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Rakesh
 Department of Plant Pathology,
 CCS HAU, Hisar, Haryana,
 India

Anil Kumar
 Department of Plant Pathology,
 CCS HAU, Hisar, Haryana,
 India

AS Rathi
 Department of Plant Pathology,
 CCS HAU, Hisar, Haryana,
 India

Correspondence
Rakesh
 Department of Plant Pathology,
 CCS HAU, Hisar, Haryana,
 India

Management of Alternaria blight in Indian mustard through fungicides under field conditions

Rakesh Anil Kumar and AS Rathi

Abstract

Five fungitoxicants viz., mancozeb (0.2%), azoxystrobin (0.05%), propiconazole (0.05%), difenconazole (0.05%) and hexaconazole (0.05%) were tested for their efficacy against Alternaria blight disease alone as single spray at 45 DAS and in combination with mancozeb at 45 DAS followed by spray of other four fungicides individually at 60 DAS under field conditions for two consecutive years during rabi 2015-16 and 2016-17. The spray of different fungitoxicants alone as single spray treatment or each fungicide in succession with mancozeb (0.2%) significantly reduced the Alternaria blight disease over control; however the level of efficacy varied among the treatments. In general, the combinations of two fungicides spray i.e. mancozeb at 45 DAS followed by other four fungicides each at 60 DAS have recorded lower Alternaria blight severity as compared to all single spray treatments. Foliar spray with mancozeb (0.2%) at 45 DAS followed by hexaconazole (0.05%) at 60 DAS was found most effective in controlling Alternaria leaf blight severity up to 78.0 percent and Alternaria pod blight severity up to 56.5 percent and increased seed yield upto 29.9 percent as compared to untreated control.

Keywords: disease severity, efficacy, fungicides and rapeseed-mustard

Introduction

Indian mustard [*Brassica juncea* (L.) Czern & Coss.] is one of the major oilseed crop cultivated in India and around the world. Among the various oilseed crops cultivated in India, the rapeseed mustard is accounted for 25 percent total area and 1/3 of total oil production in the country after groundnut. India ranked third after Canada and China in area (19.3%), and production i.e. 11.1 percent (Shekhawat *et al.*, 2012; Saharan *et al.*, 2016)^[8, 7]. Despite considerable increase in productivity and production in recent years, still a wide gap exists between yield potential and yield realized at farmer's field, which is mainly due to biotic and abiotic stresses. Among biotic stresses, Alternaria blight disease has been reported to be one of the most widespread and destructive fungal diseases of rapeseed-mustard throughout the world. In Haryana state, Alternaria disease appears every year in severe form at pod initiation stage (Rathi and Singh, 2009)^[6] that affects the seed germination as well as quality and quantity of oil (Meena *et al.*, 2010)^[5]. In the absence of suitable resistant cultivars and introduction of high yielding moderately resistant varieties, search for the fungitoxicants and their use to control the plant disease is most feasible proposition. A large number of fungicides have been reported to be effective in management of the disease under field conditions viz. Baycor (0.2%), Blitox 50 (0.3%), Dithane M45 (0.2%), Dithane Z78 (0.2%), Rovral 50 (0.2%), Ridomil MZ (mancozeb 64%+metalaxyl 8% WP) etc (Khan *et al.*, 2007; Sultana *et al.*, 2009)^[3]. Although these chemicals found to be effective but leads to residual toxicity and also development of resistance in the target organisms and also affected the oil quality in oilseed Brassicas (McCartney *et al.*, 1999)^[4]. Rathi and Singh, (2009)^[6] reported that the 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 and 43.1 percent, respectively and significantly increased the seed yield up to 37.3 percent. Since, the pathogen is very difficult to manage due to its long viability in infected plant parts and wide host range, therefore the present study was carried out with the objective to evaluate of fungicides for the control of Alternaria blight disease in Indian mustard under field conditions.

Materials and Methods

Five fungitoxicants *viz.*, mancozeb (0.2%), azoxystrobin (0.05%), propiconazole (0.05%), difenconazole (0.05%) and hexaconazole (0.05%) were tested for their efficacy against *Alternaria* blight disease alone as single spray at 45 DAS and in combination with mancozeb at 45 DAS followed by spray of other four fungicides individually at 60 DAS under field conditions for two consecutive years during *rabi* 2015-16 and 2016-17. The highly susceptible mustard variety "Varuna" was sown during the first week of November in both the seasons, to ensure that foliage and flowering stage coincide with period of maximum disease development. The experiment was conducted under field conditions in 5m×3 m plot using randomized block design with three replications. Plots sprayed with plain water served as check/control.

Treatments

- T₁: Single spray of mancozeb 75% WP (0.2%)
 T₂: Single spray of azoxystrobin 23% SC (0.05%)
 T₃: Single spray of propiconazole 25% EC (0.05%)
 T₄: Single spray of difenconazole 25% EC (0.05%)
 T₅: Single spray of hexaconazole 5% EC (0.05%)
 T₆: mancozeb 75% WP (0.2%) followed by azoxystrobin 23% SC (0.05%)
 T₇: mancozeb 75% WP (0.2%) followed by propiconazole 25% EC (0.05%)
 T₈: mancozeb 75% WP (0.2%) followed by difenconazole 25% EC (0.05%)
 T₉: mancozeb 75% WP (0.2%) followed by hexaconazole 5% EC (0.05%)
 T₁₀: Water spray (control)

Observation on *Alternaria* leaf blight severity (%) was recorded at 90-100 days after sowing and *Alternaria* pod blight severity (%) at 15 days before harvest. The disease severity was calculated by using 0-6 disease rating scale (Conn *et al.*, 1990).

The percent disease severity was calculated by using following formula:

$$\text{Per cent disease severity} = \frac{\text{Sum of all numerical ratings}}{\text{No. of leaves examined} \times \text{maximum grade}} \times 100$$

Seed yield (kg/ha): The crop was harvested at maturity and threshed each treatment plot separately and individual plot yield was recorded. The individual plot yield was then converted to yield per hectre.

1000 seed wt (g): A lot of seeds was drawn at random from each treatment replication wise.

1000 seeds were counted from each sample, weighed separately and expressed in grams.

Oil content (%): Oil content(%) were determined by using the nuclear magnetic resonance (NMR).

Results and Discussion

Five fungitoxicants *viz.*, mancozeb 75% WP (0.2%), azoxystrobin 23% SC (0.05%), propiconazole 25% EC (0.05%), difenconazole 25% EC (0.05%) and hexaconazole 5% EC (0.05%) were tested for their efficacy against *Alternaria* blight disease alone as single spray at 45 DAS and in combination with mancozeb at 45 DAS followed by spray of other four fungicides individually at 60 DAS under field conditions for two consecutive years during *rabi* 2015-16 and 2016-17. The pooled data is presented in Table 1 revealed that spray of different fungitoxicants alone as single spray treatment or each fungicide in succession with mancozeb 75% WP (0.2%) significantly reduced the *Alternaria* blight disease over control; however the level of efficacy varied among the treatments. In general, the combinations of two fungicides spray *i.e.* mancozeb at 45 DAS followed by other four fungicides each at 60 DAS have recorded lower *Alternaria* blight severity as compared to all single spray treatments. Foliar spray with mancozeb 75% WP (0.2%) at 45 DAS followed by hexaconazole 5% EC (0.05%) at 60 DAS was found most effective in controlling *Alternaria* leaf blight (ALB) severity up to 78.0 percent and *Alternaria* pod blight (APB) severity up to 56.5 percent and increased seed yield upto 29.9 percent as compared to untreated control. However, foliar spray with mancozeb 75% WP (0.2%) followed by difenconazole 25% EC (0.05%) was found second promising treatment in controlling ALB severity up to 71.6 percent APB severity up to 51.5 percent and increased seed yield 29.4 percent over the control. None of the single spray treatment of fungicides was found superior over the combination sprays treatment against *Alternaria* blight disease. Among the single spray treatments, spray of hexaconazole was found to be best in controlling ALB (59.3%) and APB (32.7%) severity over the control with increased seed yield (20.3%). No significant differences among the treatments for oil content and 1000 seed weight were recorded; however plots sprayed with propiconazole (0.05%) at 45 DAS recorded the highest 1000 seed weight of 4.0 g, while the lowest was in treatment of azoxystrobin 23% SC (0.05%) *i.e.* 3.5 g which. The highest percentage of oil content (39.6%) was recorded from the plots sprayed with treatments of hexaconazole as single spray as well as its combination with mancozeb (Table 1).

Chattopadhyay *et al.* (2003) [1] and Singh *et al.* (2008) [9] also tested seven fungicides for their efficacy against *Alternaria* leaf blight disease under field conditions. They found that the foliar spray with iprodione twice at 45 days 60 days after sowing was effective in controlling *Alternaria* blight disease over check followed by mancozeb. However, Singh and Singh (2007) [10] reported that foliar spray with mancozeb was found effective in reducing the disease severity followed by Bavistin and Blitox-50. Cuman L was found least effective in reducing the disease intensity. Two foliar sprays of Ridomil MZ at 60 and 80 days after sowing reduced the *Alternaria* blight disease severity from 57.3 to 41.4 percent, and increased the yield from 1052 (control) to 1842 kg/ha (Yadav, 2003) [11].

Table 1: Evaluation of fungicides for management of *Alternaria* blight disease of mustard under field conditions *rabi* 2015-16 and 2016-17

Treatments	ALB severity (%) 90-100 DAS	Control (%)	APB severity (%) 15 DBH	Control (%)	Seed yield kg/ha	Control (%)	Oil Content (%)	1000 seed wt. (g)
T ₁ : single spray of mancozeb (0.2%)	16.0 (23.5)	53.9	16.4 (23.9)	24.3	1387	12.0	38.6 (38.3)	3.6
T ₂ : single spray of azoxystrobin (0.05%)	16.7 (24.1)	51.9	17.5 (24.7)	19.2	1335	8.5	38.3 (38.1)	3.5
T ₃ : single spray of propiconazole (0.05%)	15.7 (23.3)	54.7	15.7 (23.3)	27.6	1508	19.1	39.1 (39.0)	4.0

T ₄ : single spray of difenconazole (0.05%)	14.7 (22.5)	57.6	15.2 (22.9)	29.6	1523	19.9	38.6 (38.3)	3.8
T ₅ : single spray of hexaconazole (0.05%)	14.1 (22.0)	59.3	14.6 (22.4)	32.7	1532	20.3	39.6 (38.6)	3.6
T ₆ : T ₁ followed by T ₂	13.5 (21.5)	61.1	16.8 (24.2)	22.4	1716	28.9	38.9 (38.5)	3.7
T ₇ : T ₁ followed by T ₃	12.9 (21.0)	62.8	14.0 (21.9)	35.4	1728	29.4	38.6 (38.3)	3.7
T ₈ : T ₁ followed by T ₄	9.9 (18.2)	71.6	10.5 (18.8)	51.5	1730	29.4	38.6 (38.4)	3.9
T ₉ : T ₁ followed by T ₅	7.6 (16.0)	78.0	9.4 (17.8)	56.5	1741	29.9	39.6 (38.9)	3.9
T ₁₀ : water spray (control)	34.7 (36.0)	-	21.7 (27.7)	-	1221	-	38.3 (38.2)	3.5
CD (p=0.05)	0.93	-	1.46	-	52.86	-	0.40	NS
CV (%)	2.35	-	3.71	-	1.98	-	0.61	5.24

All the figures are mean of two years data

Note: Values in parentheses are angular transformed, DAS- Days after sowing, DBH- Days before harvest. ALB- Alternaria leaf blight. APB- Alternaria pod blight. Two sprays applied at 45 and 60 DAS in T₆ to T₉

Conclusion

In conclusion, it revealed from the investigation that the foliar spray with mancozeb at 45 DAS followed by hexaconazole at 60 DAS was found most effective in controlling Alternaria leaf and pod blight severity and increased seed yield over untreated control. It may be tested as prophylactic sprays at farmer's fields in mustard, so that a recommendation can be made for control of this pathogen.

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