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Epidemiological Studies of Leaf Spot of Pigeonpea [*Cajanus cajan* (L.) Millsp.] Caused by *Cercospora cajani*

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A B S T R A C T

Cercospora leaf spot caused by *Cercospora cajani Henningsis* one of the most important fungal diseases of Pigeon pea [*Cajanus cajan (L.)* Millsp.]. Epidemiology of *Cercospora cajani* of pigeon pea. The correlation studies between individual parameters and CLS intensity was carried out and the data are summarized in which reveals that maximum temperature (-0.06089) showed correlation coefficient with the disease intensity. This non significant and negative correlation indicates that the disease incidence increased with decrease in maximum temperature. On the other hand minimum temperature (-0.86547*), average maximum relative humidity (-0.82866*), total rainfall (-0.75349*) and number of total rainy days (-0.79524*) showed negative correlation coefficient with the disease intensity which clearly indicates that the disease increased with the decrease in average relative humidity, average minimum relative humidity, total rainfall.

Introduction

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is an important grain legume crop of rainfed agriculture in the semi-arid tropics. Besides Indian sub-continent, it is widely grown in Eastern Africa and Central America. It is not only an important source of protein, but also plays an important role in atmospheric nitrogen fixation into soil (Reddy *et al.*, 2012). Globally pigeon pea is cultivated in about on 4.7 million ha area with 3.69 million tonnes annual production. India accounts 78% of the global output with current production of 2.78 million tonnes from 3.5 million ha. In Madhya Pradesh Pigeon pea is grown in about 0.57 million ha with an annual production of 0.57 million tonnes. The average yield of Pigeon pea in M.P. is 848 kg/ha which is much larger than the potential yield of crop (1500-2000 kg/ha). Several biotic and abiotic factors are responsible for reducing the yield

(Anno. 2018). Cercospora leaf spot inflicts heavy yield losses ranging from 23 to 96 per cent under natural epiphytotic conditions. (Kasno, 1990; Iqbal *et al.*, 1995; Kaur, 2007). The yield losses vary depending upon how early the crop is infected in the season, crop variety and prevailing weather. The leaf spot disease is caused by fungus *Cercospora cajani*. It is present in parts of Uttar Pradesh, Bihar and several places of south India (Reddy *et al.*, 2012).

Materials and Methods

Experimental site

The field experiments were conducted during kharif 2018 at the experimental field of Department of Plant Pathology, R.A.K. College of Agriculture, Sehore (M.P.).

Epidemiology

The weekly weather data for the period of the observations *i.e.* July to December 2018. The meteorological parameters data on temperature, relative humidity (RH), rainfall and number of rainy days were also recorded separately at weekly interval during crop season in year 2018-19 from the Meteorological Department of College of Agriculture, sehore **(Table-1).** After emergence 10 plants from each plot were randomly selected tagged and inoculated with conidial suspension of *Cercospora cajani*. The inoculated plants were covered by polythene bags for three days. The initiation and progress of the disease was recorded on tagged plants at weekly interval starting from the first appearance of the symptoms. Simultaneously the meteorological parameters *viz.*, temp. (Max and Min.), RH (Max. and Min.), number of rainy days will also were recorded and their after a correlation study was made to find out the role of individual meteorological parameter on the development of the disease. The linear relationship of disease development with environmental factors was calculated by Karl Pearson linear correlation coefficient. The *quantity r, called the linear correlation coefficient,* measures the strength and the direction of a linear relationship between two variables. The linear correlation coefficient is sometimes referred to as the *Pearson product moment correlation coefficient* in honor of its developer Karl Pearson.

The mathematical formula for computing ***r*** is:

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}$$

Where, *n* is the number of pairs of data.
Based on disease incidence the lines were categorized as per the scale described by Reddy and Jain (1989) where-

Results and Discussion

Epidemiology of *Cercospora cajani* of pigeon pea

The correlation studies between individual parameters and Cercospora leaf spot intensity was carried out and the data are summarized in (**table-3)** which reveals that maximum temperature (-0.06089) showed correlation coefficient with the disease intensity. This non significant and negative correlation indicates that the disease incidence increased with decrease in maximum temperature. On the other hand minimum temperature (-0.86547*), average maximum relative humidity (-0.82866*), total rainfall (-0.75349*) and number of total rainy days (-0.79524*)showed negative correlation coefficient with the disease intensity which clearly indicates that the disease increased with the decrease in average relative humidity, average minimum relative humidity, total rainfall. (Table-3 and table-4).

Maximum temperature showed negative correlation, disease increased with the decrease in maximum temperature. On the other hand minimum temperature, average relative humidity, total rainfall and number of total rainy days showed negative correlation which indicated that the disease increased with the decrease in that parameters.

Earlier, Windels *et al*., 1998 also worked on different date sowing against *Cercospora sp.* 90-100% relative humidity for production of conidia and 20-26^{o}C temperature. For germination and to cause the infection the ideal temperature recorded is 25-30^{o}C. If the temperature is below than 10^{O}C then no conidia are formed (Windels *et al*., 1998). Wallin & Loonan (1971) reported an increase in leaf spots in the order of 30 to 80 times after periods of 48 or 72 h leaf wetness, respectively, compared to a leaf wetness period of 24 h. Optimal temperatures between 22-28^{o}C are reported for these pathogens during infection of their respective hosts.

Table.1 Meterological parameters

Date	Standard week	Temp (Max.°C)	Temp. (Min.°C)	Relative humidity (%)	Rainfall (mm)	Number of rainy days
9-15 July	28	29.64	23.94	89.36	280.00	5
16-22 July	29	28.36	24.39	91.43	268.50	4
23-29 July	30	26.44	23.56	93.5	71.00	2
30-5 Aug	31	30.04	24.50	81.07	0.00	-
6-12 Aug.	32	28.24	23.76	81.9	19.00	1
13-19 Aug	33	28.86	23.99	92.64	132.00	3
20-26 Aug	34	26.53	23.00	97.71	100.10	2
27-2 Sept.	35	26.34	22.44	94.36	4.90	1
3-9 Sept	36	24.94	20.91	79.71	33.50	1
10-16 Sept	37	29.67	20.56	75.50	8.60	1
17-23 Sept	38	31.57	21.61	71.14	41.00	1
24-30 Sept.	39	33.50	20.66	64.79	2.00	1
1-7 Oct	40	34.46	20.06	58.79	19.50	1
8-14 Oct.	41	34.46	18.10	56.00	0.00	-
15-21 Oct	42	34.03	19.17	45.50	0.00	-
22-28 Oct.	43	33.10	15.70	42.6	0.00	-
29Oct-4 Nov.	44	30.74	16.07	53.8	0.00	-
5-11 Nov.	45	30.14	12.66	45.9	0.00	-
12-18 Nov.	46	30.07	13.24	45.4	0.00	-
19-25Nov.	47	29.87	15.61	47.6	0.00	-
26Nov- 2Dec	48	26.40	11.69	58.9	0.00	-
03 – 09Dec	49	24.66	12.71	53.7	0.00	-
10-16 Dec.	50	22.83	9.79	59.1	0.00	-
17-23 Dec.	51	22.91	4.86	55.0	0.00	-

Based on disease incidence the lines were categorized as per the scale described by Reddy and Jain (1989) where-

Table.2 Disease rating scale

Disease grade	Description	Disease grade	Disease reaction
0	No symptom	0-1	Immune
1	Lesion small pin head covering less than 1% leaf	1.1-3	Resistant
3	Lesion 1-2 mm diameter covering 1-10 % leaf area	3.1-5	Moderately Resistant
5	Enlarged lesion with 11-25 % leaf coverage	5.1-7	Moderately Susceptible
7	Lesion covering 26-50% of the leaf area	7.1-9	Susceptible
9	More than 50% of the area covered by large coalescing lesion and defoliation		Highly Susceptible

Table.3 Weather and disease progress during year 2018-19 at Sehore date of sowing 8th July 2018

Date	Standard week	Temp (Max.°C)	Temp. (Min°C)	Relative humidity (%)	Rainfall (mm)	Number of rainy days	Progress of disease (%)
9-15 July	28	29.64	23.94	89.36	280.00	6	5.5
16-22 July	29	28.36	24.39	91.43	268.50	6	11.55 (6.05)
23-29 July	30	26.44	23.56	93.5	71.00	5	18.31 (6.76)
30-5 Aug	31	30.04	24.50	81.07	0.00	0	20.1 (1.79)
6-12 Aug.	32	28.24	23.76	81.9	19.00	3	22.4 (2.3)
13-19 Aug	33	28.86	23.99	92.64	132.00	6	26.4 (4.0)
20-26 Aug	34	26.53	23.00	97.71	100.10	6	34.4 (8.00)
27-2 Sept.	35	26.34	22.44	94.36	4.90	2	37.3 (2.9)
3-9 Sept	36	24.94	20.91	79.71	33.50	4	38 (0.7)
10-16 Sept	37	29.67	20.56	75.50	8.60	3	39.11 (1.11)
17-23 Sept	38	31.57	21.61	71.14	41.00	2	40.2 (1.09)
24-30 Sept.	39	33.50	20.66	64.79	2.00	1	41.11 (0.91)
1-7 Oct	40	34.46	20.06	58.79	19.50	0	43.44 (2.33)
8-14 Oct.	41	34.46	18.10	56.00	0.00	0	46.12 (2.68)
15-21 Oct	42	34.03	19.17	45.50	0.00	0	49.0 (2.88)
22-28 Oct.	43	33.10	15.70	42.6	0.00	0	51.5 (2.5)
29Oct-4 Nov.	44	30.74	16.07	53.8	0.00	0	54.55 (3.05)
5-11 Nov.	45	30.14	12.66	45.9	0.00	0	54.75 (0.20)
12-18 Nov.	46	30.07	13.24	45.4	0.00	0	55.12 (0.37)
19-25Nov.	47	29.87	15.61	47.6	0.00	0	55.78 (0.66)
26Nov-02Dec	48	26.40	11.69	58.9	0.00	0	58.12 (2.34)
03 – 09Dec	49	24.66	12.71	53.7	0.00	0	58.78 (0.66)
10-16 Dec.	50	22.83	9.79	59.1	0.00	0	59.00 (0.44)
17-23 Dec.	51	22.91	4.86	55.0	0.00	0	61.00 (2.88)

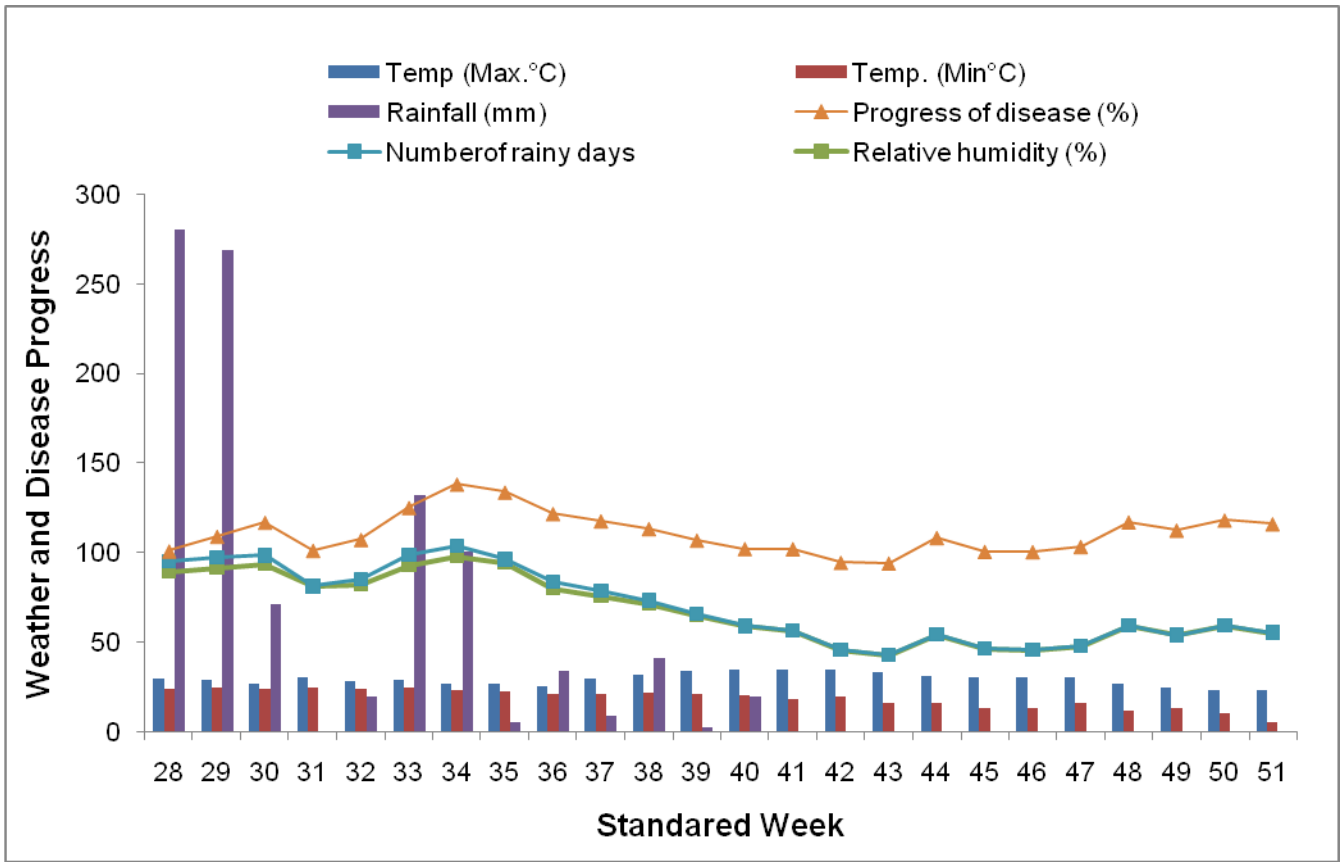
(*Figures in parentheses are arcsine transformed values**)**

Table.4 Correlation coefficient of individual meteorological parameters with progressive development of Cercospora leaf spot of Pigeon pea

S.No	Weather Parameters	Correlation coefficient
1	Maximum temperature	-0.06089
2	Minimum temperature	-0.86547*
3	Relative humidity %	-0.82866*
4	Rainfall (mm)	-0.75349*
5	Total rainy days	-0.79524*

R-square value (0.754), * Significant at 5%

Fig.1 Weather and disease progress during year 2018-19, at Sehore.



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