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Evaluation of Efficacy of Fungicides against Alternaria Blight Disease of Linseed

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ABSTRACT

The study on efficacy of fungicides against Alternaria blight disease of linseed caused by *Alternaria lini* was conducted during *rabi* season 2020-21 to select suitable fungicides against this disease. Six fungicides were evaluated *in vitro* and *in vivo* studies. The results revealed that all the tested fungicides showed significantly better performance over control. Among the tested fungicides Propiconazole 25 EC proved be the best at all the concentration (100, 150 and 200 ppm) as it showed 100% of mycelial growth inhibition over control. In the field condition too, Propiconazole 25EC was the superior among all the fungicides with the lowest disease severity (10.66%). It showed the highest disease control over check (77.63 %) and also highest yield (884.33 kg/ha) which was further followed by Azoxystrobin 23% SC and Carbendazim 12% + Mancozeb 63% WP.

Keywords Fungicides, Alternaria blight, Linseed, Disease severity, Yield.

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INTRODUCTION

Linseed (*Linum usitatissimum* L.) is one of the oldest oilseed crops which is also known as flax. Among the oilseed crops grown during *rabi* season, linseed is next in important to rapeseed and mustard in area and production. It is an annual dicotyledonous plant (Anonymous 2000) and is commonly known as 'Ulsee' or 'Tisee'. It is a multipurpose crop and is grown in India mainly for oil, whereas in western countries, it is grown especially for fiber. The plant is native to West Asia and the Mediterranean. Linseed is one of the important crops of the world cultivated over 32.63 lac hectares with a total production of 31.82 lac tonnes. The important linseed growing countries are India, Canada, China, USA and Ethopia. In India it is cultivated in an area of 1.72 lac hectares with a total production of 0.99 lac tonnes (Directorate of Economics and Statistics, DAC and FW, 2018-19). Its cultivation is mostly confined to Madhya Pradesh, Maharashtra, Chhattisgarh, Uttar Pradesh, Bihar and Orissa.

Almost every part of the linseed plant is utilized commercially, either directly or after processing. On a very small scale, the seed is directly used for edible purposes, about 20% of the total oil produced is used in farmers home and about 80% of the oil goes to industries. The oil is also utilized for manufacturing paints, varnishes, oilcloth, linoleum, pad ink, printers ink, soaps, patent leather and other products. The components present in flaxseed attract the food technologists and nutritionists to explore its activities in health sector (Mishra and Verma 2013). Linolenic fatty acids (omega-3) reduce the risk of cardiovascular disease (Hurteau 2004). Linseed protein was

found more effective in lowering triglycerides (TAG) and plasma cholesterol (Bhathena *et al.* 2002). The antioxidant activity of it has been found to reduce total cholesterol and platelet aggregation.

But this crop is ravaged by a number of diseases and insect pests at various phases of its growth which reduce the crop yield and quality. Amongst diseases Alternaria blight caused by *Alternaria lini* Dey is a major biotic stress, limiting crop yield in hot and humid environment (Singh and Singh 2004, 2005). This disease caused 18-43.88% yield loss depending upon its severity (Singh *et al*. 2003, Singh and Singh 2004). Low production of linseed occurs mainly due to this diseases. Considering the importance of the crop and destructive nature of the disease the present study was undertaken to find out the efficacy of the fungicides under *in vitro* and *in vivo* condition against Alternaria blight of linseed.

MATERIALS AND METHODS

Six commonly available fungicides namely Mancozeb 75% WP, Propiconazole 25 EC, Carbendazim 50% WP, Azoxystrobin 23% SC, Carbendazim 12% + Mancozeb 63% WP and Metalaxyl 18% + Mancozeb 64% WP were evaluated against *Alternaria lin*i *in vitro* as well as in field.

For *in vitro* evaluation of fungicides, poison food technique potato dextrose agar as basal medium was followed. The fungicides Mancozeb, Propiconazole, Carbendazim, Azoxystrobin, Carbendazim + Mancozeb and Metalaxyl + Mancozeb were tested at three different concentrations of 100 ppm, 150 ppm and 200 ppm. The calculated quantities of fungicides were thoroughly mixed in the medium before pouring into Petri plates so as to get the desired concentration of active ingredient of each fungicide separately. 20 ml of fungicide amended medium was poured in each of 90 mm sterilized Petri plates and allowed to solidify. The plates were inoculated centrally with 8 mm disc of 10 days old young sporulating culture of Alternaria lini. Controls without fungicides were also maintained. The inoculated Petri plates incubated at room temperature 28±1 ^{0}C in the laboratory. The colony diameter were measured after 7days when the control plates full of fungal grow.Three replications were maintained for each treatment. Radial growth was converted into percent growth inhibition by using following formulae:

$$\text{Percent growth inhibition} = \frac{C - T}{C} \times 100$$

Where, C = Colony diameter in check plate (mm), T= Colony diameter in the treated plate (mm).

The per cent inhibition were transformed into arc sin percentage transformation and then analyzed statistically.

To see the effect of foliar spray to fungicides on Alternaria blight of linseed. Field trails was conducted during *rabi* season 2020-21at research farm of Bihar Agricultural University, Sabour, Bhagalpur, Bihar. Field trials were laid out in Randomized Block Design with 3 replication and Sabour Tisi-1 variety. Recommended dose of fertilizers and spacing was followed. In fungicidal trial two spraying at 10 days interval were given in all cases. Observations on disease severity were recorded at flowering stage following 0-5 scale. The yields (kg/ha) were recorded after harvest of the crop. Pant disease index was calculated by the formula as given by McKinney (1923).

$$\text{Disease index (\%)} = \frac{\text{Sum of all numerical ratings}}{\text{Total no.of leaves} \times \text{Maximum grade}} \times 100$$

RESULTS AND DISCUSSION

All the fungicides tested were able to inhibit the growth of *Alternaria lini* (Table 1 and Fig. 1). Higher concentration was more effective as compared to lower concentration in all the case. Among different fungicides at 100 ppm concentration, mycelial growth of *Alternaria lini* ranged from (0-62.75) mm being minimum (0 mm) in Propiconazole 25 EC and maximum (62.75 mm) in Carbendazim 50% WP. After Propiconazole 25 EC, Azoxystrobin 23% SC was found second most effective fungicide at 100 ppm by giving 59.68% mycelial inhibition which was followed by Carbendazim 12% + Mancozeb 63% WP, which inhibited 51.35% of mycelial growth. Carbendazim 50% WP was found least effective growing

Table 1. Effect of different fungicides on mycelial growth (mm) and inhibition over control against Alternaria blight of linseed. *Average of three replications.

Treatments	Radial growth (mm) 100 ppm	150 ppm	200 ppm	Mean	Inhibition over control (%)
Mancozeb 75% WP	49.00	46.80	33.50	43.10	47.60
Propiconazole 25 EC	00.00	0.00	0.00	0.00	100.00
Carbendazim 50% WP	62.75	59.50	55.50	59.25	27.96
Azoxystrobin 23% SC	45.60	33.40	20.50	33.17	59.68
Carbendazim 12% + Mancozeb 63% WP	49.75	37.80	32.50	40.02	51.35
Metalaxyl 18% + Mancozeb 64% WP	54.20	43.80	38.40	45.47	44.72
Control	82.25	82.25	82.25	82.25	0.00
CD at 1%	2.69	1.67	1.34		
SE (m)±	0.93	0.57	0.46		
CV (%)	3.68	2.54	2.31		

27.96% mycelial inhibition. Same trends were followed at 150 and 200 ppm concentration also where highest inhibition (100%) was by Propiconazole 25 EC and lowest inhibition recorded in Carbendazim 50% WP. The results are closely supported with the findings reported by Arora *et al*. (1994) found Dithane M-45 (Mancozeb) to be toxic to *Alternaria alternata.* Khan *et al*. (1995) reported that Carbendazim (Bavistin), Pronev (Entracol) and Thiophonate significantly reduced mycelial growth of *Alternaria alternata.* Majumdar (1987) tested six fungicides and reported that Bavistin was most effective against *Alternaria lini in vitro.* On increasing the concentration of the fungicide, the inhibition effect of fungus was also increased (Choulwas *et al*. 1989). Huq *et al.* (1994) reported Rovral as the most inhibitive fungicide against *Alternaria porri.*

Results related to *in vivo* evaluation of fungicides against *Alternaria lini* (Table 2 and Fig. 2) revealed that all the fungicides reduced the disease severity significantly as compared to check. Disease severity recorded varied in the range from (10.66-47.66 %). Maximum disease severity (47.66 %) was recorded in the check and minimum (10.66 %) in Propiconazole 25 EC @ 0.2% followed by Azoxystrobin 23% SC @ 0.2% (18.33 %) and Carbendazim 12% + Mancozeb 63% WP @ 0.2% (22.66 %). Highest disease severity (32.66 %) was recorded in Carbendazim 50% WP @ 0.2% after check.

Maximum per cent reduction over control (77.63 %) was recorded in Propiconazole 25 EC @ 0.2% which was followed by Azoxystrobin 23% SC @ 0.2% (61.54 %) and Carbendazim 12% + Mancozeb 63% WP @ 0.2% (52.45 %). Lowest per cent reduction over control (31.47 %) was recorded in Carbendazim 50% WP @ 0.2% after check.

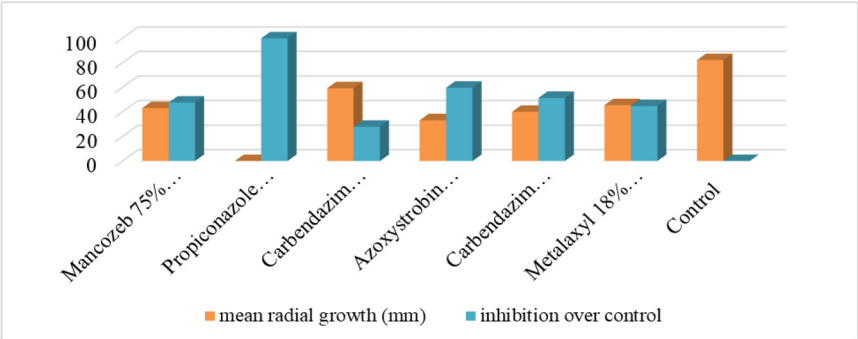

Fig. 1. Effect of fungicides on the mean radial growth (mm) and percent inhibition against *Alternaria lini.*

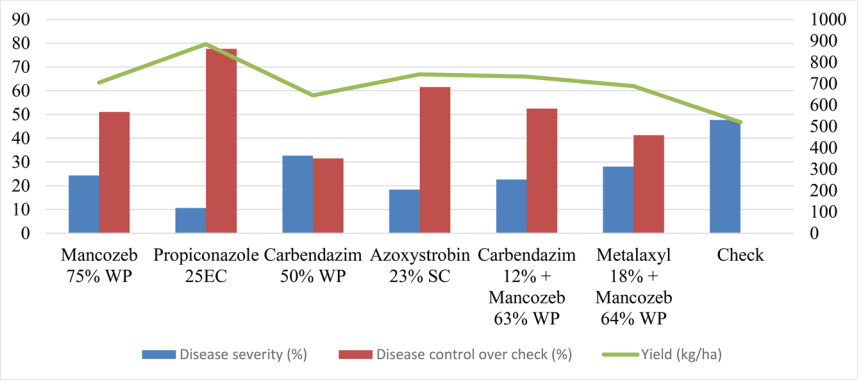

Fig. 2. Effect of fungicides on the disease severity (%), disease control over check (%) and yield (kg/ha) against *Alternaria lini.*

All the fungicides increased yield (kg/ha) significantly as compared to check. Yield (kg/ha) recorded varied in the range from (519.33- 884.33 kg/ha). Minimum yield (519.33 kg/ha) was recorded in case check and maximum yield (884.33kg/ha) in Propiconazole 25 EC @ 0.2% followed by Azoxystrobin 23% SC @ 0.2% (743.33 kg/ha) and Carbendazim 12% + Mancozeb 63% WP @ 0.2% (732.33 kg/ha). Lowest yield (645.00 kg/ha) was recorded in Carbendazim 50% WP @ 0.2% after check. The present findings are in congruent with the findings of Biswas and Singh (2005), Kumar *et al.* (2009) who reported Propiconazole to be effective in managing leaf blight disease. Singh *et al.* (2009) evaluated 7 fungicides against Alternaria blight of linseed and found that all the fungicides were significantly effective for reducing the intensity of Alternaria blight over control. Verma *et al*. (2009) also found that minimum diseases

Table 2. Effect of different fungicides under *in-vivo* condition against *Alternaria lini.* *Average of three replications.

Fungicides	Concentration (%)	Disease severity* (%)	Disease control over check (%)	Yield* (kg/ha)
Mancozeb 75% WP	0.20%	24.33 (29.51)	51.05	705.00
Propiconazole 25EC	0.20%	10.66 (19.03)	77.63	884.33
Carbendazim 50% WP	0.20%	32.66 (34.82)	31.47	645.00
Azoxystrobin 23% SC	0.20%	18.33 (25.32)	61.54	743.33
Carbendazim 12% + Mancozeb 63% WP	0.20%	22.66 (28.34)	52.45	732.33
Metalaxyl 18% + Mancozeb 64% WP	0.20%	28.00 (31.91)	41.25	688.33
Check	-	47.66 (43.64)	-	519.33
CD @5%		3.87		141.63
SE (m)±		1.24		46.04
CV (%)		7.08		12.79

severity of Alternaria blight of linseed was recorded in Dithane M -45.

CONCLUSION

The results of the *in-vitro* chemical management studies by poisoned food technique revealed that minimum mycelial growth (0 mm) was recorded with Propiconazole 25 EC at all the tested concentrations (100, 150 and 200 ppm) as compared to control. Maximum percent inhibition (100 %) was recorded with Propiconazole 25 EC at all the tested concentration (100, 150 and 200 ppm) as compared to control after 15 days of incubation. Results of the experiment conducted at field revealed that among different treatments Propiconazole 25 EC @ 0.2% proved to be the best in reducing the disease severity (10.66 %) followed by Azoxystrobin 23% SC @ 0.2% (18.33 %) and Carbendazim 12% + Mancozeb 63% WP @ 0.2% (22.66 %). Maximum disease control (77.63%) over check were recorded in the case of Propiconazole 25 EC @ 0.2% followed by Azoxystrobin 23% SC @ 0.2% (61.54 %) and Carbendazim 12% + Mancozeb 63% WP @ 0.2% (52.45 %). Maximum yield (884.33 kg/ha) were recorded in the case of Propiconazole 25 EC @ 0.2% followed by Azoxystrobin 23% SC @ 0.2% (743.33 kg/ha) and Carbendazim 12% + Mancozeb 63% WP @ 0.2% (732.33 kg/ha).

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