Research Article

INCIDENCE AND DAMAGE SEVERITY OF POD BORERS COMPLEX IN PIGEONPEA

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Abstract: The present findings of Helicoverpa male moths trapped in pheromone trap indicated that the activity of moths was found to be more or less during 36th to 52nd MW *i.e.*, September to December. Maximum population of Helicoverpa was trapped during the second week of December (50th MW). All the weather parameters were negatively correlated with Helicoverpa male moth catches. However, the significantly high degree of negative correlation with the population of moths and minimum temperature and evening relative humidity was observed during the period of study.

Keywords: Helicoverpa, male moth, correlation

Introduction

India is a leading producer of pigeonpea, its productivity has not been improved significantly during the last decades due to its susceptibility to insect pests and narrow genetic base. The main area of pigeonpea cultivated in Maharashtra, Uttar Pradesh, Karnataka, Madhya Pradesh and Gujarat. In India pigeonpea grown on nearly 111.9 lakh hectors with production of 6.05 lakh tones. Among the several factor responsible for low yields of pigeonpea, insect pests are major limiting factors. It is damaged by about 300 species of insect pests infesting at various growth stages [6]. In this crop major threats are posed by insect pests feeding on buds, flowers and pods and grains. The gram pod borer, *Helicoverpa armigera* (Hubner) (Noctuidae: Lepidoptera), Plume moth, *Exelastis atomosa* (Walshingham) (Pterophoridae : Lepidoptera) and pod fly, *Melanagromyza obtusa* (Malloch) (Agromyzidae: Diptera) are collectively called pod borers, are the great significance because they inflict direct damage to the developing grains and pods. The damaged grain become unfit for consumption and the yields are drastically affected. Out of these pod borers, *H. armigera* is a polyphagous lepidopteran insect present throughout the year and can its life cycle up to seven generations in a year under favorable conditions (1) and others are predominantly observed on pigeonpea crop. *M. obtusa* is a monophagous species and cause destruction to the developing seeds of pigeonpea crop. Farmers have become reluctant to cultivate Pigeonpea due to its susceptibility to pod borer complex. It is essential to find out the incidence, population fluctuation and damage severity of the pest for developing in IPM approach. So, the work was conducted to study the seasonal incidence, population fluctuation and damage severity of pod borer complex for developing its management package.

Materials and Method

The experiment on seasonal incidence of pod borers on pigeonpea were carried out at Pulses Improvement Project, MPKV, Rahuri with variety Vipula having four rows of 4 m length in a randomized block design.

Method of recording Helicoverpa moths through pheromone trap

The monitoring of Helicoverpa male moth population was carried out from the month of August, 2013 (31th Meteorological Week) to last week of December, 2013 (52nd MW) with the help of sex pheromone trap.

The trap was installed in the experimental field of pigeonpea on August 1, 2013 at Pulses Improvement Project, MPKV, Rahuri. The Helicoverpa male moths were attracted towards pheromone rubber septum and lodged in funnel of trap unit were collected in the polythene bag. The rubber septum was changed after every 21 days. The count of moths trapped was taken at a weekly interval. After each count the collected moths in the polythene bag were destroyed and the trap was made free from moths so as to record freshly attracted moths up to subsequent observations.

Recording of weather parameters

In order to study the influence of abiotic factors *viz.*, temperature (maximum and minimum), relative humidity (morning and evening), rainfall on the incidence of pod borers and the population of Helicoverpa moths trapped in pheromone trap. The weekly meteorological data were obtained from the Meteorological Observatory located at the Central Campus of MPKV, Rahuri. The correlation coefficient (r) was worked out between seasonal incidence and the population of male moths trapped with meteorological parameters.

Statistical analysis of the data

The data was obtained on the seasonal incidence pod borers, Helicoverpa moth catches trapped in pheromone trap, screening of germplasms against pod borers and influence of physico-chemical characters on pod damage and subjected to statistical analysis after suitable transformations for interpretation of the results.

Result and Discussion

Seasonal incidence of pod borers on pigeonpea

Observations on seasonal incidence of pests *viz.*, *H. armigera*, *E. atomosa*, *M. vitrata* and *M. obtusa* were recorded at each meteorological week (MW) on the pigeonpea crop variety 'Vipula'. The weekly data on pest incidence and corresponding weekly data on meteorological parameters *viz.*, temperature (°C), relative humidity (%) and rainfall (mm) for the period of August 2013 to December 2013 are presented in [Table-1]. The correlation coefficient ('r' values) between pest incidence and meteorological parameters are indicated in the [Table-4].

Table-1 Incidence of pod borers on pigeonpea with corresponding meteorological data for the period of August 2013, to December, 2013

Meteorological week	Pod borers larvae/5 plants			Pod damage by *M. obtuse / 50 pods*	Weather parameters				
	Helicoverpa armigera	*Exelastis atomosa*	*Maruca vitrata*		Temperature (⁰C)		Relative humidity(%)		Rainfall (mm)
					Maximum	Minimum	Morning	Evening	
August									
31	0	0	0	0	28.20	21.90	81.00	70.50	0
32	0	0	0	0	29.57	21.85	78.71	64.00	0
33	0	0	0	0	30.34	22.10	78.14	59.00	0
34	0	0	0	0	29.20	21.82	78.70	63.80	0
35	0	0	0	0	31.40	20.40	78.20	50.00	0
September									
36	0	0	0	0	32.31	19.72	79.20	49.10	0
37	0	0	0	0	31.40	22.02	81.71	62.70	0
38	0	0	0	0	29.60	21.50	83.70	60.50	0
39	0	0	0	0	30.50	21.10	80.00	56.00	0
October									
40	0.2	0	0	0	31.90	21.20	81.80	58.00	0
41	0.2	0	0.2	0	31.10	19.90	77.10	57.10	0
42	0.8	0	0.8	0	32.02	20.12	66.28	46.00	0
43	1.2	0.4	1.2	0	31.20	19.60	58.70	55.71	0
44	1.0	0.2	1.4	0	31.38	16.85	63.28	47.71	0
November									
45	1.4	0	0.2	0	30.62	14.61	65.00	35.57	0
46	3.0	0.6	0	0	25.82	12.42	60.42	30.71	0
47	3.1	0.8	0	3.0	30.97	13.57	67.85	36.57	41.80
48	3.5	3.0	0	0	29.35	16.85	75.14	54.00	0
December									
49	4.0	4.0	0	4.0	28.94	13.50	72.28	38.14	0
50	1.4	4.1	0	1.0	28.72	7.40	74.57	25.57	0
51	1.4	3.2	0	1.0	29.54	9.65	55.57	28.14	0
52	1.0	6.0	0	5.0	29.15	13.87	67.37	29.87	0

Table-2 Correlation coefficient (r) between the incidence of pod borer on pigeonpea and meteorological parameters

Pests	Coefficient of correlation (r)				Rainfall (mm)
	Weather parameters				
	Temperature (⁰C)		Relative humidity (%)		
	Maximum	Minimum	Morning	Evening	
Helicoverpa armigera	-0.4174	-0.7209**	-0.5741**	-0.6283**	0.3481
Exelastis atomosa	-0.3914	-0.7163**	-0.3097	-0.6513**	-0.0267
Maruca vitrata	-0.3385	-0.3813	-0.4101	-0.3882	-0.1130
Melanagromyza obtusa	-0.2050	-0.5123*	-0.2427	-0.5507**	0.3685

**Significance level at 0.05 % (0.423), *Significance level at 0.01 % (0.537)*

H. armigera

The data revealed that the incidence of *H. armigera* was noticed from the month of October. The pest was found in the range of 0.00 to 4.0 larvae/5 plants. The maximum incidence of larvae was recorded on first week of December *i.e.* 49th meteorological week (MW) with the corresponding meteorological parameters *viz.*, maximum temperature (°C) and minimum temperature (°C), morning RH (%), evening RH (%) and rainfall (mm) were 28.94, 13.50, 72.28, 38.14 and 0.00, respectively. The larval population during first week of October to first week of December showed increasing trend (0.2 to 4.0) larvae/ 5 plants, thereafter it showed decreasing trend up to last week of December (1.4 to 1.0) larvae/5 plants. Significantly negative correlation was found between weather parameters *viz.*, minimum temperature (°C) and morning and evening RH (%), while other meteorological parameters did not significantly influence the incidence of this pest. The present findings *H. armigera* on pigeonpea are in accordance with the result of [4] who reported incidence of *H. armigera* was first noticed in the middle of October and reached its peak in the beginning of December and declined after second week of December. The similar results also reported by [8] who revealed that pest incidence at pod maturity stage in September/ October 1999. And also [13] revealed that the seasonal incidence of *H. armigera* started from the beginning from bud stage to till pod maturation stage. The present findings are contradictory with results of [11] who reported the significant correlation between both maximum and minimum temperature and *H. armigera* incidence in chickpea. The correlation coefficient of relative humidity was r = -0.66 and rainfall was positive but non- significant.

E. atomosa

The incidence of *E. atomosa* was noticed from the month of October. The pest population was found in the range of 0.00 to 6.0 larvae/5 plants. The maximum incidence of 6.0 larvae/ 5 plants recorded on last week of December *i.e.*, 52nd meteorological week with the corresponding meteorological parameters *viz.*, maximum temperature (°C) and minimum temperature (°C), morning RH (%), evening RH (%) and rainfall (mm) were 29.15, 13.87, 67.37, 29.87 and 0.00, respectively. The larval population during second week of November to second week of December showed increasing trend (0.6 to 4.10) larvae/ 5 plants; thereafter it is decreased in third week of December and again increased in last week of same month (6.00). Significantly negative correlation was found between climatic parameters *viz.*, minimum temperature (°C) and morning and evening RH (%), while other meteorological parameters did not significantly influence the incidence of this pest. The present findings agree with [3] who reported the *E. atomosa* was highest peak active from 2nd week of November with the peak activity was recorded in the last week of December. The present findings are contradictory with [7] they found that peak incidence of *E. atomosa* observed during third week of November.

M. vitrata

The incidence of *M. vitrata* was noticed from 41st meteorological week *i. e.* 2nd week of October. The pest population was found in the range of 0.00 to 1.4 larvae/5 plants. The maximum incidence of 1.4 larvae/ 5 plants was recorded on last week of October.

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Table-3 Helicoverpa male moth catches and meteorological data from August, 2013 to December, 2013

Meteorological week	*Helicoverpa* moths catches/trap/week	Weather parameters				
		Temperature (⁰C)		Relative humidity (%)		Rainfall (mm)
		Maximum	Minimum	Morning	Evening	
August						
31	0	28.20	21.90	81.00	70.50	0
32	0	29.57	21.85	78.71	64.00	0
33	4	30.34	22.10	78.14	59.00	0
34	0	29.20	21.82	78.70	63.80	0
35	0	31.40	20.40	78.20	50.00	0
September						
36	8	32.31	19.72	79.20	49.10	0
37	0	31.40	22.02	81.71	62.70	0
38	6	29.60	21.50	83.70	60.50	0
39	2	30.50	21.10	80.00	56.00	0
October						
40	4	31.90	21.20	81.80	58.00	0
41	2	31.10	19.90	77.10	57.10	0
42	7	32.02	20.12	66.28	46.00	0
43	8	31.20	19.60	58.70	55.71	0
44	10	31.38	16.85	63.28	47.71	0
November						
45	8	30.62	14.61	65.00	35.57	0
46	4	25.82	12.42	60.42	30.71	0
47	4	30.97	13.57	67.85	36.57	41.80
48	2	29.35	16.85	75.14	54.00	0
December						
49	2	28.94	13.50	72.28	38.14	0
50	39	28.72	7.40	74.57	25.57	0
51	7	29.54	9.65	55.57	28.14	0
52	4	29.15	13.87	67.37	29.87	0

Table-4 Correlation coefficient (r) between Helicoverpa male moth catches trapped in pheromone trap and meteorological parameters

Weather parameters	Coefficient of correlation (r)
Maximum temperature	-0.0766
Minimum temperature	-0.6028**
Morning relative humidity	-0.1920
Evening relative humidity	-0.5226*
Rainfall	-0.0413

**Significance level at 0.05 % (0.423), *Significance level at 0.01 % (0.537)

The corresponding meteorological parameters *viz*., maximum temperature (°C) and minimum temperature (°C), morning and evening RH (%) and rainfall (mm) were 31.38, 16.85, 63.28, 47.71, and 0.00, respectively. Negatively non-significant correlation was found between all climatic parameters. The present findings are in accordance with the (15) revealed that the correlation coefficient between population of *M. testulalis* and weather parameters. Minimum temperature showed negative correlation, rests of the parameters were non-significant and negatively correlated. The present findings are not in agreement with the [13] they found that *M. testulalis* commenced during first week of September and reached peak during second week of October whereas it exhibited positive non-significant relationship with rainfall, significantly positive correlation with maximum temperature and shown significantly negative correlation with relative humidity.

M. obtusa

The incidence of *M. obtusa* was noticed from 47th meteorological week *i.e.* 2nd week of November. The pod damage was found in the range of 0 to 5 per cent. Highest pod damage (5%) was recorded on last week of December. The corresponding meteorological parameters *viz*., temperature (°C) (maximum and minimum), relative humidity (%) (morning and evening) and rainfall (mm) were 29.15, 13.87, 67.37, 29.87 and 0.00, respectively. Significantly negative correlation was found between weather parameters *viz*., minimum temperature and relative humidity (evening), while other meteorological parameters did not significantly influence the incidence of this pest. The present findings are in accordance with (12) revealed that the pod fly infestation in medium and late duration varieties from December to March. The present findings are not in agreement with (5) they found that *M. obtusa* active during September and October.

Trap studies on Helicoverpa moths through pheromone trap

The data on Helicoverpa male moths trapped in the pheromone trap and meteorological data are presented in [Table-5]. The correlation coefficient ('r' values) between the weekly trapped catches of Helicoverpa and meteorological parameters are indicated in the [Table-6]. The data recorded from the month of August, 2013 to December, 2013. There was not recorded constant increase or declined trapped of moths during the present study. Number of Helicoverpa male moths found in the range of 0 to 39. The highest (39) numbers of male moths trapped in pheromone trap during 50th meteorological week *i.e.*, second week of December with corresponding meteorological parameters *viz*., maximum and minimum temperature (°C), morning and evening RH (%) and rainfall were 28.72, 7.40, 74.57, 25.57 and 0.00, respectively and rate was decreased up to last week of December. Significantly negative correlation was found between weather parameters *viz*., minimum temperature and relative humidity (evening), while other meteorological parameters did not significantly influence the population of Helicoverpa moth catches.

Application of research: The present findings are in accordance with the [10] who found that peak of Helicoverpa on 50th SW at Raichur and minimum temperature recorded highly significant negative correlation similarly [9] also where they found, a significant negative correlation was evident with minimum temperature during 2005 whereas the contrast results reported by [14] found Helicoverpa moth catches were increasing from 4th week of December.

Research Category: Pod Borers Complex

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