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Management of *Alternaria* leaf blight and white rust diseases of mustard in tarai agro-ecological zone of West Bengal

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Four different fungicides viz. Indofil M-45 (mancozeb, 75% WP) @ 0.25%, Fytolan (copper oxychloride, 50%WDP) @ 0.4%, Bavistin (carbendazim, 50%WP) @ 0.1% and Ridomil MZ, (metalaxyl + mancozeb 72%WP) @ 0.15% and their two specific combinations viz., Ridomil @ 0.075% + Fytolan @ 0.2% and Ridomil @ 0.075%+ Bavistin @ 0.05% were tested against *Alternaria*-leaf blight and white rust diseases of mustard. Fytolan alone or in combination with Ridomil was found superior to other treatments with respect to the reduction of leaf blight incidence and increment of crop yield. However, Fytolan+Ridomil was found better than Fytolan alone because of its effectiveness against white rust of mustard in addition to lowering of blight incidence and increase in crop yield. Positive correlation was evident between reduction of leaf blight and increase in seed yield which was absent in case of white rust. Reduction of disease incidence of leaf blight by fungicides was found to be associated with inhibition of mycelial growth and spore germination.

Key words : *Alternaria, Albugo,* fungicides, mycelial growth, spore germination

INTRODUCTION

Alternaria leaf blight caused by *Alternaria brassicae* (Berk) Sacc. and/or *A. brassicicola* (Schw.) Wilts is the most destructive and wide spread disease of rapeseed and mustard in India. The appearance of white rust caused by *Albugo candida* (Pers. ex. Lev.) Ktz. alongwith leaf blight further aggravates the disease situation. Crop loss due to leaf blight and white rust was found to be 35-46% (Kolte *et al.*, 1988) and 23-54.5% (Saharan *et al.*, 1984) respectively. These diseases appear both on early as well as late sown mustard crop in each year in tarai region of West Bengal. Disease severity is more in late than in early sown crop when yield and its components are markedly affected. Most of the present day mustard varieties are susceptible to these diseases. Therefore at the present moment use of fungicides appears to be the only parctical solution to its control to achieve full yield potential of the crop. No informations are available about experiment conducted with some fungicides to either singly or in combination to find out the best and effective control of the diseases.

MATERIALS AND METHODS

The experiment was conducted during 1998-99 at Pundibari farm of Bidhan Chandra Krishi Viswavidyalaya in Cooch Behar district of West Bengal in plot sizes of 2.1 m × 2.1 m following randomized block design with four replications. Four different fungicides alongwith their two specific combinations including a suitable untreated control constituted seven different treatments of the field experiment. The same treatment schedule was also followed for *in vitro* studies.

Mustard cultivar Rohini was sown within first week of November following spacing of 30 cm × 20 cm. Thinning was done within five days after seedling emergence. Fertilizers @ 80 kg N, 40 kg P_2O_5 and 40 kg K_2O and manures @ 2 tonnes/ ha were applied. Two sprayings of borax @ 3.0 g / litre of water were done at 21 and 42 days after sowing (DAS). Weedings and irrigations were done as and when necessary. *Alternaria*-leaf blight and white rust disease appeared on 45 and 70 DAS. Fungicides sprayings were started at the time of appearance of the disease 45 DAS and continued

Table 1 : Effect of different fungicides and their specific combinations on diesease incidence and yield parameters

Treatments	Dose (%)	Percent disease index (PDI) of		Percent Reduction of PDI over control		Average number of fruits/plant	Seed yield (g) /100 fruit	Seed yield (g) /plot
		Leaf blight	White rust	Leaf blight	White rust	(increased over control)	(increased over control)	(increased over control
Indofil M-45 (Mancozeb, 75% WP)	0.25	11.6 (3.5)*	2.5 (1.7)*	42.9	10.7	139.3 (16.0)	5.345 (0.645)	874.1 (113.5)
Fytolan (Copper oxychloride, 50% WDP	0.40	8.3 (3.0)	2.6 (1.8)	59.1	7.1	157.4 (34.1)	5.651 (0.951)	1004.4 (243.8)
Bavistin (Carbendazim, 50% WP)	0.10	10.6 (3.3)	2.5 (1.7)	47.8	10.7	147.3 (21.0)	5.239 (0.539)	819.9 (59.3)
Ridomi MZ (Metalaxyl + Mancozeb 72% WP)	0.15	9.2 (3.1)	1.2 (1.3)	54.7	57.1	148.5 (25.2)	5.086 (0.386)	945.5 (184.9)
Ridomil + Fytolan	(0.075 + 0.2)	8.7 (3.1)	1.9 (1.5)	57.1	32.1	148.7 (25.4)	5.390 (0.690)	938.8 (178.2)
Ridomil + Bavistin	(0.075 +0.05)	11.7 (3.4)	2.2 (1.6)	42.4	12.0	140 (16.7)	5.000 (0.300)	904.0 (143.4)
Control	—	20.3 (4.6)	2.8 (1.8)	—	—	123.3 (—)	4.700 (—)	760.6 (—)
S. Em (±)		0.1	0.1			3.7	0.1	32.3
CD at 0.05%		0.3	0.2			10.9	0.4	95.5

* Figure within parenthesis indicates square root transformed value.

Relation of percent reduction of leaf blight PDI with increased no. of fruits/plant (r = 0.938*), seed yield / 100 fruit (r = 0.587 NS) and seed yield/plot (r = 0.736*).

Relation of percent reduction of white rust PDI with increased no. of fruits/plant (r = 0.153 NS), seed yield / 100 fruit (r = – 0.381 NS) and seed yield/plot (r = 0.261 NS).

upto 75 DAS at 15 days interval. Data on disease incidences of *Alternaria*-leaf blight and white rust were recorded 90 DAS. Data on yield parameters were recorded after harvest. Disease intensity was recorded by scoring all leaves of eight randomly selected plants from each replication based on 0-6 scale (0 = 0%, 1 = 1-5%, 2 = 6-10%, 3 = 11-25 %, 4 = 26-50%, 5 = 51-75%, and 6 = 75-100%) and percent disease index (PDI) was computed by using following formula :

$$PDI = \frac{\text{Sum of total ratings} \times 100}{\text{No. of plants examined} \times \text{Maximum grade}}$$

With a view to test the *in vitro* fungitoxicity of the fungicides and their specific combinations, *A. brassicae* was isolated and brought to pure culture following standard methods. Mycelial discs of 8 mm diameter were used to measure inhibition of mycelial growth by poisoned food technique. Data on radial growth was recorded at 48, 96, 144 and 192 hs after incubation at 25 ± 1° C. Spores of *A. brassicae* were collected from naturally infected leaf materials with the help of a moistened camel hair brush to test the inhibition of spore germination. Spore germination in the cavity slides of untreated control started 4 hrs after incubation at 25 ± 1° C. Data on percent spore germination for all treatments were recorded after 25 hrs of incubation.

RESULTS AND DISCUSSION

Results presented in Table 1 indicate that incidence of leaf blight is higher than that of white rust in this tarai region of West Bengal. All fungicides and

their specific combinations significantly reduced percent diseae index (PDI) of leaf blight over control but reductions were more pronounced with Fytolan and with its Ridomil combination. On the other hand Ridomil either sole or in combinations was found to be effective in the reduction of PDI of white rust. It caused considerable reduction of leaf blight disease incidence also. However, Fytolan as well as Bavistin, Indofil M-45 were not effective against white rust. Blitox-50WP, a copper oxychloride, was also found to be highly effective against *Alternaria*-leaf blight of mustard by Shivpuri *et al.*, (1988) and against white rust of mustard by Srivastava and Verma (1989). The excellent control of white rust and leaf blight by Ridomil was also recorded by Kolte (1996). He indicated that reduction of white rust and leaf blight might be due to the presence of its metalaxyl and mancozeb components respectively. In this experiment Fytolan + Ridomil combination not only reduced leaf blight disease incidence at par with Fytolan but also caused significant level of reduction in white rust incidence. So, Fytolan + Ridomil will provide better protection of plant at any time against both the diseases.

Different fungicidal treatments significantly increased seed yield / plot, seed yield / 100 fruits and average number of fruits/ plant along with the reduction of disease incidence. There were positive correlations in reduction of leaf blight disease with average number or increased fruits (r = 0.938*) and seed yield / plot (r = 0.736*). But the relations of reduction of white rust disease incidence with yield parameters were found non-singificant. The increment of yield parameters though highest in Fytolan, it remained still at par with Fytolan + Ridomil treatment. Similar yield increment by reduction of incidence of *Alternaria*-leaf blight and white rust was recorded by Shivpuri *et al.* (1988) and by Srivastava and Verma (1989).

Table 2 : Effect of different fungicides and their specific combinations on spore germination and mycelial growth

Treatments	Dose (%)	% Spore germination (% inhibition over control)	Mean diameter of mycelial growth (cm) in hrs (% inhibition over control)			
			48	96	144	192
Indofil M-45 (Mancozeb, 75% WP)	0.25	0.0 (0.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)
Fytolan (Copper oxychloride, 50% WDP)	0.40	0.0 (0.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)
Bavistin (Carbendazim, 50% WP)	0.10	18.3 (78.7)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)
Ridomil MZ (Metalaxyl + Mancozeb, 72% WP)	0.15	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)
Ridomil + Fytolan	(0.075 + 0.2)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)
Ridomil + Bavistin	(0.075 + 0.05)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)	0.0 (100.0)
Control	–	85.8 (–)	2.3 (–)	4.7 (–)	6.2 (–)	9.7 (–)

Mycelial growth was completely inhibited till 192 hs of incubation in all treatments except control (Table 2). But in case of percent inhibition of spore germination, all fungicidal treatments caused total inhibition except Bavistin (78.7%). Reduction of disease incidence by different fungicidal treatments can be attributed to the inhibition of spore germination as well as mycelial growth.

It is clearly evident from the experimental results that Fytolan either sole or combination cause significant increment of all parameters studied through greater reducion of PDI as compared to other treatments. The reduction was due to inhibition of both spore germination and mycelial growth. Based on *in vitro* and field results, Fytolan + Ridomil is found to remain at par with Fytolan for all parameters tested except in white rust disease incidence reduction. Fytolan + Ridomil reduced white rust disease significantly perhaps due to presence of metalaxyl in Ridomil while Fytolan alone failed to do so. As combined application of Fytolan and Ridomil is advantageous over sole application of Fytolan it can be recommended against both *Alternaria*-leaf blight and white rust of mustard for tarai region of West Bengal.

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