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Effect of plant defence inducers on foliar disease and test weight of linseed

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Abstract

Field experiment to study the effect of different plant defence inducers on percentage reduction of foliar diseases namely *Alternaria* blight and powdery mildew in linseed crop was conducted, during the year 2020-21, using T397 linseed variety at College of Agriculture, Raipur. Among the ten different treatments including a positive check for powdery mildew T9 (foliar spray of hexaconazole (0.1%), maximum percentage reduction of *Alternaria* blight over control was observed in treatment T7-Seed treatment with SA at 50 ppm + foliar spray of salicylic acid at 50 ppm (*i.e.* 24.45%) which remained at par with T4-seed treatment with SA at 100 ppm + foliar spray of SA (100ppm) with 17.81% reduction over control. T9-foliar spray of hexaconazole (0.1%) recorded highest reduction in powdery mildew (65%) disease which was at par with the treatments T1- seed treatment with SA(50ppm) and T8- seed treatment with SA+ foliar spray of sodium propionate (1%) with percentage reduction over control (35% and 31.67%) respectively. While, minimum percentage reduction over control (6.67%) was observed in the treatment T6-seed treatment with SA+ foliar spray of monopotassium phosphate (1%). Maximum test weight (24.50 g of 1000 seeds) was recorded in treatment T1-seed treatment with SA (50ppm).

Keywords: *Alternaria* blight, linseed, powdery mildew, plant defence inducers

Introduction

Linseed (*Linum usitatissimum* L.) belongs to the family, Linaceae. It is an important oilseed crop grown for seed, oil and its fibre. Linseed is widely adapted to temperate varied climates of the world. The major linseed growing states of the country are Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Maharashtra, Bihar, Odisha, Jharkhand, West Bengal, and Assam it's mainly grown for oil purposes. In India, linseed was grown in total area of 292.1 thousand ha, production 141.2 thousand tonnes and productivity 671 kg/ha (Anonymous 2020-21). Linseed crop suffers by number of diseases *i.e.* *Fusarium* wilt, *Alternaria* blight, powdery mildew, collar rot etc. Among them the *Alternaria* blight powdery mildew and rust are important foliar diseases. *Alternaria* blight is an important disease causing huge yield losses (Radhamani *et al.* 2006). *Alternaria* blight is known to be caused by two different species of fungal pathogen *i.e.* *Alternaria lini* (Dey) and *Alternaria linicola* (Groves and Skolko). Disease affects the quality as well as quantity of crop produces. Brown necrotic spots symptoms on the leaf margins were observed which further expand towards the midrib of leaf. The causal organism of powdery mildew is *Oidium lini* Skoric, the fungus produces white powdery growth on all the foliar parts of the plant, which reduces the photosynthetic area and ultimately reduces yield. In the present study an attempt was done to evaluate the efficacy of plant defense inducers on the disease severity of *Alternaria* blight and powdery mildew disease.

Materials and Methods

Experimental site: The field experiment was conducted in the Research cum Instructional farm of IGKV, Raipur, during the Rabi season of 2021-22 with the objective to study the effect of different plant defence inducers against *Alternaria lini*. The experiment was laid in randomized block design (RBD) with ten treatment combinations (Table no. 1) each replicated three times, T397 linseed variety (susceptible to powdery mildew and moderately susceptible to *Alternaria* blight) was sown in the plots {size 4×3 (12 m²) each} in lines with row to row distance of 30 cm. Sowing was done during the first fortnight of November.

The disease severity data *i.e.* percentage foliage infected for *Alternaria* blight on randomly selected and tagged 5 plants / plot was recorded by using 0-5 scale ((Das *et al.*,2016))

calculated by using the given formula (1 and 2) and the data was analyzed statistically.

Table 1: Disease rating scale (0-5 scale)

S. No.	Scale	Description	Reaction
1	0	Free from disease	Highly Resistance
2	1	0.1 to 10% infection	Resistance
3	2	10.1 to 25% infection	Moderately resistance
4	3	25.1 to 50% infection	Moderately susceptible
5	4	50.1 to 75% infection	Susceptible
6	5	75.1 to 100%infection	Highly susceptible

To calculate percent disease severity as per the formula given below:-

$$\text{Percent disease Index (PDI)} = \frac{\text{sum of all ratings of diseased plants}}{\text{Total no.of observation} * \text{highest rating}} \times 100 \quad \dots\dots\dots (1)$$

The percent disease control in each control was calculated by using following formula;

$$\text{PDC} = \frac{\text{PDI Control} - \text{PDI Treatment}}{\text{PDI Control}} \times 100 \quad \dots\dots\dots (2)$$

Statistical analysis

Statistical analysis of data was done by using methods of variance and means were tested for significance, critical differences (C.D.) were calculated at 5% level of significance for comparison of treatments and percent disease control.

Results and Discussion

The results revealed (Table 2, Figure 1) that there were significant differences among the treatments over control. Maximum disease severity was recorded in control treatment (T10) 85.33% after 100 days after sowing. Maximum percentage reduction of *Alternaria* blight over control was observed in treatment T7-Seed treatment with SA at 50 ppm + foliar spray of salicylic acid at 50 ppm (*i.e.* 24.45%) remain at par with T4-seed treatment with SA at 100 ppm + foliar spray of SA (100ppm) with 17.81% reduction over control. The next best treatment were T8-seed treatment with SA+ foliar spray of sodium propionate(1%), T2-seed treatment with SA (100ppm), T1-seed treatment with SA (50ppm), T6-seed treatment with SA+ foliar spray of monopotassium phosphate (1%), and T9-foliar spray of hexaconazole (0.1%) with percentage reduction over control (16.09%, 14.37%, 11.56%, 10% and 8.59%) respectively. Minimum percentage reduction over control was observed in T3-seed treatment with SA +

foliar spray of SA at 50 ppm (*i.e.* 6.09%) remain at par with T5-seed treatment with SA (50ppm)+ foliar spray of monopotassium phosphate (1%) 6.25% reduction over control. The result of the present studies correlated with the findings of Garget *et al.* (1990) and Singh *et al.* (2001). Similarly, among the nine treatments, maximum percentage reduction (65%) over control of powdery mildew was observed in treatment T9-foliar spray of hexaconazol (0.1%), which is at par with treatment T1- seed treatment with SA (50ppm) and treatment-T8 seed treatment with SA+ foliar spray of sodium propionate(1%)with percentage reduction over control (35%, 31.67%) respectively. While, minimum percentage reduction over control (6.67%) was observed in treatment T6-seed treatment with SA+ foliar spray of monopotassium phosphate (1%) which was at par with treatment T2-seed treatment with SA (100ppm), T3-seed treatment with SA + foliar spray of SA at 50 ppm, T4-seed treatment with SA at 100 ppm + foliar spray of SA (100ppm), T5-seed treatment with SA (50ppm) + foliar spray of monopotassium phosphate (1%), T7-seed treatment with SA at 50 ppm + foliar spray of salicylic acid at 50 ppm. Maximum seed weight was recorded 24.50 in treatment T1-seed treatment with SA (50ppm).

Table 2: Effect of plant defence inducers on percent disease control of *Alternaria* blight and powdery mildew and test weight of linseed

S. No.	Treatments	<i>Alternaria</i> blight					Percent disease control	Powdery mildew		Test weight (1000 seeds)
		60DAS*	70DAS	80DAS	90DAS	100DAS		100DAS	Percent disease reduction over control	
T1	Seed Treatment with salicylic acid (SA) at 50 ppm	13.60 (21.62)	37.87 (37.95)	45.87 (42.60)	60.27 (50.94)	75.47 ^b (60.64)	11.56	65 ^b (53.84)	35.00	24.50 ^a
T2	Seed Treatment with salicylic acid at 100 ppm	14.13 (22.06)	35.27 (36.37)	46.67 (43.06)	62.07 (51.97)	73.07 ^b (58.74)	14.37	100 ^a (90.00)	0.00	3.63 ^c
T3	T1 + foliar spray of salicylic acid at 50 ppm at 30 and 45 DAS	13.47 (21.51)	37.07 (37.44)	59.73 (50.66)	67.33 (55.24)	80.13 ^a (63.76)	6.09	100 ^a (90.00)	0.00	8.70 ^b
T4	T2 + foliar spray of salicylic acid at 100 ppm at 30 and 45 DAS	14.40 (23.09)	29.87 (33.00)	44.80 (41.96)	56.80 (48.93)	70.13 ^c (56.92)	17.81	100 ^a (90.00)	0.00	5.00 ^c
T5	T1 + foliar spray of Monopotassium phosphate (1%) at 30 and 45 DAS	14.67 (23.04)	37.20 (37.53)	49.33 (44.60)	66.67 (54.74)	80.00 ^a (63.42)	6.25	100 ^a (90.00)	0.00	6.23 ^c
T6	T2+ foliar spray of Monopotassium phosphate (1%) at 30 and 45 DAS	13.33 (21.40)	33.27 (37.02)	51.87 (46.06)	66.93 (55.06)	76.80 ^b (61.33)	10.00	93.33 ^a (81.14)	6.67	9.90 ^b

T7	T1+ foliar spray of Sodium propionate (1%) at 30 and 45 DAS	13.60 (21.06)	27.33 (31.49)	37.93 (37.99)	48.27 (43.98)	64.47 ^c (53.41)	24.45	100 ^a (90.00)	0.00	10.40 ^b
T8	T2+foliar spray of Sodium propionate (1%) at 30 and 45 DAS	12.80 (21.79)	32.80 (34.86)	44.67 (41.91)	59.47 (50.45)	71.60 ^b (57.78)	16.09	68.33 ^b (55.80)	31.67	13.30 ^b
T9	Foliar spray of Hexaconazole (0.1%), first spray at initiation of disease and second spray with 10 days intervals.	14.40 (22.56)	40.40 (39.43)	52.60 (46.47)	64.53 (53.44)	78.00 ^b (62.01)	8.59	35 ^b (36.22)	65.00	3.97 ^c
T10	Control	12.53 (20.72)	47.33 (43.54)	62.80 (52.40)	76.80 (61.20)	85.33 ^a (67.46)	0.00	100 ^a (90.00)	0.00	6.13 ^c
SE m (±)		0.32	1.91	2.09	2.25	2.24	---	3.253	---	2.206
CD at 5%		0.97	5.74	6.28	6.73	6.70	---	9.74	---	6.606

*DAS-days after sowing

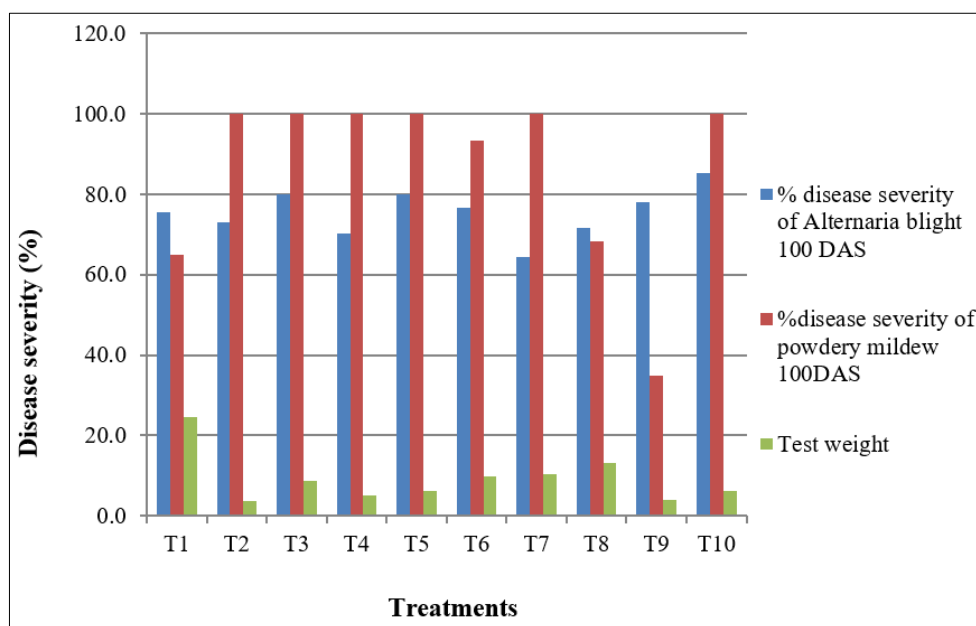


Fig 1: Effect of plant defense inducers on percent disease severity of *Alternaria* blight and powdery mildew and test weight of linseed

Conclusion

Salicylic acid (SA) is a phenolic compound involved in the regulation of growth and development of plants, and its involvement in the induction of defense related genes is well known. In the present study, it was observed that in linseed, seed treatment with salicylic acid (SA) at 50 ppm (T1) and treatment combination of seed treatment with salicylic acid 100 ppm+ foliar spray of sodium propionate 1% (T8) gave moderate percentage reduction of *Alternaria* blight and powdery mildew (11.56%; 35% and 16.09; 31.67% respectively). Highest percentage reduction (65%) in powdery mildew was recorded in T9 (foliar spray of hexaconazole 0.1% at disease initiation and after 10 days intervals). Highest test weight (1000 seeds) was recorded in T1 (Seed treatment with SA at 50 ppm) i.e., 24.50g. In all the treatment combinations with T1 (Seed treatment with SA at 50 ppm) recorded an increase in test weight as compared to all the treatment combinations with T2 (seed treatment with SA at 100 ppm), however, treatment combination with T1/ T2 along with foliar spray of sodium propionate (T7 and T8) favored an increase in test weight (10.40g and 13.30g respectively).

Similar results in increase in seed weight after foliar application of SA in different crops by various researchers had been reported viz., in Indian mustard (Sharma *et al.*, 2013) [21]; in rapeseed (Yazdanpanah *et al.*, 2015) [26]; in soybean (Sharma and Kaur, 2003) [22]; in pea Amal and Amira (2009) [11]; in garden pea Thompson *et al.* (2017) [23].

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