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Seasonal incidence of spotted pod borer, *Maruca vitrata* (Geyer) on pigeonpea

SJ Shejulpatil, SR Kulkarni, AP Chavan, NS Kute and AB Tambe

Abstract
The present investigation entitled "Seasonal incidence of spotted pod borer, *Maruca vitrata* (Geyer) on pigeonpea" were carried out to observe the incidence of spotted pod borer on pigeonpea variety ICPL 87 revealed that the infestation the pest incidence commenced from 2nd week of August and the active population of spotted pod borer, *M. vitrata* on pigeonpea crop observed during flowering and pod development season. The correlation studies between the seasonal incidence of spotted pod borer, *M. vitrata* population and per cent pod damage with weather parameters revealed that maximum temperature and bright sunshine had significantly positive correlation with mean number of *M. vitrata* webs/plant and per cent pod damage respectively whereas morning relative humidity had significantly negative correlation with per cent pod damage.

Keywords: Seasonal incidence, *Maruca vitrata*, pigeonpea, weather parameters

Introduction

Pulses are a wonderful gift of nature. They provide nutrition to human beings and animals. Their importance as a source of protein for masses in India is well recognized and therefore, their production and availability assume special significance for the nutritional security of the people. Protein mal-nutrition is widespread among poor of developing and under developed countries. Since animal protein is beyond the reach of this group, their primary protein supply comes from plant based products. Amongst these, pigeonpea or red gram (*Cajanus cajan* (L.) Millspaugh) is an important food legume that can be grown under rainfed conditions with least inputs. Pigeonpea is rich in starch, protein, calcium, manganese, crude fiber, fat, trace elements, and minerals. Besides its high nutritional value, pigeonpea is also used as traditional folk medicine in India, China, Philippines and some other nations (Saxena *et al.*, 2010) [10].

Though 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. 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 (Lal, 1998) [5]. 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* (Walshinghan) (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 spotted pod borer, *Maruca vitrata* (Geyer) (Crambidae: Lepidoptera) is also the main limiting factor in production of pigeonpea. It feeds on reproductive parts of pigeonpea i.e. on buds, flowers, pods, seeds. The pigeonpea varieties which flushes only once are more prone to damage by spotted pod borer, *Maruca vitrata.*

In pigeonpea, incidence and loss in grain yield by *M. vitrata* also varies between seasons and locations (Dharmasena *et al.*, 1992; Patel and Singh, 1977; Patnaik *et al.*, 1986; Vishakantaiah and Jagadeesh Babu, 1980) [3, 7, 8, 17]. To determine the effect of abiotic factors like, maximum temperature (ºC), minimum temperature (ºC), rainfall (mm), morning relative humidity (per cent), evening relative humidity (per cent), bright sunshine hours (hrs), wind speed (Km/hr) and evaporation (mm) on seasonal occurrence of spotted pod borer, *Maruca vitrata* under field conditions, therefore the attempts were made to carried out the seasonal incidence and correlation study for two consecutive years (2017-18 and 2018-19) at Post Graduate Research Farm, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.

Materials and Methods

Experimental details

The experiment was laid out in randomized block design (RBD replicated thrice on the field of Post Graduate Research Farm, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra during Kharif 2017 and 2018. The pigeonpea variety ICPL 87 (Pragati) was sown during first season (June, 2017 to December, 2017) and second season (June, 2018 to December, 2018). Sowing was done in last week of June with 3.60 x 3.00 m2 plot size and 45 cm x 10 cm spacing and all agronomical practices recommended by MPKV, Rahuri were adopted except plant protection measures.

Method of recording observations

The observations on the incidence of spotted pod borer (*M. vitrata*) were initiated when the pest appeared in the field till crop maturity. The webs of spotted pod borer (*M. vitrata*) were recorded at weekly intervals from the 5 tagged plants from each plot per replication.

Meteorological data

The meteorological data of June 2017 to December 2017 and June 2018 to December 2018 have been procured from Interfaculty Department of water management, MPKV, Rahuri, Ahmednagar (M.S.).

Correlation studies

The seasonal population of spotted pod borer (*M. vitrata*) was correlated with the meteorological weather parameters *viz*., maximum temperature (Max T), minimum temperature (Min T), rainfall (mm), morning relative humidity (RH1), evening relative humidity (RH2), bright sunshine hours (BSS), wind speed (WS) and evapo-transpiration (EP) using standard statistical procedure as suggested by Steel and Torrie, (1980)[16] to find out the specific impact of above mention weather parameters on spotted pod borer (*M. vitrata*) on pigeonpea crop.

Result

Seasonal incidence of spotted pod borer, *Maruca vitrata* (Geyer) on pigeonpea during *Kharif*, 2017

The incidence of spotted pod borer, *M. vitrata* on pigeonpea crop presented in Table 1. The data indicated that the pest incidence commenced from 33rd standard meteorological week i.e. 2nd week of August with 1.24 webs/plant and the spotted pod borer *M. vitrata* population ranged between 0.23 to 9.88 webs/plant during the crop growth period. The active population of spotted pod borer, *M. vitrata* on pigeonpea crop observed during flowering and pod development season i.e. from 1st week of September (3.92 webs/plant) to 2nd week of November (8.65 webs/plant). There were four peaks of *M. vitrata* population during the crop growth period, first peak observed at 37th standard meteorological week with 5.96 webs/plant, second peak was observed at 40th standard meteorological week i.e. 1st week of October with 7.86 webs/plant, third peak was observed at 43th standard meteorological week i.e. 4th week of October with 9.28 webs/plant and fourth peak observed at 1st week of November i.e. 45th standard meteorological week with 9.88 webs/plant. *M. vitrata* population decreased from 47th standard meteorological week with 2.64 webs/plant and reached 0.58 webs/plant at last week of December i.e. 52nd standard meteorological week by the end of kharif season.

The per cent pod damage 37.94 recorded on 40th standard meteorological week with 7.86 webs/plant. The per cent pod damage ranges between 1.06 and 54.63 during entire crop growth period. There were three peaks of per cent pod damage during entire crop growth period, the first peak was observed at 40th standard meteorological week i.e. 2nd week of October with 30.10 per cent pod damage, the second peak was observed at 43th standard meteorological week i.e. 4th week of October and third peak was observed at 45th standard meteorological week i.e. 1st week of November with 54.63 and 45.63 per cent pod damage.

Seasonal incidence of spotted pod borer, *Maruca vitrata* (Geyer) on pigeonpea during *Kharif*, 2018

The data pertaining to the incidence of spotted pod borer, *M. vitrata* on pigeonpea crop was presented in Table 2. The data indicated that the pest incidence commenced from 33rd standard meteorological week i.e.2nd week of August with 0.40 webs/plant and the spotted pod borer *M. vitrata* population ranged between 0.40 to 8.17 webs/plant during the crop growth period. The active population of spotted pod borer, *M. vitrata* on pigeonpea crop recorded from 38th standard meteorological week (3.67 webs/plant) to 48th standard meteorological week (7.45 webs/plant). The population gradually reached peak, the first peak observed at 4th week of September (i.e. 39th standard meteorological week) with 5.52 webs/plant and the second peak with 8.17 webs/plant observed in 44th standard meteorological week i.e. 5th week of October and the last peak observed in 3rd week of November (i.e. 47th standard meteorological week) with 7.55 webs/plant. Later the *M. vitrata* population decreased by the end of the kharif season from 49th standard meteorological week with 4.67 webs/plant reaching 0.93 webs/plant at 52nd standard meteorological week i.e. from 1st week to 4th week of December.

The per cent pod damage 10.86 appeared on 40th standard meteorological week with 3.98 webs/plant and two peaks of per cent pod damage observed, first peak observed at 44th standard meteorological week with 40.02 per cent pod damage and highest number of webs/plant i.e. 8.17 and 2nd peak observed at 46th standard meteorological week with 41.12 per cent pod damage. The per cent pod damage was between 4.88 to 41.12 during entire crop growth period.

Correlation relationship of weather parameters with incidence of *M. vitrata* and per cent pod damage on pigeonpea during *Kharif* 2017 and 2018

The correlation studies between the seasonal incidence of spotted pod borer, *M. vitrata* population and per cent pod damage with weather parameters in Table 3 during *Kharif* 2017 revealed that maximum temperature (r = 0.5802) and (r = 0.4341) and bright sunshine (r = 0.5503) and (r = 0.5561) had significantly positive correlation with mean number of *M. vitrata* webs/plant and per cent pod damage respectively. Morning relative humidity (r = -0.6107) had significantly negative correlation with per cent pod damage whereas wind velocity (-0.2533) had significantly positive correlation with mean number of *M. vitrata* webs/plant. There were negative correlation observed in mean number of *M. vitrata* webs/plant and per cent pod damage with abiotic factors like, minimum temperature (r = -0.0610) and (r = -0.2507), evening relative humidity (r = -0.0878) and (r = -0.4311) and rainfall (r = -0.2533) and (r = -0.3052), respectively. Morning relative humidity (r = -0.1576) and wind velocity (r = -0.3763) had

negative correlation with mean number of *M. vitrata* webs/plant and per cent pod damage respectively. There was significantly positive correlation between mean number of *M. vitrata* webs/plant and evaporation (r = 0.4349) and positive correlation (r = 0.2850) with per cent pod damage.

The correlation studies between the seasonal incidence of spotted pod borer, *M. vitrata* population and per cent pod damage with weather parameters in Table 4 during *Kharif* 2018 revealed that, maximum temperature (r = 0.6335) and (r = 0.4349), bright sunshine (r = 0.6975) and (r = 0.6081) and evaporation (r = 0.7294) and (r = 0.5967) had significantly positive correlation with mean number of *M. vitrata* webs/plant and per cent pod damage respectively.

Table 1: Seasonal Incidence of *M. vitrata* and per cent pod damage on pigeonpea during *Kharif*, 2017

Month	Meteor. Week	Mean no of *M. vitrata* webs/plant	Pod damage (per cent)	Temperature (^{0}C)		Relative humidity (per cent)		Sunshine (hrs)	Wind velocity (Km/hr)	Rain (mm)	No. of rainy days	Evaporation (mm)
				Max	Min	I	II					
August 2017	32	0.00	0.00	32.1	22.8	75	52	2.8	3.8	000.4	0	6.3
	33	1.24	0.00	31.2	22.2	75	60	3.5	4.4	002.4	0	5.8
	34	0.23	0.00	27.8	21.1	86	73	3.4	3.5	209.8	3	3.6
	35	1.12	0.00	30.7	22.3	79	59	5.4	6.4	009.4	2	4.7
September 2017	36	3.92	0.00	31.7	22.0	82	56	6.2	01.5	013.0	1	5.7
	37	5.96	0.00	32.2	22.9	87	60	4.4	00.8	028.2	3	5.2
	38	3.68	0.00	29.1	22.1	86	73	3.4	00.9	145.4	4	3.5
	39	6.48	0.00	32.5	22.1	82	48	8.4	00.4	0	0	5.2
October 2017	40	7.86	37.94	33.9	21.5	70	43	7.5	01.1	0	0	6.5
	41	6.18	30.10	31.2	22.5	84	64	4.5	00.9	049.4	3	3.4
	42	5.92	45.96	32.8	20.6	65	50	6.7	00.5	0	0	4.8
	43	9.28	54.63	32.7	16.9	61	36	8.3	00.6	0	0	5.5
	44	8.26	42.18	31.4	13.8	58	29	9.6	01.2	0	0	5.8
November 2017	45	9.88	45.63	30.3	13.3	63	36	9.7	01.6	0	0	5.5
	46	8.65	29.13	30.3	12.2	66	34	9.0	00.6	0	0	5.7
	47	2.64	20.96	30.2	16.6	74	35	6.2	00.5	000.6	0	4.2
	48	0.84	11.16	29.8	11.4	66	34	8.3	00.6	0	0	4.3
December 2017	49	1.18	8.11	28.5	17.6	71	49	4.6	01.6	0	0	3.8
	50	1.02	6.06	29.8	14.6	73	39	6.6	00.9	0	0	4.4
	51	0.36	3.11	28.2	10.8	70	31	6.7	01.3	0	0	4.1
	52	0.58	1.06	28.8	09.4	59	31	8.9	00.4	0	0	4.5

Whereas, morning relative humidity (r = -0.5752) and (r = -0.7639), evening relative humidity (r = -0.5970) and (r = -0.6551), wind velocity (r = -0.5594) and (r = -0.5231) had significantly negative correlation with mean number of M. vitrata webs/plant and per cent pod damage respectively. The minimum temperature (r = -0.2381) and rainfall (r = -0.3225) had negative correlation with mean number of M. vitrata webs/plant and per cent pod damage whereas the minimum temperature (r = -0.4633) and rainfall (r = -0.4360) had significantly negative correlation with mean number of M. vitrata webs/plant and per cent pod damage.

Discussion

The present findings are in accordance with the findings of Srivastava *et al*. (1992) [15] who reported that at Hisar, the major activity period was from standard week 37 to 43, i.e., from mid-September to mid-October. Srinivasan Rao *et al*. (2006) [14] also reported that, M. vitrata incidence associated with flower bud initiation. More or less similar observations were also reported by Sonune *et al*. (2010) [12] who revealed that the incidence of this pest commenced after the 2nd week of August and gradually increased and attained a peak during the 4th week of August. Later on, it started to decline slightly during the first week of September. Further, the pest continuously declined with increase in age of crop. It indicated that the pest was active from mid-August to first week to October. It was also concluded that maximum pest population was observed at the time of flowering stage. Whereas, Sampath kumar and Durairaj (2015) [10] stated that the incidence of M. vitrata started from IV week of June i.e. 26thSMW and reached its peak during 34th SMW i.e. IV week of August and at 36th SMW means I week of September pest started declining. The second peak was registered during 50 (II week of December) and 52nd (IV week of December) SMWs.

The results of the present findings are in agreement with Pandey *et al*. (2015) [6] who reported that the first peak was recorded in 46 standard week and the second peak in 48 standard week. Berani *et al*. (2017) [2] also observed the first activity of spotted pod borer was recorded during 32nd standard week i.e. 2nd week of August which reached at its peak during 34th standard week (4th week of August). Simillarly, Keval *et al*. (2018) [4] observed the first incidence of M. vitrata larvae was observed at the flowering stage during the 39th standard week in both the years (Kharif of 2015 and 2016), in both the varieties i.e. ICPL-87 and UPAS 120 and the pest population persisted up to 49th standard week.

In case of per cent pod damage the present findings in confirmation with Bairwa and Singh (2017) [1] who revealed that infestation of spotted pod borer started in 32nd standard week (2nd week of August i.e. 5th week of sowing) with 10.33per cent pod damage. After 32nd standard week, there was increase in the per cent infestation of spotted pod borer which produced 14.00per cent pod damage in the 33rd standard week (3rd week of August i.e. 6th week of sowing). After 33rd standard week, there was a sudden increase in the per cent infestation of spotted pod borer which produced 39.67per cent pod damage in the 34th standard week (4th week of August i.e. 7th week of sowing). The present findings of correlation of weather parameters with incidence of spotted pod borer and per cent pod damage in close agreement with Sahoo and

Table 2: Seasonal incidence of *M. vitrata* and per cent pod damage on pigeonpea during *Kharif*, 2018

Month	Meteor. Week	Mean no of *M. vitrata* webs/plant	Pod damage (per cent)	Temperature (^{0}C)		Relative humidity (per cent)		Sunshine (hrs)	Wind velocity (Km/hr)	Rain (mm)	No. of rainy days	Evaporation (mm)
				Max.	Min.	I	II					
August 2018	32	0.00	0.00	30.0	23.0	75	62	01.5	06.8	0	0	5.1
	33	0.40	0.00	27.8	22.5	81	73	00.6	04.8	058.4	1	3.6
	34	1.08	0.00	27.9	21.5	80	70	03.0	05.0	024.2	2	3.7
	35	1.87	0.00	29.6	21.1	75	61	05.0	03.5	006.4	1	4.4
September 2018	36	3.67	0.00	30.1	19.6	70	53	05.8	04.1	0	0	5.1
	37	2.98	0.00	32.4	19.5	69	49	07.6	00.8	0	0	5.5
	38	4.52	0.00	31.9	22.1	71	45	06.1	02.7	003.8	1	5.5
	39	5.52	0.00	33.8	22.3	71	44	08.1	01.3	0	0	6.3
October 2018	40	3.98	10.86	34.0	21.5	67	43	07.8	01.3	0	0	6.3
	41	3.85	16.53	34.0	18.4	55	30	08.8	01.6	0	0	7.0
	42	6.13	28.87	33.5	18.6	50	30	08.2	01.3	0	0	6.6
	43	5.97	34.86	34.4	16.8	46	30	08.5	01.0	0	0	6.6
	44	8.17	40.02	31.7	14.4	58	39	09.4	01.9	002.0	0	6.5
November 2018	45	6.58	38.86	33.1	16.8	59	37	08.1	00.8	0	0	6.4
	46	7.22	41.12	32.5	12.9	43	23	09.9	00.8	0	0	5.9
	47	7.55	32.06	31.7	16.3	61	46	07.7	01.3	0	0	5.7
	48	7.45	26.13	30.1	11.3	58	32	09.2	00.8	0	0	5.6
December 2018	49	4.67	22.16	30.3	15.0	60	35	06.6	01.5	0	0	4.9
	50	2.63	12.36	28.1	11.3	55	35	05.6	00.7	0	0	4.9
	51	1.87	9.54	26.5	09.1	64	36	09.1	00.5	0	0	4.4
	52	0.93	4.88	27.8	08.9	51	30	08.8	00.6	0	0	4.6

Table 3: Correlation relationship of weather parameters with incidence of *M. vitrata* and per cent pod damage on pigeonpea during *Kharif*-2017

Weather parameters	Correlation coefficient value	
	Mean no. of *M. vitrata* webs/plant	Pod damage (per cent)
Max. Temperature (^{0}C)	0.5802*	0.4341*
Min. Temperature (^{0}C)	-0.0610	-0.2507
Morning RH (per cent)	-0.1576	-0.6107**
Evening RH (per cent)	-0.0878	-0.4311
Bright Sunshine (hrs)	0.5503**	0.5561**
Wind velocity (Km/hrs)	0.4331*	-0.3763
Rainfall (mm)	-0.2533	-0.3052
Evaporation (mm)	0.4349*	0.2850

Table 4: Correlation relationship of weather parameters with incidence of *M. vitrata* andper cent pod damage on pigeonpea during *Kharif*-2018

Weather parameters	Correlation coefficient value	
	Mean no. of *M. vitrata* webs/plant	Pod damage (per cent)
Max. Temperature (^{0}C)	0.6335**	0.4349*
Min. Temperature (^{0}C)	-0.2381	-0.4633*
Morning RH (per cent)	-0.5752**	-0.7639**
Evening RH (per cent)	-0.5970**	-0.6551**
Bright Sunshine (hrs)	0.6975**	0.6081**
Wind velocity (Km/hr)	-0.5594**	-0.5231*
Rainfall (mm)	-0.4360*	-0.3225
Evaporation (mm)	0.7294**	0.5967*

* 5per cent level of significance df20=0.4329
**1per cent level of significance df 20 =0.5487

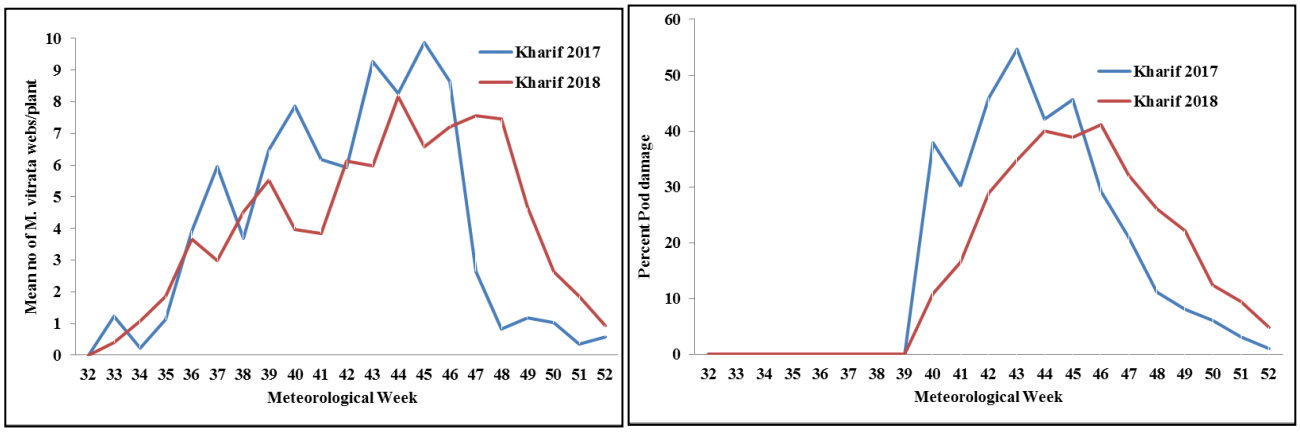

Fig 1: Seasonal incidence of *M. vitrata* and per cent pod damage on pigeonpea during *Kharif*, 2017 and *Kharif*, 2018

Behera (2001) [9] who revealed that there was a positive correlation between populations of *Maruca vitrata* and the minimum, maximum and average temperatures. Similarly, Sonune *et al.* (2010) [12] revealed that larval population of spotted pod borer exhibited a significant negative correlation with minimum temperature, whereas the pest population showed positive correlation with maximum temperature and mean bright sunshine hours. But they were non-significant whereas only maximum temperature and bright sunshine hours exhibited a positive correlation with per cent pod damage while other factors had negative relationship. Similarly, Sreekanth *et al.* (2015) [13] observed highly significant correlation between *M. vitrata* and minimum, mean temperatures and wind speed with correlation coefficient (r) being -0.759, -0.815 and -0.838, respectively at 5per cent level. Moderately significant correlation was obtained between *M. vitrata* and sunshine hours and evening relative humidity (RH-II) with correlation coefficients (r) being 0.656 and -0.609, respectively at 1per cent level. Berani *et al.* (2017) [2] also indicated that minimum temperature exhibited significantly negative correlation with spotted pod borer larval population. Morning relative humidity, evapotranspiration and bright sunshine hours exhibited positive correlation, while maximum temperature, evening relative humidity, vapour pressure and rainfall exhibited negative correlation with spotted pod borer larval population whereas, minimum temperature highly significant positive correlation with per cent pod damage of spotted pod borer. Morning relative humidity, rainfall, evapotranspiration and bright sunshine hours exhibited positive correlation, while maximum temperature, evening relative humidity and vapour pressure exhibited negative correlation with per cent pod damage.

Conclusion

The peak population of spotted pod borer, *M. vitrata* occurred in September, October and in November month during both the kharif seasons. The weather parameters like maximum temperature, bright sunshine, wind velocity and evaporation had significantly positive correlation with mean number of *M. vitrata* webs/plant whereas morning relative humidity had significantly negative correlation with per cent pod damage due to spotted pod borer larvae. Seasonal incidence of spotted pod borer, *M. vitrata* on pigeonpea and their correlation with weather parameters may assist to develop the suitable forecasting and forewarning model which provide lead time for managing impending pest attacks and thus minimize crop loss and optimize pest control leading to reduction of cost of cultivation.

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