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Seasonal Incidence of Spotted Pod Borer *Maruca vitrata* (Geyer) in Rice Fallow Blackgram

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ABSTRACT

A field experiment on seasonal incidence of spotted pod borer, *Maruca vitrata* in rice fallow blackgram was conducted during 2009-10 *rabi* season in the farmers field at Munipalle village in Guntur district in relation to biotic and abiotic factors *viz.,* maximum and minimum temperatures, morning and evening relative humidity, rainfall, spiders and coccinellids. The results indicated that the incidence of this pest commenced from the second week of January and remained active up to the fourth week of February. The pest reached its peak level at the first week of February with the population of twenty one larvae per twenty plants. Correlation studies indicated that morning and evening relative humidities showed significant positive correlation and minimum temperature showed significant negative correlation on the larval population of *M. vitrata*. On flower damage only morning relative humidity showed significant positive correlation, while on pod damage, all weather factors showed non significant correlation. There was no effect of biotic factors on the larval population, flower damage and pod damage.

Key words : Blackgram, *Maruca vitrata*, Seasonal incidence

Blackgram, *Vigna mungo* (L.) Hepper is the fourth important pulse crop in India and second most important in Andhra Pradesh in terms of area of cultivation. In India, it is cultivated in about 2.97 million ha with a production of only 1.25 million tonnes (Anonymous, 2008). In Andhra Pradesh, blackgram is cultivated in 3.38 lakh ha, with a production of 2.2 lakh tonnes and productivity of 653 kg/ha during 2008-09 (AICRP on Pulses Report (MULLARP), 2009). About 90% of this area in fact in Andhra Pradesh is in rice fallow which is a unique feature in the state. Blackgram is cultivated to an extent of 64,161 ha in Guntur district as rice fallow blackgram (Joint Director of Agriculture, 2009). Losses due to insect pests was one of the main factors responsible for low productivity in rice fallow blackgram. To meet the growing pulse demand of human population and to reach self sustainability in blackgram production. The avoidable losses due to insect pests have to be reduced.

Important pod borers of blackgram are spotted pod borer, *Maruca vitrata* (Geyer), tobacco caterpillar, *Spodoptera litura* (Fabricius), gram pod borer, *Helicoverpa armigera* (Hubner) and blue butterfly, *Lampides boeticus* (L). Among these, *H. armigera, S. litura* and *M. vitrata* are regular in occurrence and cause considerable yield loss (Tirumala *et al.,* 1990). Singh and Allen, 1980 opined that spotted pod borer, *M. vitrata* has become a serious pest on rice fallow *rabi* blackgram and assumed the major pest status causing 20-60 per cent loss in grain yield.

The weather parameters play a vital role in the development and population build up of insect species. These weather parameters vary greatly from place to place and season to season. In a region, the size of the pest population and the severity of damage they inflict can be governed by the environmental factors as well as by the number of enemies (Becker, 1974).

Pest monitoring is very much essential to record any changes in number of peaks or brood emergences and to alert the farmers to take up pest management practice at right time for getting higher yield. Hence, the present study was conducted to know whether there is overlapping broods or single multiple broods in *M. vitrata* in rice fallow blackgram and its relation with abiotic factors.

MATERIAL AND METHODS

A field experiment was conducted at farmers field in Munipalle village of Guntur district

during *rabi* 2009-10, to study the seasonal incidence of spotted pod borer in rice fallow blackgram in relation to biotic and abiotic factors. *viz.,* spiders, coccinellids, maximum and minimum temperatures, morning and evening relative humidities and rainfall. A bulk plot of 200m^2 of LBG-645 blackgram in rice fallow was raised and maintained without any insecticidal application.

The incidence of *M. vitrata* was recorded at weekly interval on twenty randomly selected and tagged plants at five different spots in a bulk plot of 200m^2 @ four plants per spot from one week after sowing and continued till the crop maturity. The observations were taken by counting the number of larvae per plant and number of damaged flowers and pods per plant on the selected and tagged plants.

The incidence of natural enemies was also observed simultaneously on twenty randomly selected and tagged plants. The number of predators per plant were recorded at weekly interval from one week after sowing till the crop maturity.

Abiotic factors such as maximum and minimum temperatures, morning and evening relative humidities and rainfall were recorded daily to study the relationship with the occurrence of *M. vitrata* and natural enemies in rice fallow blackgram.

The data thus collected were analysed through simple correlation and multiple linear regression anlysis (Gomez and Gomez, 1984) to know the influence of abiotic factors on the occurrence of spotted pod borer.

RESULTS AND DISCUSSION

A) Influence of biotic & abiotic factors on population buildup of spotted pod borer, *M. vitrata*

The data recorded on the incidence of spotted pod borer (Table 1) revealed that the larval population of spotted pod borer was observed from 2nd standard week (second week of January) to 8th standard week (fourth week of February). The incidence started during 2nd standard week with a mean population of 8 larvae/20 plants. The population of spiders and coccinellid predatory beetles during 2nd standard week were 3 spiders and 4 beetles /20 plants respectively.

The incidence of spotted pod borer in rice fallow blackgram on the basis of larval population increased gradually from 2nd standard week and reached a peak by 5th standard week (first week of February) with a mean population of 21 larvae/ 20 plant. The populations of spiders and coccinellid predatory beetles during 5th standard week were 2 spiders and 1 beetle per 20 plants, respectively. There after the larval population declined gradually and reached a minimum by 8th standard week with mean of 5 larvae/20 plants. The populations of spiders and coccinellid beetles during the period were nil.

Correlations were worked out to find the influence of weather parameters on the abundance of larval population and its natural enemies and are presented in Table 2. Among the five weather parameters correlated with larval population, only morning and evening relative humidities encouraged the pest population build up as they showed significant positive correlation. These results are in agreement with Arulmozhi (1990), Lakshmi (2001), Sahoo and Behra (2001) and Sivaramakrishna (2004). Rainfall depicted non-significant negative correlation which may be due to very low rainfall received during the experimental period. While the minimum temperature showed significant negative correlation with larval population, the maximum temperature showed non-significant negative correlation, The present findings are in confirmity with findings of Arulmozhi (1990), Lakshmi (2001) and Sivaramakrishna (2004).

The data on the occurrence of larval population of spotted pod borer were subjected to multiple linear regression analysis (Table 3) and the following equation was derived.

$$Y = 15.8201 - 7.2700\ X_1 + 8.7585\ X_2 + 2.6865\ X_3$$
$$2.7806\ X_4 - 14.4482 X_5 + 3.8541\ X_6 - 6.0045\ X_7$$

The results of the analysis revealed that the abiotic and biotic factors together were able to cause variation in the larval incidence of *M. vitrata* to the extent of 94.18 per cent. Out of which the minimum temperature and morning relative humidity showed significant positive influence on the larval population of *M. vitrata*. Whereas evening relative humidity and rainfall showed significant and negative influence on the larval population of *M. vitrata*.

Table 1. Influence of weather parameters on population fluctuation of *M. vitrata* on rice- fallow blackgram during *rabi* 2009-10.

Standard week	Date of observation	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)	*Maruca* larvae per 20 plants	No. of damaged flowers/ 20 plants	No. of damaged pods/20 plants	Natural enemies per 20 plants	
		Max.	Min.	Morning	Evening					Cocci-nellids	Spiders
49 (3rd Dec-9th Dec)	09.12.2009	30.44	19.21	90.57	74.57	0	0	0	0	0	0
50 (10th Dec-16th Dec)	16.12.2009	30.90	19.21	88.57	69.71	0	0	0	0	0	0
51 (17th Dec-23rd Dec)	23.12.2009	29.70	19.66	92.00	72.43	1.23	0	0	0	0	0
52 (24th Dec-30th Dec)	30.12.2009	29.34	18.46	83.14	63.71	0	0	0	0	2	3
1 (31st Dec -6th Jan)	06.01.2010	29.84	18.73	89.86	69.00	0	0	0	0	2	3
2 (7th Jan-13th Jan)	13.01.2010	29.83	20.47	91.71	76.29	0	8	25	0	4	3
3 (14th Jan-20th Jan)	20.01.2010	30.47	20.67	91.86	75.14	0	15	49	0	3	2
4 (21st Jan-27th Jan)	27.01.2010	29.81	16.10	92.33	62.50	0	18	58	0	4	2
5 (28th Jan-3rd Feb)	03.02.2010	30.14	18.36	91.14	63.43	0	21	67	11	1	2
6 (4th Feb-10th Feb)	10.02.2010	30.06	17.03	91.43	62.71	0	15	30	17	0	0
7 (11th Feb-17th Feb)	17.02.2010	30.23	18.20	88.86	67.86	0	10	22	23	0	0
8 (18th Feb-24th Feb)	24.02.2010	31.71	20.87	90.86	73.71	0	5	17	27	0	0
9 (25th Feb-3rd Mach)	03.03.2010	32.10	22.24	88.29	76.00	0	0	0	0	0	0
10 (4th March -10th March)	06.03.2010	32.84	23.17	88.14	79.14	0	0	0	0	0	0

Table 2. Correlation between weather parameters and incidence of spotted pod borer during *rabi,* 2009-10.

Variable	Correlation co-efficients		
	Larval population	Flower damage	Pod damage
X_1 Max. temperature (^{0} C)	-0.3067	-0.2816	-0.0991
X_2 Min. temperature (^{0} C)	-0.5070*	-0.4364	-0.1814
X_3 Morning relative humidity (%)	0.5247*	0.5315*	0.1323
X_4 Evening relative humidity (%)	0.5144*	-0.4454	-0.2495
X_5 Rainfall (mm)	-0.2412	-0.2306	-0.1646
X_6 Coccinellids	0.4073	0.4941*	-0.3951
X_7 Spiders	0.2469	0.3293	-0.3661

B) Influence of abiotic factors on flower damage of blackgram by *M. vitrata*

The flower damage due to spotted pod borer in rice fallow blackgram was observed from 2nd standard week to 8th standard week (Table 1). During 2nd standard week, a mean number of 25 damaged flowers/20 plants was recorded.

The flower damage increased gradually from 2nd standard week and reached a peak by 5th standard week (67 damaged flowers/20 plants). Thereafter damage declined gradually and reached a minimum by 8th standard week with a mean of 17 damaged flowers/20 plants. The populations of spiders and coccinellid beetles during the period were nil.

Correlation studies were also carried out on the influence of weather parameters on flower damage (Table 2). From these studies it can be inferred that except morning relative humidity which showed significant positive correlation, the remaining all four major weather parameters like maximum and minimum temperatures, rainfall and evening relative humidity played little role in exerting their influence on flower damage as these showed non significant negative correlation.

The data on the flower damage due to spotted pod borer were subjected to multiple linear regression analysis (Table 3) and the following equation was derived.

$$Y = -128.3327 - 15.6978\,X_1 + 23.8901\,X_2 + 7.9754\,X_3 - 7.8196\,X_4 - 34.5388\,X_5 + 11.8166\,X_6 - 13.8070\,X_7$$

It indicated that weather factors together caused 92.31 per cent of total variation in flower damage due to the spotted pod borer. Of these only the morning relative humidity showed significant positive influence on the flower damage. Whereas evening relative humidity showed significant and negative influence on the flower damage.

C) Influence of abiotic factors on pod damage of blackgram by *M. vitrata*

The data recorded on the pod damage due to spotted pod borer in rice fallow blackgram was presented in Table 1. It indicated the presence of pod damage from 5th standard week to 8th standard week. The incidence started during 5th standard week with a mean number of 11 damaged pods/20 plants. .

The data also showed the gradual increase of pod damage from 5th standard week and reached the peak level by 8th standard week (27 damaged pods/20 plants). Thereafter damage disappeared by 9th standard week (first week of March).

Correlations were worked out to find out the relationship between pod damage and the major weather parameters (Table 2). The results revealed that maximum and minimum temperatures showed negative and non-significant effect, morning relative humidity exerted positive and non-significant effect on pod damage, while it was negative and non-significant with evening relative humidity. The relationship between the pod damage and the rainfall was negative and non-significant. The results conclude that all the weather parameters

Table 3. Multiple linear regression analysis between spotted pod borer *M. vitrata* and biotic and abiotic factors in rice fallow blackgram during *rabi* 2009-10.

	Regression equation	R^2 value	Intercept (a)
Larval population	$Y = 15.8201 - 7.2700\ X_1 + 8.7585^*\ X_2 + 2.6865^*\ X_3 - 2.7806^*\ X_4 - 14.4482^*\ X_5 + 3.8541\ X_6 - 6.0045\ X_7$	0.9418	15.82
Flower damage	$Y = -128.3327 - 15.6978\ X_1 + 23.8901 X_2 + 7.9754^*\ X_3 - 7.8196^*\ X_4 - 34.5388\ X_5 + 11.8166\ X_6 - 13.8070\ X_7$	0.9231	- 128.33
Pod damage	$Y = 88.7613 - 8.4648\ X_1 + 7.2848\ X_2 + 2.0774\ X_3 - 2.0457\ X_4 - 19.1268\ X_5 - 1.7159\ X_6 - 5.9627\ X_7$	0.7017	88.76

X_1 = Maximum temperature (^{0}C)
X_2 = Minimum temperature (^{0}C)
X_3 = Morning relative humidity (%)
X_4 = Evening relative humidity (%)
X_5 = Rainfall (mm)
X_6 = Coccinellids
X_7 = Spiders

* Significant at 5% level

had little role on pod damage as they recorded non-significant correlation.

The data on the pod damage due to spotted pod borer were subjected to multiple linear regression analysis (Table 3) and the following equation was derived.

$$Y = 88.7613 - 8.4648\ X_1 + 7.2848\ X_2 + 2.0774\ X_3 - 2.0457\ X_4 - 19.1268\ X_5 - 1.7159\ X_6 - 5.9627\ X_7$$

The multiple linear regression analysis indicated that the total influence of all the weather parameters together were responsible for 70.17 per cent on the pod damage done by spotted pod borer.

Spiders

The initial incidence of spiders was observed during 52nd Standard week (fourth week of December) with a population of 3 spiders/20 plants. The population maintained up to 2nd standard week thereafter, the population declined gradually and reached to the lowest levels by 5th standard week with 2 spiders/20 plants (Table 1).

From the above data it can be inferred that there was only single peak without any multiple peaks or overlapping broods of *M. vitrata* in rice fallow blackgram. Hence the farmers can be alerted at first week of February where the pest reached the peak level to take up pest management practices at right time.

LITERATURE CITED

All India Coordinated Research Project on Pulses Report (MULLARP) 2009 Lam Farm, Guntur, Andhra Pradesh.

Anonymous 2008 Project Co-ordinators Report of AICRP on MULLARP. Indian Institute of Pulses Research, Kanpur, India.

Arulmozhi K 1990 Bioecology of *Maruca vitrata* (Geyer) and its management. M.Sc.(Ag) Thesis submitted to Tamil Nadu Agricultural University, Coimbatore.

Becker P C 1974 Pest of ornamental plants. Ministry of Agriculture, Fisheries and Food, London.

Gomez K A and Gomez A A 1984 Statistical Procedure for Agricultural Research, John Wiley Sons, Newyork: pp.68.

Joint Directorate of Agriculture 2009 Department of Agriculture, Andhra Pradesh.

Lakshmi P S R 2001 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.

Sahoo B K and Behera U K 2001 Influence of abiotic factors on the incidence of pigeonpea pod borers in coastal belt of Orissa. *Environment and Ecology* 19(4): 882-884.

Singh S R and Allen D J 1980 Pests, diseases, resistance and protection of *Vigna unguiculata* (L.) Walp.In; Advances in legume science (eds) Summer Field R J and Bunting A H. London Royal Botanic Garden, Kew and Ministry of Agriculture, Fisheries and Food, London. pp. 419-443.

Sivaramakrishna J Rajasekhar P and Ramachandra Rao G 2004 Influence of weather parameters on the occurrence of major lepidopteran pests on blackgram. *The Andhra Agricultural Journal* 51(1&2): 86-89.

Tirumala K Rao N V Abhaiah K and Satyanarayana A 1990 Yield losses due to insect pests and diseases of blackgram (*Vigna mungo*) in Andhra Pradesh. *Indian Journal of Plant Protection* 18: 287-289.

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