

EFFICACY OF SEED WASHING WITH WATER AND TREATMENT WITH GARLIC EXTRACT AND CARBENDAZIM FOR REDUCING SEED-BORNE FUNGAL PATHOGENS FROM RICE VARIETY KALIJIRA

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ABSTRACTS

Seed health of aromatic rice variety Kalijira collected from Mymensingh Sadar Upazilla was studied following standard blotter method. Six different treatments namely water wash, garlic (1 : 1), water wash + garlic (1 : 1), Knowin 50WP (Carbendazim) @ 0.2% and water wash + Knowin-50WP @ 0.2% were used in this experiment. The identified seed-borne fungi were *Alternaria padwickii*, *Aspergillus niger*, *Aspergillus flavus*, *Bipolaris oryzae*, *Curvularia lunata*, *Fusarium moniliforme*, *Fusarium oxysporum* and *Penicillium* sp. Highest seed infection (30.67%) was recorded for *F. oxysporum* and the lowest seed infection (9.33%) was recorded for *A. padwickii*. Germination of seeds significantly varied in different treatments that ranged from 85.33 to 98.86%. Among the treatments, the highest (98.86%) germination was found by water wash + Knowin-50WP and lowest (85.33%) by control (untreated). After washing of seeds in water, the treated seeds with plant extract or chemical showing better performance than when only treated with plant extract or chemical for controlling seed borne pathogens.

Key Words: Rice, Kalijira, Seed-borne fungi, Washing with water, Garlic

INTRODUCTION

Rice is the main crop of Bangladesh, which covers about 80 percent of the total cultivable land (BBS, 2010). The average world yield of rice is 3.84 t ha⁻¹ (FAO, 2007), but the average yield of rice in Bangladesh is only 1.507 t ha⁻¹ (BBS, 2010). Moreover, the yield of aromatic rice grown in Bangladesh is lower than non-aromatic rice. Unfortunately, the aromatic rice often has undesirable agronomic characters, such as low yield, susceptibility to diseases and strong shedding (Berner and Hoff, 1986). Kabir *et al.* (2004) reported that aromatic rice variety Chinigura-1 produced the highest grain yield (2.47 t ha⁻¹) followed by Kalijira (2.15 t ha⁻¹) and Begunbitchi (0.92 t ha⁻¹). Because aromatic rice yield is very low as well as diseases and pest are considered as major constrains for aromatic rice production.

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In Bangladesh, 43 diseases are known to occur on the rice crop and among these diseases 27 are seed-borne of which 14 are major (Fakir, 2002). He also reported that fungi are the principal organisms associated with seeds in storage and all the seed-borne diseases of rice. Fungi associated with discolored rice seed resulted in poor germination and vigor, and cause diseases to emerged seedling or growing plants (Danquah *et al.*, 1976 and Sharma *et al.*, 1987).

There is a need to increase the yield and improve the health and seed quality of the crop by controlling seed-borne fungal pathogens. Treatments of seed should be done as a routine practice as it is a cheap insurance against possible disasters at a later stage (Bilgrami and Dube, 1976). Various methods have been practiced to control these pathogens. Use of plant extracts against plant disease control is one of them. To ensure eco-friendly disease management, plant extracts are using instead of hazardous chemicals. Successful use of plant extracts in controlling fungal pathogens has been demonstrated by a number of authors (Assadi and Behroozin, 1987; Miah *et al.*, 1990; Ashrafuzzaman and Khan, 1992; Hossain and Schlosser 1993 and Suratuzzaman *et al.*, 1994).

In view of the above facts, the present study was undertaken to know the efficacy of seed washing with water and treatment with garlic extract and Carbendazim for reducing seed-borne fungal pathogens.

MATERIALS AND METHODS

Farmer's seeds of rice variety Kalijira were collected from Mymensingh Sadar Upazila of Mymensingh district. The seeds were then kept in brown paper bags and stored in the refrigerator at 4°C in Seed Pathology Center (BAU) until use. The experiment was conducted during the period from January 2012 to May, 2013 at Seed Pathology Center (SPC), Plant Disease Clinic and M. S. Laboratory, Department of Plant pathology, Bangladesh Agricultural University (BAU), Mymensingh. For the experiment seeds were treated with water, garlic extracts and fungicides. The treatments were T₁ = Water wash, T₂ = Garlic extract (1 : 1), T₃ = Water wash+ garlic extract (1 : 1), T₄ = Knowin 50 WP (Carbendazim) @ 0.2%, T₅ = Water wash + Knowin 50 WP @ 0.2% and T₆ = control (untreated). Garlic extract was prepared by using the method described by Hossain *et al.* (1997). For water wash, 5g of seeds were washed with running tap water properly and then dried in open air for 5 hrs. Seed treatment with garlic extracts was done by dipping seeds in previously prepared garlic extracts (1: 1) for 20 minutes. Required amount of Knowin 50 WP was used for a seed treating at the rate of 0.2% of seed weight. 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 following the keys outlined by Ramnath *et al.* (1970), and Khan and Islam (1975). For proper identification of fungi temporary slides were prepared from the fungal colony and observed under a compound microscope and identified with the help of keys suggested by Malone and Muskette (1964); Booth (1971); Ellis (1971), Neergaard (1979) and Mathur and Kongsdal (1994).

The treated Kalijira rice seeds were sown in trays containing sands for vigour test. After 10 days of sowing, shoot length and root length were measured and seedling vigor was calculated as vigor index following the formula given by Baki and Anderson (1972). The collected all data were analyzed following computer package MSTAT-C and mean differences among the treatments were compared by Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The incidence of major seed-borne fungal pathogens associated with Kalijira were analyzed and presented in the Table 1. In total eight fungi were detected in all samples of seeds under control condition (non-treated). The identified fungi were *Alternaria padwickii*, *Aspergillus niger*, *Aspergillus flavus*, *Bipolaris oryzae*, *Curvularia lunata*, *Fusarium moniliforme*, *Fusarium oxysporum* and *Penicillium sp.* Highest seed infection (30.67%) of *F. oxysporum* followed by *F. moniliforme* (24.00%), *Penicillium sp.* (17.33%), *B. oryzae* (17.33%), *C. lunata* (12.00%), *A. niger* (10.67%), *A. flavus* (9.43%). The lowest seed infection was recorded by *A. padwickii* (9.33%). Fakir (2000) reported some important pathogenic fungi viz. *A. padwickii*, *Fusarium spp.*, *B. oryzae*, *P. oryzae* and *Sarocladium oryzae* in rice seed samples collected from three different locations in Bangladesh. Another researcher Nahar (2003) found *B. oryzae*, *F. oxysporum*, *F. moniliforme*, *Trichoconis padwickii*, *Alternaria tenuis* and *C. lunata* in farmers stored rice seeds. The association of seed-borne fungi of rice also have been reported by a good number of researchers (Shrestha et al., 1977; Mia and Mathur 1983; Mendoza and Molina 1980; Ahmed et al. 1989; Agarwal et al., 1990 and Purushattam et al., 1996).

Table 1. Effect of different treatments on germination and seed-borne fungi of rice seeds var. Kalijira

Treatments	Percent (%) seed borne infection							
	<i>Alternaria padwickii</i>	<i>Aspergillus niger</i>	<i>Aspergillus flavus</i>	<i>Bipolaris oryzae</i>	<i>Curvularia lunata</i>	<i>Fusarium moniliforme</i>	<i>Fusarium oxysporum</i>	<i>penicillium sp.</i>
T ₁	9.330 ^a	8.000 ^b	8.000 ^b	10.67 ^b	9.330 ^b	22.67 ^b	25.33 ^b	10.67 ^b
T ₂	7.000 ^b	8.000 ^b	7.670 ^b	10.67 ^b	6.670 ^c	17.33 ^c	22.67 ^c	9.330 ^c
T ₃	5.330 ^c	6.670 ^c	5.330 ^c	8.000 ^d	5.330 ^d	9.330 ^e	12.00 ^e	9.330 ^c
T ₄	5.330 ^c	8.000 ^b	5.330 ^c	9.330 ^c	5.330 ^d	10.67 ^d	18.67 ^d	9.330 ^c
T ₅	2.670 ^d	5.330 ^d	5.330 ^c	5.330 ^e	5.330 ^d	9.330 ^e	12.00 ^e	8.000 ^d
T ₆	9.330 ^a	10.67 ^a	9.330 ^a	17.33 ^a	12.00 ^a	24.00 ^a	30.67 ^a	17.33 ^a
LSD _{0.05}	0.803	0.521	1.18	0.785	0.964	0.963	1.92	1.23
Level of significant	*	*	*	*	*	*	*	*
CV (%)	6.77	3.76	9.74	4.33	7.40	3.48	5.37	6.51

* = Significance at 5% level. Data were subjected to Duncan's Multiple Range Test (DMRT). Each value represents the mean and std 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. T₁ = Water wash, T₂ = Garlic extract (1:1), T₃ = Water wash + Garlic extract, T₄ = Knowin 50 WP, T₅ = Water wash + Knowin 50WP and T₆ = Control (non-treated)

Table 2. Effect of different treatments on shoot length, root length and vigor index of seedlings

Treatments	Shoot length (cm)	Root length (cm)	Total length (cm)	Vigor index
T ₀	9.100 ^d	8.380 ^d	17.48 ^d	1442.1
T ₁	10.10 ^c	8.620 ^d	18.72 ^c	1572.8
T ₂	10.18 ^c	9.260 ^c	19.44 ^{bc}	1652.4
T ₃	11.36 ^b	11.80 ^a	23.16 ^b	2048
T ₄	10.62 ^{bc}	10.66 ^b	21.28 ^{bc}	1830
T ₅	14.42 ^a	12.00 ^a	26.42 ^a	2443.85
LSD _{0.05}	0.964	0.598	2.91	
Level of significant	*	*	*	
CV (%)	4.95	3.32	7.77	

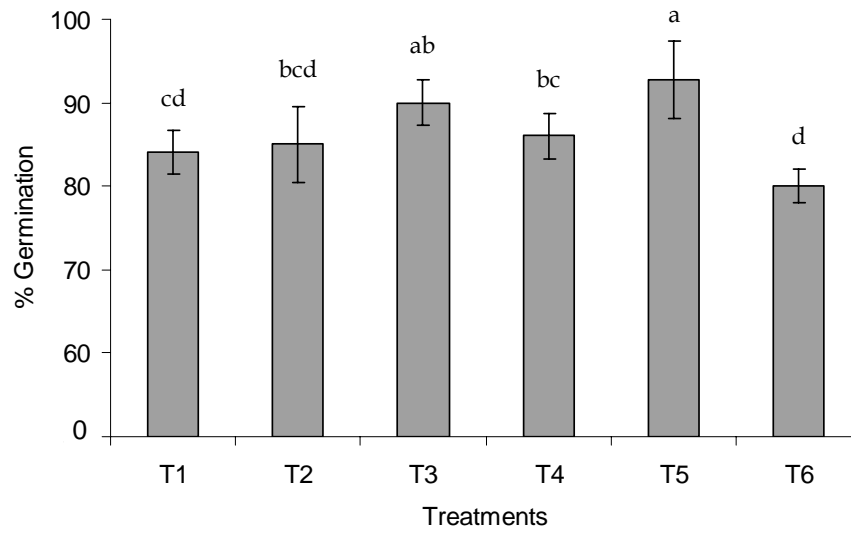
T₁ = Water wash, T₂ = Garlic extract (1 : 1), T₃ = Water wash + Garlic extract, T₄ = Knowin 50 WP, T₅ = Water wash + Knowin 50WP and T₆ = Control (non-treated)

The highest seed-borne infection of *A. padwickii* was recorded in untreated control (9.33%). Best control was achieved by Water wash + Knowin 50 WP (2.67%), while Water wash, Garlic extract (1 : 1), Water wash + garlic extract (1 : 1) and Knowin 50 WP showed 9.33%, 7.00%, 5.33%, and 5.33% infection respectively.

The highest seed-borne infection of all other detected fungi was found in untreated control (T₆). The lowest seed-borne infection of *A. niger* was recorded in Water wash + Knowin 50 WP (5.33%) treatment, whereas the lowest seed-borne infection of *A. flavus* was recorded in Water wash + garlic extracts, Knowin 50 WP and Water wash + Knowin 50 WP (5.33%) treatment. The lowest infection of *B. oryzae* was recorded in T₅ (5.33%) followed by Water wash + garlic extracts (8.00%). Best control of *C. lunata* was achieved by Water wash + garlic extracts, Knowin 50 WP and Water wash + Knowin 50 WP treatments (5.333%) followed by Garlic extracts. The lowest seed-borne infection of *F. oxysporum* and *F. moniliforme* was observed by Water wash + Knowin 50 WP followed by Water wash + garlic extracts treatment. The lowest infection of *Penicillium sp.* was recorded by Water wash + Knowin 50 WP (8.0%). Garlic extracts, Water wash + garlic extracts, Knowin 50 WP showed similar results (9.33%) and these are statistically similar.

Using tray sand method, highest percentage of germination was observed by Water wash + Knowin 50 WP (92.5%) and lowest percentage of germination was observed by untreated control (Fig. 1). In control treatment mean shoot length was 9.1 cm, mean root length was 9.26 cm and vigor index was 1468.8 cm, whereas after treatment the highest mean of shoot length was 14.42 cm and highest root length was 11.80 cm as well as highest vigor index was 2443.85 cm were found by Water wash + Knowin 50 WP. Roos and Puhl (1994) reported that fungal diseases caused by *Fusarium* and *Helminthosporium* can be controlled by seed treatment before sowing. 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*. Hasan (2000) reported that rice seeds become free from *Bipolaris oryzae* when washed with brine solution. Panna *et al.* (2009) reported reduced fungal association in seeds washed with brine solution. From these results and discussion, it can be concluded that after water washing of seeds with normal water followed by treating with plant extract or chemical it gives a better result than when only treated with plant extract or chemical.



T₁ = Water wash, T₂ = Garlic extract (1 : 1), T₃ = Water wash + Garlic extract, T₄ = Knowin 50 WP, T₅ = Water wash + Knowin 50WP and T₆ = Control (non-treated)

Fig. 1. Effect of different treatments on seed germination (%) of rice variety Kalijira. Data were subjected to Duncan's New Multiple Range Test (DMRT) using MSTAT-C. Each value represents the mean and standard deviation of three replications. In a column figure with same letter or without letter do not differ significantly whereas figure with dissimilar letters differ significantly.

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