ENTOMON 41(3) : 203-208 (2016)
Article No. ent. 41307

Influence of meteorological factors on population build-up of spotted pod borer, M*aruca vitrata* Geyer in yam bean under agro-climatic zone I of North Bihar

S.K. Sathi, P.P. Singh* and R. Prasad

Department of Entomology, Tirhut College of Agriculture, RAU, Dholi 843121, Bihar, India
Email: ppsinghdholi@rediffmail.com

ABSTRACT: Population build-up studies of spotted pod borer, *Maruca vitrata* Geyer, on yam bean in relation to meteorological parameters *viz;* average ambient temperature, relative humidity and rainfall revealed that the pest was active between the second week of October to last week of December, while web formation abruptly stoped after third week of November. It attained and maintained its peak activity during November in both seasons recording a mean larval population ranging 9.51 to 17.51 and 11.31 to 19.31 per flower shoot while number of webs ranged from 1.59 to 3.00 and 1.73 to 3.68 webs per flower shoot during 2009-10 and 2010-11, respectively. Pest population build-up was favoured by a decline in average maximum and minimum temperature (from 30.15 to 26.55^{0}C and 16.25 to 12.10^{0}C, respectively) and in relative humidity at 7 am and 2 pm (96.30 to 94.70 per cent and 50.90 to 54.40 per cent respectively). No significant correlation existed between the larval and webs population with the factors, except the relative humidity at 2 pm which indicated negative but significant effect on larval and webs population.

KEY WORDS: *Maruca vitrata,* population build-up, temperature, humidity and rainfall

INTRODUCTION

Root and tuber crops are known to be the energy banks of nature serving either as primary or secondary staple food, meet the calorie needs of about one fifth of world's population. As such the tuber crops play a vital role in the food security, hunger reduction and poverty elimination. Amongst, yam bean (*Pachyrhizus erosus* L.) occupies an important place next to sweet potato and is being widely grown in uplands of Bihar, West Bengal (W.B), Uttar Pradesh, Odisha and Jharkhand. It is popularly known as Mishrikand, Kesaur in Bihar, Sankalu in W.B. and Odisha. Unlike other tuber crops it is leguminous and commercially propagated by seed. Yam bean crop grown for seed purpose, its flower buds, flowers and pods were reported to be infested by a lepidopteran pest identified as spotted pod borer, *Maruca Vitrata* Geyer., with the extent of pod damage due to its being as high as 40.0 per cent in Bihar (Singh *et al.,* 2006). Besides yam bean, it also occurs on many other economically important grain legumes. Among the constituents of pod borer community infesting early pigeonpea, the spotted pod borer, *Maruca testulalis* Geyer, predominantly throughout the crop season and poses serious threat in its cultivation in Bihar (Saxena, 1974; Sinha *et al*., 1979 and Akhauri *et al.,* 1994). No works seems to have been done to find out the relationship between larval population

* Author for correspondence

and number of webs on yam bean caused by *M. vitrata* and abiotic factors in any part of the country. This necessitated study on the influence of meteorological factors in population build-up of spotted pod borer, *M. vitrata* in yam bean grown under agro-climatic conditions prevailing in North Bihar.

MATERIALS AND METHODS

The yam bean, cv. R.M-1, was grown by following the normal agronomics practices under pesticide free conditions at the research farm of Tirhut College of Agriculture, Dholi, Muzaffarpur (Bihar) in two consecutive crop season *i.e*., 2009-10 and 2010-11. Weekly observations with regards to larval population and number of webs of *M. vitrata* were recorded on randomly selected twenty five plants. The data so obtained were used to work out the mean number of pest larvae per flower shoot. Weekly metrological data on temperature (maximum and minimum) and average relative humidity (%) at 7am and 2pm were obtained from the locally stationed meteorological observatory for the period under study. The quantitative relationship between the weekly mean larval population per flower shoot and the weather parameters *viz;* mean maximum and minimum temperature (^{o}C) and average relative humidity (%) were worked out by using the method of correlation and regression analysis and were expressed in the form of mathematical equations. The quantitative influences of the two weather parameters on pest population prevailing during observation as well as one and two weeks prior to the corresponding period of observations were also worked out separately for the two crop seasons and finally on pooled basis.

RESULTS AND DISCUSSION

A comparative examination of the data presented in Table-1, revealed that larval population of *M. vitrata* remarkably fluctuated to changing abiotic factors. The mean larval population was found to increase progressively from 0.53 to maximum 22.00 larvae per flower shoot during the period between the 41st standard week to 47th standard week when the average maximum and minimum temperature decreased from 31.55^{0}C to 27.20^{0}C and from 21.85^{0}C to 1.05^{0}C, respectively, whereas average relative humidity at 7 am and 2 pm fluctuated between 94.20 to 95.45 and 60.50 to 44.75 per cent (Table-1). Its population started to decline gradually from 18.14 to 10.94 larvae per flower shoot from 48th standard week to 49th standard week and abruptly declined from 5.09 to 0.17 larvae per flower shoot in 50th and 52th standard week, respectively. It could also be noted that the mean number of webs per flower shoot in the beginning was low (0.37 webs/flower shoot) in 41st standard week which gradually increased and attained its peak (3.34 webs/flowers shoot) in 47th standard week.

The correlation coefficient (r) between the mean larval and webs population of *M. vitrata* per flower shoot on yam bean cv. R.M-1 and the environmental factors revealed that maximum temperature (r = -0.229), minimum temperature (r = -0.093) and rainfall (r = -0.309) showed negative but non-significantly influenced the mean number of larvae per flower shoot, while relative humidity at 2pm showed negative but significant effect with correlation coefficient value of -0.518 (Table-2). The mean number of webs per flower shoot showed positive but non-significant correlation with maximum and minimum temperature (r = 0.124 and 0.024, respectively) while, remaining abiotic factors *viz;* relative humidity at 7 am, 2 pm and rainfall showed negatively but non-significant effect on mean number of webs per flower shoot (r = -0.349, -0.402 and -0.215, respectively).

It may be further seen in Table-3 that the coefficient of determination (R^2) although varied from one year to another, its value on pooled basis gave an indication that the maximum and minimum temperature, relative humidity at 7 am, 2 pm and rainfall together contribute 51.70 and 52.00 per cent towards the changes in larval population and number of webs on flower shoot, respectively.

No work seems to have been done to find out the relationship among larval population, number of webs per flower shoot of yam bean caused by *M. vitrata* and abiotic factors in any part of the country.

Table-1. Population fluctuation of spotted pod borer, *Maruva vitrata* Geyer, in relation to seasonal changes during 2009-10 and 2010-11

Month	Standard week	Crop season	Mean no of larvae/flower shoot	Mean no. of webs/ flower	Weather factors				
					Average temperature (°C)		Average relative humidity (%)		Rainfall (mm)
					Maximum	Minimum	7AM	2PM	
September	38	A	0.00	0.00	30.50	25.00	94.70	79.50	4.4
		B	0.00	0.00	32.60	25.30	94.50	70.20	82.6
		C	0.00	0.00	31.55	25.15	94.60	74.85	43.50
	39	A	0.00	0.00	32.50	24.00	94.40	63.40	-
		B	0.00	0.00	33.70	25.50	90.70	65.40	-
		C	0.00	0.00	33.10	24.75	92.55	64.40	-
October	40	A	0.00	0.00	33.90	23.50	94.40	63.80	-
		B	0.00	0.00	32.20	25.00	92.10	76.70	-
		C	0.00	0.00	33.05	24.25	93.25	70.25	-
	41	A	0.39	0.33	31.50	22.20	95.00	65.50	-
		B	0.67	0.40	31.60	21.50	93.40	55.50	-
		C	0.53	0.37	31.55	21.85	94.20	60.50	-
	42	A	1.21	0.55	31.10	24.00	92.20	75.50	5.34
		B	1.40	0.57	32.60	18.50	94.10	46.20	-
		C	1.31	0.56	31.85	21.25	93.15	60.85	2.67
	43	A	5.80	1.09	31.20	20.30	97.20	55.70	-
		B	6.76	1.15	31.90	15.10	91.40	38.20	-
		C	6.28	1.12	31.55	17.70	94.30	46.95	-
November	44	A	9.51	1.59	29.30	16.50	90.70	55.40	-
		B	11.31	1.73	31.00	16.00	95.40	46.40	-
		C	10.41	1.66	30.15	16.25	96.30	50.90	-

Month	Standard week	Crop season	Mean no of larvae/flower shoot	Mean no. of webs/ flower	Weather factors				
					Average temperature (°C)		Average relative humidity (%)		Rainfall (mm)
					Maximum	Minimum	7AM	2PM	
	45	A	13.48	2.03	31.00	18.00	93.50	57.50	-
		B	15.67	2.13	30.90	15.80	93.10	42.20	-
		C	14.57	2.08	30.95	16.90	91.90	48.20	-
	46	A	16.68	2.68	30.00	17.70	95.40	48.10	-
		B	18.51	2.81	28.70	19.60	92.50	68.70	-
		C	17.59	2.75	29.35	18.65	93.00	63.10	-
	47	A	20.33	3.00	28.10	15.20	95.20	56.40	-
		B	23.67	3.68	26.30	10.90	95.50	41.40	-
		C	22.00	3.34	27.20	13.05	95.45	44.75	-
	48	A	17.51	-	26.40	13.20	98.00	52.80	-
		B	19.31	-	26.70	11.00	94.20	52.40	-
		C	18.41	-	26.55	12.10	94.70	54.40	-
December	49	A	11.57	-	26.50	11.60	99.40	61.70	-
		B	10.31	-	26.40	10.30	98.70	50.20	-
		C	10.94	-	26.45	10.95	98.35	51.50	-
	50	A	4.91	-	24.80	9.10	98.70	52.00	-
		B	5.27	-	24.80	10.10	98.20	56.00	-
		C	5.09	-	24.80	9.60	98.80	58.85	-
	51	A	2.30	-	23.90	6.80	98.20	51.70	-
		B	2.96	-	24.90	9.50	99.00	51.10	-
		C	2.63	-	24.40	8.15	98.85	51.55	-
	52	A	0.13	-	23.70	5.80	99.20	73.50	-
		B	0.20	-	22.30	6.20	98.80	48.80	-
		C	0.17	-	23.00	6.00	98.50	50.25	-

A= 2009-10, B= 2010-11 and C= Pooled mean of A and B

Table 2. Correlation co-efficient (r) between weather parameters (x) and damage pattern of spotted pod borer (*Maruca vitrata* G.) (Y) during 2009-10 and 2010-11

Meteorological parameters	Larval population (Y_1) (Mean No. larvae/flower shoot)			Number of webs (Y_2) (Mean No. of webs/flower shoot)		
	2009-10	2010-11	Pooled	2009-10	2010-11	Pooled
Maximum temperature (X_1)	-0.179	-0.300	-0.229	0.198	0.232	-0.0229
Minimum temperature (X_2)	-0.249	-0.365	-0.312	0.087	0.145	-0.312
Relative Humidity at 7AM (X_3)	-0.156	-0.025	-0.093	-0.381	-0.377	-0.093
Relative Humidity at 2AM (X_4)	-0.574*	-0.362	-0.518*	-0.385	-0.122	-0.518*
Rainfall (X_5)	-0.345	-0.295	-0.309	-0.172	-0.185	-0.309

* Significant at 5%, other are non-significant

Table 3. Co-efficient of determination (R) and multiple regression equations in relation to larvae and webs population of *Maruca vitrata* G. on yam bean cv. R.M-1 versus meteorological parameters at Dholi during 2009-10 and 2010-11

Year	R^2	Regression equation
2009-10	0.634	$Y_1 = 281.893 = 4.0393\ X_1 + 2.3079\ X_2 - 1.4082\ X_3 - 1.0378\ X_4 - 3.0111\ X_5$
2010-11	0.396	$Y_1 = 310.908 - 1.0422\ X_1 - 0.8899\ X_2 - 2.6969\ X_3 - 0.05716\ X_4 + 0.047796\ X_5$
Pooled	0.517	$Y_1 = 392.868 - 3.3281\ X_1 + 1.0522\ X_2 - 2.8283\ X_3 - 0.6533\ X_4 + 0.03053\ X_5$
(b) Meteorological parameters prevail during the period of web formation		
Year	R2	Regression equation
2009-10	0.569	$Y_2 = 24.42 - 0.1024\ X_1 + 0.14157\ X_2 - 0.1458\ X_3 - 0.1564\ X_4 + 0.2580\ X_5$
2010-11	0.212	$Y_2 = 16.89 - 0.02725\ X_1 + 0.010738\ X_2 - 0.1551\ X_3 - 0.1564\ X_4 + 0.2580\ X_5$
Pooled	0.520	$Y_2 = 46.24 - 0.609\ X_1 + 0.3772\ X_2 - 0.2696\ X_3 - 0.1468\ X_4 - 0.002406\ X_5$

However, the present result got a good support from the reports of several workers who determined the relationship between larval population and number of webs caused by *M. vitrata* vis-a-vis the physical factors like temperature, relative humidity and rainfall from India and abroad on various leguminous crops other than yam bean (Akhauri *et al.,* 1996; and Saxena *et al.,* 2007).

ACKNOWLEGEMENT

This research forms part of the approved Ph.D.

thesis work of the senior Author submitted to the Rajendra Agricultural University.

REFERENCES

Akhauri R.K., Sinha M.M. and Yadav R.P. (1994) Population build-up and relative abundance of pod borer complex in early pigeonpea, *Cajans cajan* (L.). Journal of Entomolgy Research, 18(2):121-126.

Akhauri R.K., Sinha M.M. and Yadav R.P. (1996) Influence of meteorological factors on population build-up of spooted pod borer, *Maruca testulalis* Geyer in early pigeonpea under conditions of North Bihar (India). Journal of Entomolgy Research, 20(2): 109-114.

Saxena H.P. 1974. Severe and widespread occurrence of *Maruca testulalis* Geyer in red gram, *Cajans cajan.* Entomologist's Newsletter, 4 (3):21.

Sinha M.M., Yadav R.P and Kumar A. (1979) Multidirectional approach for the pest management in arhar (*Cajans cajan*) in Bihar. Pesticides, 13 (11):14-16.

Saxena Kuldeep and Ujagir Ram (2007) Effect of temperature and relative humidity on pod borer in pigeon pea. Journal of food legumes, 20 (91):121-123.

Singh P.P. and Yadav R.P. (2006) Field evaluation of yam bean (*Pachyrrhizus erosus* L.) genotypes against spotted pod borer, *M. vitrata* G. Infestation in Bihar. In: Root and Tuber crops in Nutrition, Food Security and Sustainable Environment (eds. Naskar *et. al.* 2006), published by RC of CTCRI, Bhubaneswar, pp.221-224.

(Received 05 May 2016; accepted 29 July 2016; published 15 September 2016)