J. Agrofor. Environ. 4 (1): 185-188, 2010 ISSN 1995-6983

Prevalence of seed-borne fungi of jute seeds of Sadar upazilla of Jamalpur district and its control with plant extracts

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Abstract**:** Jute seeds collected from twenty locations of Sadar upazilla in Jamalpur district were studied for seed-borne fungal prevalence and it's control by plant extracts. Four hundred seeds of each sample were tested by dry inspection and blotter incubation method. Incidence of the seed-borne fungal pathogens and number of seeds sprouted were recorded. Different seed-borne fungi such as *Macrophomina phaseolina, Botryodiplodia theobromae, Colletotrichum corchori, Fusarium sp., Cercospora corchori* and *Curvularia lunata* were found predominantly associated with the jute seeds**.** Percent sprouting and percent seed borne infection of fungal pathogens were influenced by different plant extracts. Out of five extracts (Garlic clove, Allamanda leaf, Neem leaf, Tobacco leaf and Bishkatali leaf @ 1:1 and 1:2 concentration), garlic (*Alium sativum*) clove extract @ 1:1 and 1:2 concentrations were found most effective in controlling seed-borne fungal infections. Garlic clove extract @ 1:1 conc. reduced highest fungal infection whereas tobacco leaf extract @ 1:2 conc. reduced lowest percentage of fungal infection.
Key words: Plant extracts, Seed-borne fungi, Jute.

Introduction

Jute (*Corchorus capsularis* L. and *C. olitorius* L.) is the most important cash crop of Bangladesh and plays an important role in the economy of our country. It suffers from more than 12 different diseases of which 10 are known to be seed-borne (Rashid *et al.,* 1995). Among the fungal pathogens *Colletotrichum corchori, Botryodiplodia theobromae, Macrophomina phaseolina, Fusarium* spp., *Cercospora corchori* and *Corynespora cassiicola* are of major importance in causing different diseases and frequently transmitted through jute seeds (Fakir *et al.,* 1990). *Macrophomina phaseolina,* alone can cause up to 10% yield loss (Ahmed, 1968). In Bangladesh, yield loss due to diseases is about 8-20% depending on the severity of the diseases (Ahmed and Sultana, 1985). Among the practices used, seed treatment is probably the cheapest and safest method of direct plant disease control (Ahmed and Sultana, 1985). So far an appreciable amount of work has been done on the control of seed borne pathogens of jute by fungicidal seed treatment (Fazli,S.F.I. and Ahmed, Q. A.1960).Very few works have been done for the control of seed-borne of jute by plant extracts (Fakir and Khan 1992).On the basis of the above facts, the present study was under taken to achieve the aim of determining the seed-borne fungi associated with jute seeds and their control by plant extracts.

Materials and Methods

The experiment was conducted at the Seed Pathology Center (SPC) and Department of Plant pathology, Bangladesh Agricultural University (BAU), Mymensingh during the period from November, 2008 to March, 2009. A total of 20 seed samples of jute (*Corchorus capsularis L.*) were collected from 20 locations of Sadar upazilla of Jamalpur district. The seeds were then kept in paper bags and stored in the refrigerator at 5-7°C, till these were used for the subsequent studies. All the collected samples were subjected to dry inspection to find out the percentage of healthy, diseased, shriveled, discoloured and mechanically injured seeds. Seed-borne fungi associated with the seed samples were detected following the Standard Blotter Method (ISTA, 1996). The seeds were treated with five plant extracts viz., garlic (clove), neem (leaf), allamanda (leaf), bishkatali (leaf), tobacco (leaf) extracts @ 1:1 (Water: Extracts) and 1:2 (Water: Extracts) concentrations. The collected plant parts were chopped after cleaning under running tap water. The extracts were prepared by crushing the plant parts in a blender with distilled water at 1:1(100 gms. crushed plant materials in 100 ml water). 100 ml. more water added to prepared the 1:2 dilution. The extracts were filtered through cheese cloth. The extracts thus obtained were kept in a refrigerator at 4±1° C until use. Seed samples were treated following dipping method. The seeds were dipped into previously prepared 1:1 and 1:2 dilutions of garlic, allamanda, neem, bishkatali and tobacco extracts for 20-30 minutes. After proper covering of the seed coat with the extracts, plants extracts remain were drained out from the petriplates. The treated seeds were put to test following the standard blotter method (ISTA, 1976). Four replications were conducted for each sample. After incubation, the fungi yielded and sprouting of seeds were observed and the prevalence was recorded. Data were analyzed following Completely Randomized Design (CRD) and the mean differences among the treatments were compared by Duncan's Multiple Range Test (DMRT).

Results and Discussion

Dry inspection: The results of dry inspection of twenty jute seed samples were high (83.5%) at Bashchara and low (62.25%) at Godashimla. Highest number (5.25%) of diseased seeds was recorded at Ranorampur and lowest number (1.25%) of diseased seeds was recorded at Bashchara. Shrivelled and discoloured seeds were found in high number (29.75%) at Naricali and low number (9.0%) at Shahbajpur. Seed samples of Srirampur contained high amount (5.5%) of mechanically injured seeds. It was low (1.2s5%) at Rajpara.

Prevalence of seed-borne fungi associated with jute seeds: After incubation of seeds on blotter, six major seed-borne fungi such as *Colletotrichum corchori, Macrophomina phaseolina, Botryodiplodia theobromae, Fusarium* sp., *Cercospora corchori,* and *Curvularia lunata* were found (Table 1). The highest germination was recorded from seeds of Charpara (73.5%) and the lowest from seeds of Barapathalia (51%). The germination of seed observed in the present study corroborate with the findings of different workers indicating that the fungi associated with seed affect the germination of seeds (Miah, 1974; Akanda and Fakir, 1985; Begum, 1989).

Table 1. Seed-borne infection of fungi recoded on jute seeds collected from different locations at sadar Upazilla in Jamalpur district

Locations	Sprouting (%)	% seed borne infection					
		Colletotrichum corchori	*Macrophomina phaseolina*	*Botryodiplodia theobromae*	*Fusarium sp.*	*Cercospora corchori(*)*	*Curvularia lunata(*)*
1.Shahbajpur	66.50^{b}	2.75^{i}	9.25^{d}	6.75^{e}	12.00^{bc}	0.50^{d}	1.00^{b}
2. Nayapara	60.50^{cde}	10.75^{bc}	8.25^{e}	7.25^{de}	13.00^{b}	1.25^{c}	0.75^{b}
3.Charpara	73.50^{a}	5.50^{gh}	2.75^{i}	5.00^{f}	14.50^{a}	2.75^{b}	0.00^{c}
4. Rajpara	72.25^{a}	6.50^{gh}	11.75^{a}	2.75^{g}	10.75^{cde}	2.75^{b}	0.00^{c}
5. Nandina	58.75^{ef}	11.00^{bc}	10.75^{bc}	8.00^{cd}	6.50^{ij}	0.00^{d}	1.00^{b}
6.Srirampur	53.50^{g}	11.75^{b}	12.00^{a}	10.00^{b}	8.00^{gh}	3.75^{a}	0.00^{c}
7.Godashimla	65.50^{b}	6.50^{gh}	5.25^{g}	6.75^{e}	8.25^{gh}	0.00^{d}	0.00^{c}
8.Barapathalia	51.00^{g}	9.25^{de}	12.00^{a}	12.00^{a}	11.00^{cde}	0.00^{d}	0.00^{c}
9. Sripur	62.75^{be}	8.00^{f}	11.75^{a}	3.25^{g}	9.25^{fgh}	0.25^{d}	0.00^{c}
10. Bashchara	73.50^{a}	8.50^{ef}	3.75^{h}	2.75^{g}	5.50^{j}	0.50^{d}	0.25^{b}
11. Fotepur	64.00^{bc}	7.00^{gh}	11.25^{ab}	4.50^{f}	6.50^{ij}	0.00^{d}	0.00^{c}
12.Ranorampur	59.00^{def}	5.25^{h}	10.25^{cd}	8.25^{c}	9.75^{efg}	0.00^{d}	0.00^{c}
13.Naricali	52.00^{g}	13.00^{a}	12.00^{a}	10.00^{b}	12.00^{bc}	3.50^{a}	2.75^{a}
14.Atabari	63.25^{bcd}	10.25^{cd}	7.50^{e}	7.25^{de}	6.50^{ij}	3.00^{b}	0.00^{c}
15.Kendua	70.50^{a}	3.75^{i}	9.50^{de}	4.25^{f}	10.00^{def}	0.00^{d}	0.00^{c}
16.Suntia	51.75^{g}	13.00^{a}	11.75^{a}	8.25^{c}	9.75^{efg}	3.50^{a}	2.75^{a}
17.Goneshpur	53.00^{g}	10.50^{c}	7.25^{ef}	10.50^{b}	7.75^{hi}	0.00^{d}	3.00^{a}
18.Pakshimary	61.25^{cde}	7.50^{f}	5.50^{g}	8.00^{cd}	8.50^{fgh}	2.75^{b}	0.00^{c}
19.Hajipur	55.00^{fg}	10.50^{c}	10.50^{bc}	7.25^{de}	10.00^{def}	0.00^{d}	2.75^{a}
20. Digpait	60.75^{b-e}	7.50^{f}	8.25^{ef}	10.00^{b}	11.25cd	0.00^{d}	0.00^{c}
Sx	0.85	0.33	0.32	0.30	0.28	0.17	0.13
Level of Signi.		**	**	**	**	**	**
CV (%)		9.04	6.02	7.66	9.22	7.11	6.52

** = Significant at 1% level of probability, NS = Not significant, In a column figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT), (*) Data are transformed by square root method.
Note: All the letters (alphabet) used for showing statistical difference among the treatment mean should be superscript.

Table 2. Effect of different plant extracts in controlling seed-borne fungi of jute

Name of the extracts	(%) Sprouting	Seed born infection (%)						Total seed borne fungi (%)	Reduction (%)
		Colletotrichum corchori	*Macrophomina phaseolina*	*Botryodiplodia theobromae (*)*	*Fusarium sp.*	*Cercospora corchori(*)*	*Curvularia lunata(*)*		
Garlic extract (1:1)	79.25a	2.75f	1.50h	0.00f	3.00h	0.00e	0.00g	7.25	85.2
Garlic extract (1:2)	77.00a	3.25f	2.75ef	0.50ef	3.75fgh	0.25d	0.50e	11.00	77.55
Neem extract (1:1)	76.50a	3.25f	1.75gh	0.00f	4.25f	0.00e	0.75d	10.00	79.59
Neem extract (1:2)	74.75ab	4.00e	2.25fg	0.75ef	5.25e	0.50cd	1.25c	14.00	71.42
Allamanda Extract (1:1)	78.50a	3.00f	1.75gh	1.00de	3.25gh	0.00e	0.25fe	9.25	81.12
Allamanda Extract (1:2)	76.75a	4.50e	2.50ef	1.25d	4.00fg	0.75c	0.50e	13.5	73.46
Bishkatali extract (1:1)	72.00bc	5.25d	3.00e	2.00c	6.25d	0.00e	1.75abc	18.25	62.75
Bishkatali extract (1:2)	69.75c	6.50c	3.75d	3.00b	7.50c	0.75c	2.50b	24.0	51.02
Tobacco extract (1:1)	63.25d	8.25b	6.50c	3.00b	8.00c	1.75b	2.00ab	29.5	39.79
Tobacco extract (1:2)	60.50d	8.50b	8.00b	3.25b	8.75b	2.50ab	2.25b	33.25	32.14
Control	51.75e	13.00a	11.75a	8.25a	9.75a	3.50a	2.75a	49.00	
Level of significance	**	**	**	**	**	**	**		

** = Significant at 1% level of probability, NS = Not significant, In a column figures with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT), (*) Data are transformed by square root method.

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 roffisi, Chaetomium, Curvularia lunata, Fusarium spp.* and *Phomopsis sp.* were found to be associated with the jute seeds (Fazli and Ahmed, 1960; Miah, 1974; Fakir; 1977).

Association of *Colletotrichum corchori* with seeds of Naricali and Suntia was observed in highest percentage (13.0%). This fungus was found to have the lowest association with the seed sample collected from Shahbajpur (2.75%). *Macrophomina phaseolina* was found to be associated more or less with all the seed samples. The seed sample of Naricali & Barapathalia yielded highest percentage (12.0%) of this fungus whereas the lowest percentage (2.75%) was observed with the sample of charpara. Prevalence of *Botryodiplodia theobromae* was recorded highest (12.0%) with the sample collected from Barapathalia and the lowest from Rajpara & Bashchara (2.75%). *Fusarium* sp. was found to be associated more or less with all the seed samples. Highest percentage of association (14.5%) was observed with the seed sample of Charpara and lowest with the seeds of Bashchara (5.50%) .

Effect of plant extracts: The effect of plant extracts on germination and prevalence of seed-borne fungi is presented in Table 2. From the results, it was observed that all the extracts except tobacco increased the percentage of seed germination significantly. Germination was recorded highest (79.25%) when seeds were treated with garlic extracts @ 1:1 concentrations, followed by allamanda extract (78.5%) @ 1:1 concentration which corroborate with the findings of Ahmed and Sultana, 1985 and Islam 2005). In controlling *Macrophomina phaseolina,* extract of garlic @ (1:1) appeared to be the best showing 1.5% infection only and the extract of neem @ (1:2), allamanda @ (1:2) & garlic @ (1:2) v/v showed 2.25%, 2.5% and 2.75% infection respectively. Extract from garlic @ (1:1) was also found to be more effective (2.75%) in controlling the seed-borne infection of *Colletotrichum corchori* which differed significantly all other extract except extract of garlic and neem @ 1:2 conc.(Table 2). The extract of garlic effectively controlled *Macrophomina phaseolina* and *Colletotrichum* spp. when associated with the soybean seeds. This results also support the present findings (Suratuzzaman, 1995).

Botryodiplodia theobromae was found to be completely controlled when the seeds were treated with the extract of garlic @ (1:1) & neem @ (1:1) conc. The extract of garlic (1:2), neem (1:2) & allamanda (1:1) conc. appeared to be moderately effective showing only 0.5%, 0.75% and 1.0% infection respectively which corroborate with the findings of Mohanty *et al.* (1995), Meah *et al.* (2004), Jebunnahar (2004), Islam (2005).

In case of the inhibition of *Fusarium sp.,* garlic extract @ (1:1) conc. appeared to be the most effective which differed significantly among all the treatments. Moderately infection 3.75%, 4.25%, 5.25% shown from the extract of garlic @ (1:2), neem @ (1:1) and neem @ (1:2) respectively. The Extracts from tobacco @ conc.1:2 showed 8.75% infection which is less effective from all other treatments (Table 2). This results supported by the findings of Dubey and Dwivedi (1991), Khan (1999) and Rahman *et al.* (1999).

In considering the inhibition of seed-borne infection by the major pathogen tested, the extract of garlic @ 1:1 conc. showed strong fungicidal effects which showed 85.2% inhibition and the extracts of allamanda @ 1:1 conc., neem @ 1:1conc. & bishkatali @ 1:1 cinc. which showed moderately inhibition like 81.12%, 79.59% & 62.75% respectively. Seeds treated by the extract from chirata @ 1:2 conc. have less inhibition capacity which is 32.12%.There exists insignificant differences among all the treatments (Table 2).

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