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Effect of Sowing Date and Weather Parameters on Severity of Alternaria Blight on Different Varieties of *Brassica juncea*

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A B S T R A C T

The oilseed crops especially rapeseed-mustard play a pivotal role in agricultural economy of the world. In Punjab, the area under cultivation of mustard has been decreased due to *Brassica* crops are extremely susceptible from some major biotic and abiotic stresses. Alternaria blight caused by *Alternaria brassicae* is one of the most widespread and destructive fungal disease of rapeseed- mustard throughout the world. Field trials were conducted to determine the influence of two sowing dates (22nd October and 05th November) and effect of weather parameters on Alternaria blight intensity during *Rabi* season 2018-19. In first sowing (D1) 26.16 percent and second sowing (D2) 45.39 highest percent disease intensity (PDI) was recorded by PBR-97 and Giriraj was comparatively less disease severity in both sowing dates (D1-4.79, D2-10.65). Overall mean percent of disease severity was 17.73 and 30.35 at D1 and D2 respectively. Disease severity was increase with delay in date of sowing. Weather factors also play an important role in disease flourish. The maximum temperature (17.9-31.8°C) and minimum temperature (2.2-15.2°C) positively correlated and minimum relative humidity (30.6-63.7%), maximum relative humidity (74.1-92.6%) and rainfall had significant negative correlated with disease severity.

Introduction

In India, rapeseed-mustard is the 2nd important edible oil crop after groundnut and 27.8 % share of oil production. Mustard occupies 6.421 million hectares area 6.33 million tonnes production in India (Anonymous, 2017-2018). In Punjab, rapeseed-mustard were grown on 31.7 thousand hectares during 2016-17 with production of 44.8 thousand tonnes and an average yield of 14.13 quintals per hectare (Anonymous, 2018-19).

Brassica spp. is extremely susceptible from some major biotic (diseases and pests) and abiotic stresses (environment factors). Major abiotic stress namely; Temperature, humidity,

rainfall and sunshine are playing vital role in the development of the disease. More than thirty diseases are known to occur on Brassica crop in India (Saharan *et al.,* 2005). Some major and common disease of rapeseed-mustard in India are Leaf spot and blight (*A. brassicae, A. brassicicola, A. altetrnata*), White rust (*Albugo candida*), Sclerotinia rot (*Sclerotinia sclerotiorum*), Downy mildew (*Peronospora brassicae*), Black rot (*Xanthomonas compestris* pv. *Campestris*) and Mosaic, which influence the quality and quantity of seed (Saha and Singh, 1988; Kolte, 2005; Mehta *et al.,* 2005). Alternaria blight is one of the major and important fungus disease of rapeseed-mustard. Alternaria blight of mustard caused by *A. brassicae* and *A. brassicicola* are found everywhere in rapeseed-mustard cropping areas and decrease 15-71 percent in productivity, 14-36 percent in oil content (Meena *et al.,* 2010).

Besides losses in oil content and crop yield, also harmful effect on seed quality causing reduction in seed size and leading to discoloration (Prasad and Lallu, 2006). Hence, the most cost effective and eco-friendly mean of managing the Alternaria blight of rapeseed-mustard would be use resistant and tolerance varieties. However, the information in regard of resistant source is not available, but some sort of tolerance may be available (Shah *et al.,* 2005; Rajendra *et al.,* 2002). Some other points, date of sowing or planting are important factors for severity of crop disease. Adjust the sowing time of Indian mustard is basic techniques to reduce the Alternaria blight incidence (Ayub, 2001; Mian and Akanda, 1989). Khatun *et al.,* (2011) conducted a field trail to find out the effect of sowing date on disease severity (Alternaria blight) of mustard. They describe that, disease percentage on leaf and silique and spot per part were found lower under 21st October sowing. Dang *et al.,* (1995) research the relationship of weather conditions with Alternaria blight on rapeseed-mustard. Suitable weather conditions for development of *A. brassicae* are 16.3°C to 25.7°C temperature and 2.5-6.0 km/hrs wind velocity. Temperature, relative humidity and sunshine hours are playing major and important role for development of *A. brassicae* on rapeseed-mustard. The result of weather factors on *A. brassicae* had a positive correlation between PDI and temperature, while it was negatively correlated with rainfall and relative humidity (Bal and Kumar, 2014). The existing fungicidal control measures are neither economical nor environmental friendly; therefore an economically and eco-friendly way to manage the disease effectively is required. Identification of resistant varieties and alteration of sowing time can be a better agronomic practice to control the diseases; in this regard we attempted four verities and two different sowing dates to evaluate the effect of weather parameters and sowing dates on the severity of Alternaria blight of Indian mustard.

In order to determine the most effective dates of sowing that permits high or low level of

Materials and Methods

The experiment was conducted at Guru Kashi University, Talwandi Sabo (Bathinda) during *Rabi* crop season 2018–2019, in a split plot design with three replications and different four varieties of *B. juncea* (PBR-97, Varuna, Giriraj and Parasmani 2), were sown on two sowing dates [October 22nd (D1) and November 05th (D2)] standard spacing and use recommended doses of N, P and K fertilizers in natural conditions. Data was recorded from the initial date of appearance of Alternaria blight symptoms on leaves of mustard were scrutinized. Observe data once in 7 days for recorded the percent disease intensity (PDI). The meteorological data was

obtained from Punjab Agriculture University-Regional Research Station, Bathinda-151001 (Punjab). Selected five randomly plants in each plot and were tagged for taking observations for disease component. To calculated PDI, use 0 to 9 disease rating scale developed by Mayee and Datar, (1986) (Table 1 and Fig.1). Percent disease intensity was calculated by the formula as below:

Percent disease intensity (PDI) =

$$\frac{\text{Sum of individual rating scale}}{\text{No.of disease Plants observed} \times \text{Maximum disease}}$$

Results and Discussion

Effect of sowing dates and varieties on Alternaria blight intensity

At GKU field during *Rabi* season (2018-19); PBR-97, T-59 (Varuna), Giriraj and Parasmani-2 significantly highest overall mean of disease intensity 45.39, 29.37, 10.65 and 35.99 percent recorded in 2nd sowing and 26.16, 14.86, 4.79 and 23.89 percent recorded in 1st sowing respectively. Overall mean of disease severity is 17.73 and 30.35 in D1 and D2 respectively. Disease severity has increase with delay in date of sowing. These results also support the finding of Mian and Akanda, (1989) who have recommended early sowing for minimum damage of crop from Alternaria leaf blight disease. Khatun *et al.,* (2011) reported that delay in sowing increase the infection of Alternaria blight and reduction in seed yield.

Results expose that in all four *B. juncea* varieties, Alternaria blight intensity varied significantly with the sowing dates and has also found to be increased steadily with age of the crop. PBR-97 recorded maximum mean of disease intensity of 26.16 and 45.39 percent in the crop sown on D1 and D2 respectively. Giriraj recorded minimum mean of disease intensity 4.79 and 10.65 percent in the crop sown on D1 (Highly resistant) and D2 (Moderately resistant) respectively. During this season disease intensity on all the Indian mustard varieties, from its first appearance increased steadily with age of the crop and the rate of disease intensity was maximum in susceptible cv. PBR-97 than that of Parasmani-2, T-59 (Varuna) and Giriraj. Parasmani-2 also shows higher disease intensity 23.89 and 35.99 in D1 and D2 respectively than T-59 (Varuna) and Giriraj. Interaction effects (D x V) in respect of disease severity at various intervals has found significant. The effect of sowing dates and varieties on Alternaria blight intensity is summarized in Table 2 and Fig. 2.

Effect of Weather parameters on Alternaria blight intensity

The different weather parameters viz., temperature (maximum and minimum), relative humidity (maximum and minimum) and rainfall (mm) affecting epidemic development under field conditions were considered. The progress of Alternaria blight was studied on four varieties namely; PBR-97, T-59 (Varuna), Giriraj and Paramsani-2 in terms of increase in number of spots. Temporal progress was measured at seven days interval starting from the appearance of the disease symptoms during 2018-19 crop seasons.

The maximum number of spots has observed on PBR-97 followed by Parasmani-2, T-59 (Varuna) and Giriraj. Temperature (maximum and minimum) showed significant positive correlation, while relative humidity and rainfall has significant negative correlation with the varieties sown on 22nd October and 05th November. Correlation analysis of disease intensity with weather factors indicated that maximum temperature (17.9-31.8°C) and minimum temperature (2.2-

15.2°C) has a significant positive correlation with disease intensity, While minimum relative humidity (30.6-63.7%), maximum relative humidity (74.1-92.6%) and rainfall has significant negative correlation (Table 3 and Fig. 3). These results are in agreement with the earlier studies like Bal and Kumar, (2014) testified the result of weather factors (temperature, relative humidity and rainfall) on Alternaria leaf blight of mustard had a positive correlation between the disease intensity and temperature, it was negatively correlated with rainfall and relative humidity. The inference from the current study is that 2nd fortnight of October is suitable for the sowing of mustard.

Table.1 Alternaria blight disease rating scale

Rating Scale	Disease Intensity Per cent	Disease reaction
0	0	Immune (I)
1	Less than 5%	Highly resistant (HR)
3	5-10%	Resistant (R)
5	11-25%	Moderately resistant (MR)
7	26-50%	Susceptible (S)
9	More than 50%	Highly susceptible (HS)

Table.2 Effect of sowing dates and Indian mustard varieties on Alternaria blight intensity during *Rabi*, 2018-2019

Sowing Dates	Varieties	Per cent disease intensity (Severity)	
		Plant	
		PDI	Disease Reaction
D1 (22.10.2018)	PBR-97	**26.16**	**S**
	T-59 (Varuna)	14.86	MR
	Giriraj	**4.79**	**HR**
	Parasmani-2	23.89	MR
Overall mean		**17.43**	
D2 (05.11.2018)	PBR-97	**45.39**	**S**
	T-59 (Varuna)	29.37	S
	Giriraj	**10.65**	**MR**
	Parasmani-2	35.99	S
Overall mean		**30.35**	
C.D. (P= 0.05)	D	2.88	
	V	2.32	
	D×V	3.804	

D1- First sowing
D2- Second sowing

Table.3 Correlation-coefficient between weather parameters and Alternaria blight intensity on Indian mustard varieties during *Rabi*, 2018-19

Variety	Date of sowing	Correlation Coefficient (r) Weather factor				
		X1	X2	X3	X4	X5
PBR 97	D1	0.28	-0.12	-0.38	-0.258	-0.236
	D2	-0.189	0.416	0.241	-0.499	-0.484
Giriraj	D1	0.342	0.094	-0.392	-0.254	-0.290
	D2	0.309	-0.134	-0.119	-0.457	-0.351
T-59	D1	-.0348	0.219	0.039	0.142	-0.047
	D2	0.417	0.718	-0.239	-0.009	0.356
Parasmani 2	D1	0.456	0.242	-0.418	-0.231	-0.238
	D2	0.014	-0.270	0.158	-0.512	-0.437
Overall Mean		**0.199**	**0.146**	**-0.174**	**-0.312**	**-0.216**

Fig.1 Disease rating scale for Alternaria blight in mustard

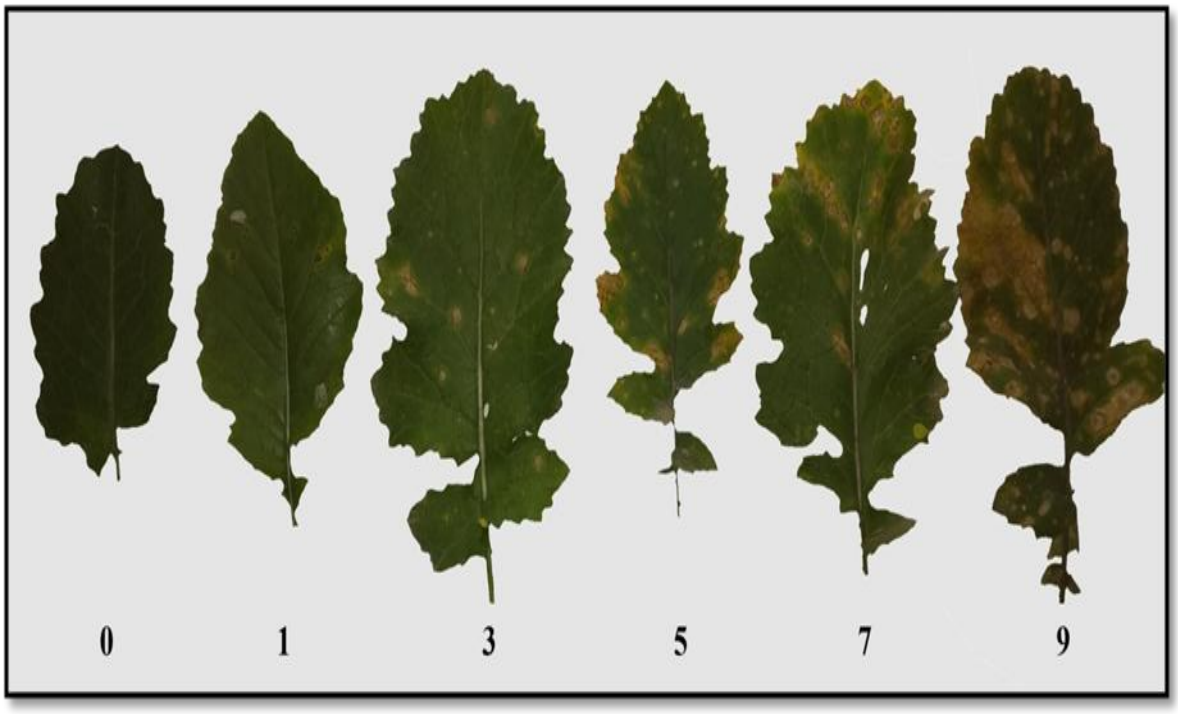


Fig.2 Effect of sowing dates and Indian mustard varieties on Alternaria blight intensity during *Rabi*, 2018-2019

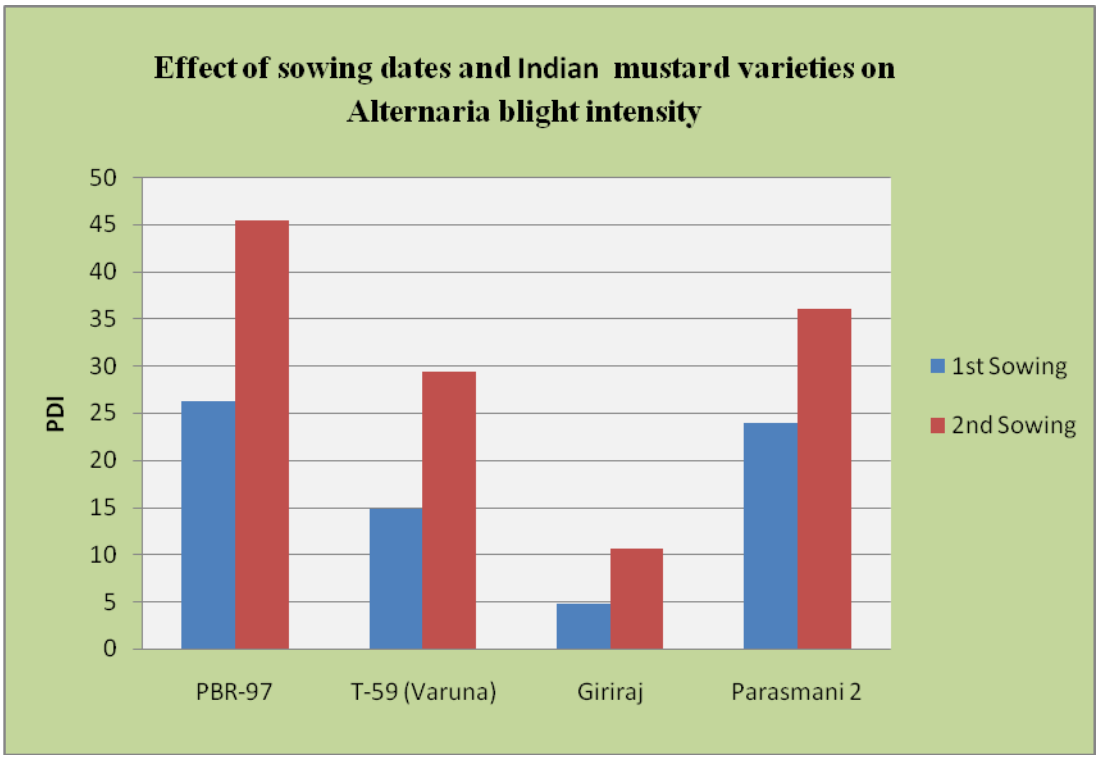
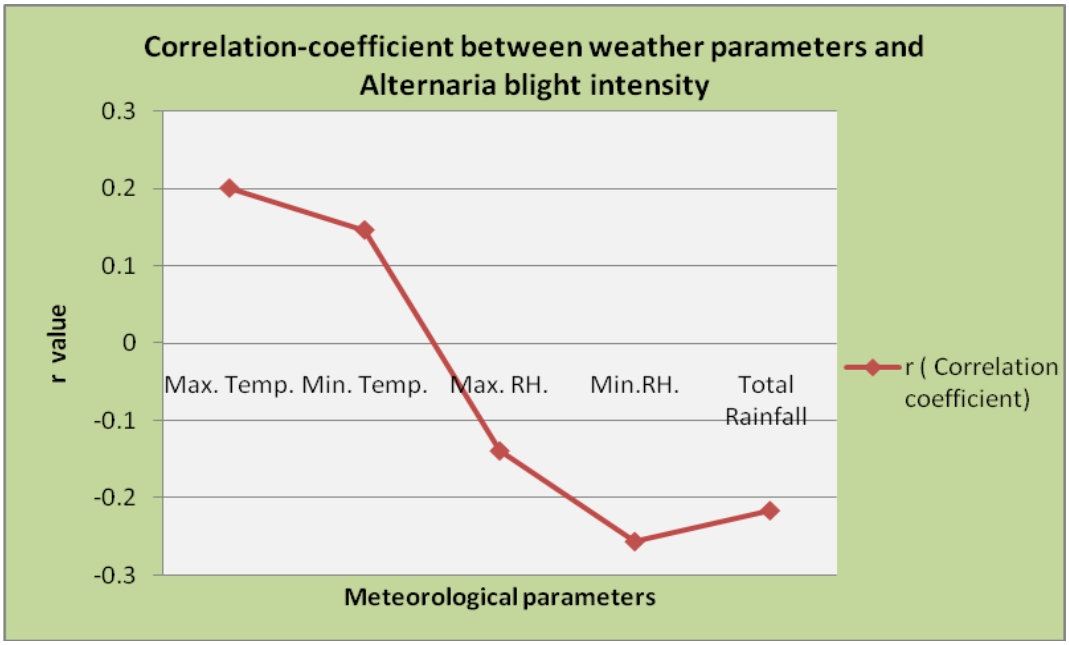


Fig.3 Correlation-coefficient between weather parameters and Alternaria blight intensity on Indian mustard varieties during *Rabi*, 2018-19



In the present investigation, the data for the *Rabi* season (2018-19) revealed that is periodical increase in the disease severity with delay in date of sowing. Overall mean of PDI is 17.43 and 30.35 at D1 and D2 respectively. Hence, it means disease severity increase with delay in date of sowing and 2nd fortnight of October is suitable for the sowing of mustard and control disease severity. Similar findings have also been advocated by Mian and Akanda (1989); Khatun *et al.*, (2011) and Kolte *et al.*, (1987). PBR-97 recorded maximum mean disease intensity 26.16 and 45.39 percent in the crop sown on D1 and D2 respectively and Giriraj recorded low mean disease intensity 4.79 and 10.65 percent in the crop sown on D1 and D2 respectively. Giriraj variety of *B. juncea* is highly resistant against *A. brassicae,* while PBR-97 and Parasmani-2 are more susceptible from *A. brassicae*.

Suitable weather factors viz., temperature, relative humidity and rainfall are playing an important role in the progression of *A. brassicae*. Maximum and minimum temperature showed significant and positive correlation with Alternaria blight while relative humidity (maximum and minimum) and rainfall has significant negative correlation. These results are in agreement with the earlier studies by Bal and Kumar, (2014); Awasthi and Kolte, (1994).

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