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Ashish Kumar Tripathi
Scientist (Plant Protection)
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Krishi Vigyan Kendra, Bhopal Road, Sagar, Madhya Pradesh, India

Correspondence
Ashish Kumar Tripathi
(Plant Protection)
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Krishi Vigyan Kendra, Bhopal Road, Sagar, Madhya Pradesh, India

Impact of weather parameters on pod borer, phytophthora blight and wilt incidence in Pigeonpea and their management

Ashish Kumar Tripathi

Abstract
Pigeon pea (*Cajanus cajan* [L.] Millspaugh) is the second most important pulse crop in India. Weather conditions play a predominant role in determining the course and severity of pest incidence. The present investigation was therefore aimed to analyse the relationship between weather parameters and insect pest and disease incidence in Pigeonpea. The Phytophthora blight appeared in the last week of July after heavy rains where maximum temperature was 32.5 and relative humidity was 78.5 per cent and show maximum mortality when continuous draggling up to 3-4 days. The wilt disease incidence initiated with the flowering of Pigeonpea in the last of October and continuously/gradually increased with the scarcity of moisture in the soil. The maximum incidence of pod borer was found in the second week of November when the temperature was 34.4 and relative humidity was 61.5 per cent. Results of field demonstration showed reduced wilt incidence from 16.3 to 5.3 per cent, number of pod borer larvae from 1.6 to 0.9 per plant and grain damage by pod fly from 21.6 to 13.4 per cent in IPM technology which ultimately increased the yield of pigeonpea 790 kg/ ha to 980 kg/ha over farmer practice.

Keywords: Pigeonpea, Weather Parameters, IPM

Introduction
Pigeon pea (*Cajanus cajan* [L.] Millspaugh) is an important legume crop belonging to the Fabaceae family. It is a highly nutritious and very important grain legume of the tropical and sub-tropical regions of the world. It is the second most important pulse crop in India after chickpea. It has multiple uses and occupies an important place in the prevailing farming systems in the country and vegetarian diet. It also plays an important role in sustainable agriculture by enriching the soil through biological nitrogen fixation along with deep root system of this crop which makes it more suitable for its cultivation under rainfed conditions [1]. It is a short-lived perennial shrub grown either as an annual or perennial. The green seeds serve as vegetables and the dry grains serve as food for humans and livestock. In Madhya Pradesh, a leading state of pulse production, pigeonpea occupies /contributing 15 Per cent of total production of 45 million tons in the area of 4,60,000 hectare. The Pigeonpea crop is being cultivated in *kharif* season in about 42500 ha area under rainfed conditions in the Chhatarpur and Sagar districts of Bundelkhand region of Madhya Pradesh. Irregular distribution of rains, sometimes it occurs heavily, but almost it is short up to 50-60 per cent with normal precipitation the productivity of pigeonpea continuous to be lower. Another factor is the infestation of insect pest and diseases in changing climate situations. Damage caused by insect pests as a major factor responsible for low crop yield where several insect pests attack from the seedling stage until harvest [2,3].
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 [4, 5] . Weather conditions play a predominant role in determining the course and severity of pest incidence, the information on this aspect of Pigeonpea pest (Phytophthora blight, wilt and pod borer) is limited. The present study was undertaken to establish the relationship between pest incidence and weather parameters.

Materials and Methods
The experiment was conducted at Instructional farm of Krishi Vigyan Kendra, Nowgong, Chhatarpur. Each plot consisted of 3 meter long rows 60 cm apart.

The plant to plant distance was maintained at 10 cm. Pigeonpea variety ICPL 87119 was sown in the first week of July with recommended agronomical practices like fertilizers, weeding, irrigation etc. Disease progress was recorded at fortnightly intervals in randomly selected 100 plants per plot. The weather data (maximum and minimum temperature, relative humidity, rainfall) was recorded and statistically analysed for calculating the correlation between incidence between disease / insect and weather parameters [6].

To overcome the problems of insect pests and diseases in Pigeonpea, demonstrations on IPM package was conducted at 10 farmers field. Medium duration variety of Pigeonpea ICPL 87119, soil application of *Trichderma viride* 2.5 kg/ ha with FYM for control of soil borne fungi (Phytophthora, Fusarium), seed treatment with carbendazim @ 2 g/kg, installation of pheromone trap for catching of adult of pod borer @ 10/ ha, spray of quinolphos 20 EC 1.0 lit/ha at pre-flowering stage in the last of October followed by dimethoate after 20 days of first spray. In the same area near demonstration farmers practices was maintained as control plot (Variety ICPL 87119, Spray of Trizophos at insect appearance). Observation on the number of phytophthora blight and wilt affected plants were recorded periodically. Observation on the number of *Helicoverpa armigera* per plant were recorded at the peak period of incidence, while grain damage caused by pod fly was recorded 7 days before harvest of the crop on randomly selected 100 pods of Pigeonpea from each plot.

Results and Discussion

Meteorological observation (Table-1) indicated that the minimum / maximum temperature, relative humidity and rainfall play an important role in the development of disease and insect population in Pigeonpea. The Phytophthora blight appeared in the last week of July after heavy rains where maximum temperature was 32.5 and relative humidity was 78.5 per cent. The maximum intensity of Phytophthora blight occurred at continuous draggling up to 3-4 days. The wilt disease incidence initiated with the flowering of Pigeonpea in the last of October and continuously/gradually increased with the scarcity of moisture in the soil. Incidence of pod borer, a key pest of Pigeonpea starts from the first week of October and continuously up to harvest of the crop. Maximum incidence was found in the second week of November when the maximum temperature was 34.4 and relative humidity was 61.5 per cent.

The relationship of phytophthora blight disease with minimum and maximum temperature exhibited negative correlation but in case of minimum temperature the correlation was not significant. Maximum temperature showed 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 showed positive association with disease intensity but in case of rainfall the correlation was significant (0.703) which revealed that phytophthora blight disease increased with corresponding increase in rainfall (Y= -2.86 + 0.18 X). The maximum and the minimum temperature had a negative correlation with disease index of phytophthora blight though it was not significant statistically [4].

Incidence of wilt disease shows a positive correlation with maximum/minimum temperature and relative humidity but not significant. Earlier studies also showed that the temperature is one of the important factors which favor the development of wilt disease [7, 8]. The relationship of wilt disease with rainfall was negative and significant (-0.776) showed that disease incidence increase with the decrease in rainfall which ultimately related to soil moisture. Decreased rate of rainfall favoured the disease occurrence at the rate of 0.84 (Y=1.56 – 0.87 X). The wilt disease incidence and disease severity highly significant and negative correlation coefficient with rainfall [9].

Pod borer incidences in pigeonpea were positively associated with maximum temperature and negatively with minimum temperature but both are non-significant. Pod borer incidence was negatively and significantly correlated with relative humidity (-0.985) and rainfall (-0.691) 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 a unit increase in relative humidity and rainfall. The maximum temperature had a positive correlation with build-up of the pest population while the minimum temperature, relative humidity and rainfall had the negative correlation with gram pod borer [6].

The data of results shown in table-3 indicate that IPM package in Pigeonpea reduced wilt incidence from 16.3 to 5.3 per cent, number of pod borer larvae 1.6 to 0.9 per plant and grain damage by pod fly from 21.6 to 13.4 per cent which ultimately increased the yield 790 kg/ ha to 980 kg/ha and B:C ratio from 3.95 to 4.35 in comparison to farmer practice. Integrated pest management package (Wilt resistant variety JA 4 with seed treatment, installation of 20 pheromone trap and spray of Endosulphan 35 EC followed by Dimethoate) reduced the wilt disease as well as pod borer incidence in Pigeonpea effectively [10, 11]. Spray of Dimethoate in Pigeonpea at pod filling stage given best management of pod fly with higher yield [12].

Table 1: Meteorological data and pest incidence in Pigeonpea (Mean of two years)

Date of observation	Meteorological data				Pest incidence		
	Max. temp.	Min. Temp.	R.H. (%)	Rainfall (mm)	Phy. Blight (%)	Wilt (%)	Pod borer (Larvae /plant)
15 July	32.5	18.6	78.5	216.4	1.17	0.0	0.0
2 Aug	28.0	19.1	80.0	111.6	4.11	0.0	0.0
18 Aug	31.9	19.7	81.5	231.9	3.35	0.0	0.0
4 Sept	29.6	19.4	87.0	259.4	1.11	0.0	0.0
25 Sept	32.3	19.4	88.8	42.2	0.468	0.26	0.0
10 oct	36.8	17.2	76.0	0.0	0.351	0.31	0.02
25 oct	33.7	16.5	83.0	0.0	0.0	1.18	0.06
10 Nov	34.4	11.5	61.5	7.8	0.0	0.81	0.84
25 Nov	34.7	10.0	73.5	0.0	0.0	0.29	0.54
11 Dec	29.1	7.1	67.0	0.0	0.0	0.54	0.62

Table 2: Correlation between meteorological parameters and pest incidence

Variables	Phytophthora blight	Wilt	Pod borer
Maximum temperature	- 0.732*	0.498	0.154
Minimum temperature	-0.578	0.240	-0.904
Relative humidity	0.244	0.112	-0.985*
Rainfall	0.703*	-0.776*	-0.691*

Significant at 5%

Table 3: Results of field demonstration of IPM in pigeonpea

Treatments	Wilt incidence (%)	Pod Borer (No. per plant)	Grain damage by pod fly (%)	Yield (Kg/ha)	Increase in yield (%)	B : C ratio
IPM Technology	5.7	0.90	13.6	980	24.0	4.35
Farmers practice	16.3	1.6	21.4	790	--	3.95

Conclusion

Weather parameters plays important role in the severity of pest and disease incidence in Pigeonpea. Good agricultural practices with IPM given better results in controlling pest and disease in Pigeonpea. The results from the trails clearly brought out the potential of IPM technology for Pigeonpea cultivation in Madhya Pradesh. Therefore, the participatory programme of demonstrations could convince the farmers to use IPM technology on account of its obvious advantages and minimize farmer's problem, improve decision-making and innovativeness to modify their farming practices.

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