



Evaluation of Some Indigenous Plant Extracts for Suppressing *Bipolaris sorokiniana* in Wheat Seed

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Abstract

Studies were conducted in the Seed Pathology Laboratory, Department of Plant Pathology, Sher-e-Bangla Agricultural University to evaluate some indigenous plant extracts on the incidence of *Bipolaris sorokiniana* of wheat and seed germination. Seed treated with plant extracts reduced the incidence of *Bipolaris sorokiniana*. The lowest incidence was counted (12.33%) in seeds treated with Burmuda grass extracts (1:2^{W/V}). While the highest seed germination (99.60%) was recorded in seeds treated with this grass extract followed by 99.33% germination in seeds treated with Neem leaf extract (1:2^{W/V}), 98.00% with nut sedge grass rhizome extract (1:2^{W/V}), 87.67% with Allamanda leaf extract (1:2^{W/V}). Comparatively the lowest incidence of *Bipolaris sorokiniana* (14.00%) was observed in seeds treated with Neem leaf extracts (1:2^{W/V}) followed by 14.50% in seeds treated with Nut sedge grass rhizome extracts (1:2^{W/V}), Black cumin seed extracts (15.20%) and Allamanda leaf extract (24.00%).

Keywords: Seed sorting, plant extracts, black point, *Bipolaris sorokiniana*, wheat

1. Introduction

Wheat (*Triticum aestivum* L.) is the most important cereal crop in the world. About two third of the World's population use wheat as staple food (Majumder, 1991). It is the second most important grain crop in Bangladesh that plays a vital role in the national economy by reducing the volume of import of cereals (Razzaque *et al.*, 1992). In spite of its importance, yield of the crop in Bangladesh is low in comparison to the other countries of the world, where average yield was estimated to be 2.69 t/ha (FAO, 1997). About 706.86 thousand hectares of land in Bangladesh is covered by wheat cultivation with the annual production of 1570 thousand tons (BBS, 2006). In wheat, 26 seed borne pathogens are reported to cause 14 seed borne diseases, among them leaf spot and black point caused by *Bipolaris sorokiniana* has become a serious concern in Bangladesh (Azhar

et al., 1972; Fakir, 1988). The most economic method for controlling the disease is to cultivate resistant variety (Hossain and Azad, 1992). The second most acceptable method for controlling this disease is to sow pathogen free seeds. On the other hand, chemical treatments are most effective but expensive for controlling the disease, at the same time continuous use of chemicals pollutes the environment and develops tolerance against pathogens. In this aspect seed treatment with botanicals may be a safe option in controlling seed borne pathogens. Uses of plant extracts in controlling pathogens are now found to be promising and successful against certain fungal pathogens (Assadi and Behroozin, 1987; Miah *et al.*, 1990; Fakir and Khan, 1992; Surattuzaman, 1995; Hossain *et al.* 1997). Hossain and Schlosser (1993) reported sound fungicidal effect of Neem (*Azadirachta indica*) extracts against *Bipolaris sorokiniana*. Now a

days scientists are giving more emphasis on sustainable technology for environment friendly agriculture. So, it has become necessary to find out ecologically sound, economically viable, culturally appropriate and socially adoptable technology. Considering the above facts the present investigation was undertaken to evaluate some indigenous plant extracts for suppressing *Bipolaris sorokiniana* of wheat and to observe the success in seed germination.

2. Materials and Methods

The experiment was conducted at the Seed Pathology Laboratory, Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh from January to September, 2007. The experiment was laid out in Completely Randomized Design (CRD). Four hundred (400) seeds were tested for each treatment. The seed health testing was done by Blotter method (ISTA, 1999). Data was recorded on germination percentage and percent seed affected by *Bipolaris sorokiniana*. Five different plant extracts of Allamanda leaf, Neem leaf, Nut sedge grass Rhizome, Burmuda grass and Black cumin seed were tested against *Bipolaris sorokiniana* through five sets of experiments. About 6 kg seed sample of wheat cv. Kanchan was collect from a farmer of Gazipur district and

used in this study. Apparently healthy looking seeds were separated from farmer's seed by manual seed sorting by eliminating inert matter, varietal mixture, seeds of other crops and weed seeds, crop residues and black pointed seeds.

Botanicals were collected locally and their extracts were prepared by using the method of Hossain *et al.* (2005). For preparation of extracts, collected leaves, seeds and rhizomes were weighed and then washed in water. After washing the big leaves and rhizomes were cut into pieces. For getting extract, weighed plant parts were blended in an electric blender and then distilled water was added into the jug of the blender. For getting 1:2 (^W/_V) ratios; 200 ml of distilled water was added in 100 g plant parts. Similarly to get 1:4 (^W/_V), 1:6 (^W/_V) ratios and 1:8 (^W/_V) ratios, 400, 600 and 800 ml distilled water was added in 100g plant parts respectively. Desired concentration of the botanicals used in the present experiment is shown in Table 1.

Seeds were treated by dipping method separately in different extracts. Four hundred (400) seeds were dipped in the solution for 1 hour. The treated seeds were then taken out of the extract and spread on blotting paper to remove excess moisture prior to placing them in the petridishes.

Table 1. The particulars of the botanicals used in the study along with their desired concentration.

Common name	Scientific name	Plant parts used	Concentration
Allamanda	<i>Allamanda cathartica</i>	Leaf	1:2, 1:4, 1:6, 1:8 (^W / _V)
Neem	<i>Azadirachta indica</i>	Leaf	1:2, 1:4, 1:6, 1:8 (^W / _V)
Kalizira	<i>Nigella sativa</i>	Seed	1:2, 1:4, 1:6, 1:8 (^W / _V)
Burmuda grass (Durba)	<i>Cynodon dactylon</i>	Whole plant	1:2, 1:4, 1:6, 1:8 (^W / _V)
Nut sedge (Mutha)	<i>Cyperus rotundus</i>	Rhizome	1:2, 1:4, 1:6, 1:8 (^W / _V)

For seed health study, three layers of filter paper (Whatman Paper No. 1) soaked in sterilized water and was placed at the base of a plastic petridishes (9 cm diameter.) then 25 seeds were placed on filter paper maintaining equal distance among seeds and covered with the lid. The petridishes containing seeds were incubated at 25 ± 1 °C for 7 days maintaining alternative 12:12 hr light and dark cycle in the laboratory. Time to time water was added to keep the filter paper moist. After 7 days of incubation the incubated seeds were examined under stereoscopic microscope in order to record the incidence of *Bipolaris sorokiniana*. Germination of the seeds was also recorded. Identification of *Bipolaris sorokiniana* under the stereoscopic microscope was confirmed by preparing temporary slides and examining under the compound microscope with the help of keys described in taxonomic books (Booth, 1971, Ellis 1971). Later on the pathogen was purified using hyphal tip culture method and grown on PDA media at 25 ± 1 °C for 2 weeks and identified.

The collected data on different parameters were analyzed statistically by using MSTAT-C package program. The means for all the treatments were compared by DMRT. The significance of differences among the means was calculated by LSD test.

3. Results and Discussion

3.1. Evaluation of Allamanda leaf extracts against *Bipolaris sorokiniana*

The effects of Allamanda leaf extract treated apparently healthy and farmer's saved wheat seed on germination and incidence of *Bipolaris sorokiniana* are presented in Table 2. Germination (%) of farmer's seed ranged from 76.50% to 82.50% treated with different doses of Allamanda leaf extract. The highest seed germination (82.50%) was recorded in 1:4 (W/V) concentration of Allamanda leaf extract and the lowest (76.50%) in untreated seeds (control). Germination percent of apparently healthy seeds was always found to be higher over farmer's seed. The highest germination (87.67%) of apparently healthy seeds was recorded in 1:4 (W/V) concentrations of Allamanda leaf extract and the lowest (78.00%) in control.

The incidence of *Bipolaris sorokiniana* on Allamanda treated wheat seeds was always higher in farmers saved seed over apparently healthy seeds (Table 2). The incidence of *Bipolaris sorokiniana* on farmer's saved seed ranged from 29.00% to 43.00% where the highest and lowest range was recorded in untreated control and 1:2 (W/V) concentration of Allamanda leaf extract, respectively. Similarly these two treatments resulted the highest (39.43%) and the lowest (24.00%) incidence of the fungi, respectively in apparently healthy seeds. It was found that apparently healthy seeds had comparatively lower incidence of the fungi over farmer's seed.

3.2. Evaluation of Neem leaf extracts against *Bipolaris sorokiniana*

The effects of Neem leaf extract treated apparently healthy and farmer's saved wheat seeds germination and incidence of *Bipolaris sorokiniana* are presented in Table 3. Germination percent in case of farmer's seed ranged from 76.50% to 93.00%. The highest seed germination (93.00%) was recorded in 1:2 (W/V) and 1:4 (W/V) concentration of Neem leaf extract and the lowest (76.50%) in the control. Germination percent of apparently healthy seeds was found to be higher over farmers saved seed. The highest germination (99.33%) of apparently healthy seeds of wheat was recorded in 1:2 (W/V) concentrations of Neem leaf extract and the lowest (78.00%) in the control.

The incidence of *Bipolaris sorokiniana* on Neem leaf extract wheat seeds was always higher in farmers saved seed over apparently healthy seeds (Table 3). The incidence of *Bipolaris sorokiniana* on farmer's saved seed ranged from 16.50% to 43.00% in untreated control and 1:2 (W/V) concentration of Neem leaf extract. Similarly these two treatments resulted the highest (39.43%) and the lowest (14.00%) incidence of the fungus, respectively in apparently healthy seeds. It is found that apparently healthy seeds had comparatively lower incidence of the fungus over farmer's seed.

Table 2. Effect of seed treatment with Allamanda leaf extract on germination and incidence of *Bipolaris sorokiniana* of wheat.

Treatments	Concentration	% Germination		% Incidence of <i>Bipolaris sorokiniana</i>	
		Farmer's saved seed	Apparently healthy seed	Farmer's saved seed	Apparently healthy seed
Untreated control		76.50c	78.00b	43.00a	39.43a
Allamanda leaf extract	1:2 (^W / _V)	82.07a	87.33a	29.00c	24.00c
Allamanda leaf extract	1:4 (^W / _V)	82.50a	87.67a	32.00b	27.33b
Allamanda leaf extract	1:6 (^W / _V)	79.00b	87.17a	32.50b	27.33b
Allamanda leaf extract	1:8 (^W / _V)	77.00c	86.17a	34.00b	29.00b
LSD (P≤0.05)		1.718	4.311	1.975	3.789

Table 3. Effect of seed treatment with Neem leaf extract on germination and incidence of *Bipolaris sorokiniana* of wheat.

Treatments	Concentration	% Germination		% Incidence of <i>Bipolaris sorokiniana</i>	
		Farmer's saved seed	Apparently healthy Seed	Farmer's saved seed	Apparently healthy seed
Untreated control		76.50c	78.00d	43.00a	39.43a
Neem leaf Extract	1:2 (^W / _V)	93.00a	99.33a	16.50c	14.00e
Neem leaf Extract	1:4 (^W / _V)	93.00a	99.00a	17.50c	15.50d
Neem leaf Extract	1:6 (^W / _V)	92.00a	97.00b	24.50b	20.33b
Neem leaf Extract	1:8 (^W / _V)	89.50b	90.00c	26.00b	19.50c
LSD (P≤0.05)		2.139	1.566	2.063	0.367

3.3. Evaluation of Nut sedge grass rhizome extracts against *Bipolaris sorokiniana*

The effects of Nut sedge grass rhizome extract treated apparently healthy and farmer's saved wheat seeds germination and incidence of *Bipolaris sorokiniana* are presented in Table 4. Germination (%) of farmer's seeds treated with different doses of Nut sedge grass extract ranged from 76.50% to 93.00%. The highest seed germination (93.00%) was noted in 1:2 (^W/_V) concentration of Nut sedge grass extract and the lowest (76.50%) in the control. Germination percent of apparently healthy seeds was found to be higher over farmer's seed. The highest germination (98.00%) of apparently healthy seeds was observed in 1:2 (^W/_V) and 1:4 (^W/_V) concentrations of Nut sedge grass extract and the lowest (78.00%) in the control.

The incidence of *Bipolaris sorokiniana* on Nut sedge grass extract treated wheat seeds was always higher in farmers saved seed over apparently healthy seeds (Table 3). The incidence of *Bipolaris sorokiniana* on farmer's saved seed ranged from 19.00% to 43.00% where the highest and lowest range was noted in untreated control and 1:2 (^W/_V) concentration of Nut sedge grass extract. Similarly these two treatments resulted the highest (39.43%) and the lowest (14.50%) incidence of the fungus, respectively in apparently healthy seeds. It was found that apparently healthy seeds had comparatively lower incidence of the fungus over farmer's seed.

3.4. Evaluation of Burmuda grass extracts against *Bipolaris sorokiniana*

The effects of Burmuda grass extract treated apparently healthy and farmer's saved wheat seeds germination and incidence of *Bipolaris sorokiniana* are present in Table 5. Germination (%) of farmer's seed ranged from 76.50% to

95.83%. The highest seed germination (95.83%) was observed in 1:2 (^W/_V) concentration of Burmuda grass extract and the lowest (76.50%) in the control. Germination percent of apparently healthy seeds was always found to be higher over farmers saved seed. The highest germination (99.60%) of apparently healthy seeds was noted in 1:2 (^W/_V) concentration of Burmuda grass extract treated seeds and the lowest (78.00%) in the control.

The incidence of *Bipolaris sorokiniana* in Burmuda grass extract treated wheat seeds was always higher in farmers saved seeds over apparently healthy seeds (Table 5). The incidence of *Bipolaris sorokiniana* on farmer's saved seed ranged from 16.50% to 43.00% in untreated control and 1:2 (^W/_V) concentration of Burmuda grass extract treated seeds respectively. Similarly these two treatments resulted the highest (39.43%) and the lowest (12.33%) incidence of the fungus, respectively. It was found that apparently healthy seeds had comparatively lower incidence of the fungus over farmer's seed.

3.5. Evaluation of Black cumin seeds extracts against *Bipolaris sorokiniana*

The effects of Black cumin seed extract treated apparently healthy and farmer's saved wheat seeds germination and incidence of *Bipolaris sorokiniana* are present in Table 6. Germination (%) of farmer's seed ranged from 76.50% to 83.17%. The highest seed germination (83.17%) was recorded in 1:2 (^W/_V) concentration of Black cumin seed extract and the lowest (76.50%) in the control. Germination (%) of apparently healthy seeds was found to be higher over farmer's seed. The highest germination (91.00%) of apparently healthy seeds of wheat was noted in 1:2 (^W/_V) concentration of Black cumin seed extract and the lowest (78.00%) in the control.

Table 4. Effect of seed treatment with Nut sedge grass extract on germination and incidence of *Bipolaris sorokiniana* of wheat.

Treatments	Concentration	% Germination		% Incidence of <i>Bipolaris sorokiniana</i>	
		Farmer's saved seed	Apparently healthy seed	Farmer's saved seed	Apparently healthy seed
Untreated control		76.50d	78.00d	43.00a	39.43a
Nut sedge rhizome extract	1:2 (^W / _V)	93.00a	98.00a	19.00d	14.50e
Nut sedge rhizome extract	1:4 (^W / _V)	90.00bc	98.00a	20.33d	15.50d
Nut sedge rhizome extract	1:6 (^W / _V)	91.00b	95.00b	23.00c	20.50c
Nut sedge rhizome extract	1:8 (^W / _V)	89.17c	91.00c	26.50b	25.00b
LSD (P≤0.05)		1.702	0.842	1.702	0.2147

Table 5. Effect of seed treatment with Burmuda grass extract on germination and incidence of *Bipolaris sorokiniana* of wheat.

Treatments	Concentration	% Germination		% Incidence of <i>Bipolaris sorokiniana</i>	
		Farmer's saved seed	Apparently healthy seed	Farmer's saved seed	Apparently healthy seed
Untreated control		76.50d	78.00c	43.00a	39.43a
Burmuda grass extract	1:2 (^W / _V)	95.83a	99.60a	16.50e	12.33e
Burmuda grass extract	1:4 (^W / _V)	95.50a	99.53a	19.50d	15.57d
Burmuda grass extract	1:6 (^W / _V)	92.50b	99.40b	23.17c	17.50c
Burmuda grass extract	1:8 (^W / _V)	90.50c	98.27b	24.40b	18.57b
LSD (P≤0.05)		0.4874	1.210	0.4874	0.3622

Table 6. Effect of seed treatment with Black cumin seed extract on germination and incidence of *Bipolaris sorokiniana* of wheat.

Treatments	Concentration	% Germination		% Incidence of <i>Bipolaris sorokiniana</i>	
		Farmer's saved seed	Apparently healthy seed	Farmer's saved seed	Apparently healthy seed
Untreated control		76.50d	78.00d	43.00a	39.43a
Black cumin seed extract	1:2 (^W / _V)	83.17a	91.00a	27.17d	15.20d
Black cumin seed extract	1:4 (^W / _V)	82.17b	85.17b	30.17c	23.00e
Black cumin seed extract	1:6 (^W / _V)	82.50b	84.17c	31.50c	26.50c
Black cumin seed extract	1:8 (^W / _V)	81.00c	84.50c	34.50b	30.50b
LSD (P≤0.05)		0.3622	0.421	1.670	0.2063

The incidence of *Bipolaris sorokiniana* on Black cumin seed extract treated wheat seeds was always higher in farmer's saved seeds over apparently healthy seeds (Table 6). The incidence of *Bipolaris sorokiniana* on farmer's saved seed ranged from 27.17% to 43.00%, the highest and the lowest incidence was recorded in untreated control and 1:2 (^W/_V) concentration of Black cumin seed extract treated seeds. Similarly these two treatments resulted in the highest (39.43%) and the lowest (15.20%) incidence of the fungus, respectively in apparently healthy seeds. It was found that apparently healthy seeds had comparatively lower incidence of the fungus over the farmer's seed.

Seed treatment with plant extracts had profound effect on seed germination and incidence of *Bipolaris sorokiniana*. The present findings agree with the findings of Rahman (2007) who found that botanicals have strong effect against *Bipolaris sorokiniana*. Islam (2006) also reported that Kalizira, Neem, Onion and Zinger extracts significantly reduced the incidence of

Bipolaris sorokiniana on wheat seeds. The present findings are also supported by Alice and Rao (1987), Fakir and Khan (1992), Khan and Kumar (1992), Hossain and Schlosser (1993), Khan and Fakir (1995) and Hossain *et al.* (1997). Ashrafuzzaman and Hossain (1992) reported that Neem extract is effective against *Bipolaris sorokiniana* and inhibited the growth of the fungus and also reduced its pathogenicity on wheat leaves. Hossain and Schlosser (1993) reported that germination rate of wheat seeds increased while treated with extract of Neem seed and Neem oil cake. Hossain *et al.* (2005) reported that Neem extract reduced the incidence of *Bipolaris sorokiniana* significantly and increased seed germination. They also found that out of six plant extracts, Neem extract was superior followed by garlic, Bishkatali and Vatpata. Alice and Rao (1987) evaluated plant extracts against seed borne infection of fungi and found increased germination of the treated seeds. Khan and Kumar (1992) also observed the antifungal activity of leaf extracts of Neem against seed mycoflora of wheat. They found

remarkable reduction of seed mycoflora and increased seed germination of treated seeds.

4. Conclusions

On the basis of the present findings a comparative evaluation of the observed best concentrations of the five plant extracts may be undertaken for final recommendation.

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