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YIELD LOSS ASSESSMENT AND INFLUENCE OF TEMPERATURE AND RELATIVE HUMIDITY ON CHARCOAL ROT DEVELOPMENT IN SESAME (*SESAMUM INDICUM* L.)

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ABSTRACT
Charcoal rot of sesame caused by *Macrophomina phaseolina* is one of the major yield reducing factor in sesame (*Sesamum indicum* L.). Temperature and relative humidity play a significant role in development of this disease. In the present studies which was carried out at Instructional farm of IGKV, Raipur during *kharif* 2011-12 both factors were found to have a significant role in disease development on sesame under field conditions. Maximum temperature (31.6°C), minimum temperature (24.0°C) and relative humidity (88%) favoured high disease development. Positive and non significant correlation was observed between disease and temperature while significant, negative correlation was noticed between disease development and relative humidity. Assessment of yield losses in sesame due to *M. phaseolina* was done at capsule formation stage. The plants protected with fungicides gave more (46) number of capsules per plant, number of seeds per capsule (45.0), weight of 1000 seeds in healthy capsule (2.91 g) and infected capsule (1.83 g).

INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important oilseed crop of tropical and sub tropical region and is called as queen of oil seed crops because of its oil quality. Sesame oil has excellent stability due to the presence of the natural antioxidants sesamoline, sesamin, and sesamol. India ranks first in the world in sesame cultivation (27.7% area) but its productivity is quite low (368 kg/ha) as compared to world average (489 kg/ha) (www.fao.org). The main reason for the low productivity of this crop is due to the attack of various fungal [Charcoal rot of sesame (*Macrophomina phaseolina*), Alternaria leaf spot (*Alternaria sesami*), Corynespora blight (*Corynespora cassiicola*), Powdery mildew (*Erysiphe cichoracearum),* Cercospora leaf spot *(Cercospora sesami*)], bacterial [Bacterial blight (*Xanthomonas campestris pv. sesami*)], viral and phytoplasma [phyllody] diseases.

The crop is severely infected by *M. phaseolina* and is widely distributed in all sesame growing regions. *M. phaseolina* infected seeds show drastically reduced germination, and seedling stand (Yu and Park,1980; Gonzalez and Subero, 1984). The losses from the disease are 5-100 % in farmers and experimental fields. [Sundararaman (1933), Murugesan *et al*. (1978)].

Environmental factors play an important role in development of charcoal rot on sesame, caused by *M. phaseolina*. Temperature (maximum and minimum) and relative humidity play a major role in the growth of the pathogen and disease development. However there is lack of precise information on the influence of environmental factors on the development of charcoal rot on sesame. Therefore, the present investigation was undertaken to know their effect on disease development in sesame crop.

MATERIALS AND METHODS

Disease development in relation to environmental factors

To know the effect of weather factors like temperature (maximum and minimum) and relative humidity (morning in per cent) on the incidence and development of charcoal rot of sesame were studied at the research farm, IGKV Raipur. This study was undertaken during *kharif* season 2011-12. All other cultural and pest control practices were followed as recommended in package of practices.

For this study one cultivar [TKG-22 (NC)] was grown and five plants from that cultivar were selected randomly and tagged. Seven observations on disease development were taken at an interval of two days. The observations were recorded as soon as the first symptom of charcoal rot was seen in the field till maturity. The incidence of disease was correlated with weather factors. The meteorological observation at Agriculture Research Station, IGKV, Raipur was used for this experiment.

Yield loss assessment due to charcoal rot

Seeds of sesame were sown in field which were treated with

Penflufen + Trifloxystrobin along with one foliar application of carbendazim and without treated seeds were kept as unprotected. All other cultural and pest control practices were followed as recommended in package of practices. Diseased and healthy pods 50 per plant from each plot were collected before harvesting and seeds per fifty pods will be weighed and yield loss percent was calculated in terms of 1000 seed weight in protected and unprotected plots and also number of capsules per plant and number of seeds per capsule in both protected and unprotected plots.

Yield loss per cent was calculated by using the formula,

Yield loss per cent = H–I/H × 100

Whereas

H = Healthy seed weight (g)

I = Infected seed weight (g)

RESULTS AND DISCUSSION

Disease development in relation to environmental factors

The importance of weather parameters and disease development revealed that the disease first appeared in the field on 10th September 2011. The results indicated that lesion length and width of charcoal rot were considerably influenced by the prevailing weather conditions. The lesion length (23.58 cm) and width (0.666 cm) were considerably more noticed on 28 sept, 2011 when the maximum, minimum temperature and relative humidity (31.6°C, 24.0°C and 80% respectively) prevailed in the field (Table 1). It was also noticed that lesion length and width of charcoal rot increased as the temperature increased and relative humidity decreased in the field. This clearly indicated that weather parameters play a crucial role in the charcoal rot development.

The correlation of different weather parameters with disease development are depicted the (Table 2). Significant and negative correlation of mean lesion length between charcoal rot disease and relative humidity (-0.777) was recorded. However, effect of maximum temperature (0.625) and minimum temperature (0.043) was non significant and showed positive correlation with respect to disease development in terms of mean lesion length. The width of lesion due to charcoal rot was correlated with maximum, minimum temperature and relative humidity during disease development period. The data given in the table clearly indicated that width of lesion positively correlated with maximum (0.729), minimum (0.060) temperature and negatively correlated with relative humidity (-0.731).

When weather data was subjected for regression, three regression coefficients both for length and width were obtained for independent variables viz., maximum temperature (°C), minimum temperature (°C) and relative humidity (%) as the dependent variable for disease incidence. Based on the regression coefficients obtained for mean lesion length and mean lesion width, linear equations were derived to predict the disease depending upon weather conditions prevailing during crop season. The present findings are similar with the results of Patel and Patel (1990) who reported higher temperature (35°C) and low relative humidity to be favourable for maximum disease incidence of charcoal rot of sesame (*M. phaseolina*). Similar results were also obtained by Sabalpara *et al*. (2007) for blight of green gram caused by *M. phaseolina* in which maximum disease incidence was found in the month

Table 1: Effect of weather parameters on lesion length and width of charcoal rot of sesame

S. No.	Date	Temperature (°C)		Relative humidity(%)	Length of lesion(cm)	Width of lesion(cm)
		Maximum(°C)	Minimum(°C)			
1	10/9/2011	25.9	23.6	97	0.56	0.115
2	13/9/2011	30.3	25.0	93	3.2	0.251
3	16/9/2011	31.3	24.2	97	7.36	0.335
4	19/9/2011	30.9	22.5	97	10.57	0.415
5	22/9/2011	31.1	24.1	94	13.87	0.523
6	25/9/2011	30.1	24.8	90	17.46	0.545
7	28/9/2011	31.6	24.0	88	23.58	0.666

Table 2: Correlation coefficients between disease incidence (length and width) and meteorological factors

(a) Correlation coefficient between weather parameters and lesion length of charcoal rot of sesame

	Length	Max temp	Min temp	RH
Length	1			
Max. temp	0.6257641	1		
Min. temp	0.0439474	0.1036966	1	
RH	-0.777863	-0.366525	-0.512541	1

(a) Correlation coefficient between weather parameters and lesion width of charcoal rot of sesame

	Width	Max temp	Min temp	RH
Width	1			
Max temp	0.729714	1		
Min temp	0.060163	0.103697	1	
RH	-0.73122	-0.36652	-0.51254	1

$y = 253.0472 + 1.447\ x_1 + (-4.313)\ x_2 + (-1.947)\ x_3$ for length of lesion, $y = 4.5876 + 0.0480x_1 + (-0.0846)\ x_2 + (-0.0383)\ x_3$ for width of lesion. Where x_1 - maximum temperature, x_2 - minimum temperature, x_3 - relative humidity

Table 3: Assessment of yield losses due to charcoal rot of sesame

S. No	Nature of observation	Unprotected	Protected	% Reduction
1	No. of capsules per plant	31	46	32.61
2	No. of seeds per capsule	29	45	35.55
3	1000 seed wt. (g) (healthy capsule seed)	2.50	2.91	14.08
4	1000 seed wt. (g) (infected capsule seed)	1.83	2.20	16.81

of October when maximum (35°C), minimum temperatures (25°C) and relative humidity (85%) prevailed in the field.

Yield loss assessment due to charcoal rot

Assessment of yield losses in sesame due to *M. phaseolina* was done at capsule formation and data obtained is presented in (Table 3). The data in the table showed that the losses in yield of sesame depend upon the number of capsules per plant, number of seeds per capsule and weight of seeds.

The plants protected with fungicides gave more (46) number of capsules per plant, number of seeds per capsule (45.0), weight of 1000 seeds in healthy capsule (2.91 g) and infected capsule (1.83 g). In unprotected plot 32.6%, 35.55%, 14.08% and 16.81% reduction was noticed in number of capsules per plant, number of seeds per capsule, weight of 1000 seeds in healthy and infected capsules, respectively as compared to protected.

The results obtained in the present investigation are in accordance with the findings of Chattopadhyay and Sastry (1999) who reported 50% yield loss in sesame due to *M. phaseolina*. Charcoal rot (*M. phaseolina*) reduced 57% grain yield of sesame also have been reported by Sunderaraman (1933). Satyanarayana and Begum (1996) estimated 50% losses in yield of maize due to *M. phaseolina*.

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