Int.J.Curr.Microbiol.App.Sci (2019) *8*(11): 2231-2235

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 11 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.811.260

Relationship of Weather with Disease and Pest Incidence in Pigeonpea and its Effect on Production in Vindhya Plateau

A.K. Singh* and A.K. Tripathi

Jawaharlal Nehru Agriculture University, Agricultural Science Centre, Sagar - 470002 (MP), India

**Corresponding author*

Keywords

Pigeonpea, Meteorological parameters, Mortality, Phytopthora blight, Wilt

Article Info

Accepted:
22 October 2019
Available Online:
10 November 2019

A B S T R A C T

In India, pigeonpea grown mainly in the semi-arid tropics and it is a drought-tolerant legume of *kharif* season. The crop represents about 5 per cent of global legume production, with more than 70 per cent being produced in India. Madhya Pradesh is a leading state in pulse production which contributes 10 per cent of the total pigeon pea production in the country. Bundelkhand region of the state is well known for cultivation of the pulses especially pigeonpea due to prevailing rainfed situation, however its production is usually affected by diseases and pest incidence due to change in certain weather parameters (rainfall, temperature and relative humidity). Keeping in view the above, the relationship of disease and insect incidence in pigeonpea with meteorological parameters was studied in Sagar district of Bundelkhand region which falls in Vindhya Plateau agro-ecological zone. It was noticed that the phytophthora blight disease occurred in the Ist week of August after heavy rains where maximum temperature was 32.8 and relative humidity was 76.5 per cent and maximum mortality was observed during continuous drizzling which continued for 2 to 3 days. Wilt disease incidence was observed at flowering stage of pigeonpea during IInd fortnight of October and it gradually increased with the lack of moisture in the soil. Pod borer incidence of was found maximum in the second week of November when temperature was 31.7 and relative humidity was 60.7 per cent. Pigeonpea yield affected due to occurrence of diseases and pests which largely attributed to variation in the above meteorological parameters.

Introduction

Pigeonpea (*Cajanus cajan* (L.) Millspaugh) is the fifth most important food legume crop in the world after soybean, groundnut, dry beans, and peas. It is commonly known as red gram, well recognized as a valuable source of dietary proteins of very high quality. It is mainly cultivated for its dry seeds and green vegetables in dry areas of the tropics and sub tropics. The major pigeonpea producing areas in the world are India, Eastern Africa, Central and South America, the Caribbean and West indies. In India, pigeonpea is grown in 4.04 million hectares area which accounts for 2.65 MT of total production with the productivity

of 656 kg/ha. About 90 per cent of the global pigeonpea area falls in India with 93 per cent of the global production. In addition to its nutritional value it also has a unique property of maintaining and restoring soil fertility through biological nitrogen fixation and improvement of physical properties of the soil by virtue of its deep root system. Madhya Pradesh is a leading state of India in pulse production which contributes 10 per cent of the total pigeon pea production in the country. Bundelkhand region of the state is well known for cultivation of the pulses especially pigeonpea, however its productivity is considerably less than the National average. Productivity of pigeonpea in Sagar district is 643 kg/ha. It is usually affected by diseases and pest incidence due to change in climatic conditions i.e. certain weather parameters (Rainfall, temperature and relative humidity). Various pests usually infest the crop at different stages of growth. Some of its diseases and insects like phytophthora blight, wilt and pod borer account for nearly 15-20 per cent seed yield loss on a national basis. This effect has been widely studied Agrawal *et al.,* (2003) and Goyal *et al.,* (1991). Weather conditions play a predominant role in determining the course and severity of pest incidence; however, limited information is available on pigeonpea diseases (Phytophthora blight, wilt) and pests namely pod borer. Keeping in view the above, the relationship of disease and insect incidence in pigeonpea with meteorological parameters was studied in Sagar district under Bundelkhand region of Madhya Pradesh which falls in Vindhya Plateau agro-ecological zone.

Materials and Methods

The trial was conducted during *Kharif* 2016 in participatory mode in Sagar district of Buldelkhand region. The nursery of pigeonpea variety TJT 501 seeded in polythene bags during first week of June 2016. Thirty days old nursery saplings were transplanted at 90 cm plant to plant and 150 cm row to row distance in first week of July with recommended agronomical practices like application of NPK and micronutrient fertilizers based on soil test value, weeding and inter-culture operations, irrigation etc. Disease progress was recorded at fortnightly intervals in randomly selected plants. The weather data (maximum and minimum temperature, relative humidity, rainfall) was recorded and the correlation of disease / insect incidence and weather parameters was statistically analyzed by the methods given by Panse and Sukhatme (1985). Soil application of *Trichderma viride* 2.5 kg/ ha with FYM was done for control of soil borne fungi responsible for phytophthora and fusarium, seed treatment was done by carbendazim @ 2 g/kg seed, installation of pheromone traps for catching of adult of pod borer @ 10/ha, spray of profenophos 50 EC @ 1.5 litre/ha at pre-flowering stage in the first week of October followed by dimethoate 35 EC @ 0.75 litre/ha at pod formation stage. Farmer's practice field was maintained as control plot. Observation on the number of phytophthora blight and wilt affected plants were recorded periodically. Observation on the number of *Helicoverpa armigera* per plant was recorded at peak period of incidence, while grain damage caused by pod fly was recorded 7 days prior to harvest of the crop on randomly selected pods of pigeonpea from each trial plots.

Results and Discussion

Meteorological data (Table 1) indicated that the minimum/maximum temperature, relative humidity and rainfall play an important role in the incidence of disease and insect population in pigeonpea. It was noticed that the phytophthora blight disease occurred in Ist week of August after heavy rains when maximum temperature was 32.8 and relative humidity was 76.5 per cent and maximum

mortality was observed during continuous drizzling which continued for 2 to 3 days. Wilt disease incidence was observed at flowering stage of pigeonpea during IInd fortnight of October and it gradually increased with the lack of moisture in the soil. The pod borer incidence of was found maximum in the second week of November when temperature was 31.7 and relative humidity was 60.7 per cent.

The relationship of phytophthora blight disease with minimum and maximum temperature showed negative correlation but in case of minimum temperature the correlation was not significant (Table 2). Maximum temperature indicated significant association which revealed that disease intensity decreased at the rate of 0.87 (Y=0.88 – 0.87 X) with unit increase in maximum temperature. Rainfall and relative humidity indicated positive association with the disease intensity but in case of rainfall the correlation was significant (0.714) which indicated that phytophthora blight disease increased with corresponding increase in rainfall (Y= -2.86 + 0.18 X). Similar finding was also observed by Agrawal and Khare (1987) in which they indicated that minimum and maximum temperature had negative correlation with disease index of phytophthora blight though it was not statistically significant.

Incidence of wilt disease showed positive correlation with maximum/minimum temperature and relative humidity but it was non-significant. The findings of previous studies (Singh and Bhargava, 1981; Reddy *et al.,* 1990) also indicated that the temperature is one of the important factors which favor the development of wilt disease. The relationship of wilt disease with rainfall was found to be negative and significant (-0.764) which indicated that disease incidence increased with decrease in rainfall which was ultimately related to soil moisture. Similar findings were reported by Chhetry and Ranjana Devi (2014). Decreased rate of rainfall increased the disease occurrence at the rate of 0.84 (Y=1.56 – 0.87 X).

Pod borer incidence in pigeonpea positively associated with maximum temperature and negatively with minimum temperature but both were non-significant. Incidence of pod borer negatively and significantly correlated with relative humidity (-0.952) and rainfall (-0.679) which revealed that pod borer attack decreased at the rate of 0.47 and 0.35 per cent (Y= 15.45 - 0.47 X; Y= 12.28 - 0.35 X) with unit increase in relative humidity and rainfall. This effect has been extensively studied by Tripathi (2017).

The data of results of the technology trials and local check on pigeonpea given in Table 3 indicates that wilt incidence reduced from 6.3 to 0.84 per cent, number of pod borer larvae 1.95 to 0.87 per plant and grain damage by pod fly from 28.3 to 7.1 per cent in comparison to the local check. The seed yield under the trial was recorded to be 2514 kg/ha over check plot (610 kg/ha). The increase in seed yield was 312 percent which largely attributed to transplanting technique and the IPM practices adopted in the experimentation. The B:C ratio in the trial was recorded to be 9.79 which was quite high over the local check (2.68). Many researchers reported integrated pest management package (wilt resistant variety with seed treatment, installation of pheromone trap and spray of endosulphan) reduced the wilt disease as well as pod borer incidence in pigeonpea effectively (Agrawal *et al.,* 2003; Rao and Reddy, 2003). It was reported that dimethoate effectively controlled the pod fly in pigeonpea (Shrivastava and Mahapatra, 2003).

Table.1 Meteorological data *vs.* disease/pest incidence in pigeonpea

Date of observation	Meteorological data				Disease/Pest incidence		
	Max. Temp. (^{0}C)	Min. Temp. (^{0}C)	R.H. (%)	Rainfall (mm)	Phytopthora Blight (per cent)	Wilt (per cent)	Pod borer (Larvae /plant)
15 July	29.5	18.7	75.0	143.5	1.09	0.0	0.0
2 Aug	32.8	19.6	76.5	217.8	4.12	0.0	0.0
18 Aug	31.5	19.3	79.3	204.7	3.38	0.0	0.0
4 Sept	29.8	18.9	84.0	237.4	1.41	0.0	0.0
25 Sept	32.4	19.7	86.5	83.5	0.435	0.26	0.0
10 Oct	34.3	17.2	76.0	6.0	0.361	0.31	0.04
25 Oct	33.7	16.5	79.0	0.0	0.0	1.17	0.08
10 Nov	31.7	13.5	60.7	0.0	0.0	0.84	0.87
25 Nov	30.5	12.0	73.5	3.2	0.0	0.31	0.51
11 Dec	28.1	7.1	63.0	0.0	0.0	0.58	0.68

Table.2 Correlation between meteorological parameters and disease/pest incidence

Variables	Phytophthora blight	Wilt	Pod borer
Maximum temperature	- 0.746*	0.486	0.148
Minimum temperature	-0.537	0.238	-0.893
Relative humidity	0.251	0.109	-0.952*
Rainfall	0.714*	-0.764*	-0.679*

*Significant at 5%

Table.3 Disease, pest incidence and yield under field trials and farmer's practice in pigeonpea

Treatments	Wilt incidence (per cent)	Pod Borer (No. per plant)	Grain damage by pod fly (per cent)	Yield (Kg/ha)	Increase in yield (per cent)	B : C ratio
Trial: transplanting of 30 days old saplings of pigeon pea cv. TJT 501, application of *Trichoderma viridae* @ 2.5 kg/ha, Seed treatment with Carbendazim @ 2 g/kg, Pheromon trap – 10 Nos/ha, Spray of profenophos 50 EC @ 1.5 L/ha at pre-flowering stage followed by dimethoate 35 EC @ 0.75 L/ha at pod formation stage	0.84	0.87	7.1	2514	312.0	**9.79**
Farmer's practice: direct sowing of TJT 501 on flat bed, Spray of trizophos 40 EC at insect appearance	**6.7**	**1.95**	**28.3**	**610**	--	**2.68**

On the basis of above findings it may be concluded that phytophthora blight disease positively correlated with rainfall and humidity as occurred at initial stage in humid condition after heavy rains, however, wilt disease had positive correlation with temperature and humidity. Pod borer incidence was closely associated with maximum temperature but negatively with minimum temperature and it observed at later stage. Thus the IPM practices may be taken care of these conditions and stages to minimize the loss due to occurrence of the above diseases and pests.

References

Agrawal, S.C., Singh, K.J. and Tripathi, A.K. 2003. Integrated pest management in pigeonpea. Indian J. Agril. Sci. 73:291-295.

Agrawal, S.C. and Khare, M.N. 1987. Development of stem blight of pigeonpea in relation to environmental factors. Indian J. Mycol. Pl. Pathol. 17:305-309.

Chhetry, G.K.N. and Ranjana Devi, T. 2014. Wilt epidemiology of pigeonpea *(Cajanus cajan* L. Millsp) in organic farming system. IOSR J. Agri. Vet. Sci. 7:1-6.

Goyal, S.N., Patel, B.S. and Nizoma, J.R. 1991. Response of pigeonpea to fusarium wilt and insect pest. International Pigeonpea Newsletter 14:17-19.

Panse, V.G and Sukhatme, P.V. 1985. Statistical methods for agricultural workers, Indian Council of Agricultural Research New Delhi. pp. 87-89.

Rao, M.S. and Reddy, K.D. 2003. IPM of pod borers in long duration pigeonpea. Annals Pl. Protect. Sci. 11:26-30.

Reddy, M.V., Sharma, S.B. and Nene, Y.L. 1990. Pigeonpea disease management. In: The pigeonpea. A CAB International, Wallingford, Oxon, U.K., Y. L. Nene, SD Hall and VK Sheila (Ed) publication. pp. 303-307.

Shrivastava, C.P. and Mahapatra, S.D. 2003. Efficacy and economics of insecticides along with NSKE against pigeonpea pod fly and pod bug. Annals Pl. Protect. Sci. 11:143-145.

Singh, A.P. and Bhargava, S.N. 1981. Survival studies on three species of *Fusarium* causing wilt of pigeonpea. Phytopathologische Zetschrift. 100:300-311.

Tripathi, A.K. 2017. Impact of weather parameters on pod borer, phytophthora blight and wilt incidence in pigeonpea and their management. Journal of Entomology and Zoology Studies. 5:400-402.

How to cite this article:

Singh, A.K. and Tripathi, A.K. 2019. Relationship of Weather with Disease and Pest Incidence in Pigeonpea and its Effect on Production in Vindhya Plateau. *Int.J.Curr.Microbiol.App.Sci.* 8(11): 2231-2235. doi: https://doi.org/10.20546/ijcmas.2019.811.260