

Alternaria blight of mustard and its association with weather parameters

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ABSTRACT

Field experiment was conducted at research farm, College of Agriculture, Tikamgarh during Rabi 2015-16 to find out the weather association with *Alternaria* blight of mustard. The weather parameters (maximum, minimum temperature, rainfall and morning, afternoon relative humidity) were correlated with *Alternaria* blight intensity. The weather data were compared with Percent Disease Index and the prevailing weather condition during peak disease intensity has been carried out. It was observed that the PDI during 4th to 5th week is ranged from 36.92 to 38.44 per cent. Maximum and minimum temperature ranged between 19.9 and 27.2°C and 4.8 and 9.4°C, respectively. It was observed that associations of rainfall and relative humidity were more with disease intensity than maximum temperature. A high day weekly temperature ($\geq 28^\circ\text{C}$) is detrimental for this disease multiplication under field conditions. Relative humidity and rainfall were significantly associated with disease intensity. It was observed that an increasing trend of last seven days rainfall event and relative humidity indicates more *Alternaria* blight infestation.

Keywords: Weather, correlation, *Alternaria* blight intensity, mustard

INTRODUCTION

Mustard is an important oilseed crop of India and ranks first position in area and production. India is the fourth largest producer of oilseeds in the world and stands second in Asia. In India Mustard is cultivated in an area about 5.79 million hectare with the production of 6.31 million tonnes and productivity of about 1089 kg ha⁻¹ (Anonymous, 2015). In Madhya Pradesh, Mustard crop is cultivated in area about 12.31million hectares with the production of about 11.36 million tonnes and productivity of about 1006 kg ha⁻¹ (Anonymous,2015). In Tikamgarh district mustard crop is cultivated in area about 0.40 million hectares with production of 0.21million tonnes and productivity of about 539 kg ha⁻¹ (Anonymous, 2016). The mustard crop is affected by a number of diseases limiting productivity of the crop over a wide area. Among them, *Alternaria* blight [*Alternaria brassicae* (Berk.) Sacc] is the most important. A wide gap exists between the potential yields and the yield realized at the farmer's field, which is largely because of number of biotic and abiotic stresses to which the rapeseed- mustard crop is exposed (Singh *et al.*, 2013). The disease causes an average yield loss of 10-70 per cent. Severe infection of this disease causes substantial yield loss as a result of early defoliation, flower-bud abortion, pre-maturing ripening, siliquae dehiscence and seed shriveling. The weather

conditions during crop seasons plays on important role and effect the disease severity. Therefore, this study was carried out to find the congenial weather parameters associated with this disease.

MATERIALS AND METHODS

The experiment was conducted at College of Agriculture, Tikamgarh during the Rabi season of 2015-16. The experiment was laid out in randomized block design with three replications. The mustard variety Pusa Bold was shown on 9 November 2015, with a seed rate 4 kg ha⁻¹ in lines in well pulverized and level land, with a uniform spacing of 30 cm between the rows. Seven days after emergence additional plant population were uprooted to fix 15 cm spacing between the plants in each row. Recommended doses of fertilizer 60:50:40 were applied and crop received three irrigations at 25, 50 and 75 days after sowing. No fungicide and insecticides were sprayed on the crop. From each plots five plants were selected at random and disease intensity of *Alternaria* blight were recorded at weekly interval throughout the crop period. The intensity of *Alternaria* leaf blight was calculated by observing the percent infected plants spread across the field. The intensity of the disease was calculated by following 0-5 scale (Conn *et al.*, 1990) on randomly selected plants among the same place as under:

- 0 No symptoms
- 1 1-10% leaf or pod area infected
- 2 11-25% leaf or pod area infected
- 3 26-50 leaf or pod area infected
- 4 51-75% leaf or pod area infected
- 5 75% above leaf or pod area infected

The formulae employed to arrive at the disease intensity is given below:

Disease Intensity Per cent (PDI) =

$$\frac{\text{Sum of all numerical ratings}}{\text{Total no. of leaves observed} \times \text{Maximum rating}} \times 100$$

Data of weather factors such as maximum and minimum temperature, morning and afternoon relative humidity and total rainfall were obtained to estimate the association between disease development and its intensity. The daily weather data was collected from the meteorological observatory situated near by (within 30 meter radius) the experimental plot at College of Agriculture, Tikamgarh. Correlation coefficient was calculated between weekly maximum temperature, minimum temperature and morning, afternoon relative humidity and rainfall with disease intensity. Correlations for past seven and fifteen days prior to disease observation were also done. Simple correlation was obtained between average PDI and weather parameters.

RESULTS AND DISCUSSION

Congenital environment for disease development and intensity

The data on weather parameters and PDI of *Alternaria brassicae* have been presented in Table 1. Daily weather data is converted into weekly and presented in Table 1 along with weekly disease PDI scores. It was observed that disease intensity score increased at faster pace during first to fifth standard meteorological week (SMW) number, when the maximum and minimum temperature ranged between 19.9 and 27.2, 4.8 and 9.4, respectively. A closer look of these data indicates that temperature above 28°C stopped the increasing trend of disease intensity (Table 1). The maximum temperature conditions or hot days are detrimental for this disease. Gruia *et al.* (2015) conducted artificial infection of *Alternaria brassicae* on mustard

leaves with different temperature range in laboratory. They reported that leaves incubation period of the *A. brassicae* fungus was 14 days at 2°C and 4°C. With increasing temperature, the least incubation period of 6 days was found between 18°C and 28°C. It was reported that when the temperature rises above 28°C infections were stopped. This finding was supported by the results reported by Banerjee *et al.* (2010). They have showed that the effect of dates of sowing on per cent disease index of alternaria blight of rape and mustard was highest in the crop sown 8 November and with delay in sowing beyond this date, the PDI decreased.

Table 1: Weekly weather and PDI during the crop period (*Rabi*-season 2015-16)

SMW	Temperature (°C)		Relative humidity (%)		Rainfall (mm)	PDI
	Max.	Min.	Mor.	Eve.		
45	32.6	17.7	83	51	0	0
46	31.2	15.7	82	52	0	0
47	30.2	11.3	87	41	0	0
48	31.3	14.5	86	55	1	0
49	28.7	9.7	93	34	0.1	0
50	25.4	7.1	85	32	0	2.73
51	22.2	3.9	86	35	0	7.84
52	23.9	5.2	82	34	0	12.35
1	27.2	7.2	85	36	0	19.68
2	27.9	8.0	82	38	0	21.52
3	19.9	9.4	89	65	9.4	29.67
4	23.7	4.8	91	36	0	36.92
5	27.2	9.1	88	40	0	38.44
6	25.9	6.9	83	34	0	38.76
7	26.7	11.2	100	42	1.1	38.82
8	30.1	10.4	84	34	0	38.82
9	31.4	11.4	80	29	0	38.82
10	33.0	15.4	86	38	1.5	38.82
11	31.7	15.1	71	33	11.3	38.82

Disease severity was influenced by maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, and rainfall. To quantify these relationships, correlation coefficient between weather parameters and *Alternaria* blight intensity were calculated and presented in Table 2. It was found that rainfall was highly and positively associated with *Alternaria* blight intensity followed by evening relative humidity. The other weather parameters are weakly and negatively associated with disease intensity. To have a more clear view the weekly PDI, maximum, minimum temperatures and rainfall

Fig 1: Weekly pattern of temperature and PDI of Alternaria blight on Mustard

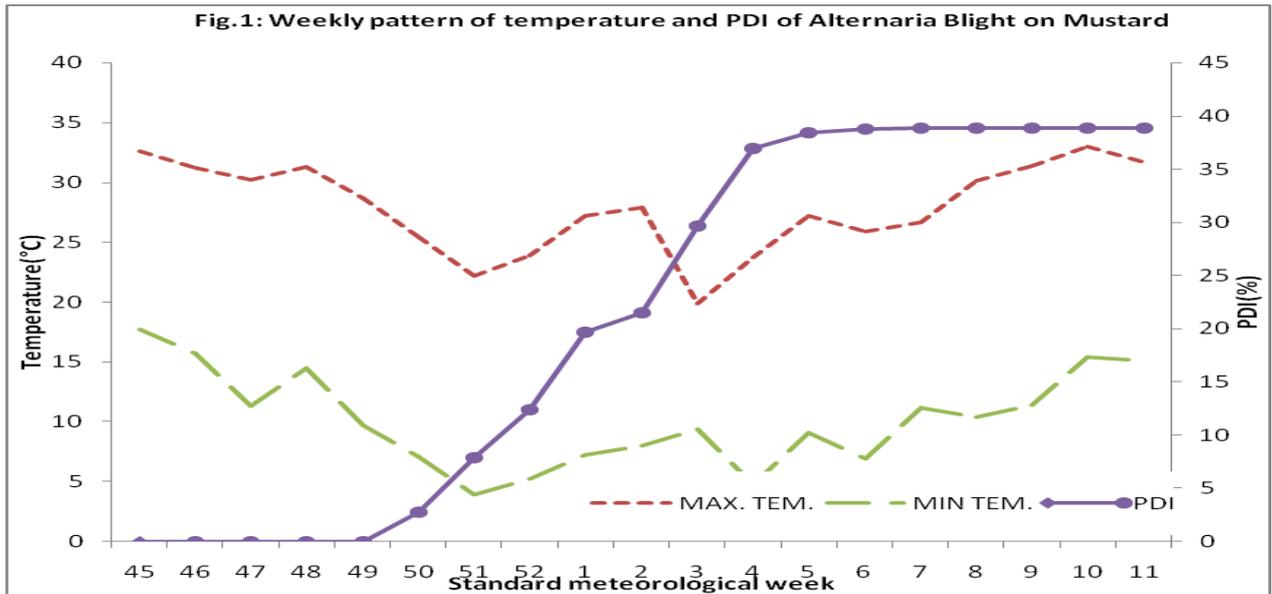
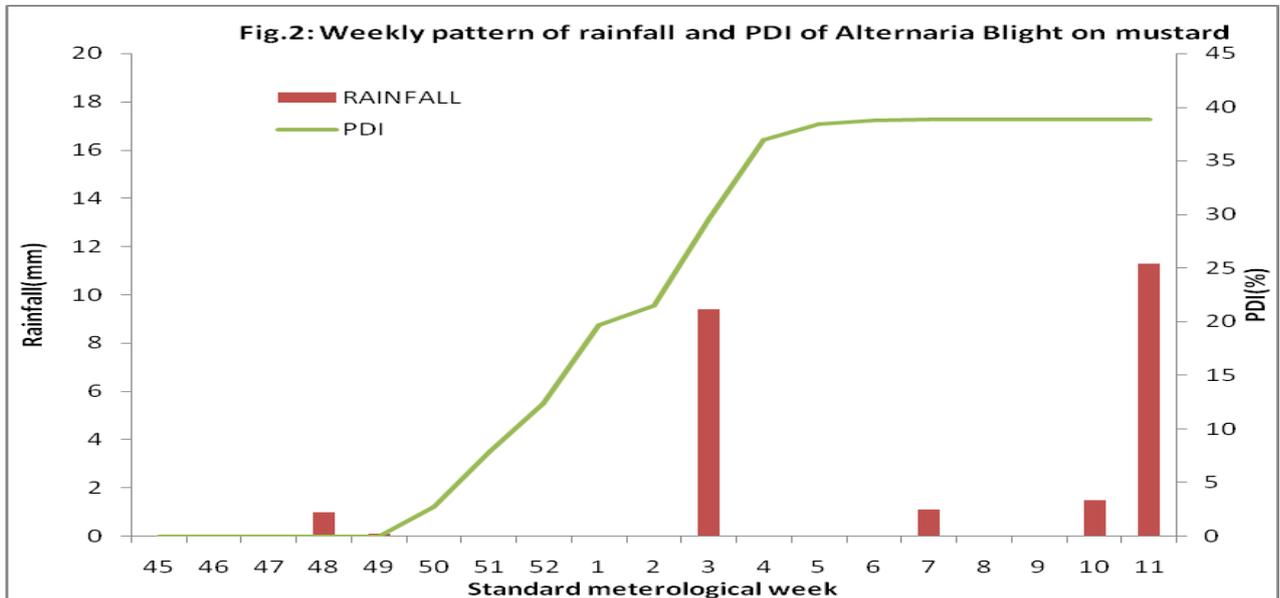


Fig 2: weekly pattern of rainfall and PDI of Alternaria Blight on mustard



were plotted and is presented in Fig.:1 and Fig.: 2. From these figures, it is clear that rainfall events during vegetative as well as reproductive period were very much influenced the disease intensity. It was found that the rainfall played double role and has potential to affect disease intensity. From the results, it is clear that the disease increased rapidly during 3th, 4th and 5th meteorological weeks as PDI were 29.67, 36.92 and 38.44 per cent, respectively in 2016. Morning and evening relative humidity ranged between 88 and 91 and 36 and 65 per cent respectively and rainfall ranged 0 mm - 1.1 mm.

Table 2: Weather parameters and its association with *Alternaria brassicae* on mustard

Weather parameters	Correlation of Alternaria blight
Maximum (temperature)	-0.08
Minimum (temperature)	-0.11
Relative humidity (morning)	-0.02
Relative humidity (evening)	-0.29*
Rainfall (mm)	0.30*

*Significant at 5% level

The results of correlation between disease and weather parameters were significantly associated with rainfall and evening relative humidity. These results were supported by Gupta *et al.* (2003) who reported that high disease severity of *Alternaria* blight in mustard occurred when maximum temperature ranged from 20.4 to 31.6°C and minimum temperature from 4.9 to 14.4°C, along with evening relative humidity (33 to 56 per cent). These parameters had significantly positive correlation with the disease severity. Shrestha *et al.* (2005) reported that the relative humidity was more than 80 per cent with maximum temperature ranging between 18-25°C and minimum between 10-14°C. Meena *et al.* (2010) reported that the disease severity on mustard was favoured by the preceding week, mean temperature >10°C, and mean relative humidity of >70%. Goyal *et al.* (2011) observed that temperature range from 25-30°C was found optimum to different isolates of *Alternaria brassicae* for mycelia and

sporulation and all the isolates also grow best at 100 per cent relative humidity. Chandel (2016) reported that morning and evening relative humidity are highly (0.786, 0.423 respectively) and positive correlation with the *Alternaria blight* severity. He has also mentioned that the total rainfall had positive correlation (0.292) with the *Alternaria blight* percent severity. The correlation was significant with rainfall. The increased rainfall and relative humidity are major weather factors influencing the disease intensity under field conditions.

From the study it can be concluded that the severity of disease significantly correlated with weather parameters. The abiotic factors are important factors in the *Alternaria brassicae* fungus evolution. This study indicates that *Alternaria blight* severity increased with increase in relative humidity and rainfall. Moist (≥70% relative humidity) weather coupled with warm weather (≥28°C) and intermittent rains favours disease development.

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