

RESEARCH ARTICLE :

Effect of sowing dates on white rust caused by *Albugo candida* in mustard

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SUMMARY : Mustard (*Brassica juncea*) is one of the major *Rabi* oilseed crops containing 30 to 48 per cent oil in India, being next in importance to groundnut, both in area and production, containing 30 to 48 per cent oil. White rust incited by *Albugo candida* (Pers. Ex. Lev.) Kuntz is an economically important and widely distributed disease of mustard and other cruciferous crops grown worldwide causing yield losses to the tune of 17 to 34%. Therefore, present field study was carried out by sowing mustard cv. PUSA BOLD at five different dates, replicated four times in RBD, during *Rabi*, 2014-15. The results indicated that, the crop on 1st Oct. (D₁) exhibited minimum disease incidence (15.84%) and severity (12.75%) while, maximum disease incidence (34.10% and 28.24%) and severity (17.59% and 14.59%) were recorded in the crop sown late on 15th Nov. (D₄) and 1st Nov. (D₃), respectively. Staghead incidence was maximum in 1st Oct. sown crop (D₁) (6.70%) with severity (14.62%); whereas, incidence was minimum in 1st Nov. sowing (D₃) (7.08%) with severity (18.95%). Also, seed yield was high in the early sown crop *i.e.* 1st Oct. sowing (D₁) (6.11 q/ha), compared to other dates of sowing. It indicated that, early sowing recorded less disease incidence and severity and maximum seed yield.

KEY WORDS :

Brassica juncea, White rust, *Albugo candida*, Sowing dates, Incidence, Severity, Seed yield

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BACKGROUND AND OBJECTIVES

Mustard crop is affected by several fungal, bacterial, viral and nematode diseases. Major fungal diseases of mustard are *Alternaria* blight / Black spot (*Alternaria brassica*, *A. brassicola*, *A. raphani*), Anthracnose (*Colletotrichum gloeosporoides*), Black leg (*Leptosphaeria maculans*), *Cercospora* leaf spot (*Cercospora brassicicola*), Club root (*Plasmodiophora brassicae*), Damping-off (*Fusarium* spp., *Rhizoctonia solani*), Downy mildew

(*Peronospora parasitica*), Head rot (*Rhizoctonia solani*), Leaf spot (*Myrothecium roridum*), Powdery mildew (*Erysiph epolygoni*); bacterial Black rot (*Xanthomonas campestris* pv. *armoraceae*); Viral diseases like Mosaic of (Cauliflower mosaic virus, Rai mosaic virus, Turnip mosaic virus) and Root knot (*Meloidogyne* spp.) nematode. Among these diseases, white rust incited by *Albugo candida* (Pers. Ex. Lev.) Kuntzan are widely distributed diseases of mustard and other cruciferous crops.

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The pathogen causes two types of infections *i.e.* local and systemic. Local infection is characterized by the formation of raised creamy white sporangial pustules on undersurface of the leaves, on tender shoots and occasionally on green siliquae and the affected tissue turns necrotic and dies. Systemic infection is usually seen on young inflorescences and terminal leaves. The pathogen stimulates hypertrophy and hyperplasia resulting in abnormal swelling and malformation of the affected organ.

The disease has been reported to cause 17-34 per cent seed yield losses (Yadav and Gupta, 2011).

In Maharashtra state, mustard though nit traditional crop, but during recent years its cultivation is upcoming and acreage under this group is increasing steadily. The mustard crop was found to be infected by white rust disease and knowledge of region specific effect of sowing dates on incidence and severity of white rust disease is very meagre.

RESOURCES AND METHODS

The field experiment was conducted to study the effect of various dates of sowing on incidence and severity of white rust of mustard, in Randomized Block Design with five sowing dates *viz.*, 1st Oct. (D₁), 15th Oct. (D₂), 1st Nov. (D₃), 15th Nov. (D₄) and 1st Dec. (D₅), 2014-15 and four replications, by sowing (45x15cm) mustard cv. PUSA BOLD. Recommended agronomical / cultural practices were followed properly.

Observations on disease incidence and severity were recorded at first appearance of the symptoms and continued at weekly interval till harvest of the crop.

Observations on staghead incidence and severity was recorded from the appearance of the stagheads and subsequent at 7 days interval.

To record white rust disease severity observed on leaves following 0-9 disease rating scale given by Mayee and Datar (1986) was used.

Grade/ scale	Description
0	No symptoms on leaf
1	Small, raised blisters covering 1% of the leaf area
3	Small, raised blisters covering 1-10% of the leaf
5	Blisters, raised covering 14-25% of the leaf area
7	Raised, shiny, white blisters covering 26-50% of the leaf area
9	Raised, shiny, white blisters covering 26-50% of the leaf area

Applying following staghead disease rating scale 0-9 rating scale given by Mayee and Datar (1986) observations on staghead severity was recorded

Grade/ scale	Description
0	No symptoms on leaf
1	Small, raised blisters covering 1% of the leaf area 1% or less plants having stagheads
3	1-10% plants having stagheads
5	11-20% plans having stagheads
7	21-50% plants having stagheads
9	51% or more plants having stagheads.

Based on numerical ratings observed, per cent white rust disease and staghead severity was calculated by applying following formula :

$$\text{PDS (\%)} = \frac{\text{Summation of numerical ratings}}{\text{No. of leaves/ plants observed} \times \text{Maximum rating}} \times 100$$

Per cent incidence of white rust and staghead was worked out by following formula:

$$\text{Disease incidence (\%)} = \frac{\text{No. of infected plants observed}}{\text{Total no. of plants observed}} \times 100$$

Matured and dried siliquae of mustard were harvested treatment- wise and grain yield was recorded and finally the grain yield data was presented on hectare basis (q/ha).

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Effect of sowing dates on white rust incidence and severity :

Disease incidence:

Table 1 revealed that the mustard crop sown on 1st Oct (D₁) displayed significantly least disease incidence of 10.62%, 12.97, 18.6%, 21.2%, at 45, 52, 59 and 66 DAS, respectively followed by the sowing on 1st Dec (D₅) with disease incidence of 14.15%, 15.4%, 20.17% and 24.05% at 45, 52, 59 and 66 DAS, respectively. Whereas, maximum disease incidence was evidenced on the crop sown 15th Nov. sowing (D₄) with disease incidence of 33.25%, 34.13%, 34.14% and 34.91% at 45, 52, 59 and 66 DAS followed by the crop sown on 1 Nov. sowing (D₃), with disease incidence of 26.05%, 27.42%, 28.52% and 30.97%, at 45, 52, 59 and 66 DAS .

Mean disease incidence (Table 1) was minimum on

Table 1: Effect of various sowing dates on white rust disease incidence in mustard, during Rabi, 2014-15

Treatments (Sowing dates)	Per cent disease incidence*				Mean
	45 DAS	52 DAS	59 DAS	66 DAS	
D ₁ :1 st Oct.	10.62 (6.09)	12.97 (7.45)	18.6 (10.72)	21.2 (12.24)	15.84 (9.13)*
D ₂ :15 th Oct.	18.3 (10.54)	19.12 (11.03)	21.72 (12.55)	24.97 (14.47)	21.02 (12.14)
D ₃ :1 st Nov.	26.05 (15.07)	27.42 (15.92)	28.52 (16.58)	30.97 (18.05)	28.24 (16.40)
D ₄ :15 th Nov.	33.25 (19.29)	34.14 (19.97)	34.91 (20.43)	34.13 (19.96)	34.10 (19.91)
D ₅ :1 st Dec.	14.15 (8.13)	15.4 (8.86)	20.17 (11.64)	24.05 (13.90)	18.44 (10.63)
S.E.±	0.26	0.27	0.20	0.22	-
C.D. (P=0.05)	0.82	0.85	0.62	0.69	-

* Average of four replications

Figures in parenthesis arc sine values

Table 2: Effect of different sowing dates on white rust disease severity in mustard

Treatments (Sowing dates)	Per cent disease severity*				Mean
	45 DAS	52 DAS	59 DAS	66 DAS	
D ₁ :1 st Oct.	6.81 (3.91)	7.05 (4.04)	10.61 (6.09)	11.55 (6.63)	9.05 (5.16)
D ₂ :15 th Oct.	10.63 (6.10)	11.88 (6.82)	13.28 (7.63)	13.35 (7.67)	12.28 (7.05)
D ₃ :1 st Nov.	13.23 (7.60)	14.05 (8.08)	15.06 (8.66)	16.02 (9.22)	14.59 (8.39)
D ₄ :15 th Nov.	16.36 (9.42)	17.19 (9.90)	18.01 (10.37)	18.83 (10.85)	17.59 (10.13)
D ₅ :1 st Dec.	7.97 (4.57)	8.31 (4.76)	12.18 (6.99)	12.71 (7.30)	10.29 (5.90)
SE ±	0.19	0.23	0.29	0.25	-
CD at 5%	0.60	0.73	0.89	0.77	-

* Average of four replications

Figures in parenthesis are arcsine transformed values

Table 3 : Effect of sowing dates on staghead incidence in mustard

Treatments (Sowing dates)	Per cent disease incidence*				Mean
	55 DAS	62DAS	69DAS	76DAS	
D ₁ :1 st Oct.	2.25 (8.53)	4.50 (12.25)	6.25 (14.42)	13.83 (21.81)	6.70 (15.00)
D ₂ :15 th Oct.	3.35 (10.47)	4.16 (11.68)	10.41 (18.81)	11.69 (19.91)	7.40 (15.79)
D ₃ :1 st Nov.	2.91 (9.80)	12.08 (20.27)	4.16 (11.68)	9.17 (17.56)	7.08 (15.34)
D ₄ :15 th Nov.	2.08 (8.13)	4.58 (12.25)	12.58 (20.70)	12.92 (21.05)	8.04 (16.43)
D ₅ :1 st Dec.	2.08 (8.13)	5.00 (12.92)	17.92 (25.03)	12.86 (20.96)	9.46 (17.85)
S.E. ±	0.34	2.04	3.98	1.08	-
C.D. (P=0.05)	1.04	6.29	10.18	3.35	-

Figures in parentheses are arcsine transformed values

*Average of four replications

Table 4 : Effect of sowing dates on staghead severity in mustard

Treatments (Sowing dates)	Per cent disease severity*				Mean
	55DAS	62 DAS	69 DAS	76 DAS	
D ₁ :1 st Oct.	7.75 (16.11)	12.92 (21.05)	15.72 (23.34)	22.11 (28.04)	14.62 (22.46)
D ₂ :15 th Oct.	9.69 (18.05)	15.94 (23.50)	21.60 (27.69)	32.68 (34.82)	19.97 (26.49)
D ₃ :1 st Nov.	8.12 (16.54)	13.28 (21.30)	23.93 (29.27)	30.50 (33.52)	18.95 (25.77)
D ₄ :15 th Nov.	7.18 (15.45)	11.55 (19.82)	18.41 (25.40)	29.37 (32.77)	16.62 (23.73)
D ₅ :1 st Dec.	7.01 (15.35)	12.17 (20.36)	17.39 (24.58)	27.46 (31.56)	16.00 (23.58)
S.E.±	0.62	1.07	1.60	1.88	-
C.D. (P=0.05)	1.92	3.30	4.95	5.80	-

Figures in parentheses are arcsine transformed values

*Average of four replications

the crop sown on 1st Oct. (15.84%) followed by the crop sown on 1st Dec. (18.44%). Whereas, it was maximum (34.10%) on the crop sown on 15th Nov. sowing (D₄), followed by 1st Nov. (28.24%).

Disease severity:

The results (Table 2) revealed that the crop sown early on 1st Oct.(D₁) exhibited significantly least white rust severity of 6.81%, 7.05%, 10.61% and 11.55%, respectively at 45, 52, 59 and 66 DAS, followed by the crop sown on 1st Dec. (D₅) with the disease severity 7.97%, 8.31%, 12.18% and 12.71%, respectively at 45, 52, 59 and 66 DAS. Whereas, maximum disease severity was observed in the crop sown on 15th Nov. sowing (D₄), with disease severity of 16.36%, 17.19%, 18.01% and 18.83%, respectively at 45, 52, 59 and 66 DAS followed by 1st Nov. sown crop (D₃), with the disease severity of 13.23%, 14.05%, 15.06% and 16.02%, respectively at 45, 52, 59 and 66 DAS.

Mean disease severity (Table 2) was recorded in the crop sown on 1st Oct. sowing (D₁) and was minimum (9.05%), followed by 1st Nov. sown crop (14.59%) and 15th Nov. sown crop (17.59%).

Similarly the effect of sowing dates on disease incidence and severity of mustard white rust disease were reported earlier by several workers (Dange *et al.*, (2003); Singh and Singh (2005); Kumar (2009) and Subhasinghe *et al.* (2009). These earlier worker deduced that the mustard crop sown early during the month of October affected less by white rust disease compared to late.

Effect of sowing dates on staghead incidence and severity :

Staghead incidence :

The results (Table 3) in respect of effect of sowing dates on staghead incidence and severity at various

intervals indicated that, there were no significant differences in staghead incidence in the mustard crop sown at various dates. However, based on mean values, numerically staghead incidence was minimum in the crop sown on 1st Oct sowing (6.70%) and comparatively maximum in the crop sown in 15th Nov. (8.04 %) and in 1st Dec (9.46%).

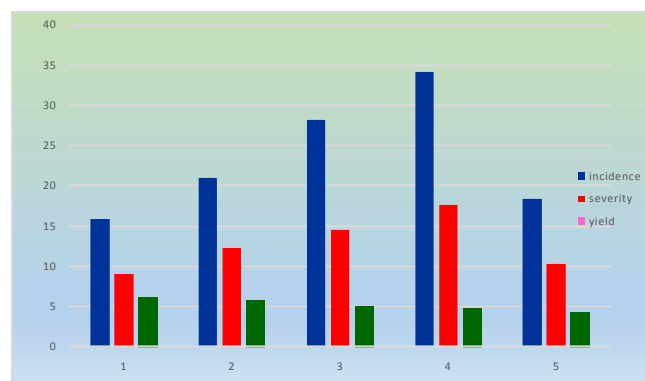
Staghead severity:

However, based on mean values, numerically staghead severity was minimum in the crop sown on 1st Oct sowing (14.62%) and comparatively maximum in the crop sown in 1st Nov. (18.95 %) and in 15th Oct. (19.97%).

The results were in consonance with the previous reports of Kaur *et al.*(2006) and Kumar (2009) who also found that minimum staghead incidence and severity in the crop sown early during the month of October

Effect of sowing dates on white rust disease incidence, severity and yield of mustard :

The results in (Table 5 and Fig.1) revealed that,



D₁, 1st Oct. , D₂, 15th Oct., D₃, 1st Nov., D₄, 15th Nov., D₅, 1st Dec.

Fig. 1: Effect of sowing dates on white rust disease incidence, severity and yield in Mustard

Table 5 : Effect of sowing dates on white rust disease incidence, severity and yield of mustard

Treatments (Sowing dates)	Mean incidence %	Mean severity %	Yield q/ha*
D ₁ :1 st Oct.	15.84 (9.13)	12.75 (5.28)	6.11
D ₂ :15 th Oct.	21.02 (12.14)	12.28 (7.05)	5.07
D ₃ :1 st Nov.	28.24 (16.40)	14.59 (8.39)	4.99
D ₄ :15 th Nov.	34.10 (19.91)	17.59 (10.13)	4.59
D ₅ :1 st Dec.	18.44 (10.63)	10.29 (5.90)	4.34
S.E.±	0.23	0.24	-
C.D. (P=0.05)	0.74	0.74	-

*Average of four replications

Figures in parentheses are arcsine transformed values

highest seed yield (5.11 q/ha) with minimum disease incidence (15.84%) and severity (12.75%) in the crop sown early on 1st Oct., followed by the crop sown on 15th Oct which gave second highest seed yield (5.07 qt/ha) with disease incidence (21.02%) and severity (12.28%). Rest of sowing dates resulted with seed yield ranged from 4.34 to 4.99 qt/ha. Thus, from the ongoing results it has been concluded that sowing of the mustard crop must be done early during the month of October and thereafter delayed sown mustard crop seems to produced to white rust disease causing accountable seed yield losses.

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