS-9 were highly susceptible (HS) in 45 days inoculated plants. As the number of days of inoculation increases, the reaction of jute varieties were susceptible (S) and moderately susceptible (MS) in 55 and 65 days inoculated plants. Only, variety CVL-1 showed resistant reaction(R) with MS-9 strains on 65 days inoculated plants. Both BJC-7370 and CVL-1 had susceptible (S) reaction with CS-1 on 45 and 55 days inoculated plants. There were moderately resistant reaction (MR) to CS-1 strain on 65 days inoculated plants in both BJC-7370 and CVL-1 varieties. Plants without inoculation were found disease free (Table 1). It might be due to as the plants become more mature, it produces more structural barriers to the pathogens activity. Agrois (1997) reported that some structural defenses are present in the plant, which include amount and quality of wax and cuticle that covers the epidermal cells, the structures of epidermal cell walls and the presence on the plants of tissues made of thick walled cells that hinder the advance of the pathogen.

Effect of different Inoculation times with strains MS-6, MS-9 and CS-1 on the production of pods plant^{-1}

Results showed that, pods plant^{-1} production was affected significantly due to inoculation with MS-6, MS-9 and CS-1 strains at different inoculation times as compared to un inoculated plants (Table 2). Pods plant^{-1} production differed significantly at different time inoculated plants. Lowest pods plant^{-1} production was found in 45 days inoculated plants of BJC-7370 (18.0) when

Table 1: Reactions of BJC-7370 and CVL-1 of Jute (*Corchorus capsularis* L.) to MS-6, MS-9 strains of *Macrophomina phaseolina* and *Colletotrichum corchori* at different inoculation times

		Strains of *Macrophomina phaseolina*				Strain of *Colletotrihum corchori*	
		MS-6		MS-9		CS-1	
Inoculation times (Days)	Jute varieties	Lesion size(mm)	Degree of severity	Lesion size(mm)	Degree of severity	Lesion size(mm)	Degree of severity
45	BJC-7370	39.00	HS	35.00	HS	30x8.0	S
	CVL-1	43.00	HS	33.00	S	35x9.00	S
55	BJC-7370	25.00	MS	22.00	MS	27x7.50	S
	CVL-1	32.00	S	22.00	MS	25x8.00	S
65	BJC-7370	19.00	MS	16.00	MS	10x4.50	MR
	CVL-1	22.00	MS	14.00	R	12.5x5.0	MR
Control	BJC-7370	-	R	-	R	-	R
	CVL-1	-	R	-	R	-	R

HS=Highly susceptible, S=Susceptible, MS=Moderately Susceptible, MR= Moderately Resistant, R =Resistant,

Table 2: Effect of different inoculation times with MS-6, MS-9 and CS-1 strains on the production of pods plant^{-1}, seeds plant^{-1}, seed germination and infection (%) of BJC-7370 and CVL-1

		Pods plant^{-1}		Seeds plant^{-1}		Seed germinations (%)		Seed infections (%)	
Strains	Inoculation times (Days)	BJC-7370	CVL-1	BJC-7370	CVL-1	BJC-7370	CVL-1	BJC-7370	CVL-1
MS-6	45	8.0c	13.0c	528.0d	1014.0d	66.67d	71.33d	35.00a	32.50a
	55	10.0bc	13.3bc	900.0c	1092.0c	70.83c	75.50c	27.50b	25.67b
	65	13.0b	17.0b	1248.0b	1330.0b	75.33b	78.83b	16.67c	15.83c
	Control	45.0a	36.0a	6368.3a	4422.7a	92.00a	95.00a	1.00d	1.00d
MS-9	45	10.3b	14.0c	690.0d	1092.0d	72.00d	74.00d	30.33a	31.00a
	55	13.0b	18.0b	1285.7c	1602.0c	75.00c	79.33c	25.67b	22.17b
	65	14.0b	19.0b	1515.3b	1944.0b	81.17b	82.83b	11.50c	15.50c
	Control	45.0a	36.0a	6363.3a	4422.7a	92.00a	95.00a	1.00d	1.00d
CS-1	45	16.0c	15.0d	786.0d	1035.0d	72.33c	73.50d	30.33a	30.33a
	55	18.0c	25.0c	1283.3c	1875.0c	73.17c	79.50c	19.33b	19.33b
	65	23.0b	29.0b	1794.0c	2523.0b	75.33b	84.33b	18.67c	13.50c
	Control	45.0a	36.0a	6363.3a	4422.7a	92.00a	95.00a	1.00d	1.00d

The means in a column having common letters do not differ significantly. Control = Plants without inoculation

Table 3: Comparison among the strains MS-6, MS-9 and CS-1 in respect of their effect on the production of pods plant^{-1}, seeds plant^{-1}, seed germination and infection (%) of BJC-7370 and CVL-1

	Pods plant^{-1}		Seeds plant^{-1}		Seed germinations (%)		Seed infections (%)	
Strains	BJC-7370	CVL-1	BJC-7370	CVL-1	BJC-7370	CVL-1	BJC-7370	CVL-1
MS-6	10.33c	14.33c	892.00	1212.00	70.94	75.22	22.25	22.89
MS-9	12.43b	17.00b	1163.67	1552.00	76.06	78.72	26.39	24.67
CS-1	19.00a	23.00a	1281.17	1811.00	73.61	79.11	22.78	21.05

Average over three inoculation times and three replications

plants were inoculated with MS-6 and highest pods plant^{-1} production was observed in 65 days inoculated plants of CVL-1(29.0) when plants were inoculated with CS-1 strain. Pods plant^{-1} productions were 45 and 36 in BJC-7370 and CVL-1 respectively when plants were uninoculated. Sultana ***et al.*** (1992), found that healthy plants produces healthy pods, diseased plants produces diseased pods and caused decreases of pods plant^{-1} production.

Effect of different Inoculation times with strains MS-6, MS-9 and CS-1 on the production of Seeds Plant^{-1}

Seeds plant^{-1} production differed significantly due to inoculation with MS-6, MS-9 and CS-1 strains at different inoculation times. Seeds plant^{-1} production was minimum in BJC-7370 (528) when plants were inoculated with MS-6 on 45 days age of the plants. Maximum seeds plant^{-1} production was found in CVL-1 (2523) when plants were inoculated with CS-1strain on 65 days old plant. Plants without inoculation had the highest seeds plant^{-1} in BJC-7370 (6363.3) and CVL-1 (4422.7). Fazli and Ahmed (1959) found that ***Macrophomina phaseolina*** and ***Colletotrichum corchori*** were responsible for the deterioration of yield and quality of jute seeds (Table 3).

Effect of different Inoculation times with strains MS-6, MS-9 and CS-1 on Seed germination

Seed germination (%) also differed significantly due to inoculation with MS-6, MS-9 and CS-1 strains at different inoculation times. Maximum seed germination was observed in CVL-1 (84.33%) when plants were inoculated with CS-1 strain on 65 days age of the plants and minimum seed germination was observed in BJC-7370 (66.67%) when plants were inoculated with MS-6 strain on 45 days age of the plants. ***Macrophomina phaseolina*** and ***Colletotrichum corchori*** are seed-borne and transmit from seed to plant to seed quite frequently (Akanda and Fakir, 1985). Islam (1987) reported that, seed germination decreased with the increase of infection of the test pathogens (Table 2).

Effect of different Inoculation times with strains MS-6, MS-9 and CS-1 on Seed infections

There were significantly different among the seed infections (%) due to inoculation with MS-6, MS-9 and CS-1 at different inoculation times. The minimum seed infection was observed in BJC-7370 (11.50%) when plants were inoculated with MS-9 on 65 days of the plants. Maximum seed infection was observed in BJC-7370 (35.00%) when plants were inoculated with MS-6 on 45 days age of the plants. AS the number of days of inoculation increases, the seed infections (%) decrease. Plants without inoculation had the lowest seed infections. Islam (1987) in his findings states that, the higher disease development by ***Macrophomina phaseolina*** and ***Colletotrichum corchori*** in jute plants attributed more seed infections in the harvested seeds (Table 2).

Comparison among the strains

Pods Plant^{-1} productions were minimum in BJC-7370 (10.33) when plants were inoculated with MS-6 strain and maximum in CVL-1 (23.00) when plants were inoculated with CS-1 strain. Seeds

plant^{-1} production was observed minimum in BJC-7370 (892) when plants were inoculated with MS-6 strain and maximum in CVL-1 (1811.00) when plants were inoculated with CS-1 strain. Seed germination (%) was also minimum in BJC-7370 (70.94) when plants were inoculated with MS-6 and maximum in CVL-1 (79.11) when plants were inoculated with CS-1 strain. As the plants were inoculated with MS-6 strains, yielded the maximum seed infections in BJC-7370 (26.39%) and inoculation with CS-1 strain yielded minimum seed infections in CVL-1 (21.05%). Pods plant^{-1}, seeds plant^{-1}and seed germinations (%) were less in plants, which were inoculated with MS-9 strain than plants inoculated with M-6 strain and that of more than the plants, which were inoculated with CS-1 strain. Plants inoculated with MS-9 strain yielded less seed infections than MS-6 inoculated plants and more seed infections than CS-1inoculated plants for both BJC-7370 and CVL-1 jute varieties. Ahmed and Ahmed (1969) reported that, in case of ***Corchorus capsularis***, strain MS-6 was more virulent than Strain MS-9. Chaudhury and Ahmed (1969) also detected that the CS-1 strain of ***Colletotrichum corchori*** has real importance as regard to its virulence.

It is concluded that, (i) Variety BJC-7370 and CVL-1 of jute had reaction with strains MS-6, MS-9 and CS-1 at every inoculation times. As the inoculation times increases the lesion size on stem decreases, (iii) Inoculation with strains MS-6, MS-9, and CS-1 increases the number of pods plant^{-1}, seeds plant^{-1}, seed germinations (%)with the increase of inoculation times and at the same time, seed Infections(%) decreases. Among the strains, MS-6 strain was more virulent than MS-9 and CS-1 in respect of pods plant^{-1}, seeds plant^{-1}, seed germination and Infections (%).

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