Integrated management of Alternaria blight and white rust in Indian mustard

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ABSTRACT

Field experiments were conducted at Hisar, Haryana, India during 2007-08 and 2008-09 *rabi* crop seasons to test the efficacy of different bio-agents, plant extract, and fungicides with different combinations as seed treatment and foliar spray against Alternaria blight and white rust diseases in Indian mustard (*Brassica juncea*). Seed treatment with *Trichoderma harzianum* @ 10 g/kg seed followed by foliar spray of Ridomil MZ 72 WP (metalaxyl 8% + mancozeb 64%) @ 2 g/ l water after 50-60 days of sowing, significantly reduced the Alternaria leaf and pod blight up to 43.6 and 30.8 per cent, respectively and white rust and stagheads up to 39.5 and 23.3 per cent, respectively. Significant increase in seed yield up to 26.4 per cent was also recorded in this treatment. However, fungicidal seed treatment with Apron 35 SD (metalaxyl 35%) @ 6 g/Kg seed followed by foliar spray of Ridomil MZ 72 WP @ 2 g/ l water after 50-60 days of sowing was found most effective in reducing Alternaria leaf and pod blight up to 54.8 an 43.1 per cent, respectively and white rust and stagheads upto to 64.2 and 34.2 per cent respectively. Significant increase in seed yield up to 37.3 per cent was recorded in this treatment. Seed treatment with Bavistin 50 WP (carbendazim 50%) @ 2 g/Kg seed followed by foliar spray of Ridomil MZ 72 WP @ 2 g/ l after 50-60 days of sowing have shown results almost at par with the above treatment.

Key words: Indian mustard - Alternaria blight - white rust - bio-agents - fungicides,

INTRODUCTION

Indian mustard [*Brassica juncea* (L.) Czern & Coss.] is one of the major oilseed crops cultivated in India and around the world. It is extensively grown traditionally as a pure crop as well as intercrop (mixed crop) in marginal and sub-marginal soils in the eastern, northern and north western states of India. Cool and moist climate of winter months is the major factor for luxuriant growth and productivity of mustard in these states. Productivity of mustard is maximum (1559 kg ha^{-1}) in the state of Haryana, where the crop is grown during *rabi* season under irrigated as well as rain-fed conditions. Despite considerable increased in productivity and production, a wide gap exists between yield potential and yield realized at farmer's field, which is largely due to biotic and abiotic stresses. Among biotic stress, white rust caused by *Albugo candida* (Pers. ex. Lev.) Kuntze and Alternaria blight caused by *Alternaria brassicae* (Berk.) Sacc. have been reported to be most wide spread and destructive fungal diseases of rapeseed-mustard throughout the world (Kolte, 1985). In India, Haryana state is the hot spot for both these diseases, where white usually appears early and become severe on lower leaves at the time of flowering, while Alternaria leaf blight, though also, appears early but remains severe at the time of pod initiation stage. Symptoms of both these diseases on same leaves are quite common, while, combined infection of downy mildew and white rust on mustard have been observed rarely because of dry cool weather in this region. Yield losses from 23 to 54.5 per cent due to both phases (leaf and stag head) of white rust and from 17-48 per cent due to Alternaria blight have been reported from India (Saharan et al., 1984 and Saharan, 1991). Control of these diseases by use of different fungicides with varying degree of success has been reported in the literature (Mehta, et al., 2005). Ideally a chemical compound should not only be safe to the human beings and other mammals, but also to the microbes. With the growing awareness of harmful effects of pesticides, use of disease tolerant cultivar, crop rotation or sanitation practices, bio- agents, plant extracts to integrate with less fungicidal spray is gaining importance in recent years. The concept of integrated disease management seeks to minimize the advantages in the use of fungicides. Therefore, present study field trials were carried out for two years using different bio-agents, plant extract and fungicides with different combinations as seed treatment and foliar spray against Alternaria blight and white rust diseases in Indian mustard to find out effective and economical control.

MATERIALS AND METHODS

To test the effectiveness of different bio-agents, plant extract and fungicides in different combinations as seed treatment and foliar spray against Alternaria blight and white rust in Indian mustard, experiments were carried out in field plots (5mx3m) replicated thrice in randomized block design at Hisar, Haryana, India during 2007-08 and 2008-09 *rabi* seasons. The soil of the experimental plots was sandy loam in texture, low in organic carbon (0.28%) and available nitrogen (170 kg N ha^{-1}), medium in available phosphorus (20 kg P_2O_5 ha^{-1}) having Ece 0.30 dS m^{-1} and slightly alkaline in reaction (pH 7.7). All the experimental plots received recommended dose of fertilizers (80 kg N and 40 kg P_2O_5 ha^{-1}). Sowing was done on Nov. 15, 2007and Nov. 4, 2008 using highly susceptible cultivar (Varuna) for both the years. Different treatments *viz*., seed treatment with aqueous bulb extract of *Allium sativum* @ 1% (w/v), *Trichoderm harzianum* @ 10g/kg, Bavistin 50 WP @ 2g/kg and Apron 35 SD @ 6g/kg integrated with different combinations of foliar sprays treatments (at 50-60 DAS) *viz*., bulb extract of *Allium sativum* @ 1% (w/v), *Trichoderma harzianum* (oil based) @ 10g/l water, *Pusedomonas flourescens* (oil based) @ 10g/l water, Bavistin 50 WP @ 2g/l water and Ridomil MZ 72 WP @ 2g/l water along with untreated control were given. Observation on per cent white rust was recorded at 65-75 DAS, while the observation on per cent Alternaria leaf blight was recorded at 90-100 DAS by the method suggested by Conn et al., 1990. Observations on Alternaria pod blight severity and per cent stagheads were recorded 15 days before maturity and seed yield was also recorded in these treatments.

RESULTS

Data in Tables 1 and 2 reveal that seed treatment with *Trichoderma harzianum* @ 10 g/kg seed followed by foliar spray of Ridomil MZ 72 WP @ 2 g/ l water after 50-60 days of sowing, significantly reduced the Alternaria leaf and pod blight up to 43.6 and 30.8 per cent, respectively and white rust and stagheads up to 39.5 and 23.3 per cent, respectively.

Significant increase in seed yield up to 26.4 per cent was also recorded in this treatment (Table 3). However, fungicidal seed treatment with Apron 35 SD @ 6 g/Kg seed followed by foliar spray of Ridomil MZ 72 WP @ 2 g/ l water after 50-60 days of sowing was found most effective in reducing Alternaria leaf and pod blight up to 54.8 an 43.1 per cent, respectively and white rust and stagheads upto to 64.2 and 34.2 per cent respectively. Significant increase in seed yield up to 37.3 per cent was recorded in this treatment. Seed treatment with Bavistin 50 WP @ 2 g/Kg seed followed by foliar spray of Ridomil MZ 72 WP @ 2 g/ l after 50-60 days of sowing, have shown results almost at par with the above treatment. Different combinations of seed treatment and foliar sprays of bio-agents and plant extract *viz*., aqueous bulb extract of *Allium sativum*, *Trichoderma harzianum* and *Pseudomonas flourescens* also showed evidence of their effectiveness in controlling white rust and Alternaria blight upto some extent(Table 1&2)

DISCUSSION AND CONCLUSION

Use of antagonists, particularly *Trichoderma* species has been reported quite effective against different pathogens (Chattopadhyay et al., 2002) particularly as seed treatment followed by fungicidal spray in managing many fungal diseases in various host pathogen combinations (Rashmi Rohila, 2001). In the present investigation, seed treatment with *Trichoderma harzianum* @ 10g g/kg seed followed by foliar spray of Ridomil MZ 72 WP significantly reduced the Alternaria blight and white rust and increased the seed yield in Indian mustard. However, fungicidal seed treatment with Apron 35 SD followed by foliar spray of Ridomil MZ 72 WP was found most effective in reducing Alternaria blight and white rust and also increased the seed yield. Despite fungicide remains more effective in reducing diseases in plants, increasing public concern about environmental health is proving to be major hindrance in use of chemical pesticides including fungicides. Hence, use of low dose of fungicides, integrated with other means like growing disease tolerant cultivars, sanitation, crop rotation, use of plant extracts and bio-agents seems to be best method of disease management without environmental pollution. Biological control has only recently been tried on commercial scale in India, but the results of farmer's acceptance of this method remain to be determined.

Table 1. Mean Alternaria leaf and pod blight severity in different treatments during *rabi* 2007-08 and 2008-09. Figures in parentheses are angular transformed values. ALB- Alternaria leaf blight, APB- Alternaria pod blight, ST- Seed treatment, SP- Spray

Treatments	Mean ALB Severity (%)	% Decrease	Mean APB Severity (%)	% decrease
ST *Allium sativum* @ 1% (w/v) + SP *A. sativum* @ 1% (w/v)	34.0 (35.7)	22.0	23.7 (29.1)	22.9
ST *Trichoderma harzianum* @ 10g/kg +SP *T. harzianum* @ 10g/l	30.5 (33.5)	30.0	21.9 (27.9)	28.8
ST *T. harzianum* @ 10g/kg +SP *Pseudomonas flouresens* @ 10g/l	32.6 (34.8)	25.2	25.2 (30.1)	18.2
ST Bavistin @ 2g/kg+ SP Ridomil MZ 72 WP @ 2g/l	20.3 (26.8)	53.4	19.5 (26.2)	36.6
ST T. *harzianum* @ 10g/kg seed+ SP Ridomil MZ 72 WP @ 2g/l	24.6 (29.7)	43.6	21.3 (27.5)	30.8
ST Apron 35 SD @ 6g/kg + SP Bavistin % 50 WP @ 2g/kg	29.2 (32.7)	33.0	23.9 (29.3)	22.4
ST Apron 35 SD@ 6g/kg + SP Ridomil MZ 72 WP @ 2g/l	17.5 (24.7)	59.8	17.5 (24.7)	43.1
Untreated control	43.6 (41.3)	-	30.8 (33.7)	-
CD (P<0.05)	4.1		2.3	
CV (%)	12.9		14.7	

Table 2. Mean white rust severity and per cent stagheads during *rabi* 2007-08 and 2008-09. Figures in parentheses are angular transformed values. WR- White rust, SH- Stagheads ST-Seed treatment, SP- Spray

Treatments	Mean WR Severity (%)	% Decrease	% stagheads	% decrease
ST *Allium sativum* @ 1% (w/v) + SP *A. sativum* @ 1% (w/v)	27.5 (31.6)	18.9	10.6 (18.1)	11.7
ST *Trichoderma harzianum* @ 10g/kg +SP *T. harzianum* @ 10g/l	21.7 (27.8)	36.1	10.5 (18.9)	12.5
ST *T. harzianum* @ 10g/kg +SP *Pseudomonas flouresens* @ 10g/l	25.0 (30.0)	26.3	10.0 (18.4)	16.7
ST Bavistin @ 2g/kg+ SP Ridomil MZ 72 WP @ 2g/l	14.9 (22.7)	56.0	9.8 (18.3)	18.3
ST T. *harzianum* @ 10g/kg seed+ SP Ridomil MZ 72 WP @ 2g/l	20.5 (26.9)	39.5	9.2 (17.7)	23.3
ST Apron 35 SD @ 6g/kg + SP Bavistin % 50 WP @ 2g/kg	25.2 (30.1)	25.8	9.7 (18.2)	19.2
ST Apron 35 SD@ 6g/kg + SP Ridomil MZ 72 WP @ 2g/l	12.2 (20.4)	64.2	7.9 (15.2)	34.2
Untreated control	33.9 (35.6)	-	12.0 (20.3)	
CD (P<0.05)	3.3	-	1.9	
CV (%)	13..0	-	6.2	

Table 3. Mean seed yield/ha in different treatments during *rabi* 2007-08 and 2008-09. ST- Seed treatment, SP- Spray

Treatments	Yield (kg/ha)	% increase
ST *Allium sativum* @ 1% (w/v) + SP *A. sativum* @ 1% (w/v)	1176	18.2
ST *Trichoderma harzianum* @ 10g/kg +SP *T. harzianum* @ 10g/l	1232	23.8
ST *T. harzianum* @ 10g/kg +SP *Pseudomonas flouresens* @ 10g/l	1155	16.0
ST Bavistin @ 2g/kg+ SP Ridomil MZ 72 WP @ 2g/l	1312	31.9
ST T. *harzianum* @ 10g/kg seed+ SP Ridomil MZ 72 WP @ 2g/l	1258	26.4
ST Apron 35 SD @ 6g/kg + SP Bavistin % 50 WP @ 2g/kg	1124	13.0
ST Apron 35 SD@ 6g/kg + SP Ridomil MZ 72 WP @ 2g/l	1366	37.3
Untreated control	995	-
CD (P<0.05)	39.3	-
CV (%)	12.9	-

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