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RESEARCH ARTICLE

Role of meteorological factors on development of stem and root rot disease of sesame

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ABSTRACT

Stem and root rot disease appeared during the second week of July in the field and its intensity increased gradually up to August 14 and after that disease development declined. Maximum apparent infection rate of 0.122 unit/day and 0.118 unit/day was calculated at July 25, during both years of experimentations, respectively. The mean temperature 26.86 to and 28.93^{0}C, mean relative humidity 77.49 to 79.4 per cent, rainfall 5.54 mm and 13.24 mm and 12 and 14 number of rainy days were favourable for maximum disease development. Multiple regression equation between disease index and weather variables exhibited strong relationship among the different component of the epiphytotics during both the years (R^2 =0.989 and 0.985).

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INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important edible *Kharif* oilseed crop grown in hotter and drier areas and in recent years. Regular occurrence of stem and root rot disease has been recorded from different districts of Jharkhand state with varying incidence per cent of 31.00 to 68.50. In India the disease has been observed in all sesamum growing areas. Singh *et al.* (1991), surveyed sesame fields in Delhi, Haryana, Uttar Pradesh, Karnataka and Tamil Nadu for root rot incidence in fields, which varied from 6.0 to 71.5 per cent (av. 17.01%) depending on the soil conditions and crop season. Choudhary *et al*. (2005) surveyed the major sesame growing areas of North Bihar and found that incidence of stem and root rot caused by *M. phaseolina* (Tassi.) Goid. ranged from 22.5 to 38.5 per cent depending upon locality. Field trials were conducted to determine the role of meteorological factors on development of the disease and the results are reported in this paper.

MATERIAL AND METHODS

To determine the role of weather variables on Macrophomina stem/root rot disease development, field trials were conducted in Randomized Block Design with three replications. Seeds of sesame variety, Kanke Safed were sown in 6 m^2 plots, 30 cm × 10 cm spacings on 25th June during both the years. PDI was recorded at 10 days intervals beginning from the initial appearance of disease. Progress of disease in terms of intensity was recorded on the basis of 100 leaves selected randomly from each replication using 0-5 rating scale (Anonymous, 1998). Weather parameters like temperature, relative humidity, rainfall and number of rainy days upto 60 days were recorded from Meteorological Observatory of the University and correlated with disease development. Stepwise multiple regression analysis (MRA) was calculated to determine the effect of individual as well as combined weather variables. Disease prediction analysis equation *viz.*, $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6$ was derived. Significance of co-efficient of multiple determination (R^2) and partial regression co-efficient (b) value were followed at 5 per cent level of probability.

Disease development in term of apparent infection rate (unit/day) was calculated with the help of formula given by Vanderplank (1963) as detailed below :

$$r = \frac{2.3}{t_2 - t_1}\left[\log\frac{x_2}{1 - x_2} - \log\frac{x_1}{1 - x_1}\right]$$

where,

r = Apparent infection rate

t_1 and t_2 = time intervals

x_1 and x_2 = disease intensities.

RESULTS AND DISCUSSION

Macrophomina stem/root rot appeared during the second week of July in the field and its intensity increased gradually upto August 14 and after that disease development declined, but average total intensity of disease as recorded was maintained till harvest of the crop during both *Kharif* 2002-03 and 2003-04. Maximum apparent infection rate of 0.122 unit/day and 0.118 unit/day were calculated at July 25, during both years of experimentations. The temperature 23.71 to 34.15^{0}C and 23.35 to 30.37^{0}C, relative humidity 69.63 to 89.17 per cent and 67.6 to 87.37 per cent, rainfall 5.54 mm and 13.24 mm and 12 and 14 number of rainy days favoured maximum disease development during June 25 to July 25, 2002-03 and 2003-04, respectively (Fig. 1 and 2).

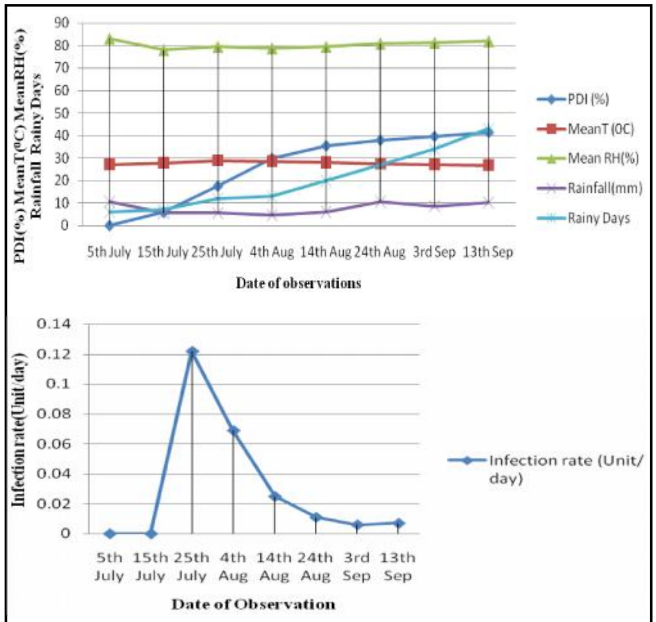

Fig. 1 : Role of meteorological factors on development of Macrophomina stem/root rot disease of sesame during 2002-03

Table 1 : Correlation co-efficient and regression equation between Macrophomina stem/root rot disease index and weather parameters

Weather factors	Correlation co-efficient (r)	Co-efficient of multiple determination (R^2)	Regression equation
2002-2003			
Maximum temperature	-0.162^{NS}	0.026	Y = 95.615 – 2.169 X_1
Minimum temperature	-0.536^{NS}	0.287	Y = 670.972 – 27.503 X_2
Maximum relative humidity	0.023^{NS}	0.001	Y = 69.598 – 0.485 X_3
Minimum relative humidity	-0.076^{NS}	0.006	Y = -6.361 + 0.457 X_4
Mean rainfall	0.162^{NS}	0.026	Y = 18.052 + 1.016 X_5
No. of rainy days	0.858**	0.736	Y = 4.984 + 1.037 X_6
2003-2004			
Maximum temperature	-0.923**	0.851*	Y = 1046.059 – 34.125 X_1
Minimum temperature	-0.979**	0.959**	Y = 2244.958 – 95.402 X_2
Maximum relative humidity	0.985**	0.969**	Y = 1180.548 + 13.708 X_3
Minimum relative humidity	0.974**	0.950**	Y = -293.284 + 4.550 X_4
Mean rainfall	-0.292$_{NS}$	0.086	Y = 71.296 – 3.775 X_5
No. of rainy days	0.894**	0.798*	Y = 2.384 + 0.838 X_6

* and ** indicate significance of values at P=0.05 and 0.01, respectively

NS = Non-significant, Y = Disease index, X_1 = Max. temp, X_2 = Min. temp, X_3= Max. RH, X_4 = Min. RH, X_5 = Mean rainfall, X_6 = No. of rainy days

Table 2 : Multiple regression equation between weather parameters an Macrophomina stem/root rot disease index during the year, 2002-03 and 2003-04

Disease index	Correlation co-efficient (r)	Co-efficient of multiple determination (R^2)	Regression equation
2002-03	0.995**	0.989**	Y = 1935.212 + 11.928 X_1 – 123.561 X_2 + 19.444 X_3 – 16.442 X_4 + 2.764 X_5
2003-04	0.993**	0.985**	Y = 1356.267 – 2.944 X_1 – 71.684X_2 + 5.281 X_3 – 0.758 X_4 + 1.082 X_5

* and ** indicate significance of values at P=0.05 and 0.01, respectively

NS = Non-significant, Y = Disease index, X_1 = Max. temp, X_2 = Min. temp, X_3= Max. RH, X_4 = Min. RH, X_5 = Mean rainfall, X_6 = No. of rainy days.

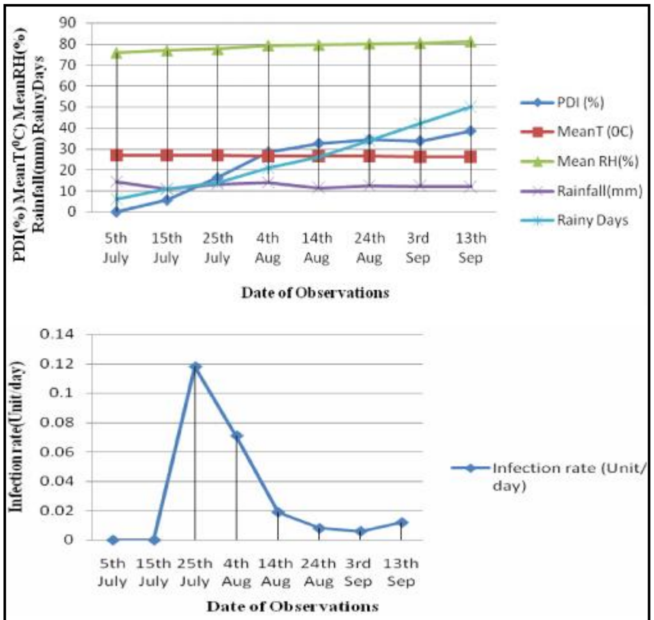

Fig. 2 : Role of meteorological factors on development of Macrophomina stem/root rot disease of sesame during 2003-04

PDI was significantly positively correlated with number of rainy days. Maximum temperature, minimum temperature and minimum relative humidity were negatively correlated and maximum relative humidity and rainfall were positively correlated and all these factors showed statistically non-significant effect during 2002-03.Highly significant negative correlation was established between maximum and minimum temperature. Highly significant positive correlation was established between maximum relative humidity, minimum relative humidity and number of rainy days whereas only rainfall showed non-significant negative correlation during 2003-04 (Table 1).

Multiple regression equation between PDI and weather variables exhibited strong relationship among the different component of the epiphytotics during both the years of study and combined effect of different weather variables favoured disease development causing upto 98 per cent variation in disease index (Table 2).

It was observed that the disease was negligible in case of plants sown during the month of August but the yield was adversely affected. However, in spite of heavy infection in case of June and July (1^{st} week) sowings, the yield was highest in later dates of sowing.

Singh *et al.* (1993) reported that the severity of stem rot caused by *Rhizoctonia bataticola (M. phaseolina)* was reduced by sowing sesame between 10-20 July, resulting in increased yield as compared with crop sown on 1^{st} July.

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