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# Seasonal incidence of *Maruca vitrata* Geyer and *Helicoverpa armigera* Hubner on black gram (*Vigna mungo* L. Hepper)

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**Abstract**
The field experiment was conducted on the seasonal incidence of spotted pod borer, *Maruca vitrata* Geyer and gram pod borer, *Helicoverpa armigera* Hubner on black gram at Chatha Farm, SKUAST-Jammu during summer 2018. The data on seasonal fluctuations of spotted pod borer and gram pod borer larval population was first observed during 10th standard week with an initial population of 0.36 larvae/ $m^2$ area and 0.46 larvae/ $m^2$ area, respectively. The maximum larval population of *M. vitrata* (12.53 larvae/ $m^2$ area) was recorded during 15th standard week, whereas, the maximum incidence of *H. armigera* (9.53 larvae/$m^2$ area) was recorded 18th standard week of sown crop. Thereafter, the spotted pod borer and gram pod borer larval population decreased till 23rd standard week up to 4.42 larvae and 0.26 larvae/ $m^2$ area, respectively on the same crop. A highly significant positive correlation was existed between weekly mean maximum temperature (0.633**) and spotted pod borer larval density, positively significant correlation with minimum temperature (0.586*), significantly negative correlation with relative humidity morning (– 0.551*) and evening (– 0.593*). While, the positive correlation between weekly mean maximum temperature (0.466) and gram pod borer larval density, positive correlation with minimum temperature (0.362), negative correlation with relative humidity morning (– 0.457) and a significant evening (– 0.498*) and non-significant negative correlation with rainfall (-0.252) and significant positive correlation with wind speed (0.489*) were recorded. The regression analysis indicated that all the weather parameters together were responsible for a significant variation of 62.50 and 54.10 per cent on the larval incidence of spotted pod borer and gram pod borer, respectively.

**Keywords:** Seasonal incidence, *Maruca vitrata*, *Helicoverpa armigera*, black gram

## Introduction
Pulses are main ingredient of human diet and being grown throughout the year in different agro climatic conditions of India. Among the pulses, Black gram (*Vigna mungo* L. Hepper) is generally called as urd bean and grown in multiple cropping systems like mixed crop and intercrop due to its short duration nature [9, 16]. However, the per cent share of black gram is 12.20 and having production of 2800.00 thousand tonnes in India [3]. In Jammu region of Jammu and Kashmir state, the area, production and productivity of black gram in Jammu division is 6.381 thousand hectares, 2.144 thousand tones and 335.98 kg/ha, respectively [2].
A large magnitude of insect pests appeared in succession at different stages of crop growth of black gram [5] but about a dozen of them cause significant damage [8, 15]. On an average, 2.5 to 3.0 million tonnes of pulses are lost annually due to pest problems [1, 11] with a monetary value of nearly Rs. 6,000 crores due to ravages caused by insect pest complex [13]. Among various insect pests, gram pod borer, *Helicoverpa armigera* (Hubner) and spotted pod borer, *Maruca vitrata* Geyer is serious pests of grain legumes causing seed and pod damage [18, 10, 17]. *Maruca vitrata* (Geyer), the one of major pest of black gram is resulted in the webbing of the flowers, buds, pods and leaves and fed from within whereas *Helicoverpa armigera* Hubner is considered to be the *numero uno* species in the pod borer complex causing damage to both flowers and pods. The attack of insect pest compelled the farmers to spray various mixtures of insecticides which results only in the economical losses but also produces the adverse impacts on the flora and fauna as well as environment. Thus, there is further need to study the incidence of *Maruca vitrata* Geyer and *Helicoverpa armigera* Hubner on black gram in the Jammu region to attain substantial information on the occurrence and behaviour of insect with respective to meteorological factors, the level of insect infestation, the loss incurred by incidence and development of suitable and effective pest management practices.

Keeping the above facts in view, the present trial was organized to study the seasonal incidence of gram pod borer and spotted pod borer on black gram.

## Materials and Methods

To study the incidence of different pod borers and their correlation with the environmental variables or abiotic factors, the experiment was carried out at Entomology experimental field, Chatha Farm, SKUAST-Jammu during 2018 *summer* crop season. The Locally available cultivar of black gram, TYPE-9 was raised in three plots with 4 × 3 $m^2$ size of each plot at 30 x 10 cm spacing using Randomized Block Design (RBD). Population of different pod borers larvae per sq meter (30 plants/ sq meter) were recorded early in the morning hours at weekly intervals from 15 days after germination up to before harvesting of black gram crop. All the recommended agronomic practices were followed for raising the crop. The plots were kept without insecticidal umbrella to allow pod borers to multiply throughout the cropping season. The seasonal population of different pod borers *i.e.* gram pod borer, *Helicoverpa armigera* (Hubner) and spotted pod borer, *Maruca vitrata* (Geyer) was correlated with the weather parameters *viz*., temperature, rainfall, relative humidity and wind velocity which were recorded from the Meteorology section of SKUAST-Jammu and their mean population were calculated using statistical procedures.

## Results and Discussions

The seasonal incidences of different pod borers were noted at weekly intervals from 7th Standard Week (SW) to 23rd SW on black gram during 2018, respectively and are presented in Table 1.

**Table 1:** Seasonal population fluctuation of *Maruca vitrata* and *Helicoverpa armigera* larval population on black gram

| Standard Weeks (SW) | Month & Year | Mean number of larval population of *Maruca*/ 30 plants | Mean number of larval population of *Helicoverpa* / 30 Plants | Maximum temp. (°C) | Minimum Temp. (°C) | Relative Humidity (R.H) morning (in %) | Relative Humidity (R.H) evening (in %) | Rainfall (in mm) | Wind speed (km/hr) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 12-Feb | 0 | 0 | 20.5 | 7.7 | 92 | 54 | 6.7 | 4.8 |
| 2 | 19-Feb | 0 | 0 | 24.2 | 9.8 | 87 | 54 | 0.5 | 2.9 |
| 3 | 26-Feb | 0 | 0 | 24.5 | 12.2 | 84 | 58 | 0.8 | 3.6 |
| 4 | 5-Mar | 0.36 | 0.46 | 27.2 | 10.3 | 88 | 43 | 0.0 | 3.2 |
| 5 | 12-Mar | 1.2 | 0.93 | 29.2 | 11.6 | 84 | 38 | 0.0 | 3.6 |
| 6 | 19-Mar | 2.73 | 1.8 | 28.2 | 12.3 | 84 | 45 | 1.1 | 4.3 |
| 7 | 26-Mar | 4.44 | 2.86 | 32.4 | 13.6 | 84 | 35 | 0.0 | 3.6 |
| 8 | 2-Apr | 10.94 | 3.46 | 33.1 | 17.0 | 77 | 39 | 0.0 | 3.2 |
| 9 | 9-Apr | 12.53 | 5.46 | 31.7 | 16.3 | 78 | 36 | 3.8 | 4.9 |
| 10 | 16-Apr | 8.33 | 6.13 | 30.4 | 16.0 | 77 | 45 | 2.6 | 5.9 |
| 11 | 23-Apr | 9.86 | 7.86 | 38.5 | 16.9 | 66 | 20 | 0.0 | 3.3 |
| 12 | 30-Apr | 10.06 | 9.53 | 36.5 | 20.2 | 60 | 30 | 1.0 | 5.8 |
| 13 | 7-May | 10.33 | 7.86 | 36.2 | 19.4 | 61 | 26 | 0.7 | 6.4 |
| 14 | 14-May | 6.66 | 5.26 | 37.2 | 21.1 | 57 | 26 | 0.4 | 6.3 |
| 15 | 21-May | 5.36 | 3.06 | 41.3 | 18.6 | 49 | 15 | 0.0 | 4.3 |
| 16 | 28-May | 7.15 | 0.93 | 42.8 | 23.5 | 47 | 15 | 0.0 | 5.4 |
| 17 | 4-Jun | 4.42 | 0.26 | 38.2 | 27.5 | 68 | 38 | 22.8 | 5.2 |

**Seasonal incidence of spotted pod borer, *Maruca vitrata*:**

The spotted pod borer larval activity on black gram was observed from 7th standard week, but no larvae were found during that period on black gram crop. The initial population of larvae started appearing from 10th standard week of March (0.36 larvae/sq m area). The weekly mean maximum temperature 27.2$^0$C, minimum temperature 10.3$^0$C, morning relative humidity 88 per cent, evening relative humidity 43 per cent, rainfall 0.0 mm and wind speed 3.2 km/hr, respectively was recorded. The highest peak of the larval population was observed during 15th standard week recording a maximum of 12.53 larvae/ sq m area when weekly mean maximum temperature 31.7$^o$C, minimum temperature 16.3$^o$C, morning relative humidity 78 per cent and evening relative humidity 36 per cent, rainfall3.8 mm, and wind speed 4.9 km/hr, respectively was recorded. Thereafter, the spotted pod borer larval population decreased till 23rd standard week (4.42 larvae/ sq m area) at the time of crop harvest (Table 1, Fig. 1). Among the various meteorological variables correlated with pest activity, a positively significant correlation exhibited with weekly mean maximum temperature (0.633**) and minimum temperature (0.586*) and negatively significant correlation with relative humidity morning (– 0.551*) and evening (– 0.593*) on spotted pod borer larval density. The influence of rainfall and wind speed remained non-significant (Table 2). The multiple linear regression equation was developed for spotted pod borer with respect to abiotic factors *i.e.* $Y = -31.875 - 0.155X_1 + 1.184X_2 + 0.337X_3 - 0.172X_4 - 0.503X_5 + 0.908X_6$, respectively. The combined influence of the abiotic factors positively influenced the population build-up of spotted pod borer with the coefficient of determination, $R^2 = 0.625$ (P= 0.05) (Table 3). The present findings are in close agreement with Naik and Mallapur, 2015 [7] who indicated that the pod borer, *M. vitrata* infestation exhibited highly significant positive correlation with maximum temperature (0.787**) while the number of webs per plant correlated negatively and significantly with morning relative humidity (– 0.629*). The results are also in confirmation with the findings of Sarkar and Roy, 2016 [14] who reported that the correlation was positive and significant between maximum temperature and significant negative correlation with relative humidity with the spotted pod borer population. Similarly, the results obtained by Umbakar *et al.*, 2010; Kumar and Kumar, 2015 [19,6] are differed from the present findings who reported that among the weather parameters, minimum temperature exhibited highly significant negative correlation with the spotted pod borer population.

**Table 2:** Correlation between Seasonal population fluctuations of major insect pests with abiotic factors

| Insect pests | Temperature ($^0$C) | | Relative humidity (%) | | Rainfall (mm) | Wind velocity |
|---|---|---|---|---|---|---|
| | Maximum | Minimum | Morning | Evening | | |
| Larval population of *Maruca vitrata* | 0.633** | 0.586* | -.551* | -0.593* | -0.081 | 0.451 |
| Larval population of *Helicoverpa* | 0.466 | 0.362 | -0.457 | -0.498* | -0.252 | 0.489* |

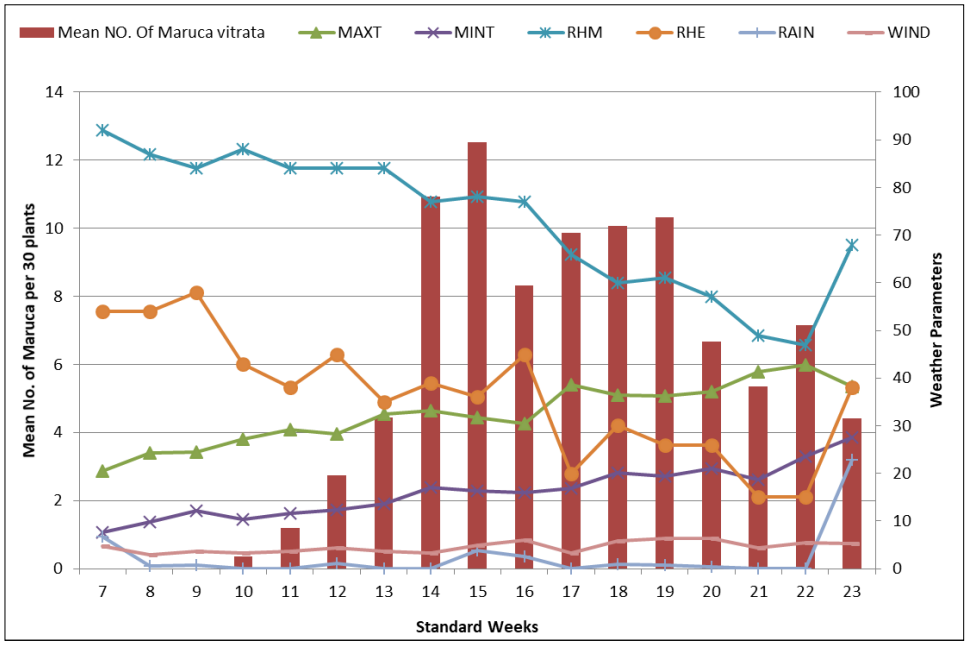


**Fig 1:** Seasonal population fluctuation of *Maruca vitrata* in relation to abiotic factors

**Seasonal incidence of Gram pod borer, *Helicoverpa armigera***

The Gram pod borer larval population on black gram was observed from 10th Standard Week of March (0.46 larvae/ sq m area) onwards and the larval population attained its peak during 18th standard week (9.53 larvae / sq m area) when corresponding mean maximum temperature 36.5$^o$C, minimum temperature 20.2$^o$C, morning relative humidity 60 per cent and evening relative humidity 30 per cent, rainfall 1.0 mm, and wind speed 5.8 km/hr, respectively was recorded. Thereafter, the gram pod borer larval population decreased till 23rd standard week on the same crop up to 0.26 larvae/ sq m area (Table 1, Fig. 2). The coherent data on correlation coefficient between population of gram pod borer and weather factors are presented in Table 2. The data signified that the larval population of Gram pod borer exhibited positively non-significant correlation with mean maximum temperature (0.466) and minimum temperature (0.362) and negatively non-significant correlation with relative humidity morning ( – 0.457) and a significant evening ( – 0.498*) and non-significant negative correlation with rainfall (– 0.252) and significant positive correlation with wind speed (0.489*). The regression equation and coefficient of multiple determination of gram pod borer with respect to abiotic factors *i.e.* $Y = -47.645 + 0.846X_1 - 0.212X_2 - 0.204X_3 + 0.092X_4 - 0.271X_5 + 2.048X_6$, respectively. The combined influence of the abiotic factors positively influenced the rise in population of gram pod borer with the coefficient of determination, $R^2 = 0.541$ (P= 0.05) (Table 3). The result obtained by Rathore *et al.* 2017 [12] is relatively similar to the present findings who reported that among the weather parameters, temperature exhibited positive and non-significant correlation (0.1641) and significantly inverse correlation with relative humidity (– 0.6447*) with the pod borer population. This finding is in close conformity with to findings Sarkar and Roy, 2016 [14] who also reported a positive and significant correlation of *H. armigera* larvae with maximum temperature and negative correlation with minimum temperature. Borah and Dutta (2004) [4] had also reported a positive and significant correlation of *H. armigera* larvae with the maximum and minimum temperatures.

**Table 3:** Regression equations and co-efficient of multiple determination ($R^2$) of major insect pests in relation to abiotic factors

| Major insect pests | Regression linear equations of | Corelation co-efficient (r) | Co-efficient of determination ($R^2$) | Co-efficient of Variation (%) |
|---|---|---|---|---|
| Larval population of *Maruca vitrata* | $Y^1 = - 31.875 - 0.155X_1 + 1.184X_2 + 0.337X_3 - .172X_4 - 0.503X_5 + 0.908X_6$ | 0.790 | 0.625 | 62.50 |
| Larval population of *Helicoverpa armigera* | $Y^2 = -47.645 + 0.846X_1 - 0.212X_2 - 0.204X_3 + 0.092X_4 - 0.271X_5 + 2.048X_6$ | 0.736 | 0.541 | 54.10 |

Where,

$Y^1$=Mean No. of *Maruca larvae* /1 m$^2$ or per 30 plants
X1= Max Temp.
X2= Min Temp.
X3=RH Morning
$Y^2$=Mean No. of *Helicoverpa larvae*/1 m$^2$ or per 30 plants
X4=RH Evening
X5=Rainfall
X6= Wind

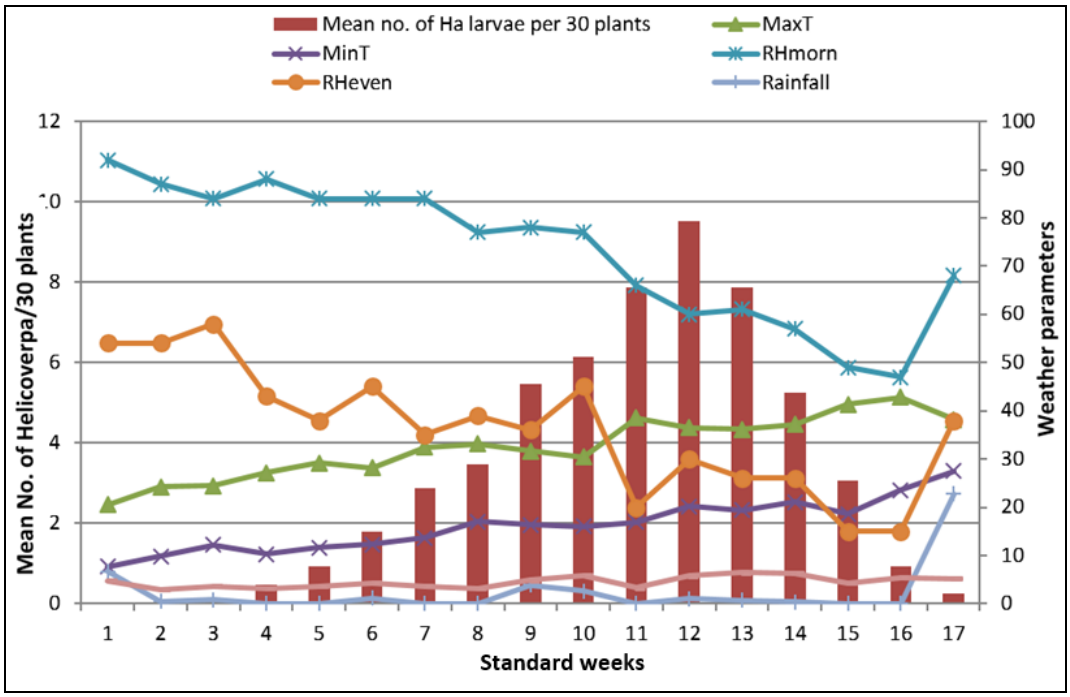


**Fig 2:** Seasonal population fluctuation of *Helicoverpa armigera* in relation to abiotic factors

## Conclusion

Thus, the present study revealed that the overall impact of meteorological variables highly influenced the incidence of larval population of spotted pod borer (62.50 per cent) and gram pod borer (54.10 per cent) on black gram. The peak larval population of *M. vitrata* and *H. armigera* was observed during 15th and 18th standard week with 12.53 and 9.53 larvae/ sq m area. The spotted pod borer larval density exhibited a highly significant positive correlation between weekly mean maximum temperature (0.633**) and minimum temperature (0.586*), significant negative correlation with relative humidity morning (– 0.551*) and evening (– 0.593*). While, the gram pod borer larval density exhibited a positive non-significant correlation between weekly mean maximum temperature (0.466) and minimum temperature (0.362), negative non-significant correlation with relative humidity morning (– 0.457) and a significant evening (– 0.498*) and non-significant negative correlation with rainfall (-0.252) and significant positive correlation with wind speed (0.489*). Hence, this finding can be invested in the building of efficient, eco-friendly and location–specific management practices for uplifting the farmer communities in the country.

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