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Short Communication

Effect of weather parameters on population build up of spotted pod borer, *Maruca vitrata* (Geyer) on pigeonpea (*Cajanus cajan* (L) Millsp.)

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The pulses being rich source of proteins with high nutritional value occupy aspecial role in diet of human beings. Pulses contain nearly 30 per cent protein that supplements the energy rich cereal diet. Among the pulses, pigeon pea consisting of 20-21 per cent protein occupies an important place next to chickpea and is widely grown in semi-arid regions of the world. Pigeonpea, *Cajanus cajan* (L.) Millsp.is an important pulse crop grown in Telangana, India. The pigeonpea production in recent years is not able to meet the requirements of growing population necessitating the losses and constraints to be curbed. The pod borers have been identified as the major constraints in increasing the productivity of pigeonpea (Sahoo and Senapati, 2002). Among the constituents of the pod borer community infesting pigeonpea, spotted pod borer, *Maruca vitrata*(Geyer) (Lepidoptera : Crambidae) is one of the most serious pest occurring during flowering and pod formation stage causing huge losses (Pappu *et al*., 2010). In India, *Maruca* damage has been found to range from 9 to 51 per cent in pigeonpea (Bhagwat *et al*., 1998). Effective management strategies have to be developed to reduce the losses caused by the pest. Understanding the population dynamics in the crop will yield valuable information for strategizing the management options of that particular pest. Various weather parameters are known to influence the population build up and suppression. Hence, an attempt was made to know the influence of weather parameters on the population of spotted pod borer, *Maruca vitrata* for planning an effective pest management strategy that will help farmers in controlling the pest with less investment without the risk of long term problem including resurgence.

Survey of insect pests of pigeonpea was carried out in farmers' fields for two years during *kharif* 2013 and 2014. Total of six fields, three in each village having minimum of one acre area were selected in Gorita and Marikal villages of Thimmajipet mandal of Mahabubnagar district. The experimental location was situated at an altitude of 182.9 m above MSL on 79°36' Nlatitude and 13°37' E longitude in the Southern Telangana zone of Telangana. The crop was sown adopting a spacing of 90 x 10 cm with application of recommended dose of fertilizers. A single spray of monocrotophos @1.6 ml was taken up by farmers' during crop growth period against pest complex. Observations on *Maruca vitrata* were made on randomly selected twenty five plants from each field at weekly intervals right from flowering stage and continued till the harvest of the crop. The number of larvae in each plant was counted directly.

The trend of population build-up of the borer was determined by working out the mean number of larvae/ plant. Simultaneously, data on weather parameters like maximum temperature (T_{max}°C), minimum temperature (T_{min}°C), morning relative humidity (RH I %), afternoon relative humidity (RH II %), rainfall (RF mm), sunshine hours (SSHr day^{-1}), wind speed (Kmhr^{-1}), evaporation (mm)were collected from meteorological observatory, RARS, Palem which is 30 km away from selected villages used for correlation and regression studies to know the influence of weather parameters on the population of *M. vitrata*.The data was then subjected to statistical analysis using SPSS software to work out correlation between weather parameters and *Maruca* pod borer and to develop regression model for *Maruca* pod borer.

The results pertaining to the studies on seasonal incidence of *M. vitrata* indicated that the incidencewas first noticed on first week of October (40th standard week) during *kharif*, 2013 and its incidence increased gradually and the pest reached its peak level (6 larvae per plant) during the first week of November (44th standard week) which coincides with the peak flowering stage of the crop, thereafter its incidence showed in decreasing trend.During *kharif*, 2014 incidence of *Maruca* pod borer was very low *i.e*., below ETL

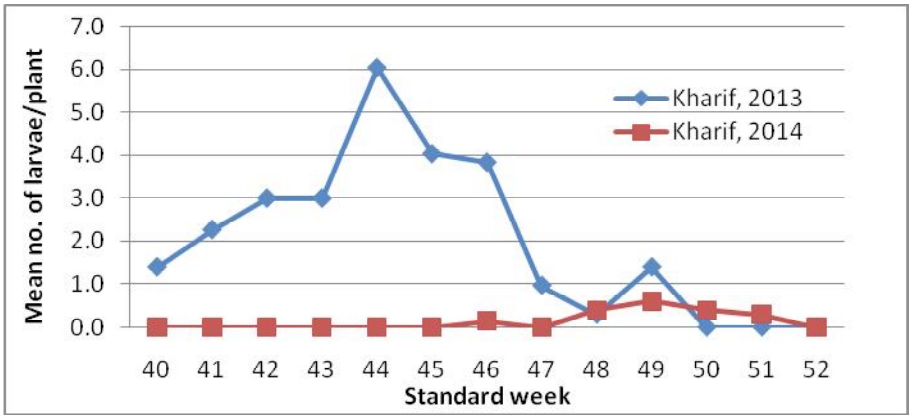

Fig. 1: Seasonal incidence of *Maruca vitrata* in pigeonpea during *kharif*, 2013 and *kharif*, 2014 at farmers' field

Table 1: Correlation coefficient between weather parameters and *Maruca vitrata* in pigeonpea (pooled data of *kharif*, 2013 and 2014)

Weather parameters	Preceeding1 week	Preceeding2 weeks	Preceeding 3 weeks
Tmax (°C)	-0.14	0.16	0.16
Tmin (°C)	0.61**	0.57*	0.57*
RHI (%)	0.23	0.12	0.58**
RH II (%)	0.05	0.05	-0.06
RF (mm)	0.65**	0.43*	0.66**
RD (days)	0.65**	0.42	0.66**
SSH	0.04	-0.29	-0.35
Tmean (°C)	0.50*	0.48*	0.42

** Significant at 0.01 level * Significant at 0.05 level

Note:Tmax (Maximum temperature °C), Tmin (Minimum temperature °C), RHI 1 (Morning relative humidity, %),RHII (Evening relative humidity %), RF (Rainfall, mm),RD (rainydays), SSH (sunshine hours), Tmean(Mean temperature)

Table 2: Different relationships established between *Maruca vitrata* and weather parameters so as to develop a forecasting model for the pest

Equation no.	Weather factor considered	Model equation	R^2
1	RD3, RF1, RF2, RF3	Y=0.20 + 0.01 (RF3) + 0.14 (RD3) + 0.01 (RF2) + 0.01 (RF1)	0.89
2	RD3, RF1, RF2 (excluded RF3)	Y=0.18 + 0.48 (RD3) + 0.01 (RF2) + 0.01 (RF1)	0.86
3	RD3,RF1 (excluded RF2, RF3)	Y=0.54 + 0.50 (RD3) + 0.015 (RF1)	0.64
4	RD3 (excluded RF1, RF2, RF3)	Y=0.6674 + 0.672 (RD3)	0.44

Note : RD3(Preceding three weeks rainy days), RF1(Preceding one week rainfall), RF2 (Preceding two weeks rainfall), RF3(Preceding three weeks rainfall)

with maximum of 0.8 larvae/plant were recorded on first week of December (49th standard week). These results are in confirmity with the reports of Sharma and Franzamann (2000) who found that, the incidence of *M. vitrata* on pigeonpea was bimodal where early infestation starts from September reaching its first peak during middle of October and second peak during December.

Comparison of larval incidence of *M. vitrata* over two years revealed that, larval incidence was far higher in first year of study *i.e.*, during *kharif* 2013 than in second

Table 3: Final model with RD3, RF1 and RF2 was thus established as follows (Equation 2, Table2) and its parameters are as follows

Predictors	Parameter estimates	Standard error	p-Value
Constant	0.18	0.22	0.42
RD 3	0.47	0.10	0.00
RF 2	0.01	0.00	0.00
RF 1	0.01	0.06	0.00

Note: R^2 = 0.86; F = 31.15**; p = <.0001.

year of study *i.e.*, during *kharif* 2014 (Fig.1)

Correlation coefficients worked out between the weather parameters and *M. vitrata* incidence (two years pooled data of *kharif* 2013 and 2014) revealed that one week lag (0.61**), two weeks lag(0.57*) and three weeks lag (0.57*) minimum temperature, one (0.65*) and three weeks lag (0.66**) rainfall, one (0.65*), two (0.43*) and three weeks lag (0.66**)rainy days, one week lag (0.50*) and two weeks (0.48*)mean temperature and three weeks lag morning relative humidity (0.58**) showed significant positive influence on *M. vitrata* incidence in pigeonpea (Table 1). Positive correlation (r=0.86) between rainfall and incidence of *M. vitrata* has been reported by Sharma and franzamana (2000). Swamy and Devaki (2015) reported that maximum, minimum temperatures showed significant positive influence, whereas evening relative humidity showed significant negative influence. The larval population of*M. vitrata* was significantly influenced by average temperature and relative humidity at Hisar. In contrast, Jat *et al. (*2017) reported that incidence of *M. vitrata* was negatively correlated with evening relative humidity.The population buildup of *M. vitrata* varied remarkably in different parts of the country probably due to differences in agro climatic conditions and crop types (Akhauri, 1992).

When rainy days and rainfall is included in the model, the model could explain the variation 89 per cent in *M.vitrata* incidence.However, removal of RF3 did not result in an appreciable reduction in coefficient of determination (R^2 = 0.86) (Equation 2, Table 2) thereby indicating insignificant influence of RF3 on *M.vitrata* incidence. However, RF2 removal resulted in reduction in R^2 (0.64) thus indicating significant role of RF2 on *M.vitrata* incidence (Equation 3, Table 2). Further, RF1 was excluded and model with RD3 could account for only 44 per cent variability in *M. vitrata* incidence, thereby suggesting significant role of one week lag rainfall (Equation 4, Table 2)

Pest–weather model clearly suggested the RD3, RF1 and RF2 to be important weather parameters that influenced *M. vitrata* incidence at Mahabubnagar district, Telangana. Similar results on interactive effect of rainfall and rainy days on *M. Vitrata* were also reported by Ba *et al*. (2009) who found that adults seem to be present only during the rainy season during the period August to October as noted in Niamey and Kano in 1993 and 1994. They also demonstrated in Burkina Faso that the moth catches in light traps varied with latitude and positively correlated with rainfall. In the Maradi, it is also noted a variation in catches of *M. vitrata* depends on rainfall.As reliable forewarning and monitoring tools are indispensible for pest management, the *M. vitrata* prediction model would prove useful in forewarning likely occurrence of the pest in Mahabubnagar region, thereby paving way for timely action and prevention of yield losses due to the pest.

It can be concluded that, one, two and three weeks lag minimum temperature; one, two and three weeks lag rainfall; one and three weeks lag rainy days; one and two weeks lag mean temperature and three weeks lag morning relative humidity had significant positive influence on the incidence of the *M. vitrata*. Whereas, one week and two weeks lag rainfall and three weeks lag rainy days showed highly significant positive impact on population build up of *M. vitrata* and these parameters together accounted for 86.00 per cent significant variation in larval population of *M. vitrata*.This shows that rainfall and rainy days was very favourable for the multiplication of *M. vitrata* population.

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