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# Seasonal abundance of pod borers on pigeon pea and their natural enemies in relation with weather parameters

**SM Dadas, SS Gosalwad and SK Patil**

**Abstract**
An investigation was carried out to study the seasonal abundance of pod borers of pigeon pea variety BDN-736 at Research farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *Kharif* 2018-19. The crop was shown on the 26th standard meteorological week (SMW). The results revealed that the incidence of the gram pod borer, *Helicoverpa armigera* initiated in the 40th SMW i.e. 0.20 larva/plant and continued till 52th SMW i.e. 1.00 and it was attained at peak of 4.2 larvae/plant in the 46th SMW. The incidence of the spotted pod borer, *Maruca vitrata* initiated in the 40th SMW i.e. 0.35 larva/plant and continued till 48th SMW i.e. 2.80 and reached its peak (3.80 larvae/plant) in the 45th SMW. The incidence of the plume moth, *Exelatis atomosa* initiated in the 41st SMW i.e. 0.80 larva/plant and continued till 49th SMW i.e. 0.20 larva/plant and its peak (3.4 larvae/plant) was in the 45th SMW. As regards the tur pod fly, *Melanoagromrza obtusa* commenced in the 43rd SMW i.e. 0.80 maggot/10 pods and continues till 49th SMW i.e. 3.05 maggots/10 pods with peak population (6.20 maggots/10 pods) was observed in the 46th SMW.
Irrespective of pod borers, two natural enemies i.e. ladybird beetle and *Apanteles* was recorded on pigeon pea during the course of investigation. The occurrence of the ladybird beetle and *Apanteles* commenced in the 41st SMW i.e. 0.10 adult/plant and 39th SMW i.e. 0.20 adult/plant and continues till 51st SMW i.e. 0.20 adult/plant and 50th SMW i.e. 0.10 adult/plant, respectively with the population attained its peak (0.60 and 0.40 adult/plant) in the 46th SMW.
As regards the correlation studies, *H. armigera*, *E. atomosa* and *M. vitrata* and natural enemy i.e. *Apanteles* found to be significantly negative correlated with morning relative humidity was r = -0.579, -0.5667, -0.540 and -0.565, respectively. Whereas, ladybird beetle correlated highly significant negatively with minimum (r = -0.579) and maximum (r = -0.579) temperature.

**Keywords:** Seasonal incidence, pod borers, pigeon pea

## Introduction
Pigeon pea (*Cajanus cajan* (L.) Mill sp.), commonly known as *red gram* or *arhar* or *tur*, is one of the most important pulse crops produced in India. The centre of origin of pigeon pea is believed to be Asia. Pigeon pea is a protein rich staple food supplying 22 percent proteins to human diet almost three times that of cereals. It is mainly consumed in the form of split pulse as Dal; an essential supplement of cereal based vegetarian diet. It is particularly rich in lysine, riboflavin, thiamine, niacin and iron. In addition to being an important source of human food and animal feed, it also plays an important role in sustaining soil fertility by improving physical properties of soil and fixing atmospheric nitrogen (Singh and Yadav, 2005) [13]. Being a drought tolerant crop, it is suitable for dry land farming and predominantly used as an intercrop with other crops.
India is a major pigeon pea producer in the world which occupies an area of 96.00 lakh ha with production of 88.32 lakh tones. The highest productivity of 6120 kg per ha was observed in Israel followed by Yemen, Canada and Egypt and in India it was 920 kg per ha. (Tiwari and Shivhare, 2016). In Maharashtra, area, production and productivity of pigeon pea was 14.35 lakh ha, 1495.75 tonnes and 1042 kg per ha, respectively during 2016-17 (Anonymous, 2017) [1]. Normal and timely rainfall proved conducive for higher production.
Pigeon pea crop is influenced by the abiotic and biotic factors. Maximum economic damage is caused by the insect pests feeding on buds, flowers and pods. About 250 insect species belonging to 8 orders and 61 families have been found to infest redgram from seedling to harvesting stage and virtually no plant part is free from insect infestation (Davies and Lateef,

1977) [4]. Among several insect pests infesting redgram; gram pod borer, *Helicoverpa armigera* (Hubner), spotted pod borer, *Maruca vitrata* (Geyer), pod fly, *Melanagromyza obtusa* (Malloch), plume moth, *Exelastis atomosa* (Walshingham) and blue butterfly, *Lampides boeticus* (Linnaeus) are most serious. The pod sucking bugs also cause considerable damage which constitutes pod bug, *Riptortus pedestris* (Fabricius), green stink bug, *Nezara viridula* (Linnaeus), green bean bug, *Clavigralla gibbosa* (Spinola), lab lab bug, *Captosoma cribraria* (Fabricius) reported by Bijewar *et al*. (2018) [3]. The indiscriminate use of insecticides reach to resistance development in insects as well as killing beneficial organisms such as pollinator (especially bees) and natural enemies (insect predators and parasites) are reported by Pedigo and Rice (2006) [11]. In this concern, to know the pest incidence on pigeon pea crop with weather parameters and to fallow the management strategy to reduce the infestation of these pests.

## Material and methods

Field experiment on seasonal abundance of pod borers on pigeon pea and their natural enemies was conducted during *Kharif* 2018-19 at the Research farm of Department of Agril. Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431402 (Maharashtra), which is situated 19º16' North latitude and 76º47' East longitudes with an altitude of 408.5 meter above mean sea level. The mean daily maximum temperature varied from 29.4 ºC in December to 45 ºC in May. The minimum temperature varies from 11.32 ºC (winter) to 25.77 ºC (summer). The mean relative humidity ranges from 30 to 90 percent. The climate is subtropical. The mean annual rainfall of Parbhani is about 800-900 mm receiving mostly during June to September. Summer is hot and dry while winter is cool.

This experiment was laid in 10 m X 10 m by dividing in four quadrates by using variety BSMR-736 with the spacing of 120 cm (plant to plant) x 30 cm (row to row). The crop was sown in 27th standard meteorological week (SMW) i.e. first week of July, 2018. All the agronomical package of practice was fallowed as per the recommendations of this university except plant protection measures.

### Observations recorded

Five plants from plot (each quadrate) was tagged and observations on larval population of pigeon pea pod borer complex *viz*., gram pod borer, *Helicoverpa armigera* (Hubner), spotted pod borer, *Maruca vitrata* (Geyer), plume moth, *Exelastis atomosa* (Walshingham) and pod fly, *Melanagromyza obtusa* (Malloch) was made from these randomly selected plants at weekly interval from sowing up to harvest. Simultaneously natural enemies i.e. ladybird beetle and *Apentalis* was recorded from each quadrate on selected five plants.

### Statistical analysis

The data observed on larval population of pigeon pea pod borer complex as influenced by different weather factors was analyzed by simple correlation analysis as per Panse and Sukhatme (1985) [8] accordingly.

## Results and discussion

The field trial was undertaken on the seasonal abundance of pod borers of pigeon pea during *kharif* 2018-19. The results obtained o different pod borers *viz*., gram pod borer, *H. armigera* (Hubner), spotted pod borer, *M. vitrata* (Geyer), plume moth, *E. atomosa* (Walshingham) and pod fly, *M. obtusa* (Malloch) infestation and correlated with the weather parameters are summarized in the Table 1-2 as given below.

**Table 1. Seasonal abundance of pod borers of pigeon pea and their natural enemies**

| Date of observations | Standard meteoro-logical week | Number of larvae/plant | | | Number of maggots/10 pods | Natural enemies/plant | | Weather parameters | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Temperature ($^0$C) | | Relative Humidity (%) | | Rainfall (mm) |
| | | *Helicoverpa armigera* | *Exelatis atomosa* | *Maruca vitrata* | *Melanogramyza obtusa* | LBB | *Apanteles* | Maximum | Minimum | Morning | Evening | |
| 18-09-2018 | 38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 35.8 | 21.2 | 83.4 | 55.7 | 1.80 |
| 25-09-2018 | 39 | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 33.6 | 20.8 | 82.3 | 41.0 | 4.00 |
| 02-10-2018 | 40 | 0.20 | 0.00 | 0.35 | 0.00 | 0.00 | 0.00 | 33.1 | 20.0 | 77.6 | 39.7 | 0.00 |
| 09-10-2018 | 41 | 1.20 | 0.80 | 1.20 | 0.80 | 0.10 | 0.20 | 33.4 | 16.3 | 71.6 | 20.3 | 0.00 |
| 16-10-2018 | 42 | 1.40 | 1.00 | 3.60 | 2.40 | 0.10 | 0.30 | 32.9 | 16.5 | 75.4 | 27.3 | 0.00 |
| 23-10-2018 | 43 | 3.00 | 2.80 | 3.60 | 3.95 | 0.20 | 0.20 | 33.4 | 16.2 | 72.0 | 26.0 | 0.00 |
| 31-10-2018 | 44 | 3.80 | 3.20 | 3.80 | 6.20 | 0.30 | 0.40 | 34.0 | 14.8 | 72.7 | 30.1 | 0.00 |
| 06-11-2018 | 45 | 3.60 | 3.40 | 3.80 | 4.45 | 0.50 | 0.30 | 34.1 | 16.3 | 71.4 | 33.0 | 0.00 |
| 13-11-2018 | 46 | 4.00 | 2.60 | 3.60 | 3.95 | 0.60 | 0.40 | 35.7 | 11.4 | 75.4 | 23.1 | 0.00 |
| 20-11-2018 | 47 | 3.40 | 2.40 | 3.00 | 3.05 | 0.40 | 0.10 | 36.1 | 16.3 | 77.4 | 34.7 | 0.00 |
| 27-11-2018 | 48 | 3.60 | 0.35 | 2.80 | 0.00 | 0.20 | 0.30 | 36.2 | 10.2 | 77.0 | 24.3 | 0.00 |
| 04-12-2018 | 49 | 3.40 | 0.20 | 0.00 | 0.00 | 0.30 | 0.00 | 36.2 | 14.3 | 75.7 | 34.6 | 0.00 |
| 11-12-2018 | 50 | 3.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.30 | 36.3 | 13.5 | 74.9 | 33.9 | 0.00 |
| 18-12-2018 | 51 | 0.40 | 0.00 | 0.00 | 0.00 | 0.20 | 0.00 | 36.4 | 9.9 | 76.4 | 33.9 | 0.00 |
| 25-12-2018 | 52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 36.1 | 8.5 | 75.0 | 20.9 | 0.00 |

**Table 2:** Correlation of seasonal abundance of pod borers of pigeon pea with weather parameters

| Pests and natural enemies | Temperature ($^0$C) | | Relative Humidity (%) | | Rainfall (mm) |
|---|---|---|---|---|---|
| | Maximum | Minimum | Morning | Evening | |
| *H. armigera* | 0.189 | -0.300 | -0.519* | -0.364 | -0.478 |
| *E. atomosa* | -0.268 | 0.004 | -0.567* | -0.291 | -0.313 |
| *M. vitrata* | -0.333 | -0.068 | -0.498 | -0.425 | -0.348 |
| *M. obtusa* | -0.329 | 0.013 | -0.540* | -0.274 | -0.290 |
| Lady bird beetel | 1.000** | -0.595* | 0.234 | 0.076 | -0.173 |
| *Apanteles* | -0.165 | -0.248 | -0.565* | -0.497 | -0.394 |

**Gram pod borer *(Helicoverpa armigera)***

The incidence of the gram pod borer (*H. armigera)* initiated in the 40th standard meteorological week (SMW) (0.20 larva/plant) and continued till 51st SMW (0.40 larva/plant). The pest population attained its peak (4.00 larvae/plants) in the 46th SMW with the weather factors *viz*., maximum temperature (35.7), minimum temperature (11.4), morning RH (75.4), evening RH (23.1) and rainfall (0.0). Significantly negative correlation was observed with respect to *Helicoverpa* with morning relative humidity (r = -0.519) and non-significant negative correlation with minimum temperature, evening relative humidity and rainfall and positively non-significant with maximum temperature.

The findings of present investigation is in close conformity with the earlier work carried out by Chavan *et al*. (2018) [2] who reported that the incidence of the *H. armigera* initiated in the 40th SMW and continued till 52th SMW. Significantly negative correlation was found with, minimum temperature and morning and evening RH, while other meteorological parameters did not significantly influence the incidence of this pest. Umbarkar *et al*. (2010) [15] reported that minimum temperature (r = -0.557) and evening relative humidity (r = -0.583) exhibited highly significant negative correlation with the gram pod borer population on green gram. Pawar *et al*. (2014) [9] they observed that *H. armigera* started infesting the pigeon pea crop during the reproductive stage i.e. 44th SW and 45th SW (0.01 egg/plant and 0.35 larva/plant) and population of the pests egg and larva available up to maturity stage i.e. 01st SW (1.8 eggs/plant and 0.15 larva/plant). Shinde *et al*. (2017) [12] revealed that the incidence of *H. armigera*, on pigeonpea ranged from 0.6 to 4.08, larvae per quadrate with maximum population noticed during 45th, SMW and it was non-significantly correlated with maximum and minimum temperature, morning and afternoon relative humidity and rainfall.

**Spotted pod borer (*Maruca vitrata)***

The incidence of the spotted pod borer (*M. vitrata)* initiated in the 39th SMW i.e. 0.35 larva/ plant and continued till 48th SMW i.e. 2.80 larvae/plant and reached its peak (3.80 larvae/ plants) in the 45th SMW when maximum temperature, minimum temperature, morning RH, evening RH and rainfall was 34.1, 16.3, 71.4, 33.0 and 0.0, respectively. All climatic parameters were found to be negatively non-significant correlation larval population of this pest.

These findings are similar with the results of Chavan *et al*. (2018) [2] who reported that the infestation *M. vitrata* commenced during the 41st SMW and continues till the 45th SMW and negatively non-significant correlation was found between all climatic parameters. Meragana *et al*. (2015) [6] reported that highly significant correlation was obtained between *M. vitrata* and minimum temperature, mean temperature and wind speed with correlation coefficient (r) being -0.759, -0.815 and -0.838, respectively. Moderately significant correlation was obtained between *M. vitrata* and sunshine hours and evening relative humidity (RH-II) with correlation coefficients (r) being 0.656 and -0.609, respectively.

**Plume moth (*Exelatis atomosa)***

The incidence of the plume moth (*E. atomosa)* initiated in the 41st SMW i.e. 0.80 larva/ plant and continued till 49th SMW i.e. 0.20 larva/plant and attained its peak (3.4 larvae/plants) was in the 45th SMW when maximum temperature (34.1), minimum temperature (16.3), morning RH (71.4), evening RH (33.0) and rainfall (0.0). Significantly negative correlation was observed with respect to *E. atomosa* with morning relative humidity (r = -0.567) while other meteorological parameters did not significantly influence the incidence of this pest.

These results are agreement with Chavan *et al*. (2018) [2] who reported that the infestation of *E. atomosa* commenced during the 43rd SMW and continues till the 52nd SMW. Significantly negative correlation was found between climatic parameters *viz*., minimum temperature and morning and evening RH, while other meteorological parameters did not significantly influence the incidence of this pest.

**Pod fly (*Melanagromyza obtusa)***

The incidence of the tur pod fly (*M. obtusa*) commenced in the 43rd SMW i.e. 0.80 maggot/10 pods and continues till 49th SMW i.e. 3.05 maggots/10 pods and the pest population attained its peak (6.20 maggots/10 pods) in the 46th SMW when maximum temperature, minimum temperature, morning RH, evening RH and rainfall was 35.7, 11.4, 75.4, 23.1 and 0.0, respectively. Significantly negative correlation was observed with respect to *M. obtusa* with morning relative humidity (r = -0.540) while other meteorological parameters did not significantly influence the incidence of this pest.

The findings of present investigation is in close conformity with the earlier worker Rathore *et al*. (2016) [11] who reported that the infestation *M. obtusa* commenced during the 41st SMW and continues till the 49th SMW. The increase in population was found non-significant inverse correlation with the mean temperature and non-significant positive correlation with relative humidity. Pandey *et al*. (2016) [7] reported that the first appearance of *M. obtusa* was noticed in the 42th SW with a mean population of 0.10 maggot/plant and attained its peaked in 45th with a mean population of 0.30 maggot/plant.

**Natural enemies**

Two natural enemies i.e. ladybird beetle and *Apanteles* was recorded on pigeon pea during the course of investigation. The occurrence of the lady bird beetle commenced in the 41st SMW i.e. 0.10 adult/plant and continues till 51st SMW i.e. 0.20 adult/plant with the population attained its peak (0.60 adult/plant) in the 46th SMW. It was highly significant negative correlated with minimum (r = -0.579) and maximum (r = -0.579) temperature. Whereas, the incidence of the *Apanteles* commenced in the 39th SMW i.e. 0.20 adult/plant and continues till 50th SMW i.e. 0.10 adult/plant. During the period the larval population of pod borers was found to maximum. The population attained its peak (0.40 adult/plant) in the 44th and 46th SMW and it was found significantly negative correlated with morning relative humidity of r = -0.565.

These findings are in accordance with Pawar *et al*. (2014) [9] reported that the two natural enemies i.e. predatory lady bird beetle, *Cheilomenes sexmaculatus* Fab. were active in vegetative i.e. 38th SW (0.56 beetle/plant) to 44th SW (0.08 beetle/plant) and larval parasitoid of Lepidoptera Cotesia (= *Apanteles*) sp. wasp pupae during late reproductive i.e. 50th SW (2 pupae/25pods) to 52nd SW (3 pupae/25pods) growth phase of the crop, respectively. Kumar and Nath (2003) [5] also recorded the natural enemies *viz*., braconid wasp (*Apanteles* sp. and *Euderus lividus*), ladybird beetle (*Coccinella septempunctata*), mirid bug (*Cyrtorrhinus lividipennis*), praying mantid (*Mantis religiosa*), dragonfly

(*Crocothemis servilia*), green lacewings (*Chrysoperla carnea*) and spiders (*Araneus* sp. and *Clubiona* sp.), the common wasp (*Vespa orientalis*) and ladybird beetle (*Cheilomenes sexmaculatus*)v on pigeon pea cultivars UPAS 120 during seedling to pudding stages in Varanasi, Uttar Pradesh, India.

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