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Research Article

EPIDEMIOLOGY OF ANTHRACNOSE OF BLACK GRAM CAUSED BY *Colletotrichum lindemuthianum*

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Abstract- The experiment was conducted to assess the effect of environmental factors in relation to development of anthracnose disease of black gram during *kharif* 2013 at RCA Udaipur.The observations on per cent disease index were recorded after 10 days of inoculation of most virulent isolate (MVL (Mavli)) of *Colletotrichum lindemuthianum* on a standard 0-5 disease rating scale on single susceptible cultivar (PUI-94-1) of black gram. July last two weeks were found favorable for initiation of disease and temperature ranged from 22°C to 29°C, relative humidity > 80% and optimum rainfall was found favorable for anthracnose disease development.

Keywords- *Colletotrichum lindemuthianum,* Rainfall, Relative humidity and Temperature

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Introduction

Blackgram [*Vigna mungo* (L.) Hepper] commonly known as urd bean, mash, black maple is an annual, semi erect to spreading herb belonging to the family fabaceae is grown as a *kharif* crop in tropical and sub-tropical countries [3].India is largest pulse producing country in the world, its having 18.45 million tonnes of pulse production from an area of 23.97 million ha [2]. *Colletotrichum lindemuthianum* (Sacc. and Magnus) Lams. Scrib., the causal organism of pulse anthracnose, is a serious soil born as well as seed borne pathogen of pulse crops throughout the world and has been reported to occur on *kharif* pulses in several countries including India, Nigeria, Thailand, Philippines, Upper Volta, Zambia, Palmira and Columbia[1]. *Colletotrichum lindemuthianum* was causing saviour yield losses nearly 80 to 100% under cool and humid environmental conditions[8]. Anthracnose diseases are favoured by high temperature and periods of high humidity and leaf wetness [9].Heavy and frequent rains with moderate temperatures (19-25 ^{0}C) and high relative humidity (>70 %) favoured the progress of anthracnose disease of kidney bean in terms of vertical and horizontal spread [5]. Yet, is limited information is available on epidemiology of anthracnose disease of black gram, So there is a great need to study the effect of different weather parameters on disease severity. Greater use of environmental data from field experiments could help to identify resistant sources for various diseases, which can use for breeding programmes. Hence, effect of different weather parameters on disease severity was investigated under control conditions.

Materials and Methods

Sources of biological materials and preparation of inoculums

PUI-94-1 black gram variety was grown in cage house assess the effect of environmental factors in relation to development of anthracnose disease of black gram during *kharif* 2013 at Rajasthan College of Agriculture, Udaipur. For preparation of the inoculum the pure culture of *C. lindemuthianum* was grown on PDA for 10 days on 28±2°C in Petri plates for profuse sporulation. The spores were harvested by flooding the plate with sterile distilled water and gently scrapping the colony with the help of a sterilized plastic loop and the conidial suspension was strained through muslin cloth. Final concentration of the spores was maintained 1x 10^3 conidia ml^{-1}[6].

Collection of weather data

The observations on per cent disease index were recorded after 10 days of inoculation on a standard 0-5 disease rating scale [Table-1]. The PDI were recorded from August first week (standard week 31) to September second week (standard week 36) [11]. The weather data i.e. maximum and minimum temperature, morning and evening relative humidity and rainfall were collected from agronomy farm observatory at RCA, Udaipur. Later on intensity of anthracnose were correlated in relation to weather parameters.

Table-1 *Disease scale for anthracnose disease of black gram (0-5)*

Per cent area covered	Score
Free from disease	0
1 to 20% area of leaf infected	1
21 to 40% area of leaf and stem infected	2
41 to 60% area of leaf and stem infected	3
61 to 80 % area of leaf, stem and pods infected	4
More than 80% area of leaf, stem and pods infected	5

Results and discussion

Maximum disease index was observed during august first week and second week, there was increased in mean PDI 18.2 to 30.8 and then 30.8 to 43.9 respectively. Subsequently in later weeks disease intensity declined with mean PDI 43.9 to 48.7 in third week of August, mean PDI 48.7 to 54.1 in fourth week of August, mean PDI 54.1 to 57.3 in first week of September [Table-2] [Fig-1]. It was concluded that July last two weeks were found favorable for initiation of disease and temperature ranged from 22°C to 29°C, relative humidity > 80% and optimum rainfall was

found favorable for anthracnose disease development. co relation value (r) was calculated, r was +0.83 with maximum temperature, -0.51 with minimum temperature, -0.83 with morning and evening relative humidity and -0.89 with rainfall [Table-3]; [Fig-1]. However, temperature of 25 °C and RH 90-100% were found most favorable for maximum sporulation and germination of *C. lindemuthianum* and *C. dematium* on *Vigna radiate in vitro* and *in vivo*[10]. Recurrence and development of anthracnose disease of kidney bean (*Phaseolus vulgaris*), in relation to weather variables in sub-humid hill areas (Zone II) of Himachal Pradesh, India, revealed that heavy and frequent rains with moderate temperatures (19-25 °C) and high relative humidity (>70 %) favored the progress of disease in terms of vertical and horizontal spread [5]. Epidemiological factors like temperature, relative humidity and pH effect spore germination of *C. lindemuthianum*, the causative organism of anthracnose disease in cowpea. Maximum spore germination was marked at optimum temperature 28°C and Relative humidity 95-100 per cent [7]. Weather variables have profound impacts on the disease occurrence, the interactions between weather variables and diseases based on long term data-sets, which can be used to elucidate the critical variables and the sensitive period in crop season for management aspects. Good correlation was observed from 27 to 36th meteorological week (second week of July–first week of September) for the anthracnose [5].

Table-2 Effect *of environmental factors in relation anthracnose disease of black gram progression during kharif 2013 at RCA Udaipur*

Std. week	Weekly PDI* (%)	Temperature (°C)		Relative humidity (%)		Total rainfall (mm)
		Maximum	Minimum	Morning	Evening	
31	18.2	29.0	23.2	89.4	80.3	63.6
32	30.8	28.8	23.2	88.3	76.0	85.2
33	43.9	29.2	23.3	88.3	75.3	25.6
34	48.7	30.2	23.5	80.0	71.0	16.8
35	54.1	30.0	22.7	82.1	60.1	0.0
36	57.3	31.0	22.4	76.9	50.1	0.0
r value		**0.83**	**-0.51**	**-0.83**	**-0.83**	**-0.89**

r = Correlation coefficient *Mean of five replications

Table-3 *Correlation coefficient between environmental factors and anthracnose diseaseof black gram progression during kharif 2013 at RCA Udaipur*

Dependent variables (Environmental factors)	Independent variable	'r'	R^2	Regression equation (Y=a+bx)
Maximum Temperature	PDI	0.831**	0.691	Y = 27.719 + 0.047X
Minimum temperature	PDI	-0.515	0.265	Y = 23.650 – 0.014X
Morning RH	PDI	-0.838**	0.702	Y = 96.474 – 0.292X
Evening RH	PDI	-0.838**	0.702	Y = 95.383 – 0.641X
Rainfall	PDI	-0.891**	0.794	Y = 119.856 – 2.087X

** Significant at 1% level of significance

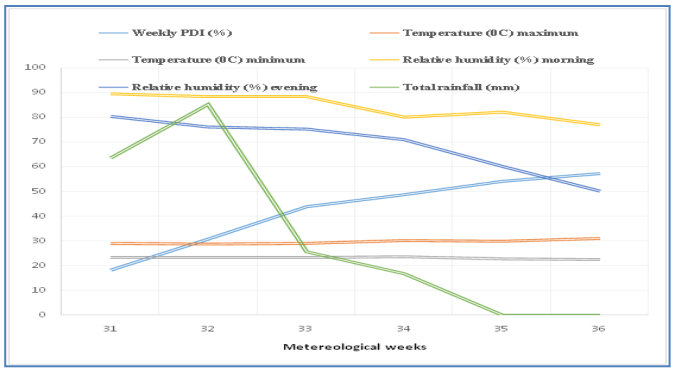

Fig-1 Effect of environmental factors in relation to anthracnose disease of black gram progression during *kharif* 2013 at RCA Udaipur

Conclusions

Anthracnose caused by *C. lindemuthianum* is a devastating soil and air borne disease of black gram in India. The aim of present investigation was tostudy the effect of different weather parameters on disease severity.Weather variables have profound impacts on the disease occurrence. Optimal temperature (22-29°C) optimum, with high relative humidity (80%) and optimal rainfall was found favorable for anthracnose disease development.There is urgent need to prepare forecasting model by using of climatic data; and evaluation of various genotype under various climatic condition to use them in resistant breeding programme.

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Abbreviations: PDI- Percent disease index, PDA- Potato dextrose Agar

Conflict of Interest: None declared

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