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Assessment of Mungbean Seed Borne Disease Suppression by Chemical and Botanical Fungicides

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Authors' contributions

This work was carried out in collaboration between all authors. Author JD sets experiments, collect samples, data, analyses data and wrote manuscript. Author EN collect data, test samples and wrote first draft manuscript. Authors TA and SCB helps to wrote and analyses data. Author RH guides and revised manuscript. Author MH designed the study, supervises experimental procedure and revised final manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Effective disease management is essential for high quality and maximum production. We conducted this experiment to know the effects of different chemical and botanical fungicides to assess the prevalence of *Cercospora* spp. on mungbean seeds *in vitro* condition. The laboratory experiment was conducted in plant pathology laboratory, Department of Plant Pathology and Seed Science, Sylhet Agricultural University, Sylhet. Mungbean seed samples were collected from five different places prior to the experiment. Five fungal pathogens viz. *Aspergillus* spp., *Penecillium* spp., *Cercospora* spp., *Rhizopus* spp. and *Fusarium* spp. were detected from the collected seed sample by Blotter test method. Pathogens were identifies by observing their growth characters on the incubated seeds under stereo-binocular microscope. Total seven different treatments were applied randomly in both conditions as seed treatment and spray solution. For treating seeds, 250 mg of each fungicide along with 100 g seeds was taken separately in 250 ml Erlenmeyer flasks.

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The combined treatment (T5: Bavistin 50 WP+Secure 600 WP) was found to be the most effective in controlling seed-borne fungi when used as a seed treating agent *in vitro* condition.

Keywords: Mungbean; chemical; botanical; fungal; pathogen.

1. INTRODUCTION

Mungbean (*Vigna radiata*) is one of the most important pulse crops in Bangladesh and the agro ecological condition of this country is favorable for its cultivation [1]. It can fix atmospheric nitrogen through symbiotic relationship with soil bacteria and improve the soil fertility [2]. There are many constraints responsible for the lower yield of mungbean in our country where, diseases are considered dominant constraints [3]. In Bangladesh, sixteen diseases of mungbean have been recorded [4,5]. Among them, Cercospora leaf spot (*C. cruenta* Sacc.) and the yellow mosaic (Mungbean yellow mosaic virus) are the most important and damaging diseases that up to 58% yield loss has been reported [6]. Considering the two diseases, Cercospora leaf spot (*C. cruenta* Sacc.) is a serious one where mungbean is grown [7]. Yield loss of mungbean was correlated with severity of the disease caused by *Cercospora cruenta* and *C. canescens*) [8]. The Cercospora leaf spot reduced the yield of mungbean grown in the wet season by 23% when 75% of the foliage damaged [9]. Seeds that developed on severely infected plants are small and immature [10]. Extract of different plant viz. bishkatali, vatpata, garlic, gagra, bitter gourd and neem were effective against fungi associated with wheat seed and out of six plant species, neem extract was turned up as superior among the selected extracts followed by garlic, biskatali and vatapta. [11]. In this context, the present research work has been undertaken to indentify the seed-borne fungal pathogens of mungbean and evaluate different botanical and chemical effects on seed borne pathogens in *in-vitro* conditions.

2. MATERIALS AND METHODS

The experiment was conducted in the laboratory of the Department of Plant Pathology and Seed Science, Sylhet Agricultural University, Sylhet. A number of 15 mungbean seed samples (300 gm in each, 3 samples/location) were randomly collected from the storage of farmers according to the rules of International Seed Testing Association [10] and kept them in refrigerator at 5±1℃ temperature. Selected mungbean seeds were tested for the presence of fungal flora by the standard Blotter Method [12]. In the blotter method, three pieces of 9 cm filter papers (Whatman No. 1) were soaked in distilled water and placed at the bottom of the Petridis (9/cm). Randomly four hundred seeds from each sample were taken and placed on the petridishes containing moist filter papers (25 seeds per plate). The petridishes with seeds were then incubated at room temperature (25℃±3) on the laboratory desk under diffused day light for seven days. After incubation, the seeds were examined for the presence of seed borne fungal pathogens and indentified by observing their growth characters on the incubated seeds under stereo-binocular microscope following the keys of [13,14]. In case of doubtful or troublesome identification under stereo-binocular microscope, temporary slides were prepared and examined under the compound microscope and identified with the help of keys outlined by [15,16]. The samples with higher level of infection were selected for further study. There were seven treatments, namely T_1 (Bavistin-50WP), T_1 (Bavistin-50 WP), T_3 (Neem leaf extracts-1:4), T_4 (Biskatali-1:4), T_5 (Bavistin-0.5+Secure-0.5) = 1 gm/ L, T_6 (Neem leaf extract-1:2+ Biskatali-1:2= mixed spray), T_7 (Control: water spray). The plant extracts were prepared by using the method of [17], the weighted plant parts were blended and added with distilled water. For getting 1:4, (w/v) ratio 400 ml of distilled water was added with 100 g plant parts. Two fungicides namely Bavistin-50 WP and Secure-600WP were used as seed treatment. For treating seeds, 250 mg of each fungicide along with 100 g seeds was taken separately in 250 ml Erlenmeyer flasks. The flasks were than shaken manually for 10-15 minutes for proper coating of the fungicides. Therefore, treated seeds were kept overnight as it is in the flasks and then tested for the presence of fungal detection. The data obtained for different characters were statistically analyzed to find out the significance of treatment on mungbean. The analysis of variance was performed by using MSTAT program. LSD (Least significance difference) at 5% level of probability estimated the difference among the treatment means.

3. RESULTS AND DISCUSSION

After incubation of seeds on blotter paper, total five seed-borne fungi were recorded namely *Aspergillus* spp*., Penecillium* spp*., Cercospora* spp*., Rhizopus* spp*. and Fusarium* spp (Table 1). The incidence of *Aspergillus* spp. *Penecillium* spp*. Cercospora spp*. *Rhizopus* spp. and *Fusarium* spp. were ranged between 8.00-14.00%, 6.33-12.00%, 6.00-14.33%, 7.67%-14.67%, 3.67-10.67% respectively*.* Various genera of fungi detected and found to be pathogenic to the germinating seeds and young seedlings while Kabir et al. (1985) conducted an experiment on one hundred twenty seeds samples of local varieties of mungbean. [18] observed seed borne fungi viz. *Aspergillus flavus, A. fumigates, A. candidus* and *Rhizopus arrhizus* associated with seeds of mungbean*,* sorghum, wheat and sesame.

The prevalence of seed-borne pathogens in different location varied significantly (Table 1). Analysis of location base prevalence of seed-borne pathogens indicated that incidence of *Aspergillus* spp. was found to the highest (14.00%) in seed samples collected from Bianibazar and the lowest (8.00%) in seeds of Gazipur. The prevalence of *Penicillium* spp*.* was highest in Bianibazar sample (12.00%) which was nearest to Sunamgonj (11.00%) sample, but there was no statistically significant difference between the samples. The lowest incidence was recorded in seed samples of Gazipur (6.33%) which was significantly varied from other locations. Seed sample from Bianibazar had highest *Cercospora* spp*.* (14.33%) while lowest (6.00%) was recorded in Gazipur sample. In case of incidence of *Rhizopus* spp. found in Bianibazar (14.67%) was highest and the lowest in Gazipur (7.67%) seed sample. *Fusarium* spp. recorded from Sunamgonj samples (10.67%) which were statistically similar to Sylhet sadar (9.33%) and Golapgonj (9.33%) where Gazipur showed lowest disease incidence (3.67%). Investigating into the seed-borne fungi of eight important pulse crops in Bangladesh, [19] found 16 fungi in blackgram and 9 fungi in mungbean seeds collected from Dhaka, Jessore and Pabna districts. [20] recorded twenty-four seed borne fungi from 145 seed samples of major legume crops grown in Pakistan belonging to different genera using blotter paper method.

However, the germination percentage of mungbean seeds ranged from 70.67% to 82.33% in different locations. The germination percentage was highest (82.33%) in Gazipur sample and lowest (70.67%) was recorded in Bianibazar sample. On the other hand, there were no significant difference between Sunamgonj (74.70%), Sylhet sadar (75.00%) and Golapgonj (76.00%). [21] Considered that seed treatment with Bavistin (carbendazim) and Cercobin (thiophanate) were the most effective fungicides in inhibiting spore germination and growth of *F. oxysporum in vitro* and wilt disease of cucurbit *in vivo*.

Germination percentage of mungbean seeds varied significantly when seeds were treated by different treatments (Fig. 1). The highest germination (91.33%) of mungbean seed was recorded when treating with T_5 (Bavisin 50WP + Secure 600WP) followed by T_6 (85.00%), T_2 (81.00%), T_1 (80.00%), T_3 (74.33%) and T_4 (71.00%). The lowest germination (64.67%) was recorded in T_7 (control). The findings agrees with [22] who found that the germination of chickpea were increased by treating seeds with secure 600WG (48.62%) followed by Provax 200WP (44.38%) over control.

The disease incidence was higher in T7, which is mainly water spray. However, disease incidences were low in other fungicide and integrated treatments. Among them, the lowest disease incidence of *Cercospora* spp. found while treating with T5 (Bavistin 50 WP+Secure 600 WP). On the other hand, highest disease

Table 1. Prevalence of seed-borne pathogens of mungbean in different locations

Sample no.	Incidence of pathogen (%)					Seed germination (%)
	***Aspergillus* spp.**	***Penecillium* sp.**	***Cercospora* sp.**	***Rhizopus* sp.**	***Fusarium* sp.**	
Gazipur	8.00 b	6.33 b	6.00 c	7.67 b	3.67 c	82.33 a
Sunamgonj	9.00 b	11.00 a	10.00 bc	11.67 ab	10.67 a	74.70 b
Sylhet sadar	11.00 ab	8.33 ab	11.33 ab	9.67 ab	9.33 ab	75.00 b
Golapgonj	10.67 ab	10.00 ab	10.00 bc	11.67 ab	9.33 ab	76.00 b
Bianibazar	14.00 a	12.00 a	14.33 a	14.67 a	7.33 b	70.67 b
LSD (P≥0.05)	3.532	4.516	4.290	6.154	3.133	5.556
CV (%)	19.14	27.05	23.70	31.76	22.18	4.19

Note: Different letter (s) in the same column indicate the significant different at 0.05 level of probability

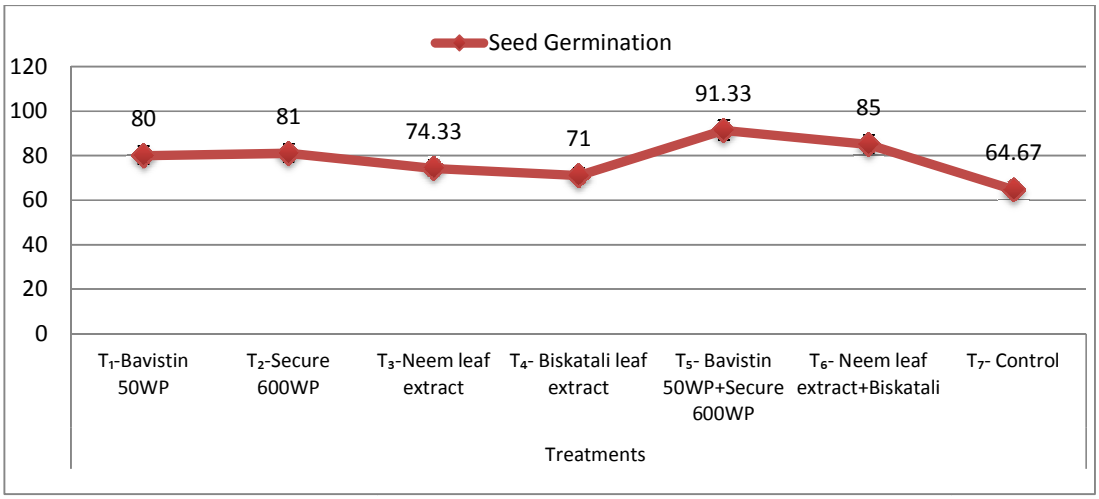

Fig. 1. Effects of seed treatment on seed germination percentage in laboratory condition

Fig. 2. Left: Untreated seed (control) and right: Treated seed with Bavistin 50 WP + Secure 600 WP (T_5)

Table 2. Effect of seed treatment for controlling seed-borne pathogen

Treatments	Seed germination (%)	Incidence of pathogen (%)				
		Aspergillus spp.	*Penecillium* spp.	*Cercospora* spp.	*Rhizopus* spp.	*Fusarium* spp.
T_1= Bavistin 50 WP	80.00b	7.33b	8.33bc	6.33bcd	5.67c	7.00bc
T_2= Secure 600 WP	81.00b	3.33c	6.00cd	4.67de	5.67c	4.67c
T_3= Neem leaf extract	74.33c	4.00c	8.00bcd	5.33cd	9.67bc	7.33bc
T_4= Biskatali leaf extract	71.00c	5.33bc	11.33b	8.67b	13.00b	8.00bc
T_5= Bavistin 50 WP + Secure 600 WP	91.33a	3.67c	4.67d	2.33e	5.67c	4.67c
T_6= Neem leaf extract + Biskatali	85.00b	7.00b	8.67bc	7.67bc	10.67bc	11.00b
T_7= Control	64.67d	14.67a	15.67a	15.00a	19.33a	18.33a
LSD (P≥ 0.05%)	5.080	2.810	3.568	2.654	5.080	4.615
CV (%)	7.37	21.08	26.35	21.82	37.65	27.20

Note: Different letter (s) in the same column showed the significant different at 0.05 level of probability

incidence was found in *Rhizopus* spp. when treated by T_4 (Biskatali leaf extract). Seed treatments with plant extract (Neem leaf + Biskatali leaf extract) and chemicals (Bavistin 50 WP and Secure 600 WP) successfully reduced all the seed-borne fungi. The reduction of the pathogen were effective with Vitavax-200 and other fungicides indicated by [23]. Carbendazim (50 WP and 25 DS) and thiram alone and in combination were highly effective in inhibiting mycelial growth *in vitro* and reducing wilt incidence under greenhouse and field conditions [24].

4. CONCLUSION

Five different seed-borne fungi viz. *Aspergillus* spp., *Penecillium* spp., *Cercospora* spp., *Rhizopus* spp. and *Fusarium* spp. were observed from blotter method in mungbean seeds. Germination percentage was lowest in case of untreated control seeds. However, the seeds treated with Bavistin 50 WP + Secure 600 WP showed highest germination percentage. From tis experiments, the treatment T_5: Bavistin 50 WP + Secure 600 WP was found to be the most effective in controlling seed-borne fungi *in vitro* condition. Further, such studies could be conducted using same treatments in field condition for more findings on seed borne diseases of mungbean.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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