

# Field efficacy of fungicides and bio-agents against *Alternaria* leaf spot of Mung bean

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## ABSTRACT

Under laboratory conditions, out of 13 fungicides, hexaconazole (400 & 300 ppm) completely inhibited the fungal growth of *Alternaria alternata* and was found as the most effective fungicide. Among 6 bio-agents, *Trichoderma viride* gave highest fungal growth inhibition (51.7%), followed by *T. harzianum* (45.3%) and *T. virens* (41.4%). In field, among 11 fungicides, three sprays of hexaconazole (0.03%) proved most effective fungicide for controlling the disease of mung bean with minimum disease severity (6.3%), minimum disease incidence (13.5%) and maximum grain yield (868.0 kg/ha). Further, the next best fungicides were mancozeb (0.25%) and indofil Z-78 (0.2%). Among 6 bio-agents, *T. viride* gave highest grain yield (740.0 kg/ha) with minimum disease severity (17.4%) and disease incidence (29.4%), followed by *T. harzianum*.

**Key words:** *Alternaria alternata*, Management, *Vigna radiata*.

Mung bean [*Vigna radiata* (L.) Wilczek] is cultivated in India as an important pulse crop during *kharif* and summer seasons. The leaf spot disease manifests as small, circular, brown spots with concentric rings on the lower side of the leaves of susceptible varieties and spreads rapidly covering entire leaf area under favourable temperature and humidity. Attempts have been made to control *Alternaria* blight by using foliar sprays of fungicides (Singh and Singh, 2004) and bio-agents (Meena *et al.*, 2004). Thus, present study was undertaken under temperate climatic field conditions of Kashmir valley.

## Materials and Methods

Infected leaves of mung bean were collected from the Experimental Farm, Faculty of Agriculture and Regional Research Station, Wadura, Sopore (J&K). Isolation of fungus was made from infected leaf samples on 2% P.D.A. medium yielded

*A. alternata*. Efficacy of fungicides and bio-agents against *A. alternata* was evaluated by assessing mycelial growth inhibition through poison food technique with three replications *in vitro* (Table 1). The dia. of test fungus was measured and the % inhibition of mycelial growth was calculated.

A field trial was conducted in R.B.D. using mung bean susceptible cv. SKAU-M- 86 with three replications at Wadura, Sopore against *Alternaria* leaf spot of mung bean during *kharif* 2008 was sown on 10<sup>th</sup> June. The sub-plot size was 3.6 x 2.4m. The row to row and plant to plant distances were 45 and 30 cm, respectively. Eleven fungicides and 06 bio-agents used as foliar sprays (Table 1-4). First spray of the fungicides and bio-agents was applied on appearance of the disease symptoms and second and third spray were done at 10 days interval. Untreated sub-plot of this crop served as control. Observations were recorded on disease incidence and disease severity on the basis

of number of plants infected and leaf area affected, respectively. Disease severity was calculated by using 0- 5 disease scale. Grain yield was also recorded after crop maturity.

### Results and Discussion

All the fungicides and bio-agents tested under laboratory conditions displayed better performance as compared to the control. Out of 13 fungicides, hexaconazole at 400 & 300 ppm completely inhibited (100%) the fungal growth of *A. alternata* and was found as the most effective fungicide. Hexaconazole (200 ppm) gave 92.8% inhibition of fungal growth of this pathogen (4.2 mm dia. of colony). The next best fungicide, mancozeb at 3000, 2000 and 1000 ppm, inhibited mycelial growth (89.6, 84.3 & 83.8% with 6.1, 9.2 and 9.5 mm dia. of fungal colony, respectively). Other fungicides such as indofil Z-78, captan and copper oxychloride at concentrations of 3000, 2000 and 1000 ppm were also effective against the mycelia growth (65.4-86.2% inhibition) which differed significantly from hexaconazole (Table 1). Among 6 bio-agents, *T. viride* registered highest fungal growth inhibition (51.7% with 28.3 mm dia. of fungal colony), followed by *T. harzianum* (45.3%) and *T. virens* (41.4%) which differed significantly from each other. *Gliricidium roseum* and *G. virens* were statistically on par but inferior to *Trichoderma* spp. (Table 2). Singh and Singh (2006) reported that mycelial growth of *A. alternata* was completely inhibited by hexaconazole. Raja and Reddy (2008) observed 100% inhibition of fungal growth of *A. tenuissima* by mancozeb and hexaconazole in eggplant. Tekade *et al.* (2009) found that maximum inhibition of *A. alternata* was observed by *T. viride* (57.8%), followed with *T. harzianum* (42.6%) against leaf blight of Ashwagandha.

All the eleven fungicides and bio-agents tested under field conditions reduced the disease intensity, disease incidence and gave better grain yield as compared to control (Table 3 & 4). Of eleven fungicides tried, hexaconazole (0.03%) found most effective against *Alternaria* leaf spot (85.4% disease control) with minimum disease severity (6.3%) as well as minimum disease incidence

**Table 1.** Inhibitory effect of fungitoxicants on mycelia growth of *Alternaria alternata* causing *Alternaria* leaf spot of mung bean.

Treatments	Concent- ration (ppm)	Av. Dia. of fungal colony (mm)	% inhibi- tion over control
Hexaconazole	400	0.0	100.0
	300	0.0	100.0
	200	4.2	92.8
Mancozeb	3000	6.1	89.6
	2000	9.2	84.3
	1000	9.5	83.8
Indofil Z-78	3000	8.1	86.2
	2000	10.9	81.4
	1000	11.3	80.7
Captan	3000	9.4	83.9
	2000	13.1	77.6
	1000	15.4	73.7
Copper oxychloride	3000	11.2	80.9
	2000	16.3	72.2
	1000	20.3	65.4
Ziram	3000	13.6	76.8
	2000	17.1	70.8
	1000	21.5	63.3
Dodine	700	15.3	73.9
	600	18.1	69.1
	500	22.7	61.3
Thiophanate methyl	2000	16.2	72.4
	1000	19.4	66.9
	500	24.3	58.6
Propineb	3000	20.7	64.7
	2000	21.4	63.5
	1000	22.8	61.1
Carbendazim	1000	21.6	63.2
	500	23.8	59.4
	300	27.2	53.6
Benomyl	1000	23.4	60.1
	500	27.2	53.6
	300	30.1	48.7
Chlorothalonil	3000	18.5	68.4
	2000	20.3	65.3
	1000	23.5	59.9
Wettable sulphur	3000	26.3	55.2
	2000	30.1	48.6
	1000	34.4	41.4
Control	—	58.7	—
CD (P= 0.05)		1.32	

Table 2. Inhibitory effect of bio-agents on mycelia growth of *Alternaria alternata*.

Treatments	Fungal colony (in dia. mm)	% inhibition over control
<i>Trichoderma viride</i>	28.3	51.7
<i>T. harzianum</i>	32.1	45.3
<i>G. virens</i>	34.4	41.4
<i>Gliocladium roseum</i>	41.8	28.7
<i>G. virens</i>	43.1	26.5
<i>Pseudomonas fluorescens</i>	47.2	19.5
Control	58.7	-
CD (P= 0.05)	2.04	

(461.0 kg/ha) of mung bean, followed by chlorothalonil (0.2%) (Table 3). Among 6 bio-agents, the application of *T. viride* resulted in highest grain yield (740.0 kg/ha) of mung bean with minimum disease severity (17.4%) and disease incidence (29.4%) with 60.1% disease control, followed by *T. harzianum* and *T. virens* with grain yield (705.0 & 673.0 kg/ha), disease severity (21.13 & 26.58%) and disease incidence (32.58 & 38.12%). However, *Trichoderma viride* and *T. harzianum* were statistically on par with each other in case of disease incidence. *Gliocladium roseum* and *G. virens* were also found statistically on par in relation to disease incidence and disease severity. *Pseudomonas fluorescens* was found least effective bio-agent against the disease with grain yield (453 kg/ha), disease severity (39.5%) and disease incidence (54.2%). Earlier, Maheshwari *et al.* (2007) also found that hexaconazole was most effective fungicide for controlling *Phyllosticta* leaf spot of mung bean under field conditions. Later, Raja and Reddy (2008) noted that ziram and hexaconazole were proved to be the best in controlling leaf spot of eggplant caused by *A. tenuissima* under field conditions. Likewise, Surwase *et al.* (2009) recorded that hexaconazole and *T. harzianum* were

13.5%) and maximum grain yield (868.0 kg/ha) (Table 3). Further, next best effective fungicides were mancozeb (0.25%) and indofil Z-78 (0.2%) which were statistically on par in case of disease intensity, but not in disease incidence and grain yield, followed by captan (0.3%), copper oxychloride (0.25%) and ziram (0.2%). However, least effective fungicide was wettable sulphur (0.2%) with maximum disease intensity (37.6%) as well as disease incidence (66.7%) and minimum grain yield

Table 3. Effect of different fungicides on disease incidence, disease severity and grain yield of mung bean.

Treatments (%)	Disease incidence (%)	Disease severity (%)	% Disease control	Grain yield (kg/ha)
Hexaconazole (0.03)	13.5 *(21.61)	6.3 *(14.49)	85.4	868.0
Mancozeb (0.25)	20.1 (26.67)	11.2 (19.58)	74.3	825.0
Indofil Z-78 (0.2)	22.0 (27.98)	12.5 (20.75)	71.3	808.0
Captan (0.3)	28.3 (32.18)	16.3 (23.85)	62.5	760.0
Copper oxychloride (0.25)	33.1 (35.14)	19.5 (26.21)	55.4	732.0
Ziram (0.2%)	39.5 (38.96)	24.7 (29.80)	43.5	700.0
Dodine (0.06)	47.6 (43.63)	26.8 (31.22)	38.6	658.0
Thiophanate methyl (0.1)	52.3 (46.37)	30.9 (33.78)	29.4	601.0
Propineb (0.3%)	60.6 (51.17)	32.4 (34.32)	25.8	547.0
Chlorothalonil (0.2%)	63.8 (53.02)	34.6 (36.24)	20.9	498.0
Wettable sulphur (0.2%)	66.7 (54.78)	37.6 (37.63)	14.1	461.0
Control	73.7 (58.90)	43.7 (41.42)	-	432.0
CD (P= 0.05)	1.35	2.30		4.46

\*Figures in parentheses are angular transformed values for analysis.



**Table 4.** Effect of bio-agents on disease incidence, disease severity and grain yield of mung bean.

Treatments (%) & inoculum load	Disease incidence (%)	Disease severity (%)	% Disease control	Grain yield (kg/ha)
<i>Trichoderma viride</i> (0.5% & 1x10 <sup>6</sup> /ml)	29.4 *(32.83)	17.4 *(24.66)	60.1	740.0
<i>T. harzianum</i> (0.5% & 1x10 <sup>6</sup> /ml)	32.5 (34.80)	21.1 (27.35)	51.6	705.0
<i>T. virens</i> (0.5% & 1x10 <sup>6</sup> /ml)	38.1 (38.13)	26.5 (31.02)	39.1	673.0
<i>G. roseum</i> (0.5% & 1x10 <sup>5</sup> /ml)	45.6 (42.48)	33.8 (35.55)	22.6	535.0
<i>G. virens</i> (0.5% & 1x10 <sup>5</sup> /ml)	48.1 (43.95)	35.1 (36.38)	19.6	481.0
<i>P. fluorescens</i> (0.5% & 1x10 <sup>8</sup> /ml)	54.2 (47.45)	39.5 (29.80)	9.5	453.0
Control	73.3 (57.24)	43.6 (41.32)	—	438.0
CD (P= 0.05)	3.27	1.97		5.09

\*Figures in parentheses are angular transformed values for analysis.

found highly effective for controlling the powdery mildew of pea and giving better seed yield. Chaudhary *et al.* (2013) reported that maximum disease reduction of *Alternaria* blight of mustard was obtained in mixture of two fungicides. Singh and Singh (2004) also reported various fungitoxicants were found effective against *Alternaria* blight of linseed. It is suggested that three sprays of hexaconazole (0.03%) or *T. viride* (0.5%; inoculum load: 1x10<sup>6</sup>/ml) starting from disease initiation could be exploited as an efficient strategy for reducing the severity of *Alternaria* leaf spot and thereupon, increasing grain yield of mung bean under field conditions.

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