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Succession and incidence of pod borers on Indian bean, *Lablab purpureus* var. *typicus* (L.) Sweet in relation to meteorological parameters

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Abstract
Studies on succession and incidence of pod borers on Indian bean, *Lablab purpureus* var. *typicus* (L.) Sweet were carried out to savvy the knowledge regarding influence of weather parameters on pest appearance. The spotted pod borer, *Maruca vitrata* (Geyer) and gram pod borer, *Helicoverpa armigera* (Hubner) were found to infest the crop with varying intensities during *Kharif*, 2019. The incidence of spotted pod borer and gram pod borer started in second week of August (33rd SMW). The peak population of spotted pod borer, *M. vitrata* (9.80 larvae/ five plants) was recorded in the second week of September (37th SMW), gram pod borer, *H. armigera* (7.90 larvae/ five plants) in the third week of September (38th SMW). The minimum temperature showed a positive significant correlation with population of both spotted pod borer and gram pod borer (r= 0.87 and 0.81 respectively). The other meteorological parameters, *viz*., maximum temperature, relative humidity and rainfall had non-significant correlation with population of the two pod borers.

Keywords: Gram pod borer, spotted pod borer, Indian bean, incidence, population

Introduction
Indian bean, *Lablab purpureus* var. *typicus* (L.) Sweet (family: Fabaceae) is an important vegetable crop in India and other countries. It is also called as Indian butter bean, lablab bean, dolichos bean, Egyptian bean, Australian bean, bonavist bean, waby bean (English) and *Sem phali* (local dialect). It is a perennial herbaceous plant, primarily grown for green pods, while dry seeds are used in vegetable and culinary preparations. The leaves are eaten as leafy vegetable and the flowers and seeds are also eaten as food. The mature seeds are eaten up as pulses. The fruit (pod) is wide and elongated pod which has seeds inside it. It is one of the major sources of proteins, minerals, and dietary fibre. The green pods have a high nutritive value, comprising of protein 3.8 g, carbohydrate 6.7 g, vitamin-A 312 IU, mineral 0.9 g, fat 0.7 g and oxalic acid 1 mg per 100 g (Bose *et al.*, 1993) [3]. The knowledge on succession and incidence of insect pests at different phenology of Indian bean crop in relation to weather parameters such as temperature, relative humidity and rainfall is essential for efficiently managing different pest species. Correlating the weather parameters with insect pest populations gives a comprehensive relationship between pest populations and each of the meteorological parameter. This type of study also helps in determining the most susceptible crop stage/ phenology to a particular pest species.

Materials and Methods
The present investigations were conducted at Horticulture Farm of S.K.N. College of Agriculture, Jobner (Rajasthan) on Indian bean crop under field conditions during *Kharif*, 2019. Geographical location of Jobner pertains to 26° 06' North latitude, 75° 28' East longitude and an elevation of 427 metres above mean sea level (MSL).

a) Experimental layout: In order to record the incidence of pod borers on Indian bean, variety Bauni was sown in five plots of 1.8x1.8 m^2 size keeping row to row and plant to plant distance of 45 cm each. The crop was sown in *Kharif* season on 25th July, 2019. The seeds were sown at the rate of 10 kg/ ha. The sowing was done in holes made by wooden peg at a row to row and plant to plant distance of 45 cm each. After sowing, the seeds were covered with a thin layer of soil. The various cultural operations were carried out without application of insecticides to allow natural infestation.

b) Observations: The observations on larval populations of *M. vitrata* and *H. armigera* were recorded from their appearance to harvesting of the crop. For this purpose, five plants were randomly selected from each plot and earmarked by tagging. The incidence of *M. vitrata* and *H. armigera* was determined by counting the population of larvae on five randomly selected and tagged plants at weekly interval.

c) Statistical analysis: The data recorded on pod borer populations and meteorological parameters were used for statistical analysis. The simple correlation was computed between population of these insect pests and abiotic factors, *viz*., maximum and minimum temperatures, relative humidity and rainfall. The following formula was used for calculating correlation coefficient (Panse and Sukhatme, 1967) [8].

$$r = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (\sum x)^2 . N \sum y^2 - (\sum y)^2}}$$

Where,
r = Simple correlation coefficient
x = Independent variables, *i.e.* abiotic components
y = Dependent variables, *i.e.* pests
N = Number of observations

Results and Discussion

The population of spotted pod borer, *M. vitrata* and gram pod borer, *H. armigera* recorded during the crop season, *Kharif* 2019 on Indian bean variety, Bauni has been presented in Table-4.1 and Fig.-4.1 along with meteorological parameters, *viz*., maximum temperature, minimum temperature, relative humidity and average rainfall. The data revealed that the spotted pod borer and gram pod borer population commenced in the 33rd standard meteorological week (SMW) and the first observation was recorded on 15th August, 2019. Initially, the population of spotted pod borer was low (0.80 larvae/ five plants). The population gradually increased and reached the peak (9.80 larvae/ five plants) in 37th SMW. A gradual decline in the pod borer population was evident thereafter. The population was 2.20 larvae/ five plants in the 42nd SMW and observed in traces thereafter. The highest spotted pod borer population, *i*.e., 9.80 larvae/ five plants was observed at 24.90 ^{0}C minimum temperature, 36.30^{0}C maximum temperature, 70 per cent relative humidity and no rainfall. The initial population of gram pod borer was low (0.20 larvae/ five plants). The population gradually increased and reached the peak (7.90 larvae/ five plants) in 38th SMW. A gradual decline in the pest population was noticed there after. The maximum gram pod borer population, *i.e.*, 7.90 larvae/ five plants was observed at 23.30 ^{0}C minimum temperature, 35.20 ^{0}C maximum temperature, 63 per cent relative humidity and no rainfall.

The correlation coefficient was worked out between mean larval population of both borers and meteorological parameters, *viz*., maximum temperature, minimum temperature, relative humidity and rainfall. It revealed that the larval population of spotted pod borer had significant positive correlation with minimum temperature (r= 0.87), positive non-significant correlation with maximum temperature and negative non-significant correlation with relative humidity and rainfall. Reddy *et al.* (2001) [10] and Shree *et al.* (2017) [13] supported the present findings that the population of spotted pod borer had positive correlation with minimum and maximum temperature. The correlation coefficient between the larval population of gram pod borer and meteorological parameters revealed that the larval population had significant positive correlation with minimum temperature (r= 0.81), positive non-significant correlation with maximum temperature and negative non-significant correlation with relative humidity and rainfall. The present findings are supported by Reddy *et al.* (2001) [10] and Spoorthi *et al.* (2017) [14]. The larvae of spotted pod borer and gram pod borer are depicted in Plate-I

Table 1: Incidence of pod borers, *Maruca vitrata* (Geyer) and *Helicoverpa armigera* (Hubner) on Indian bean in relation to meteorological parameters

S. No.	SMW*	Date of observation	Temperature (°C)		Relative humidity (%)	Rainfall (mm)	Mean larval population/ five plants	
			Maximum	Minimum			*M. vitrata*	*H. armigera*
1	33	15.08.2019	30.5	19.8	87	43.0	0.80	0.20
2	34	22.08.2019	34.0	20.0	75	00.8	2.40	1.40
3	35	29.08.2019	33.9	19.5	83	44.2	3.20	2.80
4	36	05.09.2019	33.8	22.9	83	06.6	5.60	4.20
5	37	12.09.2019	36.3	24.9	70	00.0	9.80*	7.10
6	38	19.09.2019	35.2	23.3	63	00.0	8.60	7.90*
7	39	26.09.2019	32.8	24.3	75	12.2	7.40	5.40
8	40	03.10.2019	33.3	22.7	67	00.6	5.60	3.80
9	41	10.10.2019	33.7	17.6	53	00.0	3.40	2.40
10	42	17.10.2019	34.7	17.7	55	00.3	2.20	1.60
Maximum temperature							0.61 (NS)	0.62 (NS)
Minimum temperature							0.87**	0.81**
Relative humidity							-0.14 (NS)	-0.15 (NS)
Rain fall							-0.46 (NS)	-0.42 (NS)

SMW- Standard meteorological week; * Peak population; ** Significant at 1 per cent level of significance

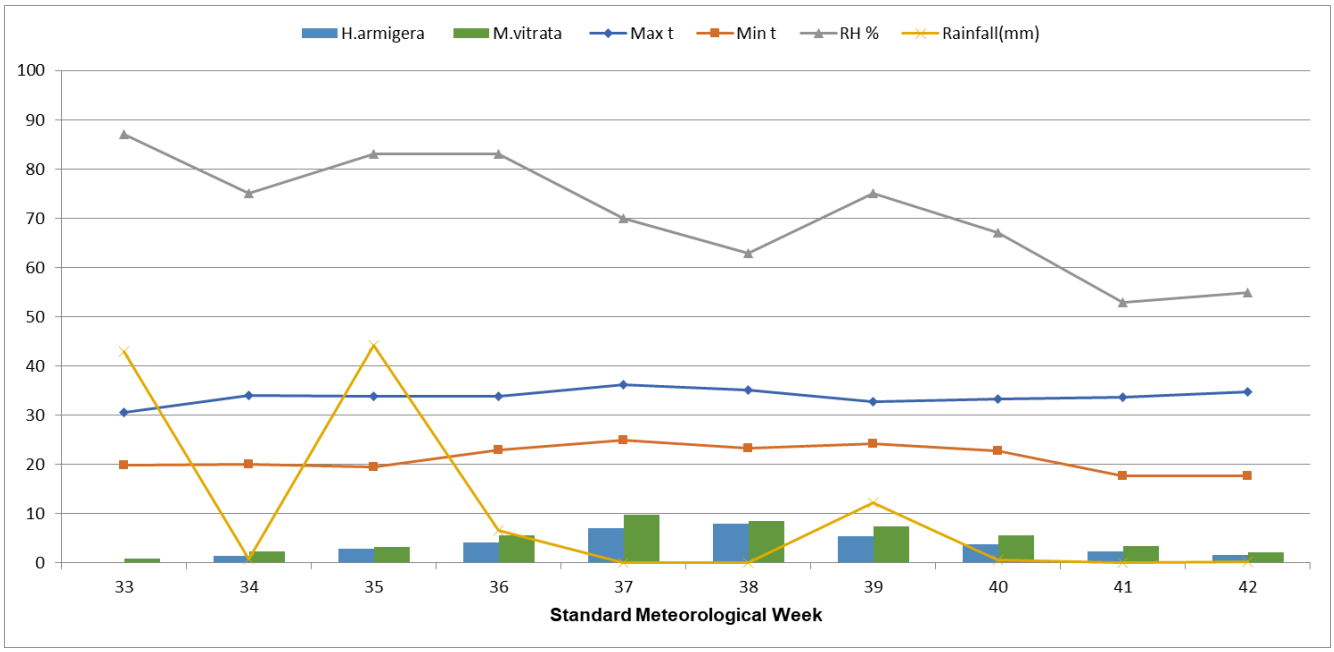

Fig 1: Succession and incidence of spotted, *Maruca vitrata* (Geyer) and gram pod borer, *Helicoverpa armigera* (Hubner) on Indian bean during *Kharif*, 2019

A. Larva of gram pod borer, *Helicoverpa armigera* (Hubner) **B.** Larva of spotted pod borer, *Maruca vitrata* (Geyer) with web

Plate I: Larvae of spotted pod borer and gram pod borer feeding on Indian bean pods

Conclusion

The spotted pod borer, *M. vitrata* and gram pod borer, *H. armigera* appeared as the major insect pests during the crop season *Kharif*, 2019. The larvae of spotted pod borer first appeared at the beginning of 33rd Standard Meteorological Week (SMW). The population attained a peak at the beginning of 37th SMW. The larvae of gram pod borer, *H. armigera* appeared first during 33rd SMW with initial mean larval population of 0.20 larvae/ five plants. The population peak of this borer was recorded at the beginning of 38th SMW. The correlation coefficient worked out revealed that the minimum temperature had a significant positive correlation with population spotted pod borer, *M. vitrata* (r= 0.87) and gram pod borer, *H. armigera* (r= 0.81). Other meteorological parameters, *viz*., maximum temperature, relative humidity and rainfall had no significant impact on population of both the borers.

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