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Deterioration of Seed Quality in Mung bean by *Macrophomina phaseolina* (Tassi) Goid. and its Management

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ABSTRACT *Macrophomina phaseolina* (Tassi) Goid., an important pathogen was associated with 0.8-4.9 per cent seed infection in infected samples of mung bean. Seed infection caused 18.9-31.0 per cent reduction in germination and 13.4-28.0 per cent reduction in seedling length in different varieties. Seed inoculation resulted in 65 to 72.6 per cent seedling emergence in mung bean with incidence of 5.4-13.2 per cent seedling blight and 16.5-32.8 per cent (PDI) of leaf blight. Variety T-44 showed minimum disease incidence and variety K-851 showed the maximum incidence. Out of six fungicides tested, carbendazim was the most effective resulting maximum germination percentage and seedling length with minimum disease incidence. Benomyl was also at par with carbendazim, followed by thiram in managing the seed-borne infection of the pathogen.

Key words: Mung bean, *Macrophomina phaseolina*, seed quality, fungicides

Availability of quality seed is a major constraint in increasing pulse production in our country. Many pathogenic fungi are associated with seeds in the field as well as in storage and cause deterioration of seed quality, which results in failure of plant stand and subsequently, development of diseases on standing crops. *Macrophomina phaseolina* is an important pathogen of mung bean [*Vigna radiate* (L.) Wilczek] which causes seed rot, seedling blight, root rot and leaf blight diseases in the field and reduces the productivity. The fungus has been reported to be predominantly associated with seeds of mung bean [1, 2, 3, 4] and other crops. Though the fungus is detected from all the parts of seed [5], seed coat is its main site of infection [6]. Most of the earlier studies were confined to the seedling and standing crops with the integrated approaches to manage the disease. However, the information on seed quality and seed health management are lacking. Therefore, the present study was carried out to study the effect of seed infection of the fungus on seed quality and disease incidence and to find out suitable fungicides for inclusion in disease management schedule.

MATERIALS AND METHODS

Seed samples of mung been were collected from seven districts of Orissa during 2006-07 and extent of *M. phaseolina* infection was assessed using standard moist blotter method [7]. The pure culture was maintained on Potato dextrose agar medium. Seeds of eight mung bean varieties were surface sterilized and rolled on seven days old culture of the fungus in Petri plates at the rate of fifty seeds per Petri plate. Inoculated seeds were incubated for 12h at 28 $\pm$ 1°C temperature to establish the fungus on the seeds. Pots of 5 kg capacity filled with sterilized sandy loam soil were sown with infected seeds and kept in green house. Observation on seedling emergence, seedling blight and per cent disease index (PDI) of leaf blight were recorded. For calculating PD1 of leaf blight, cotyledonary leaves and first two trifoliate leaves were scored in 0-4 disease scale [8] and it was calculated using formula,

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PDI = (Sum of numerical ratings/Total number of observations) x (100/Maximum score).

Simultaneously the inoculated as well as uninoculated seeds were tested for germination and seedling vigour (seedling length) following standard moist paper towel method [7].

Six commercially available fungicides viz., Thiram (Thiram WS, 0.3%), Captaf (Captan WDP, 0.3%), Carbendazim (Bavistin 50 WP, 0.15%), Benomyl (Benlate 50 WP, 0.15%), Thiophanate methyl (Topsin 70 WP, 0.2%) and Mancozeb (Indofil M45 75 WP, 0.3%) were evaluated for their efficacy in improving seed quality and reducing disease intensity under green house conditions. Inoculated seeds of variety K-851 were treated with these fungicides at their respective doses and sown on pots with sterilized sandy loam soil and maintained with an untreated control. Observations on seedling emergence, occurrence of seedling blight and leaf blight (PDI) were recorded up to 30 days after sowing. Fungicide treated as well as untreated seeds were also tested for germination and seedling vigour following standard methods.

RESULTS AND DISCUSSION

Analysis of farmer's seed samples revealed the association of *M. phaseolina* in all the seed samples of the districts surveyed. Out of a total of 64 samples collected 13 were infected with a range from 10 per cent in Khurda district to 33.3 per cent in Jajpur district. The percentage of seed infection in infected samples was from

Table 1. Effect of *M. phaseolina* infection on seed germination, seedling length and disease incidence in mung bean varieties

Variety	G(%)			SL(cm)			SE(%)	SB (%)	LB (PDI)
	Un	I	%R	Un	I	%R			
PDM-11	97.0 (80.27)	74.7 (59.85)	23.0	23.7	18.2	23.2	70.7 (57.25)	9.8 (18.22)	24.8 (29.86)
RDM-54	94.3 (76.37)	72.0 (58.09)	23.7	24.3	17.5	28.0	70.8 (57.33)	11.2 (19.44)	27.8 (31.79)
K-851	96.7 (79.66)	66.7 (54.74)	310	22.7	16.5	27.3	65.0 (53.71)	13.2 (21.28)	32.8 (34.95)
Dhauli	97.0 (80.12)	70.7 (57.22)	21.7	22.0	18.6	15.5	67.1 (55.0)	12.0 (20.16)	23.7 (29.14)
OUM-7	95.0 (77.25)	73.3 (58.92)	22.8	24.3	16.6	14.6	71.5 (57.8)	10.0 (18.44)	21.2 (27.37)
Sujata	96.3 (79.14)	70.7 (57.22)	26.6	23.3	19.6	15.9	67.3 (55.16)	7.7 (16.01)	19.9 (26.42)
T-44	95.3 (77.72)	77.3 (61.59)	18.9	24.7	21.4	13.4	72.6 (58.42)	5.4 (13.13)	16.6 (24.06)
Local	92.7 (74.3)	73.3 (58.92)	20.9	20.3	17.6	13.3	69.5 (56.46)	10.9 (19.23)	23.3 (28.87)
S.Em±	1.23	1.02	-	1.04	1.04	-	0.90	1.00	0.82
CD(P=0.05)	3.74	3.08	-	3.22	3.15	-	2.73	3.03	2.48

Figures in parentheses indicate arc sine values; I-Inoculated, Un-Uninoculated, G-Germination, SL-Seedling length, R-Reduction, SE-Seedling emergence, SB-Seedling blight, LB-Leaf blight

0.8 to 4.9 per cent in different districts and the highest seed infection was seen in samples from Kendrapara district. These results are in agreement with earlier reports [9].

Germination was significantly different among the varieties, varying from 92.7 per cent in uninoculated seeds of local variety to 97 per cent in PDM-11 and Dhauli (Table 1). Similar trend was observed in case of inoculated seeds also. It ranged from 66.7 per cent in K-851 to 77.3 per cent in T-44. This indicated a reduction in germination of 18.9-31 per cent, maximum reduction was in K-851 followed by Dhauli. Seedling length of uninoculated seeds ranged from 20.3cm in Local to 24.7cm in T-44 and that of inoculated seeds varied from 16.5cm in K-851 to 21.4cm in T-44, which indicated a reduction in seedling length of 13.3-28 per cent in different varieties. Maximum reduction was noticed in PDM-54 followed by K-851 and PDM 11.

When the infected seeds were sown in pots, seedling emergence was differing from 65 per cent in K-851 to 72.6 per cent in T-44, which indicated 27.4 per cent to 3 5.1 per cent rotting of seeds in the soil. Seed infection also caused seedling blight, which appeared as black discolouration and rotting of hypocotyl region, wilting and subsequent death of the seedlings. Incidence of seedling blight varied from 5.4 in T-44 to 13.2 per cent in K-851. Seed rot and seedling blight due to *M. phaseolina* is commonly known as charcoal rot disease. The seed rot, seedling blight and leaf blight symptoms were also reported by earlier workers [10]. When cotyledons and embryos are heavily infected, seeds rot and if the infection is light, seedlings show stunting of plumules and radicles [11], thereby reducing seedling length. Seed borne inoculum is also reported to cause seedling mortality in cluster bean [12]. Reduction in seedling length may be due to production of certain mycotoxins [13].

To manage this disease, seeds treated with fungicides could significantly improve germination and seedling length and reduce the disease intensity (Table 2). Maximum germination (93.33%) was observed in seeds treated with carbendazim followed by benomyl (90.7%). However, seedling length was high in benomyl (23.5 cm) followed by carbendazim (21.7 cm). Both carbendazim and benomyl also enhanced seedling emergence (91.4% and 89.5%, respectively) with minimum incidence of seedling blight (3.6% each) and leaf blight (PDI 0.7 and 0.5, respectively). Thiram and thiophanate methyl

Table 2. Effect of seed treatment on seed germination, seedling length and disease incidence

Fungicides	Seed germination	Seedling length(cm)	Seedling emergence	Seedling blight(%)	Leaf blight (PDI)
Thiram (0.3%)	89.2(71.01)	21.1	86.3 (68.31)	5.3(13.27)	9.2(17.65)
Captaf (0.3%)	82.7(65.53)	18.8	81.3(64.41)	7.0(15.29)	15.3(23.01)
Carbendazim (0.15%)	93.3(75.20)	21.7	91.4(71.69)	3.6(10.75)	0.7(4.62)
Benomyl (0.15%)	90.7(72.29)	23.5	89.5(71.19)	3.6(10.74)	0.5(4.05)
Thiophanate methyl (0.2%)	86.7(68.63)	19.6	83.7(66.21)	4.3(12.00)	2.3(8.74)
Mancozeb (0.3%)	81.3(63.43)	16.8	77.0(61.37)	8.2(16.58)	17.8(24.92)
Control	69.3(56.38)	14.7	66.1(54.40)	12.6(20.77)	31.3(33.99)
S.Em±	1.11	0.61	1.12	0.79	0.92
CD (P=0.05)	3.43	1.87	3.45	2.44	2.84

Figures in parentheses indicate arc sine values were moderately effective in reducing the disease incidence and improving seedling emergence. All other fungicides were less effective. Effectiveness of carbendazim and benomyl in inhibiting growth of the fungus *in vitro* [13, 15] and also in controlling the disease *in vivo* has been reported [16, 17]. Seed treatment with thiram has been found effective in eliminating the seed borne infection and in reducing disease incidence which supports the work of earlier workers [18]. However, the effectiveness of these fungicides needs to be further evaluated under field condition before recommendation.

From the present study it may be concluded that *M. phaseolina* can get associated with seeds of mung bean and reduce the seed quality and produce serious disease symptoms. Most of the varieties are severely affected by the pathogen. Seed treatment with fungicides like carbendazim or benomyl can successfully eliminate seed borne inoculums, thereby improve seed quality and reduce disease incidence.

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