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Article

Effect of seed washing either alone or in combination with garlic extract and Knowin 50WP on quality of jute seeds

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Abstract: Efficacy of seed washing, garlic extract, prewashed seeds treated with garlic extract, Knowin 50 WP (Carbendazim) and prewashed seeds treated with Knowin 50WP were evaluated on seed borne fungi of jute seeds. Nine seed borne fungi were detected on both deshi and tossa jute seed samples collected from sadar upazilla of Barisal district viz., *Macrophomina phaseolina, Botryodiplodia theobromae, Fusarium spp, Colletotrichum corchori, Curvularia lunata, Aspergillus flavus, A. niger, Penicillium spp.* and *Alternaria spp.*. Physical seed washing and garlic extract were found effective against seed borne diseases of jute which significantly decrease the association of seed borne fungi from jute seeds. Prewashed seeds treated with garlic extract showed highest germination and highest reduction of seed borne mycoflora from desi and tossa jute seeds. Knowin 50WP or prewashed seeds treated with Knowin 50WP were found effective to reduce seed borne fungi from jute seeds. Highest vigor index was obtained in jute seedlings raised from prewashed seeds treated with Garlic or Knowin 50WP. Thus, prewashed seeds treated with Garlic or Knowin 50WP resulting significant reduction of seed-borne fungal population and enhancing seeding vigor.

Keywords: jute; seed borne fungi; seed washing; garlic; Knowin 50WP

1. Introduction

Jute is an important cash crop in Bangladesh and India, which together accounts for about 84% of world production of jute fibre (BJRI, 2008). The land and climatic condition of Bangladesh is very suitable for the production of quality jute. Like other crops, diseases of jute play a vital role in decreasing the quality and yield of fibre. Biswash *et al*. (1992) reported eighteen diseases of jute caused by fungi, nematode and virus. Fakir (2000) reported 10 seed borne diseases of jute in Bangladesh. There are about 10% production loss of jute may be incurred annually due to seed-borne fungal diseases in Bangladesh (Nitul, 2009). Begum (1989) found that Colletotrichum corchori, Botryodiplodia theobromae and Macrophomina phaseolina caused germination failure and seed rot of jute leading to develop diseased symptoms on growing seedlings.

It is unquestionable that proper disease control measures should be taken for the production of quality jute seeds. Proper disease control measures can substantially improve the quality of jute and significantly increase the fiber yield. Among the practices used, seed treatment is probably the cheapest and safest method of direct plant disease control. Seed treatment, generally with a combination of selective fungicides, is a standard practice for control of the seedling disease complex (Minton and Garber, 1983). Physical seed cleaning is important practice for reducing pathogens associated with seeds. Hasan (2000) reported that physical seed sorting of rice seeds resulted 8.33% germination increase over non-sorting seeds. It is published that seed cleaning, washing and seed treatment reduce disease incidence in seedlings (Asad-ud-doullah *et al*., 2002). However, effective seed treatments are needed to effectively reduce the seed-borne inoculum. Nowadays, it is reported that combination of physical and chemical or other non-chemical seed treatment are more effective against seed borne fungi than use of single chemical or other non-chemical treatment (Mallick *et al*., 2013, Uzzal *et al*.,

2014). Islam *et al*. (2013) reported that physical seed washing with water followed by seed treatment with plant extract or chemical fungicides resulting significant reduction of seed-borne fungal population and enhancing seeding vigor in mesta seeds. Considering the above facts the present research work was undertaken aiming to know the efficacy of seed washing either alone or in combination with garlic and Knowin 50WP in reducing the incidence of fungi associated with jute seeds.

2. Materials and Methods

Farmer's stored seeds of deshi jute, BJC-7370 (Corchorus capsularis) and tossa jute, O-9897 (C. olitorius) were collected from sadar upazilla of Barisal district. The seeds were then kept in brown paper bags and stored in the refrigerator at 4oC in Seed Pathology Center (BAU) until use. The experiment was conducted at Seed Pathology Center (SPC) and M.S. Laboratory, Department of Plant Pathology, Bangladesh Agricultural University (BAU), Mymensingh. Total six treatments were applied for the experiment which were T0= Control, T1= Seed washing with normal water, T2= Garlic extract (1:1), T3= Prewashed seeds treated with garlic extract (1:1), T4= Knowin 50 WP (Carbendazim) @ 0.2% and T5= Prewashed seeds treated with Knowin 50 WP @ 0.2%. Garlic extract was prepared by using the method described by Hossain *et al*. (1997). Seed washing was done following the method of Islam *et al*. (2013). After washing, seeds were placed in open air for drying (4-5 h). Seed treatment with garlic extracts was done by dipping seeds in freshly prepared garlic extracts (1: l) for 20 minutes. Chemical fungicide, Knowin 50 WP was tested as a seed treating chemical. Five grams of seeds from both samples and .01 g of Knowin 50 WP were taken in two different 250 ml of Erlenmeyer flask and were shaken for l0 min for proper coating. The treated and untreated seeds were tested for seed-borne fungi following the standard blotter method (ISTA, 1999). Four replications were conducted for each sample. After incubations, the germination of seeds and yielded fungi were counted. The incubated seeds were observed individually under stereomicroscope and the associated fungi were detected by observing their growth characters on the incubated seeds on blotter paper following the keys outlined by Khan and Islam (1975). For proper identification of fungi, temporary slides were prepared from the fungal colony, observed under a compound microscope, and identified.

For germination and vigor tests, seeds were sown in tray soil. Watering was done to maintain soil moisture. Trays were kept in green house for protecting young and delicate seedling from heavy shower and scorching sunlight. After 10 days of sowing, seed germination, seedling shoot length and root length were measured for calculating seedling vigor (vigor index) following the formula given by Baki and Anderson (1972). All data were analyzed and mean differences among the treatments were compared by Duncan's Multiple Range Test (DMRT). A statistical computer package MSTAT-C was used for analyzing the data.

3. Results

Effect of different treatments on germination of seeds and seed borne fungi of deshi and tossa jute was recorded by using standard blotter methods (Table 1 and 2). In case of deshi jute, germination of seeds significantly varied in different treatments ranged from 56.00 to 94.67%. The lowest germination (56.00%) of seeds was found in untreated (T0) seeds and the highest (94.67%) germination was found on prewashed seeds treated with Knowin 50WP (Table 1). Plating of seeds in wet blotter yielded total nine different fungi from all the samples examined. These fungi were Macrophomina phaseolina, Botryodiplodia theobromae, Fusarium spp., Colletotrichum corchori, Curvularia lunata, Aspergillus flavus, A. niger, Penicillium spp. and Alternaria spp..

Among the six different treatments, seed treatment with garlic extract (T2), prewashed seeds treated with garlic extract (T3), Knowin 50WP (T4) and prewashed seeds treated with Knowin 50WP (T5) showed enhanced performance for reducing seed born fungal population from seeds. Association of C. corchori, M. phaseolina, B. theobromae, A. niger, Penicillium spp. and Alternaria spp. was completely eradicated in case of prewashed seeds treated with garlic extract (T3) and prewashed seeds treated with Knowin 50WP (T5). Total seed borne fungi were lowest in prewashed seeds treated with Knowin 50WP, while the second best performance was recorded by the treatment with prewashed seeds treated with garlic extract. Treatment with garlic extract and Knowin 50 WP also showed better performance for inhibiting fungal population from seeds.

In case of tossa jute, germination of seeds significantly varied in different treatments ranged from 58.66 to 96.00% (Table 2). The lowest germination (58.66%) of seeds was found in untreated (T0) seeds and the highest (96.007%) germination was found on prewashed seeds treated with garlic extract (T3) and prewashed seeds treated with Knowin 50WP @ 0.2 (T5). Plating of seeds of tossa jute in wet blotter yielded total nine different fungi from all the samples examined which were similar to deshi jute. Among the six different treatments, seed treatment with garlic extract (T2) or prewashed seeds treated with garlic extract (T3) or prewashed seeds treated with Knowin 50WP (T5) showed enhanced performance in controlling C. corchori, M. phaseolina and B. theobromae. Complete eradication of these three seed borne fungi was observed with T3 and T5. Seed washing

(T1) was found effective to control all of the detected seed borne fungal flora. Association of C. corchori, M. phaseolina, B. theobromae, C. lunata, A. niger, Penicillium spp. and Alternaria spp. with seeds was completely eradicated in prewashed seeds treated with garlic extract (T3) or prewashed seeds treated with Knowin 50WP (T5). Complete eradication of Fusarium spp. were not achieved by any treatment but lowest seed borne infection of Fusarium spp. was observed by prewashed seeds treated with Knowin 50WP (T5).

Effect of different treatments on seed germination in tray soil was recorded (Fig.1). Highest germination (82.00%) of deshi jute seed samples was observed in T5 (prewashed seeds treated with Knowin 50WP, whereas lowest germination (70.00%) was observed T0 (control). In case of tossa jute seed samples highest germination (77.00%) was observed in T5 (prewashed seeds treated with Knowin 50 WP, whereas lowest germination was found in prewashed seeds (T1) and it was 71.00%. In deshi jute seeds, higher shoot length (5.48 cm) was observed in Knowin 50WP (T4) as well as in prewashed seeds treated with Knowin 50WP (T5) whereas lowest shoot length was observed in T0 (control). Higher root length (3.72 cm) was observed in prewashed seeds treated with garlic extract (T3) whereas lowest root length was observed in T0 (2.88 cm). After calculation, highest vigor index (736.36) was found in prewashed seeds treated with Knowin 50 WP (T5) and lowest vigor index was found in T0 (581.00). In case of tossa jute seeds, highest shoot length was observed in prewashed seeds treated with garlic extract (T3=5.54 cm) whereas lowest shoot length was observed in T0 (3.66 cm). Highest root length was observed in prewashed seeds treated with Knowin 50 WP (T5=2.88 cm) whereas lowest root length was observed in T0 (3.14). Highest vigor index was found in prewashed seeds treated with Knowin 50 WP (T5=632.94) and lowest vigor index was found in T0 (496.40).

4. Discussion

Seed-borne fungi are one of the major factors of low yield of jute fiber. Therefore, it has a great impact on jute crop production and thus, the prevention of these fungi is important. In present research program, the seed-borne fungi associated with the jute seeds were investigated as well as some control measures were studied. Prevalence of nine most seed-borne fungi was detected with seeds of jute samples collected from sadar upazilla of Barisal district. Different workers studied the fungal flora associated with the jute seeds in Bangladesh and reported that Macrophomina phaseolina, Botryodiplodia theobromae, Colletotrichum corchori, Curvularia lunata, Fusarium spp. and Aspergillus spp. were found to be associated with the jute seeds (Begum, 1989; Fakir *et al*., 1990; Haider *et al*., 1992, Islam, 2013).

Seed treatment is considered as a primary and effective method for controlling seed borne fungi. It is expected to be a natural phenomenon that the percent of seed germination would be higher in case of treated seeds than that of untreated seeds. Similarly, many workers found the similar results when they treated the different crop seeds with different fungicides (Wahid *et al*. 1995 and Das and Narian, 1996). Reduced incidence of seed-borne fungi was recorded in treated seed samples of jute seeds. Garlic extract was found effective against seed borne diseases of jute. From the present experiment, it is appeared that garlic had antifungal activity. Garlic extract was effective against Macrophomina phaseolina, Botryodiplodia theobromae, Colletotrichum corchori and Fusarium spp. (Dubey and Dwivedi, 1991, Khan and Kumar, 1992 and Rahman *et al*., 1999). Sultana *et al*. (2007) reported that garlic paste increased the rate of germination and decrease the rate of post emergence seedling mortality of jute.

Physical seed washing is a good method for reducing fungal mycoflora from seeds (Uzzal *et al*. 2014). Combination of physical seed washing and other chemical or plant extract treatment is to be an effective way to control seed borne fungi. In the present study, prewashed seeds treated with garlic extract showed highest germination and highest reduction of seed borne mycoflora. Kabir *et al*. (2007) reported that farmer's stored wheat seeds washed with water or brine solution increase seed germination and suppressed the incidence of Bipolaris sorokiniana. Panna *et al*. (2009) reported reduced fungal association in seeds washed with brine solution. Reduced number of seed borne fungi were detected in prewashed mesta seeds treated with garlic extract (Islam *et al*., 2013). In the experiment, Knowin 50WP or prewashed seeds treated with Knowin 50WP were found effective to reduce seed borne fungi from jute seeds. Thus, combined treatment of water washing and garlic extract or Knowin 50 WP significantly reduced the associated fungi from jute seeds.

In deshi and tossa jute seeds, higher vigor indexes were obtained in jute seedlings raised from prewashed seeds treated with Garlic or Knowin 50WP (Table 3). Roy *et al*. (2011) reported the quality improvement of jute seed by plant extracts viz. garlic tablet, allamanda tablet, neem leaf extract, bishkatali leaf extract and zinger rhizome extract, and observed a significant increase in seedling vigor over untreated control after garlic treatment.

Table 1. Effect of different treatments on germination and seed-borne fungi of deshi jute.

Treatmens	Germination (%)	*Colletotrichum corchori*	*Macrophomina phaseolina*	*Botryodiplodia theobromae*	*Fusarium* spp	*Curvularia lunata*	*Aspergillus flavus*	*A. niger*	*Penicillium* spp	*Alternaria* spp
T_0	56.00 e	12.00 a	12.00 a	12.00 a	12.00 a	32.00 a	24.00 a	8.00 a	6.00 a	0.00
T_1	77.33 d	8.00 b	8.00 b	8.00 b	4.00 b	28.00 b	16.00 b	4.00 b	4.00 b	0.00
T_2	81.33 c	8.00 b	4.00 c	4.00 c	0.00 c	24.00 c	4.00 c	0.00 c	4.00 b	0.00
T_3	90.64 b	0.00 c	0.00 d	0.00 d	0.00 c	20.00 d	4.00 c	0.00 c	0.00 c	0.00
T_4	82.67 c	0.00 c	4.00 c	0.00 d	0.00 c	8.00 e	0.00 d	0.00 c	4.00 b	0.00
T_5	94.67 a	0.00 c	0.00 d	0.00 d	0.00 c	8.00 e	0.00 d	0.00 c	0.00 c	0.00
$LSD_{0.05}$	1.78	0.81	1.10	0.43	0.66	1.53	1.06	0.178	0.79	0.00

Data were subjected to Duncan's Multiple Range Test (DMRT) using a statistical computer package (MStatec). Each value represents the mean and standard deviation of three replications. In a column, figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). Treatments were T_0= Control (non-treated), T_1= Seed washing with normal water, T_2= Garlic extract, T_3= Prewashed seeds treated with garlic extract, T_4= Knowin 50 WP and T_5= prewashed seeds treated with Knowin 50WP.

Table 2. Effect of different treatments on germination and seed-borne fungi of tossa jute.

Treatments	Germination (%)	% seed-borne infection								
		Colletotrichum corchori	*Macrophomina phaseolina*	*Botryodiplodia theobromae*	*Fusarium* spp	*Curvularia lunata*	*Aspergillus flavus*	*Aspergillus niger*	*Penicillium* spp	*Alternaria* spp
T_0	58.66 d	32.00 a	10.00 a	8.00 a	64.00 a	12.00 a	16.00 a	8.00 a	6.00 a	8.00 a
T_1	80.00 c	4.00 b	6.00 b	0.00 c	20.00 d	12.00 a	12.00 b	8.00 a	4.00 b	4.00 b
T_2	80.00 c	0.00 c	0.00 d	4.00 b	32.00 b	8.00 b	8.00 c	4.00 b	0.00 c	0.00 c
T_3	96.00 a	0.00 c	0.00 d	0.00 c	24.00 c	0.00 c	4.00 d	0.00 c	0.00 c	0.00 c
T_4	90.00 b	0.00 c	4.00 c	0.00 c	20.00 d	0.00 c	4.00 d	4.00 b	0.00 c	0.00 c
T_5	96.00 a	0.00 c	0.00 d	0.00 c	4.00 e	0.00 c	0.00 e	0.00 c	0.00 c	0.00 c
$LSD_{0.05}$	2.52	0.73	0.66	0.16	1.31	0.51	0.49	0.21	0.32	0.28

Data were subjected to Duncan's Multiple Range Test (DMRT) using a statistical computer package (MStatec). Each value represents the mean and standard deviation of three replications. In a column, figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). Treatments were T_0= Control (non-treated), T_1= Seed washing with normal water, T_2= Garlic extract, T_3= Prewashed seeds treated with garlic extract, T_4= Knowin 50 WP and T_5= prewashed seeds treated with Knowin 50WP.

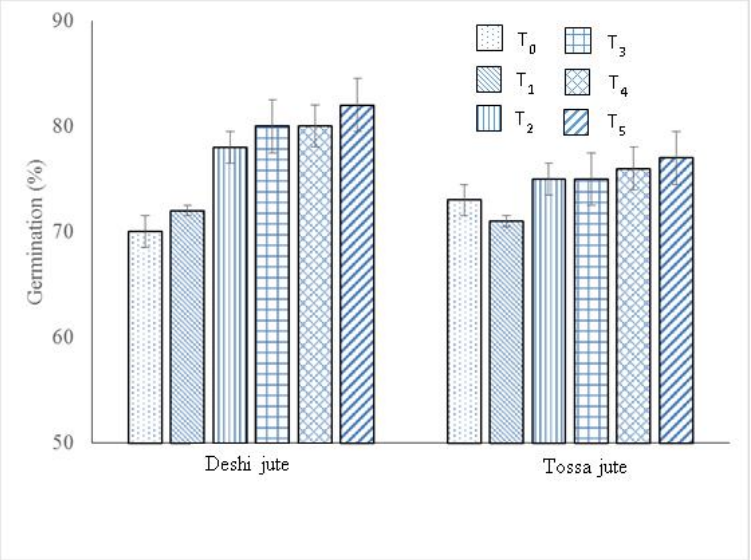

Figure 1. Effect of different treatments on seed germination (tray sand methods). Each value represents the mean and standard deviation of three replicates. Treatments were T_0= Control (non-treated), T_1= Seed washing with normal water, T_2= Garlic extract, T_3= Prewashed seeds treated with garlic extract, T_4= Knowin 50 WP and T_5= prewashed seeds treated with Knowin 50WP.

Table 3. Effect of different treatments on mean shoot length, mean root length and vigor index of deshi jute.

Treatments	Deshi			Tossa		
	Shoot length (cm)	Root length (cm)	Vigor index	Shoot length (cm)	Root length (cm)	Vigor index
T_0	5.42 a	2.88 c	581.00e	3.66 d	3.14 a	496.40e
T_1	5.36 a	3.08 c	607.68d	4.94 c	2.40 d	521.14d
T_2	5.34 a	3.38 b	680.16c	5.20bc	2.72 c	594.00c
T_3	5.16 b	3.72 a	710.40b	5.54 a	2.60 c	610.50b
T_4	5.48 a	3.42 b	712.00b	5.30ab	2.74bc	611.04b
T_5	5.48 a	3.50ab	736.36a	5.34ab	2.88 b	632.94a
$LSD_{0.05}$	0.14	0.225	12.07	0.29	0.15	6.46

Data were subjected to Duncan's Multiple Range Test (DMRT) using a statistical computer package (MStatec). Each value represents the mean and standard deviation of three replications. Columns with same letters do not differ significantly whereas dissimilar letters differ significantly (as per DMRT). Treatments were T_0= Control (non-treated), T_1= Seed washing with normal water, T_2= Garlic extract, T_3= Prewashed seeds treated with garlic extract, T_4= Knowin 50 WP and T_5= prewashed seeds treated with Knowin 50WP.

5. Conclusions

From this study, it can be concluded that seed-borne fungi of jute seeds affect seed germination and seedling vigor as well as prewashed seeds treated with garlic extract or chemical can be an effective way to decrease seed borne fungi of jute seeds.

Conflict of interest

None to declare.

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