

Performance of Seed Health Quality and the Effect of Anthracnose Disease in Germination under the Laboratory in CVL-1 Jute Seeds Collected from Different Sources of Bangladesh

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Abstract: Six hundred CVL-1 jute seed samples were collected from different sources in Bangladesh and were subjected to health test. Seed samples were categorized on the basis of presence of *Colletotrichum corchori* as 0, 5, 10, 15, 20 and 25%. Germination of the collected seed samples found to be varied significantly. The highest germination (96.00%) was recorded in breeder seeds and the lowest (67.33%) was in farmers' seeds. In seedling symptom test, the highest (96.00%) and the lowest germination (73.00%) were recorded in case of 0% and 25% initial seed borne infection of *C. corchori*, respectively. Seeds having higher level of seed infections with the pathogens caused reduction of seed germination. Lower germination was recorded at higher prevalence of initial seed borne infection by *C. corchori*.

Key words: Seed borne infection • Biotic stress • Seed health test • Seedling symptom test • *Colletotrichum* • Incidence

INTRODUCTION

Jute (*Corchorus capsularis* L. and *Corchorus olitorius* L.) is one of the cash crops of Bangladesh. In respect of production of jute 90% of the world is produced in Bangladesh and India [1]. Bangladesh ranks second (14,52,044 metric tons annually) among the jute growing countries of the world [2]. In Bangladesh, about 7,60,427 hectares of land were under jute cultivation, where produced 14,52,044 tons at 1.91 t ha⁻¹ [3]. It suffers from 12 different diseases. Ten were reported as seed borne [4]. Among all the seed borne diseases are caused by fungi except leaf mosaic. The fungal pathogens *Macrophomina phaseolina*, *Botryodiplodia theobromae* and *Colletotrichum corchori*, respectively, causing stem rot, black band and anthracnose of jute major diseases that transmitted through seed [5-7]. *Colletotrichum corchori* is seed borne and found only in *C. capsularis*. Other seed borne fungal pathogens of jute seeds are *Fusarium oxysporium*, *F. semitectum*, *Fusarium moniliformae*, *Curvularia lunata* and *Corynespora*

cassiicola. These seed borne pathogens have been found to cause seed rot and infection to young seedlings. Besides, *Aspergillus*, *Penicillium* are frequently associated with stored jute seeds and responsible for reduction in germination. Quite often, the inocula of the seed borne pathogens from the infected seeds and seedlings are transmitted to the growing plants cause diseases in jute.

Macrophomina phaseolina, *Botryodiplodia theobromae* and *Colletotrichum corchori* are transmitted from seed to plant to seed [8]. Study on transmission of seed borne infection of three major seed borne fungal pathogens- *M. phaseolina*, *B. theobromae* and *C. corchori* in jute revealed higher the seed borne infection of the pathogens, higher the disease development in the field. Transmission of *C. corchori* from infected seeds to the harvested seeds through the growing plants is a great threat for jute cultivation [8]. A few works regarding the seed health status of jute seeds of different tires and the transmission nature of *C. corchori* from seed to seedlings was conducted by Fakir, *et al.* as Begum and Fakir in

laboratory condition [8, 9]. Keeping the view of above ideas the present study was under taken to observe the health quality and effect of *Colletotrichum corchori* on germination under laboratory condition.

MATERIALS AND METHODS

Experimental Site: The experiment was conducted in Seed Pathology Laboratory at Plant Pathology Department, Pest Management Division, Bangladesh Jute Research Institute.

Jute Varieties: The variety CVL-1 belonging to deshi pat (*Corchorus capsularis*) of different seed tires was used for conducting the experiments.

Collection of Seed Sample from Different Sources: Altogether 600 seed samples were collected from different locations of Bangladesh of which there were 15 breeders, 5 foundation seeds, 7 certified seeds and 573 farmers' seeds.

Seed Collection Procedure: Seed samples were obtained from the seed lots of each tier. Primary seed sample of 50g were randomly taken from 10 different positions of the seed lot. All the primary seed samples were mixed thoroughly to make a composite sample. Thus each composite sample was 500 g of seeds. As the size of each composite sample was 500 g, so it was regarded as submitted sample. The submitted seed samples were kept in plastic container. All the seed samples were labeled properly and preserved in Gene Bank of BJRI at 5° C till the samples were used for conducting respective research. Working seed samples were taken from the preserved seed samples as per requirement. Total procedure was maintained following the Rules of ISTA [10].

Determination of Germination: Following the rules of ISTA, four hundred seeds that were taken randomly from the well-mixed seed sample [10]. The working samples were divided into four replications and thus one replication contained 100 seeds. To ensure adequate spacing, 100 seeds were divided into four sub replications and each sub replication contained 25 seeds. The seeds were germinated on top of three layers of Whatman no.1 filter paper. The filter papers were soaked in water and placed at the bottom of 9-cm diameter plastic petri dish and thereafter 25 seeds were placed on the top of filter paper. Thus 400 seeds were placed in 16 replicate of petridishes. Evaporation of water was minimized by

tightly fitting the lids of the petri dishes. The petri dishes were placed inside the incubator maintaining the temperature at 30°C for five days. Seeds producing both plumule and radical after incubation were counted as germinating seeds and expressed as percentage.

Detection of *C. corchori* in Jute Seeds: Six hundred seed samples, of variety CVL-1, were collected from different locations of Bangladesh for health analysis for detection of *C. corchori*. Seed health analysis was conducted by blotter method following the International Rules for Seed Health Testing [10]. In this method 9 cm diameter plastic petridish and locally packed Whatman no. 1 filter paper were used. Two hundred seeds were taken randomly and placed on the moist filter paper in eight replicate petridished. The petridishes with seeds were then incubated at 22±2°C for seven days in the laboratory. After incubation of the seeds was examined under stereomicroscope and the pathogen, *C. corchori* were identified by following the key of Sutton [11]. Collected seed samples from all seed tires were categorized on the basis of presence of *Colletotrichum corchori* as 0, 5, 10, 15, 20 and 25% infection with *C. corchori* for conducting further experiment.

Study on the Nature of *C. corchori*: Nature and rate of transmission of *C. corchori* were determined by water agar test tube seedling symptom test [12]. In this technique 6 ml 1% water agar were used in each glass test tube (2.0 cm diameter X 15 cm in length) and sterilized in autoclave. Highest percentage of pure infection was used for the study. Two hundred seed samples were studied where one seed was placed in a test tube and incubated in an air cooled room at 18±3°C under fluorescent tube light. Disease symptoms of the pathogens developed on the germinating seeds and emerged seedlings in the test tube were recorded after 14 days of incubation.

Statistical Analysis: Laboratory experiment data were analyzed following Completely Randomized Design (CRD) Mean comparisons among the treatments were compared by Duncan's Multiple Range Test (DMRT).

RESULTS

Percent Germination and Pathogens Found in Different Seed Samples Collected from Different Locations of Bangladesh: Germination of seeds varied from 67.33% to 96.00% depending on the seed tiers, jute varieties and sources of collection. Recorded germination of seeds was varied significantly. The lowest CVL-1 (67.33%)

Table 1: Mean Germination Percent and pathogens found in different seed samples collected from different locations of Bangladesh

Seed Tire	Breeder	Foundation	Certified	Farmers'	Level of significance
Mean Germination Percentage	96.00 a	92.00 ab	81.33 bc	67.33 c	0.05
Mean Pathogen <i>Colletotrichum corchori</i>	1.00 c	1.55bc	3.33 b	7.33 a	0.05
Pathogen <i>Macrophomina phaseolina</i>	0	1.33	3.67	6.67	*N/A
<i>Botryodiplodia theobromae</i>	0	0	2 b	4.33 a	*N/A
<i>Fusarium</i> spp	1.55 d	3.33 c	5.67 b	8.00 a	0.05
<i>Aspergillus</i> Spp	1.00 d	2.33 c	4.33 b	6.33 a	0.05
<i>Penicilium</i> spp	0	0	3.00 a	3.33 a	*N/A
Other	0	0	2 a	2 a	*N/A
Total	3.55	8.54	24.00	37.99	0.05

*N/A= Not analyzed

Table 2: Germination, seed borne infection of *Colletotrichum corchori* and disease in CVL-1 tested by seedling symptom test on water agar media in test tube

		% infection of CVL-1 with <i>C. corchori</i>		
% initial infection of CVL-1 with <i>C. corchori</i>	Germination Percent	Post emergence Infection	Germination failure	Total death (Pre and post emergence)
0.00	96.00 a	-	-	-
5.00	91.50 a	3.00 e	4.5 e	7.5 e
10.00	86.67 a	6.00 d	5.5 d	11.5 d
15.00	81.00 b	7.5 c	7.00 c	14.5 c
20.00	77.50 c	9.00 b	13.5 b	22.5 b
25.00	73.00 d	12.33 a	13.02 a	25.35 a
Level of significance	0.05	0.05	0.05	0.05

in farmers' seeds and the highest (96.00%) was in breeder seeds. Seed borne fungal infections detected in breeder, foundation, certified and farmers' seeds collected from different locations are presented in Table 1. Findings reveal that breeder seeds always had healthiest quality followed by foundation seeds and the lowest health quality was noted in farmers' seed quality. The total mean seed borne fungal infections recorded in the survey study varied from 3.55 to 37.99% in different seed tiers and seed sources. The highest total percent mean seed borne fungal infections was recorded in CVL-1 under farmers' seed tier (37.99%) preceded by 24.00% under Certified seed tier and the lowest percent mean seed borne infection (3.55%) was recorded in breeder seed tier. The highest percent seed borne infection of *C. Corchori* (7.33 %) recorded in CVL-1 of farmers' seed and the lowest (1.00%) recorded in CVL-1 of breeder seed.

Germination, Seed Borne Infection of *Colletotrichum corchori* and Disease in CVL-1 Tested by Seedling Symptom Test on Water Agar Media in Test Tube: Seedling symptom test in water agar media conducted with seed samples of 0, 5, 10, 15, 20 and 25% initial seed borne infection of *C. corchori* in the laboratory. Finding reveals that % germination, % post emergence infection, % germination failure and % total death for each initial infection varied significantly. The highest germination

(96.00%) was recorded in 0% infected seeds and the lowest (73.00%) was recorded in 25% infected seeds. The highest post emergence infection (12.33%), germination failure (13.02%) and total death (25.35%) were recorded in case of 25% initial seed infection with *C. corchori*. For seeds infected with 0% initial seed borne infection of *C. corchori* no post emergence infection, germination failure and total death were found. (Table 2).

DISCUSSION

Percent germination and pathogens found in different seed samples collected from different locations of Bangladesh varied from 67.33 to 96.00% depending on the seed tiers, jute varieties and collection of seed sources. Germination of seeds varied significantly and the lowest was in CVL-1 of farmers' seeds and the highest in breeder seeds. The total mean seed borne fungal infections recorded in the study varied from 3.55 to 37.99% in different seed tiers and seed sources. The highest seed borne infection with lowest germination was recorded in CVL-1 of farmers' seed and the lowest seed borne infection with the highest germination was recorded in CVL-1 of breeder seed. Findings evident that seeds having higher level of seed-borne infection of the pathogen may cause risk as regard to germination reduction. Haque *et al.*, Islam *et al.*, Mollah *et al.*, Islam

and Fakir and Pervin and Haque reported that least prevalence of seed borne infection of fungal pathogens in breeder seeds and highest in farmers' seeds collected from different sources of Bangladesh [13-17]. (Table 1).

Seedling symptom test in water agar media conducted with seed samples of 0, 5, 10, 15, 20 and 25% initial seed borne infection of *C. corchori* in the laboratory. Findings revealed that the highest germination was recorded in 0% initial seed borne infection of *C. corchori* and the lowest germination was recorded in 25% initial seed borne infection of *C. corchori*. The highest post emergence infection, germination failure and total death were recorded in case of 25.00% initial seed borne infection of *C. corchori* and no post emergence infection, germination failure and total death were recorded in case of 0% initial seed borne infection of *C. corchori*. According to Akanda and Fakir, Islam and Fakir, Mollah *et. al.*, Roy *et. al.* and Pervin and Haque, low germination was recorded to high prevalence of pathogens which is in consonant with the present study [14, 17-20]. (Table 2).

CONCLUSION

The highest germination was recorded in breeder seeds and the lowest was in farmers' seeds in the performance of seed health quality test. The highest seed borne infection with the lowest germination was recorded in farmers' seed and the lowest seed borne infection with the highest germination was recorded in breeder seed. In seedling symptom test the highest germination was recorded in case of 0.00% and the lowest germination was recorded in case of 25.00% initial seed borne infection of *C. corchori*. The highest post emergence infection, germination failure and total death were recorded in case of 25.00% and no post emergence infection, germination failure and total death were recorded in case of 0.00% initial seed borne infection of *C. corchori*. Findings on the incidence of anthracnose after sowing of seeds with different initial % infections of *C. corchori* at laboratory reveals that all the samples had unsuccessful germinating trend with the increase initial % infection.

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