Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(5): 821-825

Received: 04-07-2019
Accepted: 08-08-2019

M Sreekanth
Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh, India

M Ratnam
Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh, India

MV Ramana
Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh, India

Corresponding Author:
M Sreekanth
Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh, India

Influence of weather parameters on pod borers of pigeonpea (*Cajanus cajan* (L) Millsp.)

M Sreekanth, M Ratnam and MV Ramana

Abstract

The experiment conducted at Regional Agricultural Research Station, Lam, Guntur during 2014-15 on pigeonpea (*Cajanus cajan* (L.) Millspaugh) yielded a good amount of information on the trend of population build up and seasonal abundance of gram pod borer, *Helicoverpa armigera*, spotted pod borer, *Maruca vitrata* and tobacco caterpillar, *Spodoptera litura*. The male moth catches of *H. armigera* and *S. litura* were observed in 45th standard meteorological week (SMW) (Nov.5-11) and reached peak during 47th SMW (Nov.19 – 25). Second peak of *S. litura* was observed again in 52nd SMW (Dec. 24-31). The larval population of *H. armigera* and *M. vitrata* was observed in 45th SMW and reached peak during 50th SMW (Dec.10-16) which coincides with peak flowering stage of the crop. Highly significant correlation was obtained between pheromone trap catches of *H. armigera* and wind speed with correlation coefficient (r) being -0.637**.** Similarly, significant correlation was obtained with larval population of *H. armigera* and *M. vitrata* and morning relative humidity (RH I) with correlation coefficients (r) being -0.572 and -0.465, respectively. Hence, from the present findings it was concluded that as the morning relative humidity decreases the pest population increases and vice versa especially during flower bud initiation to flowering stage of the crop. Thus, farmers can predict the pest early and optimize the application of insecticides in order to check the pest population from reaching the economic threshold level.

Keywords: Gram pod borer, *Helicoverpa armigera*, *Maruca vitrata*, pigeonpea, population, *Spodoptera litura*, spotted pod borer, tobacco caterpillar, weather

1. Introduction

Pigeonpea (*Cajanus cajan* (L) Millsp.) cultivated in more than 25 countries of the world in 4.59 million hectare area with production of 3.28 million tons annually. During 2015-16, in India, it was grown on an area of 3.96 million ha, production 2.56 million tons and productivity was 646 kg per ha, whereas, in Andhra Pradesh, the area, production, productivity of pigeonpea was 2.2 lakh ha, 1.32 lakh tons and 600kg per ha, respectively [1]. Though the area under redgram is increasing, the yields have remained stagnant (500-700 kg per ha) for the past 3-4 decades due to the insect pest damage particularly, gram pod borer, *Helicoverpa armigera* and spotted pod borer, *Maruca vitrata* [2, 3]. Both the pests prefer to feed on flowers and fruiting bodies, thereby causing heavy yield loss. The yield loss due to *H. armigera* and *M. vitrata* was up to more than 60 and 84%, respectively [4]. The annual monitory loss due to *H. armigera* and *M. vitrata* was estimated globally as US $ 400 million [5] and US $ 30 million [6], respectively. The typical concealed feeding habit of spotted pod borer, protects the larvae from natural enemies, human interventions and other adverse factors including insecticides [7]. Though, larval and adult population of *Spodoptera litura* was observed, it will not cause any economic loss to farmers as it feeds mainly on leaves and the plant has the capacity to compensate the vegetative loss. Management of pod borers relies heavily on insecticides, often to the exclusion of other methods of management. However, indiscriminate use of insecticides has resulted in the development of resistance and resurgence. In order to optimize the application of insecticides, studies on monitoring and influence of various weather parameters on the population build up and seasonal incidence of the pest are very much required for planning an effective pest management strategy that will help farmers benefit financially without the risk of long term problems including resurgence. Hence, an attempt was made to monitor the pod borer population along with studies on influence of weather parameters on the population buildup.

2. Materials and Methods

The population buildup and seasonal abundance of pod borers on pigeonpea (cv. ICPL 85063) was ascertained by raising the crop in 1000 m^2 area during *Kharif*, 2014-15 at Regional Agricultural Research Station, Lam farm, Guntur, Andhra Pradesh by following all the package of practices recommended for the crop in the region and season except the insecticidal contamination. In order to monitor the population of *Helicoverpa* and *Spodoptera*, pheromone traps @ 10 ha^{-1} were erected 60 cm above the crop canopy. The male moth catches were recorded once in each standard meteorological week (SMW) starting from flower bud initiation to pod maturity stage of the crop and expressed as number of months/trap/week. The lures were changed at 30 days interval.

The larval population of *Helicoverpa*, *Spodoptera* and *Maruca* was also recorded at weekly intervals on 10 randomly selected tagged plants from three locations in the plot and expressed as number of larvae / plant. Abiotic factors such as temperature (maximum, minimum, mean), relative humidity (morning and evening), sunshine hours and rainfall were also recorded from meteorological observatory, RARS, Lam. The meteorological data thus collected was subjected to simple correlation analysis with larval population and male moth catches to know the influence of abiotic factors on the occurrence of pod borers [8].

3. Results and Discussion

The experimental results showed that male moth catches of *H. armigera* were observed from 45th standard meteorological week (SMW) and reached peak (8 adults per trap) during 47th SMW (Nov.19 – 25), which coincides with flower bud initiation stage of the crop and gradually decreased (0.7 adults per trap) by 52nd SMW (Dec. 24 - 31) and almost nil population was recorded from 1st standard week (Jan1-7). The larval population of *H. armigera* was observed from 45th SMW (Nov.5-11) (0.2 larvae per plant), which gradually increased and reached peak (10.2 larvae per plant) by 50th SMW (Dec.10-16) and then gradually decreased (0.2 larvae per plant) by 2nd SMW (Jan.8-14). The larval population of *M. vitrata* was observed and gradually increased (0.4 larvae per plant) from 45th SMW (Nov.5-11) and reached peak (18.6 larvae per plant) by 50th SMW which coincides with peak flowering stage of the crop and then gradually decreased (1.4 larvae per plant) by 3rd SMW (Jan 15-21) and nil population was recorded by 4th SMW (Jan 22-28). The adult trap catches of *S. litura* were observed in 45th SMW (Nov. 5-11) and reached peak (50.3 adults per trap) in 47th SMW (Nov. 19-25) and then gradually decreased (1.3 adults per trap) by 50th SMW (Dec.10-16). Second peak (113.7 adults per trap) was observed in 52nd SMW (Dec. 24-31) (Table 1 & Fig. 1, 2 & 3).

The results were in conformity with the findings of Sreekanth and Ramana [9, 12, 14, 15], who reported that peak larval population of *M. vitrata* was observed during 50th SMW. The larval and moth catches of *H. armigera* were more during 48th and 2nd SMW, which coincides with flowering and pod development stage of the crop [11-13]. The larval population of *Helicoverpa* and *Maruca* and adult population of *Helicoverpa* and *Spodoptera* when correlated with different meteorological parameters showed that highly significant correlation was obtained between pheromone trap catches of *H. armigera* and wind speed with correlation coefficient (r) being -0.637**.** Similarly, significant correlation was obtained with larval population of *H. armigera* and *M. vitrata* and morning relative humidity (RH I) with correlation coefficients (r) being -0.572 and -0.465, respectively (Table 2). Maximum, minimum and mean temperatures and relative humidity recorded at morning, evening and mean were found to be highly correlated with that of larval population of *M. testulalis* [12, 16, 20]. Highly significant correlation was reported between *M. vitrata* and minimum temperature and wind speed [17-19]. Population buildup of *H. armigera* and *M. vitrata* varied remarkably in different parts of the country probably due to differences in agro climatic conditions and crop types [21]. Similarly, Vishwa Dhar *et al.* [22] reported that minimum and maximum temperature and relative humidity greatly influence the moth population of *H. armigera* at Kanpur. Yadav *et al.* [23] also found that relatively cooler pre-monsoon period, lower amount of monsoon rainfall, rain free post monsoon period with high evening relative humidity have been found to be congenial for build-up of higher population and subsequently resulting higher moth catches of *H. armigera* in pheromone traps during rainy season on pigeonpea. The rain free weeks after rainy weeks were found to be congenial for population buildup. Similarly, during post monsoon period, host plants including cotton and pigeonpea were available in abundance resulting build up of population. However, the gaps in knowledge remain to be filled by concentrating on migration, survival and carryover of this dreaded pest in different agro-eco-regions of the country. Rao *et al.* [22] reported that morning and evening relative humidity showed significant positive correlation and minimum temperature showed significant negative correlation with the larval population of *M. vitrata* in rice fallow blackgram. However, the findings were in contrary to the observations of Kumar *et al.* [16], who reported that larval population of *H. armigera* remained unaffected with weather parameters, whereas strong negative correlation was observed with mean temperature [11].

Table 1: Incidence of different pod borers on Pigeonpea

Week no.	Period	Temperature (ºC)		R.H. (%)		Rain-fall (mm)	Rainy days	Sun shine (hrs.)	Wind speed (km/hr)	Evapo-ration (mm)	Mean temp (ºC)	TCP adults / trap	Incidence of GPB		SPB larvae / plant
		Max.	Min.	I	II								Larvae /plant	Adults / trap	
44	29-04 Nov	30.9	14.1	94	60	0.0	0	1.7	2.5	3.3	22.5	0.0	0.0	0.0	0.0
45	05-11	30.4	20.9	94	63	9.0	1	1.4	3.6	3.6	25.7	1.0	0.2	0.7	0.4
46	12-18	30.6	23.2	98	74	36.2	2	3.6	3.3	2.1	26.9	7.7	0.8	1.3	1.8
47	19-25	30.7	22.0	97	60	0.0	0	4.8	2.1	3.6	26.3	50.3	1.6	8.0	3.4
48	26-02 DEC, 2014	31.2	18.5	92	50	0.0	0	6.1	2.2	3.9	24.9	14.7	2.4	7.3	6.4
49	03-09	30.8	17.7	93	53	0.0	0	7.3	2.1	3.6	24.3	2.7	6.6	1.7	9.2
50	10-16	29.8	22.1	87	68	0.0	0	1.5	3.5	2.9	26.0	1.3	10.2	1.7	18.6
51	17-23	29.0	15.3	88	57	0.0	0	3.9	3.1	3.7	22.1	14.7	9.4	1.0	16.8
52	24-31	28.9	17.5	92	60	0.0	0	3.9	4.2	3.5	23.2	113.7	5.4	0.7	10.6

1	01-07 JAN,2015	30.1	21.9	95	58	0.0	0	4.1	3.7	3.7	26.0	25.7	2.2	0.0	8.2
2	08-14	29.6	14.6	86	52	0.0	0	7.3	1.6	4.1	22.1	3.0	0.2	0.0	4.8
3	15-21	29.7	16.4	94	53	0.0	0	6.5	2.4	4.4	23.0	2.3	0.0	0.0	1.4
4	22-28	30.3	16.4	94	55	0.0	0	8.0	3.5	4.4	23.3	0.0	0.0	0.0	0.0

TCP: Tobacco caterpillar; GPB: Gram Pod borer; SPB: Spotted pod borer

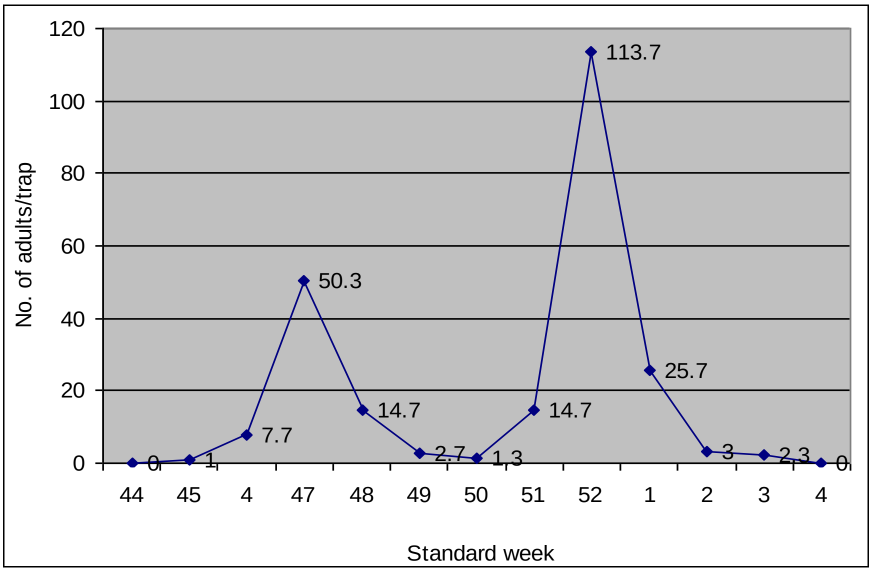

Fig 1: Incidence of *Spodoptera Litura* on pigeonpea during 2014-15 at rars, lam, guntur

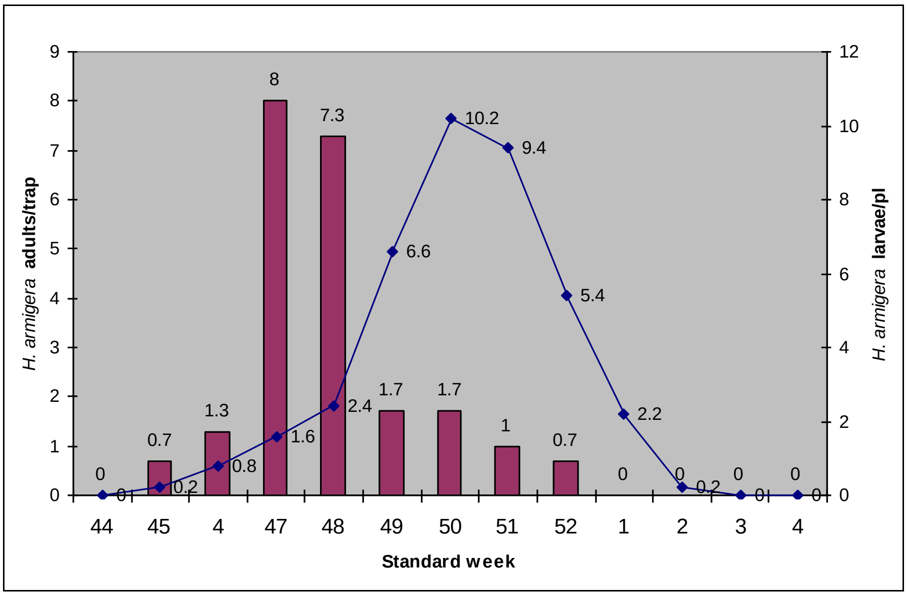

Fig 2: Incidence of *H. armigera* on pigeonpea during 2014-15 at BARS, lam, Guntur

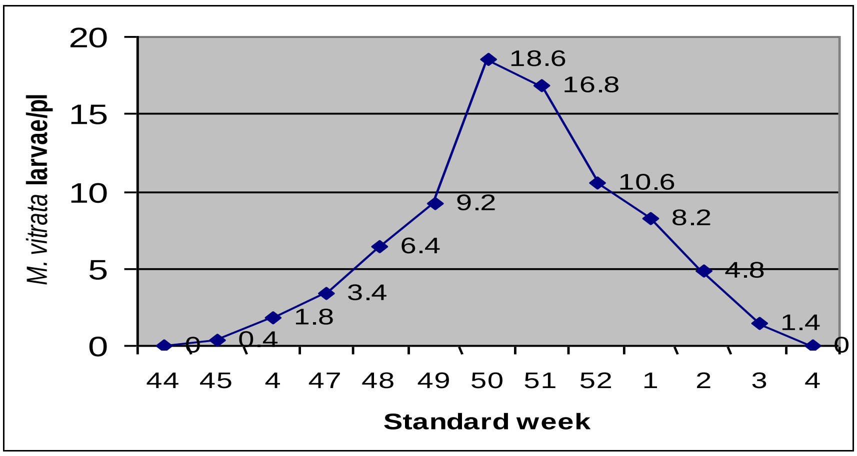

Fig 3: Incidence of *M vitrata* on pigeonpea during 2014-15 at RARS, Lam, Guntur

Table 2: Correlation coefficients between weather parameters and pest incidence

Insect pest	Weather parameters	Correlation coefficient (r)	Regression equation
Pheromone trap catches of *S. litura*	Max T (ºC)	-0.410	Y=559.283-17.947x
	Wind speed (km/hr)	0.380	Y=-26.205+15.285x
Pheromone trap catches of *H. armigera*	Max T (ºC)	0.445	Y=-46.503+1.612x
	RH-II (%)	-0.323	Y=10.431-0.136x
	Sunshine (hrs)	0.477	Y=-0.496+0.714x
	Wind speed (km/hr)	-0.637	Y=9.691-2.459x
	Evaporation (mm)	0.273	Y=-2.873+1.508x
	Mean Temp. (ºC)	0.312	Y=-11.331+0.547x
Larval incidence of *H. armigera*	Max T (ºC)	-0.434	Y=66.934-2.113x
	RH-I (%)	-0.572	Y=55.196-0.561x
	RF (mm)	-0.269	Y=3.608-0.095x
	Rainy days	-0.313	Y=3.718-1.871x
	Wind speed (km/hr)	0.312	Y=-0.848+1.434x
Larval incidence of *M. vitrata*	Max T (ºC)	-0.209	Y=51.774-1.547x
	Min T (ºC)	0.341	Y=-5.724+0.586x
	RH-I (%)	-0.465	Y=69.248-0.692x
	RF (mm)	-0.247	Y=5.582-0.132x
	Rainy days	-0.291	Y=5.732-2.639x
	Wind speed (km/hr)	0.209	Y=0.978+1.426x
	Evaporation (mm)	-0.260	Y=13.432-2.308x
	Mean Temp. (ºC)	0.270	Y=-15.621+0.852x

4. Conclusion

From the present findings it could be inferred that there was only one single peak without any multiple peaks or overlapping broods of *H. armigera* and *M. vitrata* especially during flowering stage of the crops. Further, morning relative humidity played an important role in population buildup and seasonal incidence of pod borers on pigeonpea. Thus, farmers should be vigilant on stage of the crop and weather parameters so that they can predict the pest population early and optimize the application of insecticides in order to check the pest population from reaching the economic threshold level.

5. Acknowledgement

The authors are highly thankful to Associate Director of Research, RARS, Lam, Guntur and Project Coordinator, All India Coordinated Research Project (AICRP) on Pigeonpea, IIPR, Kanpur for providing necessary facilities to carry out the work.

6. References

1. Anonymous. Area, production and yield of tur (arhar) from 1950-51 to 2016-17 along with percentage coverage under irrigation, 2017. www. Indianstat.com.
2. Akhauri RK. Management of pod borer complex in pigeonpea *Cajanus cajan* (L) Millsp through varietal reaction, intercropping and insecticidal application. Ph.D thesis submitted to R.A.U., Bihar, Pusa. 1992, 180
3. Arulmozhi K. Bio-ecology of *Maruca vitrata* (Geyer) and its management. M.Sc. (Ag) thesis submitted to Tamil Nadu Agricultural University, Coimbatore, 1990, 145.
4. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley and sons, New York. 1984, 207-215.
5. ICRISAT. The medium term plan. International Crops research Institute for the semi-arid Tropics, Patancheru 502 324, Andhra Pradesh. 2007; 3:20.
6. Imosanen, Singh HKB. Incidence of *Helicoverpa armigera* (Hub.) and *Maruca vitrata* (Geyer) on pigeonpea under Medzephema conditions of Nagaland. J of Applied Zoological Res. 2005; 16:85-86.
7. Kumar S, Singh B, Singh PP. Population build-up and seasonal abundance of borer species on pigeonpea (*Cajanus cajan*). Ind. J of Ent. 2003; 65(3):379-381.
8. Lakshmi PSR. Seasonal incidence and management of spotted pod borer, *Maruca vitrata* (Geyer) on blackgram. M.Sc (Ag) Thesis submitted to Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad. 2001, 112
9. Lal SS, Singh NB. *In* Proceedings of National Symposium on Management of Biotic and Abiotic Stresses in Pulse Crops. IIPR, Kanpur, India.1998, 65-80.
10. Naresh JS, Singh J. Population dynamics and damage caused by insect pests in flowering pigeonpea (*Cajanus cajan* (L) Millsp, Ind. J of Ent. 1984; 46(4):412-420.
11. Rao GD, Nagesh M, Chalam MSV, Rao VS. Seasonal incidence of spotted pod borer, *Maruca vitrata* (Geyer) in rice fallow blackgram. The Andhra Agril. J. 2013; 60(4):856-861
12. Saxena KB, Chandrasena GDSN, Hettiarachchi K, Iqbal YB, Fonseka HHD, Jayasekara SJB A. Evaluation of pigeon pea accessions and selected lines for reaction to Maruca. Crop Sci. 2002; 42:615-618.
13. Sharma HC. Bionomics, host plant resistance and management of legume pod borer, *Maruca vitrata* – a review. Crop Prote. 1998; 17:373-386.
14. Sharma HS, Franzamann BA. Biology of legume pod borer, *M. vitrata* (F.) and its damage to pigeonpea and adzuki bean. Insect Sci. Appl. 2000; 20:99-108.
15. Sharma HC, Pampapathy G. Effect of natural plant products, Brassinolide and host plant resistance in combination with insecticides on *Helicoverpa armigera* (Hubner) damages in pigeonpea. Ind. J of Pl. Prote. 2004; 32 (2):40-44.
16. Sivaramakrishna J, Rajasekhar P, Ramachandra Rao G. Influence of weather parameters on the occurrence of major lepidopteran pests on blackgram. The Andhra Agril. J. 2004; 51(1, 2):86-89.
17. Sreekanth M, Ramana MV. Impact of weather parameters on the population buildup of spotted pod borer, *Maruca vitrata* (Geyer) on pigeonpea (*Cajanus cajan* (L.)

Millsp.). Trends in Bio-sci. 2017; 10(40):8339-8342.
18. Sreekanth M, Ratnam M. Population buildup and seasonal abundance of *Helicoverpa armigera* on pigeonpea. J of Insect Sci. 2016; 29(1): 192-195.
19. Sreekanth M, Ratnam M, Koteswara Rao Y. Monitoring of gram pod borer, *Helicoverpa armigera* through pheromone traps on pigeonpea (*Cajanus cajan* (L) Millsp.) and impact of weather parameters on trap catch. J of Res., ANGRAU. 2016; 44(1, 2):63-66.
20. Sreekanth M, Ratnam M, Seshamahalakshmi M, Koteswara Rao Y. Population buildup and seasonal abundance of spotted pod borer, *Maruca vitrata* (Geyer) on pigeonpea (*Cajanus cajan* (L) Millsp.). J of Applied Biology and Biotechnology. 2015; 3(04):43-45.
21. Srivastava B, Vaish OP. Studies on relationship between pheromone trap catches, larval population and pod damage by *Helicoverpa armigera* (Hub.) in pigeonpea. Ind. J of Pulses Res. 2000; 134(1):244.
22. Vishakantaiah M, Jagadeesh Babu CS. Bionomics of the tur webworm, *Maruca testulalis* (Lepidoptera: Pyralidae). Mysore J of Agril. Sci. 1980; 14:529-532.
23. Vishwa Dhar V, Singh SK, Trivedi TP, Das DK, Dhandapani, Chaudhary RG *et al*. Forecasting of *Helicoverpa armigera* infestation on long duration pigeonpea in central Uttar Pradesh. J of Food Leg. 2008; 21(3):189-192.
24. Yadav SK, Trivedi TP, Ahuja DB, Das DK, Dhandapani A. Location specific weather based prediction rules for *Helicoverpa armigera* (Hubner) in Pigeonpea (*Cajanus cajan* Millspaugh) and Chickpea (*Cicer aeritinum* Linnaeus) agro-ecosystem in Western Uttar Pradesh. J of Insect Sci. 2009; 22(4):356-363.