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SEASONAL INCIDENCE OF SPOTTED POD BORER, *Maruca vitrata* (Geyer) ON GROUNDNUT (*Arachis hypogaea* L.) DURING *RABI* SEASON

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ABSTRACT

Seasonal incidence (per cent damage) of *Maruca vitrata* in groundnut was studied during *rabi* 2015-16 at dry land farm, S.V. Agricultural College, Tirupati on two groundnut varieties *i.e.,* Dharani and Kadiri-6 (K6) at two different dates of sowing D_1 and D_2. The results indicated that, the incidence (per cent damage) of *M. vitrata* on groundnut on both D_1 and D_2 was observed from 3rd to 12th standard week of 2016. In D_1 and D_2 sown groundnut varieties, damage due to *M. vitrata* was high during 3rd to 9th standard weeks. In D_1 sown crop, weather parameters such as maximum temperature, minimum temperature, sunshine hours and wind speed showed negative association with *M. vitrata* damage whereas morning relative humidity and evening relative humidity showed positive association with *M. vitrata* damage. In D2 sown crop, maximum temperature, minimum temperature, wind speed and evening relative humidity showed a negative correlation whereas sunshine hours and morning relative humidity showed a positive correlation. In D_1 sown crop, six weather parameters *viz.,* maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind speed combinedly influenced *M. vitrata* damage to the extent of 74 per cent (R^2= 0.74) and 77 percent (R^2= 0.77) in groundnut cultivars Dharani and K-6. In D_2 sown crop, six weather parameters *viz.,* maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind speed combinedly influenced *M. vitrata* damage up to the extent of 76 per cent (R^2=0.76), 77 per cent (R^2=0.77) in Dharani and K-6 respectively.

KEYWORDS: Abiotic factors, *Maruca vitrata*, *Arachis hypogaea*

INTRODUCTION

Groundnut is an important oil seed crop of tropical and subtropical regions of the world. India ranks first in groundnut cultivation with an area of 5.53 m ha and occupies second place in production (9.67 million tons) with productivity of 1750 kg ha^{-1}. In India, groundnut is mostly grown in five states *viz.,* Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra which accounts for 80 per cent of total area and 84 per cent of total production of groundnut. In Andhra Pradesh, groundnut is grown in an area of 13.86 lakh hectares with a total production of 7.48 lakh tonnes and productivity of 644 kg ha^{-1} (Indiastat, 2014).

Several insects damage groundnut crop and cause considerable yield losses. Among these insect pests, white grub cause yield losses up to 100 per cent, tobacco caterpillar causes yield losses up to 15-30 per cent, red hairy caterpillar up to 75 per cent, leaf miner up to 49 per cent, leafhoppers up to 17 per cent and thrips causes yield losses up to 17 per cent (Ghewande and Nandagopal, 1997).

Spotted pod borer *Maruca vitrata* (Geyer), which is a common pest of pulses is extending its incidence on groundnut in southern zone of Andhra Pradesh and has caused damage up to 40 per cent to the terminal growing point at crop maturity during *rabi* season. Not much work was done on seasonal incidence of *M. vitrata* in groundnut. Hence the present studies were conducted at S.V. Agricultural College Farm, Tirupati during *rabi* 2015-16.

MATERIALS AND METHODS

A field trial was laid with two groundnut varieties Kadiri-6 (K-6) and Dharani to study the seasonal incidence (per cent damage) of *M.vitrata* and influence of various weather parameters on incidence of *M. vitrata* during *rabi* 2015-16.The trial was laid in an area of 5 × 5 m^2 with four dates of sowing *i.e.*, second fortnight of November (D_1), first fortnight of December (D_2), second fortnight of December (D_3) and first fortnight of January (D_4) by following normal agronomic practices as developed by ANGRAU except for plant protection measures.

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Table.1. Per cent *M. vitrata* damage on groundnut during *rabi* 2015-16

Standard week	Weather parameters						Per cent damage by *Maruca vitrata*							
	Max. temp (°C)	Min. temp (°C)	RH mor. (%)	RH eve. (%)	SSH (hours)	WS (kmph)	D_1 (Nov II FN)		D_2 (Dec I FN)		D_3 (Dec II FN)		D_4 (Jan I FN)	
							Dharani	K6	Dharani	K6	Dharani	K6	Dharani	K6
50 (10-16 Dec)	30.4	20.6	91.9	63.9	6.6	2.2	0	0	0	0	--	--	--	--
51 (17-23 Dec	31.0	19.7	91.0	63.6	8.2	2.0	0	0	0	0	--	--	--	--
52 (24-31 Dec)	29.7	18.1	88.0	60.6	7.7	4.7	0	0	0	0	0	0	--	--
1 (01-07 Jan), 2016	30.0	16.5	90.1	58.0	8.5	3.8	0	0	0	0	0	0	--	--
2 (08-14 Jan)	29.6	14.8	89.1	54.7	8.0	3.4	0	0	0	0	0	0	0	0
3 (15-21 Jan)	30.0	17.9	91.9	60.7	5.6	3.0	13.66	13.78	0	0	0	0	0	0
4 (22-28 Jan)	30.7	20.4	91.7	58.7	6.2	5.1	11.39	10.52	0	0	0	0	0	0
5 (29 Jan – 4 Feb)	33.1	16.9	84.7	33.7	9.0	2.9	12.9	11.97	13.46	11.29	0	0	0	0
6 (05 – 11 Feb)	32.4	18.6	89.6	41.7	7.8	3.5	17.25	11.77	14.79	8.85	0	0	0	0
7 (12 – 18 Feb)	32.5	19.1	88.9	48.0	8.8	4.3	13.96	8.54	8.39	5.49	0	0	0	0
8 (19 – 25 Feb)	34.6	21.1	87.0	39.1	9.6	4.2	8.18	8.14	10.98	5.87	0	0	0	0
9 (26 Feb – 04 Mar)	33.15	21.29	87.13	43.00	7.26	4.39	7.60	7.16	7.82	5.42	0	0	0	0
10 (05 – 11 Mar)	34.54	22.11	86.00	38.14	7.80	3.93	4.90	3.90	2.5	3.34	0	0	0	0
11 (12 – 18 Mar)	36.60	25.53	79.71	41.43	6.24	4.51	3.98	2.98	1.65	2.34	0	0	0	0
12 (19 – 25 Mar)	39.19	24.90	72.14	27.00	7.61	3.96	1.02	0.96	0.89	0.66	0	0	0	0
13 (26 Mar – 01 April)	36.27	23.43	77.67	33.33	8.35	4.07	--	--	0	0	0	0	0	0
14 (02 – 08 April)	36.4	23.7	77.0	34.0	8.3	4.0	--	--	--	--	0	0	0	0
15 (09 - 15 April)	38.3	25.7	76.7	33.7	8.3	4.2	--	--	--	--	0	0	0	0
16 (16 – 22 April)	39.4	26.0	75.9	30.6	8.9	4.6	--	--	--	--	--	--	0	0
17 (23 – 29 April)	39.9	27.0	74.4	33.0	9.9	4.5	--	--	--	--	--	--	0	0

Table 2. Correlation studies of *M. vitrata* damage in relation to weather parameters during *rabi* 2015-16

Weather parameter	D_1		D_2	
	Dharani	K-6	Dharani	K-6
Maximum temperature (X1)	-0.30	-0.32	-0.09	-0.07
Minimum temperature (X2)	-0.38	-0.38	-0.29	-0.28
Morning RH (X3)	0.45*	0.46*	0.23	0.19
Evening RH (X4)	0.06	0.09	-0.24	-0.27
Sunshine hours (X5)	-0.21	-0.26	0.27	0.23
Wind speed (X6)	-0.006	-0.02	-0.07	-0.09

r value at 0.05 is 0.53
* : significant at 5%.
D_1 : Date of sowing: 27-11-2015, D_2 : Date of sowing: 12-12-2015
D_3 : Date of sowing: 27-12-2015, D_4 : Date of sowing: 11-01-2016

The observations were initiated from 30 DAS which coincides with incidence of *M. vitrata*. Data on incidence of *M. vitrata* in terms total number of plants/m^2 and number of plants damaged by *M. vitrata* were recorded at weekly interval for calculating per cent damage. The per cent damage data was correlated with meteorological parameters recorded at meteorological station.

Per cent damage was calculated by using the following formula

$$\text{Per cent damage} = \frac{\text{Number of plants damaged / m}^2}{\text{Total number of plants / m}^2} \times 100$$

RESULTS AND DISCUSSIONS

M. vitrata damage started from 3rd standard week of 2016 to 12th standard week of 2016 in two dates of sowings i.e. D_1 and D_2.

The data indicated that the *M. vitrata* damage was first noticed in 3rd and 5th standard weeks and continued up to 12th standard week of 2016 in D_1 and D_2 sown crops respectively. In D_1 damage was ranged from 1.02 to 17.25 and 0.96 to 13.78 per cent in Dharani and K-6 varieties respectively. In case of D_2 sown crop, the damage ranged from 0.89 to 14.79 per cent in Dharani and 0.66 to 11.29 per cent in K-6. In D1 sown crop (in both Dharani and K6) the damage was high from 3rd SMW to 7th SMW and thereafter started declining and no damage was noticed from 13th SMW. In D2 sown crop (in both Dharani and K6) the damage was high from 5th SMW to 9th SMW and thereafter started declining and no damage was noticed from 13th SMW (Table 1).

The results of present investigation are comparable with that of Annual report of Regional Agricultural Research Station (RARS), 2015 RARS, Tirupati, according to which the damage was high during February to March, 2015 (Anonymous, 2015).

Correlation of *M. vitrata* damage in relation to weather parameters during *rabi,* 2015-2016

Correlation studies between per cent damage and weather parameters such as maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind speed indicated that, maximum temperature (-0.30, -0.32), minimum temperature (-0.38, -0.38), sunshine hours (-0.21, -0.26) and wind speed (-0.006, -0.02) showed negative association (non-significant) with *M. vitrata* damage on Dharani and K6. Whereas morning relative humidity (0.45, 0.46) (significant) and evening relative humidity (0.06, 0.09) showed positive association (non-significant) with *M. vitrata* damage on Dharani and K6.

In case of D2 sown crop, maximum temperature (-0.09, -0.07), minimum temperature (-0.29, -0.28), evening RH (-0.24, -0.27) and wind speed (-0.07, -0.09) showed negative correlation (non-significant) and morning relative humidity (0.23, 0.19) and sunshine hours (0.27, 0.23) had a positive correlation (non-significant) with *M. vitrata* damage.

Table 3. Regression analysis for *M. vitrata* damage on groundnut in relation to weather parameters during *rabi*, 2015-16

Regression model	Regression equation *M. vitrata* damage	R^2
Dharani		
D_1 (Full model)	Y = -207.343 + (3.818)Max temp. + (-1.990)Min temp. + (1.826) RH mor. + (-0.300) RH eve. + (-2.750) SSH + (1.497) WS + 3.686	**0.744**
D_1 (Forward selection)	Y = -227.352 + (3.804) Max temp. + (-1.589) Min temp. + (1.619) RH mor. + 4.711	0.486
D_2 (Full model)	Y = -75.158 + (0.287) Max temp. + (-0.250) Min temp. + (1.164) RH mor. + (-0.593) RH eve. + (0.370) SSH + (-0.257) WS + 2.921	**0.768**
D_2 (Forward selection)	Y = -58.068 + (-0.188) Min temp. + (1.108) mor. RH + (-0.638) RH eve. + 2.688	0.759
D_3 (Full model)	Y = 0.000 + (0.000) Max temp. + (0.000) Min temp. + (0.000) RH mor. + (0.000) RH eve. + (0.000) SSH + (0.000) WS + 0.000	**0.000**
D_3 (Forward selection)	Y = 0.000 + (0.000) Max temp. + (0.000) Min temp. + (0.000) RH mor. + (0.000) RH eve. + (0.000) SSH + (0.000) WS + 0.000	0.000
D_4 (Full model)	Y = 0.000 + (0.000) Max temp. + (0.000) Min temp. + (0.000) RH mor. + (0.000) RH eve. + (0.000) SSH + (0.000) WS + 0.000	**0.000**
D_4 (Forward selection)	Y = 0.000 + (0.000) Max temp. + (0.000) Min temp. + (0.000) RH mor. + (0.000) RH eve. + (0.000) SSH + (0.000) WS + 0.000	0.000
K-6		
D_1 (Full model)	Y = -165.256 + (3.201) Max temp. + (-1.713) Min temp. + (1.466) RH mor. + (-0.237) RH eve. + (-2.591) SSH + (1.121) WS + 3.129	0.77
D_1 (Forward selection)	Y = -175.998 + (2.910) Max temp + (-1.222) Min temp. + (1.269) RH mor. + 4.070	0.448
D_2 (Full model)	Y = -32.730 + (-0.043) Max temp. + (-0.134) Min temp. + (0.714) RH mor. + (-0.446) RH eve. + (0.040) SSH + (-0.392) WS + 1.986	**0.770**
D_2 (Forward selection)	Y = -34.769 + (-0.188) Min temp + (0.716) RH mor. + (-0.437) RHeve. + 1.817	0.763
D_3 (Full model)	Y = 0.000 + (0.000) Max temp. + (0.000) Min temp. + (0.000) RH mor. + (0.000) RH eve. + (0.000) SSH + (0.000) WS + 0.000	**0.000**
D_3 (Forward selection)	Y = 0.000 + (0.000) Max temp. + (0.000) Min temp. + (0.000) RH mor. + (0.000) RH eve. + (0.000) SSH + (0.000) WS + 0.000	0.000
D_4 (Full model)	Y = 0.000 + (0.000) Max temp. + (0.000) Min temp. + (0.000) RH mor. + (0.000) RH eve. + (0.000) SSH + (0.000) WS + 0.000	**0.000**
D_4 (Forward selection)	Y = 0.000 + (0.000) Max temp. + (0.000) Min temp. + (0.000) RH mor. + (0.000) RH eve. + (0.000) SSH + (0.000) WS + 0.000	0.000

The result of present investigations were similar to the findings of Ramesh Babu *et al*. (2006) who reported the minimum temperature had significant negative influence on the larval population of *M. vitrata* on groundnut.

Present investigations are supported by the findings of Umbarkar *et al.* (2010) who reported that among the weather parameters, minimum temperature (r= -0.559) exhibited highly significant negative correlation with the spotted pod borer population on green gram.

Regression model developed for the *M. vitrata* damage in relation to weather parameters during *rabi,* 2015-2016

Regression analysis of *M. vitrata* damage with weather parameters of *rabi* 2015-2016 indicated that, all the six weather parameters *viz.,* maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind speed together influenced *M. vitrata* damage to the extent of 74 (R^2= 0.74) and 77 (R^2= 0.77) per cent in groundnut cultivars Dharani and K-6 in D1 sown crop.

In case of D2 sown crop, weather parameters *viz.,* maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours and wind speed had influenced *Maruca* damage (Table. 3).

CONCLUSIONS

M. vitrata damage was first noticed in 3rd and 5th standard weeks of 2016 in D_1 and D_2 sown crops respectively. Weather parameters such as maximum temperature, minimum temperature and wind speed showed negative association with *M. vitrata* damage in terms of foliar damage. On the contrary, morning relative humidity showed positive association with *M. vitrata* damage in groundnut and evening relative humidity showed positive association in D_1 and negative association in D_2 sown crop. Sunshine hours showed negative association in D_1 and positive association in D_2 sown crop. Among the six weather parameters, morning relative humidity (r = + 0.45, r = + 0.46) showed significant influence on *M. vitrata* damage in D_1, weather parameters did not show significant influence on the damage of *M. vitrata* while in D_2 and in D_3, D_4 sown crop *M. vitrata* incidence was not observed.

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