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Control of seed borne fungi of Jute by chemicals

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ABSTRACT
The study aims to explore the prevalence of seed-borne fungal pathogens of jute and their control with chemicals. The experiment is carried out in seed pathology center, Bangladesh Agricultural University to get pertinent information about jute seeds and explore the efficacy of chemicals as seed-treater. Two varieties are selected for this study (Deshipat and Tossapat) and jute seeds collected from two different locations of Bangladesh. The major predominant identified fungi are *Colletotrichum corchori*, *Macrophomina phaseolina*, *Fusarium spp*., and *Botryodiplodia theobromae*. The high prevalence of seed-borne fungal infections causes low germination of juter seeds. Three fungicides namely, Vitavax-200, Bavistin and Captan (@ 0.25% of seed weight) have beenused for

determining their efficacy in controlling the major seed-borne pathogens (*Colletotrichum corchori*, *Macrophomina phaseolina, Botryodiplodia theobromae, Aspergillus spp., Fusarium oxysporum, and Penicillum spp*) of jute seed. The study reveals that vitavax-200 has appeared to be most effective in controlling the seven seed-borne pathogens of jute seed among all the fungicidal treatments. In order of the efficacy of the fungicidal treatments, next Bavistin is found to be effective in case of controlling the seed-borne pathogens and *Captan* is less effective compared to the others treatment.

Key words: Jute, seed borne fungi, disease management, chemical control, stored pest.

1. INTRODUCTION

Jute is popularly known as golden fiber in Bangladesh which supply about 70% Jute and related products in the global market. Jute (*Corchorus capsularis* L. and *C. olitorius* L.) is the main cash crop of Bangladesh (Islam, 2014) and it has a great influence on socio-economic life of jute farmers in Bangladesh (Sarker, 2016c). Although jute is main cash crop of Bangladesh and it earns foreign exchange by exporting jute and jute goods, there is a great scarcity of quality healthy jute seeds in the country(Pervin and Haque, 2012). Jute suffers from a number of diseases. Of all the diseases of jute, 10 are known to be seed borne. Among the seed-borne fungal diseases, stem-rot, black band and anthracnose caused by *Macrophomina phaseolina*, *Botryodiplodia theobromae* and *Colletotrichum corchori* respectively are frequently transmitted through jute seeds. Stem rot, black band, anthracnose, foot rot and wilt (*Rhizoctonia solani*) are responsible for seed rot, pre and post emergence damping off, seedling infections and spread of the diseases to standing crops causing considerable yield loss and deterioration of quality of fiber (Srivastava *et al*., 2010; Meena *et al*., 2014; Kadam et al. 2014). Seed-borne pathogens causing diseases on the growing jute plants in the field quite often attack the capsules or pods and subsequently infect the seed, resulting production of infected or unhealthy seeds (Sheheli and Roy, 2014; Hoque *et al*., 2003; Muhammad Asif et al. 2017). Therefore, proper diseases control measure should be taken for the production of quality healthy jute seeds. Proper disease control measures can substantially improve the quality of jute and significantly increase the yield (Sarker *et al*., 2016; Sarker, 2017). Among the practices used, seed treatment is probably the cheapest and safest method of direct plant disease control (Sarker *et al*., 2017; Sarker and Sultana, 2017). In many countries regular practice of seed treatment is considered as an insurance against the building up of inoculant and has greatly reduced the yield loss and improves the quality in many crops (Sarker, 2016b).

Once chemical control of plant diseases was quite popular for reducing crop losses (Islam *et al*., 2015a; Radhaiah and Nagalakshmi Devamma, 2013). But now-a-days use of chemical for management of crop diseases is being discouraged due to health hazard and environmental pollution (Islam *et al*., 2018; Islam *et al*., 2018) and the obvious development of tolerant pathogen (Sarker, 2016a). In addition the fungicides are very expensive that is sometimes burden for the poor farmers (Sarker *et al*., 2015). In addition, their harmful effect is responsible for air, soil and water pollution. Alternative means of seed treatment i.e., use of environmentally friendly botanical pesticides or plant extract have drawn the attention of Plant Pathologists all over the world. Use of plant extracts of seed treatment may open a new area in controlling seed-borne fungal pathogens. Only a few plant species have so far been tested for controlling the seed-borne fungal pathogens of jute by treating the seed. In view of the above facts, the present study was undertaken to find out the efficacy of chemicals as seed- treater for controlling seed-borne pathogens.

2. MATERIALS AND METHODS

The experiment was carried out in seed pathology center, Bangladesh Agricultural University to obtain relevant information about the health of jute seeds and find out the efficacy of extracts as seed-treater.

2.1. Collection of Jute seed samples

A total of 40 seed samples of jute (*Corchorus capsularis* L.) of local variety, Deshipat and Tossapat (*Corchorus olitorious*) were collected from two different locations of Bangladesh (Netrokona sadar and Barhatta sadar Upazila). Ten villages were included in each Sadar Upazila. One sample was collected from each village in case of two varieties. The size of each sample was 500 g (approx.). The seeds were then kept in polythene bags and stored in the Seed Store of the Seed Pathology Laboratory at 5-7°C, till these were used for the subsequent studies.

2.2. Identification of seed-borne fungi associated with Jute seeds

All the seed samples were assayed for the presence of fungal pathogens by the Blotter Method following the International Rules for Seed Testing Association (ISTA, 2017).

2.3. Blotter method for evaluating seed health status of Jute seed

Seed health status was carried out by Blotter method to detect the seed borne pathogens associated with the jute seed samples. In this method, two hundred seeds were randomly taken from each sample. The seeds were plated on water soaked three layered Whatman No. 1 filter paper in plastic petridishes. In each Petridis, 25 seeds were plated at equal distance. All these petridishes were incubated at 20±2°C under 12 hrs, alternate cycle of Near Ultra Violet (NUV) light and darkness. After 7days of incubation, petriplates containing incubated seeds were observed under stereomicroscope for detecting seed borne pathogens in jute seed surface under stereomicroscope at 25X magnification. Where identification was difficult or doubtful under the stereomicroscope, temporary slide was prepared and examined under the compound microscope and identified with the help through literature review and expert consultation (Islam *et al*., 2015b). Number of germinated seeds was recorded along with the seed-borne fungi after seven days of incubation. The results were expressed in percentage.

2.4. Germination test

Four hundred seeds were taken randomly from the well-mixed seed sample (ISTA, 2017). The working samples were divided into four replication and thus one replication contained 100 seeds. To ensure adequate spacing, 10 seeds were divided into four sub replications and each sub replication contained 25 seeds. The filter papers 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 petridishes and thereafter 25 seeds were placed on the top of filter paper. Thus 400 seeds were placed in 16 replicate petridishes. Evaporation of water was minimized by tightly fining the lids of the petridishes. The petridishes 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 germination seeds. The result was expressed as percentage.

2.5. Treatments

2.5.1 Selected chemicals

1. Vitavax- 200 (@0.25% of seed weight)
2. Bavistin (@0.25% of seed weight)
3. Captan (@0.25% of seed weight)

2.5.2. Seed treatment with chemicals

Based on the results of analysis of the test, one seed sample from the locations of local variety of jute (*Capsularis corchorus* L) and Tossapat (*Capsularis olitorius*) having high levels of infection by the major seed borne fungi, were selected for this study. Three fungicides namely, Vitavax-200, Bavistin and Captan were tested at their recommended dose (0.25%) against the seed-borne fungal pathogens. Requisite amount of each fungicide and seeds from each sample were taken in a 250 ml Erlenmeyer flask and were shaken mechanically for 10 minutes for proper coating fungicides. After 24 hours, the efficacy of the 3 test fungicides was evaluated by comparing with an untreated control using the Standard Blotter Method (ISTA, 2004).

2.6. Analysis of data

The experiments were conducted following the Completely Randomized Design (CRD). Analysis of variance was done and the mean differences in the efficacy of the treatments were judged by Duncan's Multiple Range Test (DMRT). The percentage value of the prevalence of seed borne fungi, the efficacy of fungicidal and plant extract treatments was transformed by Arcsin transformation technique before analysis of variance (Gomaz and Gomez, 1983). In case of prevalence value of total seed borne fungi was not transformed, because the value for them in some cases were above 100%.

3. RESULTS OF THE STUDY

3.1. Identification of seed-borne fungi associated with Jute seeds

After 7 days of incubation of seeds on wet blotting paper the yielded fungi were detected and then identified by the standard blotter method. The fungi yielded were *Macrophomina phaseolina, Botryodiplodia theobromae, Colletotrichum corchori, Cercospora corchori, Curvularia lunata, Fusarium* sp., *Aspergillus* spp., and *Penicillium* spp. Among them only the major ones were taken into account in this experiment (Figure 1 to 4).

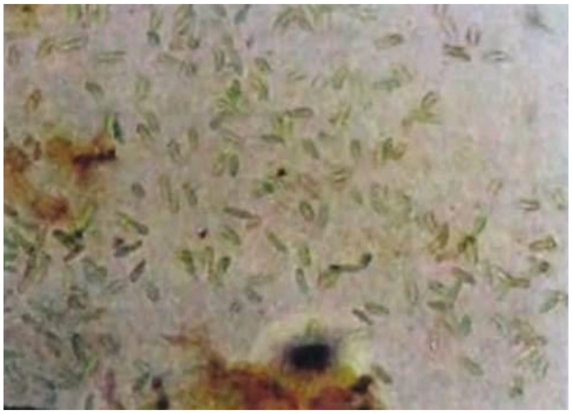


Figure 1 Conidia and pycnidium of *Macrophomina phaseolina*.

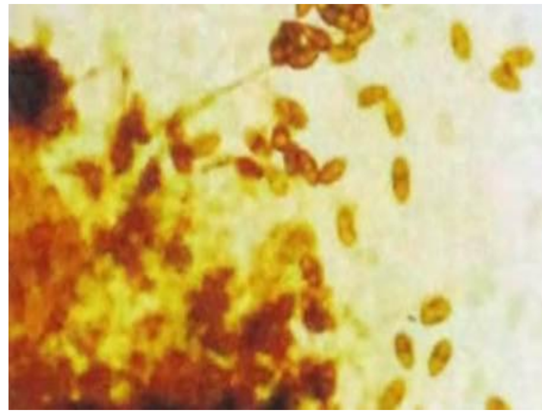


Figure 2 Conidia of *Botryodiplodia theobromae*

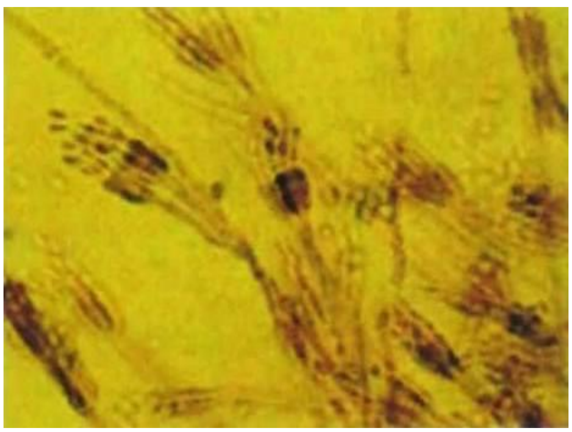


Figure 3 Conidia and conidiophore of *Penicilium* spp.

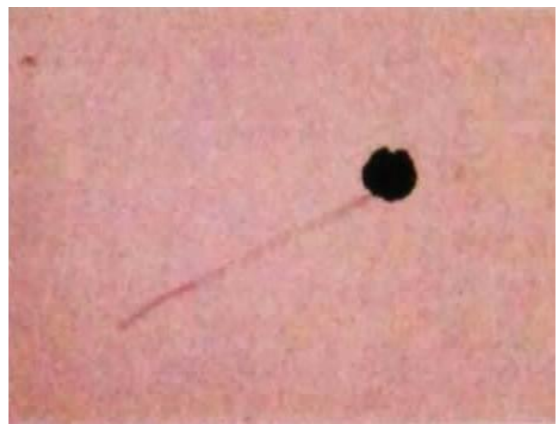


Figure 4 Conidia and conidiophore of *Aspergillus niger*

3.2. Effects of seed-borne fungi on the germination of seeds

After 7 days of incubation, viability of seed samples recorded reveals that the germination ranges from 53.00% to 69.00%. The seed samples obtained from Barhatta sadar upazila showed highest percentage of germination (69.00%). There exist significant differences of germination percentage among the seed samples.

3.3. Prevalence of seed-borne fungi associated with the jute seeds (Blotter method)

The germination of seeds and incidence of fungi associated with the seeds of two jute varieties viz. Deshipat and Tossapat collected from two different locations of Bangladesh viz. Netrokona and Barhatta sadar Upazila. After incubation of seeds on blotter, seven major seed-borne fungi such as *Colletotrichum corchori, Macrophomina phaseolina, Lasiodiplodia theobromae, Fusarium* sp., *Aspergillus* spp., and *Penicillium* spp., were found. In this experiment, ten villages (Amtola, Mudonpur, Sapmara, Parla, Ruhi, Forgati, Satorcree, Simulgani, Faridpur and Sinharbangla) under Netrokona sadar Upazila and ten villages (Asma, Serum, Borhati, Laufull, Hazigonj, Muitor, Bori, Otitpur, Islampurm and Chandreepur) under Barhatta sadar Upazila. The germination percentage of jute seeds differed significantly from variety to variety and also location to location. Seed germination of jute variety, Tossapat was significantly higher followed by Deshipat (60.95%) and presented in Table I. Seed collected from Barhatta sadar Upazila in the villages of Hazigonj and Asma showed the highest germination (69.00%) followed by Netrokona sadar Upazila in the village of Parla (67.50%).

Table 1 Effect of variety on seed germination and seed-borne pathogens

Variety	Germination (%)	*Colletotrichum corchori*	*Macrophomina phaseolina*	*Botryodiplodia theobromae*	*Fusarium oxysporum*	*Aspergillus niger*	*Aspergillus flavus*	*Penicillum spp*	Total
Deshipat	60.95 b (51.36)	8.90 a (17.31)	7.36 b (15.7)	6.57 a (14.81)	8.52 a (16.91)	5.47a (13.35)	4.45 a (6.32)	1.19 a (13.14)	42.46
Tossapat	67.00a (55.01)	7.06b (15.34)	8.64a (17.04)	5.66 b (13.65)	6.47b (14.65)	6.09a (14.14)	4.57a (12.28)	1.52a (7.02)	40.01
LSD P ≤0.01)	5.27	0.83	0.82	0.81	0.84	0.82	0.85	0.69	

Note: Column having the same letter (s) are statistically identical; Figures in parentheses indicate the transformed values and four hundred seeds were tested for each sample.

Seed collected from Barhatta sadar Upazila in the villages of Hazigonj and Asma showed the highest germination (69.00%) followed by Netrokona sadar Upazila in the village of Parla (67.50%).

3.4. Effect of variety on seed germination and seed-borne infection

Seed infection varied significantly with respect to variety. All the seven species of fungi were identified both on the two selected jute varieties. Seed germination of jute seed in Tossapat was significantly higher (67.00%) followed by Seed germination of jute seed in Deshipat (60.95%). Percent total seed borne infection in jute variety, Deshipat (42.46%) was higher and it yielded all the fungi at a higher percentage than Tossapat (40.01%). The incidence of *Colletotrichum corchori* was highest (8.9%) in Deshipat seeds and highest (7.06%) in Tossa pat which was significantly different. The incidence of *Macrophomina phaseolina* was recorded highest in Tossapat (8.64%) which was statistically different with the highest of Deshipat (7.36%).The occurrence of *Botryodiplodia theobromae* was highest in Deshipat (6.57%) which was statistically different with the highest of Tossapat (5.66%). On the other hand, the incidence of *Fusarium oxysporum* was 8.52% in Deshipat seeds and 6.47% in Tossa pat which was significantly different. *Aspergillus niger* and *Aspergillus flavus* were 5.47% and 4.45% in Deshipat and 6.09% and 4.57% respectively in Tossapat and they were statistically similar. The incidence of *Penicillum* spp. was in the seeds of two jute varieties Deshipat and Tossapat was 1.19% and 1.52% respectively.

3.5. Seed treatment with chemicals for controlling the seed-borne fungi of jute seeds

Since the *Curvularia lunata*, *Cercospora corchori*, *Rhizopus* spp., were not found to be the major seed-borne fungi of jute, they were not included in this experiment. Among the two varieties, it was observed that the highest (42.46%) total seed-borne infection was recorded in the variety of jute seeds (Deshipat). Three fungicides namely, Vitavax 200, Bavistin and Captan were used in this experiment. So far germination of the seed is concerned, it was observed that the treated seeds showed significantly higher rate of germination than untreated seeds.

3.5.1. Seed germination

The effect of fungicidal seed treatment on percent germination of jute seeds was studied following standard blotter method. All the treatment used in the experiment significantly increased the germination of jute compared to untreated control. The highest germination (84.00 %) was obtained in T1 (Vitavax @ 0.25% of seed weight) whereas lowest germination (75.00%) was recorded in untreated control T_o (control).

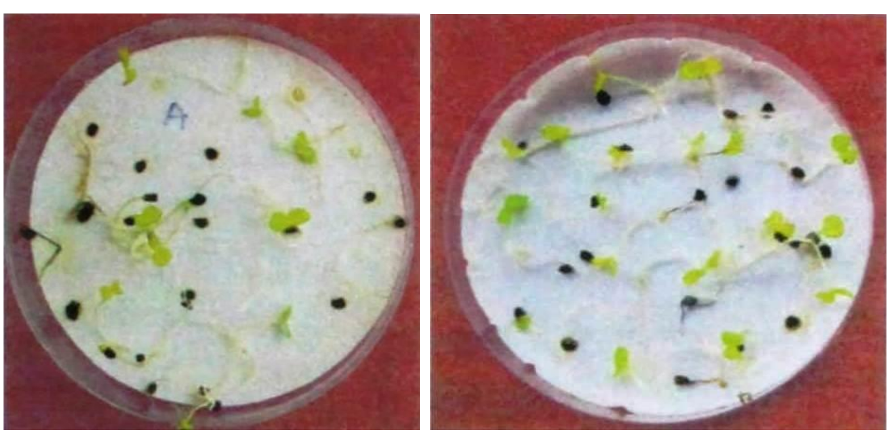
3.5.2 Seed-borne infection

The efficacy of fungicides in controlling seed-borne infection was analyzed and presented in Table 2. Effect of treatments in controlling seed-borne fungi was statistically significant. In case of *Colletotrichum corchori*, highest seed borne infection was obtained in T_o (3.00%). *Colletotrichum corchori* was found to be controlled completely when seeds were treated with Bavistin (0.00%), Captan (0.00%) (@ 0.25% of seed weight) except T_1Vitavax (1.25%) @ 0.25% of seed weight) which was statistically different (Mehedi, Sultana and Raju, 2016).

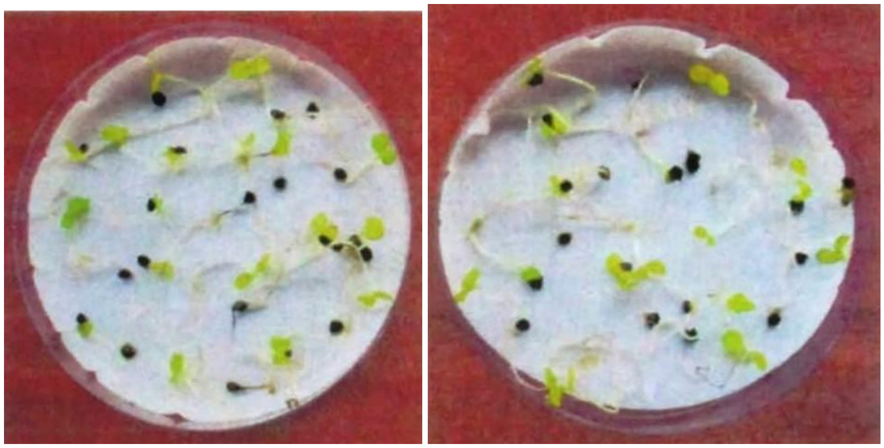
Table 2 Effect of some fungicides in controlling seed-borne fungi of Jute seeds

Chemical treatments	Germination (%)	Seed borne fungi %							Total seed borne fungi (%)	Reduction over control (%)
		Colletotrichum corchori	*Macrophomina phaseolina*	*Botryodiplodia theobromae*	*Fusarium oxysporum*	*Aspergillus niger*	*Aspergillus flavus*	*Penicillum spp*		
Control	75.00 b (59.99)	3.00 a (9.90)	2.00 a (7.99)	3.00 a (9.90)	6.25a (14.44)	2.50 a (9.05)	1.75 a (7.53)	2.00 a (7.99)	20.5 a	
Vitavax 200	84.00 a (66.61)	1.25 b (5.82)	1.0 a (5.22)	0.0 b (1.28)	1.0 c (5.22)	0.0 b (1.28)	0.0 b (1.28)	0.0 b (1.28)	3.25 b	96.75
Bavistin	79.00 ab (62.77)	0.0 c (1.28)	0.0 b (1.28)	0.0 b (1.28)	4.00 b (11.49)	0.50 b (3.51)	0.0 b (1.28)	0.50 b (3.51)	5.00 b	95.00
Captan	78.00 b (62.03)	0.0 c (1.28)	0.0 a (5.22)	0.0 b (1.28)	4.00 b (11.49)	0.25 b (2.39)	0.0 b (1.28)	0.0 b (1.28)	5.25 b	94.75
LSD P ≤0.01)	5.765	0.9695	1.089	0.6296	1.315	0.7373	0.3867	0.7703		

Note: Column having the same letter (s) are statistically identical; figures in parenthesis indicate transformed values. Four hundred seeds were tested for each sample



(A) (B)



(C) (D)

Figure 5 Effect of different chemicals in controlling seed-borne fungi of jute seed showing (A). Control, (B)Vitavax -200, (C) Bavistin and (D). Captan.

In case of *Macrophomina phaseolina*, it was totally controlled when seeds were treated with T_2 (Bavistin) which was statistically different with the other treatments except T_1 (1.00%), T_3 (1.00%) and they were statistically no difference. *Botryodiplodia theobromae* was hundred percent controlled when seeds were treated with T_1, T_2, T_3 and they were statistically no difference (Haque *et al.*, 2014). Highest seed-borne infection of *Fusarium oxysporum* was recorded in uncontrolled seed and it was T_o (6.25%). T_1 (1.00%) was found to be most effective for controlling *Fusarium oxysporum* in which it was statistically different with the treatments T_2 (4.00%) and T_3 (4.00%). T_2 was statistically similar with the treatment T_3. *Aspergillus niger* was totally controlled when seeds were treated with T_1, (0.00%) and the growth of *Aspergillus niger* was inhibited when seeds were treated with T_2 (0.50%), T_3 (0.25%) and they were statistically similar. The growth of *Aspergillus flavus* was totally inhibited when seeds were treated with T_1, T_2, T_3 and they were statistically similar. In case of *Penicillum spp*, it was totally inhibited when seeds were treated with T_1, T_3 except T2 (0.50%).

4. DISCUSSION

Seed-borne mycoflora is one of the major factors of low yield of jute. So, it has a great impact on jute crop production and thus prevention of seed-borne mycoflora demands enormous importance (Haque, 2017). The present research was undertaken to achieve this goal. Results of the present investigation revealed that the jute seeds produced by farmers are quite frequently infected by fungi. In this work, the seed-borne fungi associated with some control measures were studied. Seven prevalence seed-borne fungi were detected on the seeds of jute samples collected from different locations (villages) under two local administrative unit of Netrokona district in Bangladesh. Earlier, different workers studied the fungal flora associated with the jute seeds in Bangladesh and reported that *Macrophomina phaseolina*, *Botryodiplodia theobromae*, *Ascochyta corchoricola*, *Cercospora corchori, Colletotrichum corchori, Corynespora cassiicola, Rhizoctonia solani, Sclerotium rolfsii, Chaetomium, Curvularia lunata, Fusarium* spp. and *Phomopsis* sp., were found to be associated with the jute seeds (Özer and Coşkuntuna, 2016; Singh *et al.*, 2014; Aktar *et al.*, 2018; Chagas and Pupo, 2018).

Other than Bangladesh, many workers also reported *Botryodiplodia theobromae, Macrophomina phaseolina, Colletotrichum corchori, Alternaria tenuis, Arthrobotrytis*spp., *Cephalosporium* sp., *Curvularia lunata*, *Fusarium* spp., *Periconia* spp., and *Trichotheciurn* sp., to be associated with the jute seed (Hoque *et al.*, 2003; Islam *et al.*, 2015a; Islam *et al.*, 2015b; Haque *et al.*, 2013; Islam, 2014). *Ascochyta corchoricola, Rhizoctonia Chaetomium, Phomopsis* sp., *Alternaria tenuis, Cephalosporium* sp., *Periconia* sp., and *Trichothecium* sp., were not observed to be associated with the seed samples used in the present experiment. Two possible explanations could be given to the difference between the present and the earlier results: Firstly, the seed samples collected from the specific locations, used in this experiment does not have the additional fungal flora observed by the earlier workers. Secondly, the differences in the number of samples used by them and in the present experiment might be a cause of not having the additional fungal flora.

So far the germination of seed is concerned the results corroborate with the findings of different workers showing that the fungi associated with seed affect the germination of seeds (Dey *et al.*, 2016; Gullino and Munkvold, 2014; Fleurat-Lessard, 2017). Among the two categories of jute seed - Deshipat and Tossapat. Deshipat (60.95%) had the poorest germination compared to Tossapat (67.00%). This may be due to genetic causes. Health condition of the Tossapat was the best as it had relatively lower (40.01%) total seed-borne infection. Poor germination of Deshipat as regard to germination and seed-borne infection was probably due to less care taken by the farmers during seed crop management, seed processing and storage after harvest. In the present findings, more or less significant difference was observed in germination percentage between the seed samples. This difference might be due to the procedural differences in sample collection, differences in as well as the quantity and kinds of seed-borne fungal flora associated with them. The pathogens encountered were *Botryodiplodia theobromae, Colletotrichum corchori, Curvularia lunata, Fusarium* spp., and *Macrophomina phaseolina*. Among these, *Colletotrichum corchori* appeared to be most effective. Seed-borne infection of the three most destructive pathogens- *Botryodiplodia theobromae, Colletotrichum corchori and Macrophomina phaseolina*. In present finding, it was observed that besides three destructive pathogens, other pathogens were recorded and that was *Fusarium oxysporum and Penicillum* spp. The species of *Fusarium oxysporum* encountered in the present study were found to be responsible for seed germination failure on wet blotter. Frequent association of these species of *Fusarium oxysporum* with jute seeds and its demonstrated pathogenic potentially of causing seed rot / germination failure and seedling blight to the crop, indicates that *Fusarium oxysporum* might also be a potential seed borne pathogen causing some diseases like wilt in the growing jute crop in the field (Derbel *et al.*, 2010). *Aspergillus* species were quite frequently associated with the jute seeds and the fungi were also recorded on ingeminated / rotted seeds in wet blotter, this indicates that the two storage fungi might affect the health of jute seeds. However, other factors might also be responsible for the seed rot / germination failure. High frequency of *Aspergillus* sp., in jute seeds and its association with rotted seeds on wet blotter encountered in the present study demands further critical study on the possible role of these two storage fungi on the health of jute seeds. The incidence of *Penicillum spp* was the lowest among the fungi detected in the present investigation. A few seed samples were infected out of 40 seed samples. This might be due to *Penicillum* free seeds used by the farmers, lower inoculum potential and lower infection of the crop in the farmer's field. In the present findings, more or less significant difference was observed in germination percentage between the seed samples. This difference might be due to the procedural differences in sample collection, differences in as well as the quantity and kinds of seed-borne fungal flora associated with them (Mohapatra *et al.*, 2015). It is expected to be a logical phenomenon that the percent seed-borne infection will be reduced and percent germination will be increased due to seed treatment. In present study, all the treatments were significantly higher over control. This has the supports of the observation made by a good number of researchers (Islam*et al.*, 2015; Dey *et al.*, 2016; Sardrood and Goltapeh, 2018; Dey *et al.*, 2016).

The highest germination (4.00%) was observed in the variety of Deshipat when the seeds were treated with vitavax-200 @ 0.25% of seed weight and it increased germination by 11.20% over control (Table 2). Efficacy of different fungicides as seed treating agents were evaluated and all of them found to be effective in controlling seed borne mycoflora of jute seed. Vitavax-200 appeared to be significantly most effective against all the detective fungi @ 0.25% of seed weight. Vitavax-200 reduced the number of a symptomatic plants harboring endophytic *Fusarium oxysporum* Secondly, Bavistin is best one in controlling the all seed-borne pathogens except *Fusarium oxysporum* yielded 4.00%.In bottle gourd, Bavistin was the most effective seed treater against *Fusarium oxysporum* and this finding also support that Bavistin eliminated the entire pathogenic flora associated with linseed except *Colletotricum lini* (Kumud *et al.* 2003). Captan was found to be most effective against *Colletotricum corchori*, *Botryodiplodia theobromae*, *Aspergillus niger*, *Aspergillus flavus* and *Penicillum* spp. This is in similar result when sunflower seed treated with Captan (2 g/Kg) and also showed that these treatment improved seed germination percentage.

From the present experiment, it is observed that seed borne fungi are a threat to health of jute seeds. Thus, situation demands that due attention should be paid to health status of jute seeds prior to sowing. Seed treatment may be a unique technique applicable in this regard as it reduces or eliminates seed borne mycoflora and also increases seed germination (Mohapatra *et al.*, 2015). Treatments of seeds with Vitavax-200@ 0.25% of seed weight and Garlic extract (1:2) may be effective in controlling jute fungal flora. Thus, new seed protection means can be forwarded to the farmers to control seed borne fungi of jute. This study emphasizes the need of undertaking further comprehensive research with more varieties and chemicals and field study for its confirmation.

5. CONCLUSION

The purpose of the study was to determine the prevalence of seed-borne fungal pathogens and germination in selected varieties of jute seeds collected from two different locations in order to obtain relevant information about the health of jute seeds and find out the efficacy of chemicals as seed- treater. Three fungicides namely, Vitavax-200, Bavistin and Captan were tested for determining their efficacy in controlling the major seed—borne pathogens (*Colletotrichum corchori, Macrophomina phaseolina, Botryodiplodia theobromae, Aspergillus* spp, *Fusarium* spp. and *Penicillum* spp.) of jute seed. Vitavax-200 appeared to be most effective in controlling the seven seed-borne pathogens of jute seed among the all the fungicidal treatments. In order of the efficacy of the fungicidal treatments, next Bavistin was found to be effective in case of controlling the seed—borne pathogens and Captan was less effective compared to the others treatment in case of two varieties.

Authors' contributions

All authors contributed equally from research design to manuscript preparation. All authors checked the final manuscript and approved for publication.

Disclosures about potential conflict of interests

All the authors declare that there is no potential conflict of interest among the authors.

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