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# Seasonal incidence of pod borer complex of pigeon pea, (*Cajanus cajan* (L.) Mill Sp.)

**BJ Chopade, SK Mehendale, AL Narangalkar, VS Desai and SD Sapkal**

**Abstract**
The studies entitled 'Seasonal incidence of pod borer complex of pigeon pea (*Cajanus cajan* (L.) Millsp)' were conducted during 2017-2018 and 2018-2019. Seasonal incidence of pigeon pea against various pod borers revealed that the maximum percent infestation of *Maruca vitrata* (Geyer) (15.12) was observed in 47th SMW (4th week of November), the maximum percent infestation of *Exelastis atomosa* (Walsingham) (8.91) was observed in 45th SMW (1st week of November), the maximum percent infestation of *Helicoverpa armigera* (Hubner) (18.78) was observed in 52nd SMW (5th week of December) and the peak percent infestation of *Melanagromyza obtusa* (Malloch) (18.38) was observed in 1st SMW (1st week of January). Correlation of pest incidence and weather parameters revealed that the incidence of *M. vitrata* showed non-significant correlation with all the meteorological parameters, the incidence of *H. armigera* showed negative significant correlation with minimum temperature, the incidence of *E. atomosa* showed negative correlation with morning relative humidity and evening relative humidity and the incidence of *M. obtusa* showed negative correlation with minimum temperature.

**Keywords:** Seasonal incidence, pod borer complex, pigeon pea (*Cajanus cajan* (L.) Millsp)

## Introduction
The pigeon pea (*Cajanas cajan* (L.) Millsp.) belongs to family *Fabaceae* is originated from India. It is the second most important pulse crop grown in India after chickpea. In India the area grown under pigeon pea crop was 4.43 mh with an annual production of 4.25 m t, leading to a productivity of 960.0 kg/ha [2]. In Maharashtra, the area grown under this crop is 12.30 lakh hectares with an annual production of 10.71 lakh tonnes leading to a productivity of 873.0 kg/ha. In konkan the area grown under this crop is 5300 thousand hectares with an annual production of 4343 thousand tonnes leading to a productivity of 891.0 kg/ha [3]. A large number of insect pests (more than 300 species) attack pigeon pea [14]. The pigeon pea yield has become stagnant over last four decades, largely because of insect pest damage. Insects that attack the reproductive structures of plant cause the maximum yield losses [15]. Among the insects feeding on reproductive parts, gram pod borer, *Helicoverpa armigera* (Hubner), spotted pod borer, *Maruca vitrata* (Geyer), plume moth, *Exelastis atomosa* (Walsingham) and pod fly, *Melanagromyza obtusa* (Malloch) are of prime importance. According to Yadav and Chaudhary [18] around 14 and 10 percent pigeon pea pods were damaged by *H. armigera* and *M. obtusa*. Pigeon pea pod damage due to different insect pests including *H. armigera* and *E. atomosa* varied from 7.6 to 31.0 percent [12]. *H. armigera* caused 27 percent damage to pigeon pea pod during 2001-02. The crop suffered heavy field losses due to pod borers in Tamil Nadu [5]. All over the world an estimated loss due to pod borer complex is found to be exceeding US $ 300.00 million, forcing several research groups to investigate various strategies to control pod borer complex. It is a matter of concern as it inflicts 56.22 percent damage in India alone [16]. Looking towards the infestation of pod borer complex against pigeon pea in konkan region, no much work has been reported by the workers and therefore it is necessitated to undertake the present investigation to study the seasonal incidence of pod borer complex of pigeon pea (*Cajanas cajan* (L.) Millsp.).

## Material and Methods
The field experiment was carried out with pigeon pea crop using variety Dapoli Tur-1 were conducted at Botany farm, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during *Kharif* 2017-18 and *Kharif* 2018-19. The healthy seed of 'Dapoli Tur -1' variety of Pigeon pea was obtained from the Department of Botany, College of

Agriculture, Dapoli. A separate plot 23m x 9m (207sq.m.) was cultivated for conducting the experiment with sowing at spacing 75 × 60 cm. Fertilizer were applied in the form of straight fertilizers through Urea (46% N) and Single Super Phosphate (16% $P_2O_5$) to each plot. The recommended dose, 25:50:50 kg NPK /ha was applied at the time of sowing. The observations of pod borer complex on pigeon pea were recorded at weekly interval in a crop season when infestation was noticed. The 25 plant randomly selected for observation. The healthy and infested buds/pods from three selected twigs were counted and percent infestation of pod borer complex was worked out. The average percent infestation per three twigs per plant was taken and standard deviation was worked out. Data on weather parameters like, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, wind speed and sunshine hours, for the years 2017-18 and 2018-19 were collected from meteorological laboratory, Department of Agronomy, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli. The observations of pod borer complex of pigeon pea was recorded at weekly interval as per standard meteorological week. Data on incidence of pod borer complex of pigeon pea and different weather parameters were correlated.

## Results and Discussion

### Seasonal incidence of *Maruca vitrata* (Geyer) infesting pigeon pea

The data on seasonal incidence of *M. vitrata* infesting pigeon pea during the years 2017-2018, 2018-2019 and pooled mean of both the years are presented in Table 1 and graphically depicted in Fig.1.

The data revealed that during 2017-2018, the percent infestation of *M. vitrata* was in the range of 1.80 to 22.06. It was first noticed in the 43rd SMW (4th week of October) *i.e.* 1.80 percent, then pest infestation increased continuously upto the 47th SMW (4th week of November) and then it showed declined trend. The maximum percent infestation (22.06) was recorded in 47th SMW (4th week of November) and minimum percent infestation (1.80) was recorded in 43rd SMW (4th week of October).

The data revealed that during 2018-2019, the percent infestation of *M. vitrata* was in the range of 2.40 to 18.14. It was first noticed in the 43rd SMW (4th week of October) *i.e.* 2.40 percent, then pest infestation increased continuously upto the 46th SMW (3rd week of November) and then it decreased. The maximum percent infestation (18.14) was recorded in 46th SMW (3rd week of November) and minimum percent infestation (2.40) was recorded in 43rd SMW (4th week of October).

The pooled data of both the years revealed that the infestation was in the range of 2.10 to 15.12 percent. The pest was first noticed in the 43rd SMW (4th week of October) *i.e.* 2.10 percent, then pest infestation increased continuously up to the 47th SMW (4th week of November) and then it decreased. The maximum percent infestation (15.12) was observed in 47th SMW (4th week of November) while minimum percent infestation (2.10) recorded in 43rd SMW (4th week of October).

### Seasonal incidence of *Exelastis atomosa* (Walsingham) infesting pigeon pea

The data on seasonal incidence of *E. atomosa* infesting pigeon pea during the years 2017-2018, 2018-2019 and pooled mean of both the years are presented in Table 1 and graphically depicted in Fig.2.

The data revealed that during 2017-2018, the percent infestation of *E. atomosa* was in the range of 2.00 to 9.50. It was first noticed in the 43rd SMW (4th week of October) *i.e.* 2.00 percent, then pest infestation increased continuously upto the 48th SMW (1st week of December) and then it decreased. The maximum percent infestation (9.50) was recorded in 48th SMW (1st week of December) and minimum infestation (2.00) was recorded in 43rd SMW (4th week of October).

The data revealed that during 2018-2019, the percent infestation of *E. atomosa* was in the range of 1.80 to 11.34. It was first noticed in the 43rd SMW (4th week of October) *i.e.* 1.80 percent, then pest infestation increased continuously upto the 47th SMW (4th week of November) and then it decreased. The maximum percent infestation (11.34) was recorded in 47th SMW (4th week of November) and minimum percent infestation (1.80) was recorded in 43rd SMW (4th week of October).

The pooled data of both the years revealed that infestation was in the range of 1.90 to 8.91 percent. The pest was first noticed in the 43rd SMW (4th week of October) *i.e.* 1.90 percent, then pest infestation increased continuously upto the 45th SMW (1st week of November) and then it decreased. The maximum percent infestation (8.91) was observed in 45th SMW (1st week of November) while minimum percent infestation (1.90) recorded in 43rd SMW (4th week of October).

### Seasonal incidence of *Helicoverpa armigera* (Hubner) infesting pigeon pea

The data on seasonal incidence of *H. armigera* infesting pigeon pea during the years 2017-2018, 2018-2019 and pooled mean of both the years are presented in Table 1 and graphically depicted in Fig.3.

The data revealed that during 2017-2018, the percent infestation of *H. armigera* was in the range of 2.81 to 12.44. It was first noticed in the 47th SMW (4th week of November) *i.e.* 2.81 percent, then pest infestation increased continuously upto the 51st SMW (4th week of December) and then it decreased. The maximum percent infestation (12.44) was recorded in 51st SMW (4th week of December) and minimum percent infestation (2.81) was recorded in 47th SMW (4th week of November).

The data revealed that during 2018-2019, the percent infestation of *H. armigera* was in the range of 6.15 to 30.76. It was first noticed in the 47th SMW (4th week of November) *i.e.* 6.15 percent, then pest infestation increased continuously upto the 52nd SMW (5th week of December) and then it decreased. The maximum percent infestation (30.76) was recorded in 52nd SMW (5th week of December) and minimum percent infestation (6.15) was recorded in 47th SMW (4th week of November).

The pooled data of both the years revealed that infestation was in the range of 4.48 to 18.78 percent. The pest was first noticed in the 47th SMW (4th week of November) *i.e.* 4.48 percent, then infestation increased continuously upto the 52nd SMW (5th week of December) and then it decreased. The maximum percent infestation (18.78) was observed in 52nd SMW (5th week of December) while minimum percent infestation (4.48) recorded in 47th SMW (4th week of November).

### Seasonal incidence of *Melanagromyza obtusa* (Malloch) infesting pigeon pea

The data on seasonal incidence of *M. obtusa* infesting pigeon

pea during the years 2017-2018, 2018-2019 and pooled mean of both the years are presented in Table 1 and graphically depicted in Fig.4.

The data revealed that during 2017-2018, the percent infestation of *M. obtusa* was in the range of 4.70 to 11.81. It was first noticed in the 48th SMW (1st week of December) *i.e.* 4.70 percent, then pest infestation increased continuously upto the 01st SMW (1st week of January). The maximum percent infestation (11.81) was recorded in 01st SMW (1st week of January) and minimum percent infestation (4.70) was recorded in 48th SMW (1st week of December).

The data revealed that during 2018-2019, the percent infestation of *M. obtusa* was in the range of 7.47 to 24.94. It was first noticed in the 48th SMW (1st week of December) *i.e.* 7.47 percent, then pest infestation increased continuously upto the 01st SMW (1st week of January). The maximum percent infestation (24.94) was recorded in 01st SMW (1st week of January) and minimum percent infestation (7.47) was recorded in 48th SMW (1st week of December).

The pooled data of both the years revealed that infestation was in the range of 6.09 to 18.38 percent. The pest was first noticed in the 48th SMW (1st week of December) *i.e.* 6.09 percent, then pest infestation increased continuously upto the 01st SMW (1st week of January). The maximum percent infestation (18.38) was observed in 01st SMW (1st week of January) while minimum percent infestation (6.09) recorded in 48th SMW (1st week of December).

The results of the present finding are more or less similar with the findings of Akhilesh and Paras [1]. They reported that the tur plume moth (*E. atomosa*) appeared on 8th November (45th SMW) when pod formation was started and disappeared after 23rd December (51st SMW) when the crop matured for harvesting. They also reported that the tur pod fly (*M. obtusa*) infestation started with the egg laying on the grown up pods and the larval population recorded on 8th December (49th SMW) (3.03 larvae per ten pods), reached its peak on 23rd December (51st SMW) (5.70 larvae per ten pods) and the last observation was recorded on 7th January (1st SMW) (1.36 larvae per ten pods). Bhoyar *et al.* (4a) also revealed that the population build-up of pod borer, *H. armigera* started from the third week of October (42nd SMW) to first fortnight of February (7th SMW) with the highest peak during the last week of November (48lh SMW). They also reported that the tur plume moth, *E. atomosa* was most active from the first week of November (45th SMW) to first week of February (6th SMW). The peak population was observed in last week of December (52nd SMW). Chaitanya *et al.* [7] also revealed that the infestation of spotted pod borer started with the onset of flowering in first week of November (45th SMW) and remained in the field till crop maturity. The peak activity was observed during first fortnight of December (49th to 50th SMW) in all the three cultivars. Meragana *et al.* [12] also reported that the larval population of *M. vitrata* gradually increased from third week of November (47th standard week) and reached peak level (12.6 larvae/plant) at the third week of December (51st standard week), which coincided with the peak flowering stage of the crop. The pest remained active up to last week of January.

**Table 1:** Seasonal incidence of pod borer complex of pigeon pea during *Kharif* 2017-18, *Kharif* 2018-19 and pooled

| SMW | Mean percent bud/pod infestation per 3 twigs per plant | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *M. vitrata* | | | *E. atomosa* | | | *H. armigera* | | | *M. obtusa* | | |
| | 2017-2018 | 2018-2019 | Pooled | 2017-2018 | 2018-2019 | Pooled | 2017-2018 | 2018-2019 | Pooled | 2017-2018 | 2018-2019 | Pooled |
| 42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 43 | 1.80 | 2.40 | 2.10 | 2.00 | 1.80 | 1.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 44 | 7.40 | 9.70 | 8.55 | 3.00 | 2.90 | 2.95 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 45 | 13.90 | 15.31 | 14.61 | 4.91 | 12.90 | 8.91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 46 | 11.00 | 18.14 | 14.57 | 5.53 | 7.22 | 6.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 47 | 22.06 | 8.17 | 15.12 | 6.01 | 11.34 | 8.68 | 2.81 | 6.15 | 4.48 | 0.00 | 0.00 | 0.00 |
| 48 | 6.88 | 7.48 | 7.18 | 9.50 | 7.32 | 8.41 | 6.88 | 28.89 | 17.89 | 4.70 | 7.47 | 6.09 |
| 49 | 2.83 | 4.63 | 3.73 | 6.39 | 6.70 | 6.55 | 9.78 | 18.74 | 14.26 | 8.65 | 15.43 | 12.04 |
| 50 | 3.73 | 3.51 | 3.62 | 5.84 | 5.32 | 5.58 | 10.71 | 23.72 | 17.22 | 10.22 | 20.09 | 15.16 |
| 51 | 3.07 | 5.95 | 4.51 | 5.80 | 4.90 | 5.35 | 12.44 | 21.11 | 16.78 | 9.83 | 17.22 | 13.53 |
| 52 | 2.95 | 6.73 | 4.84 | 5.00 | 5.60 | 5.30 | 6.79 | 30.76 | 18.78 | 8.27 | 24.42 | 16.35 |
| 01 | 4.20 | 5.16 | 4.68 | 4.80 | 4.59 | 4.70 | 4.20 | 30.11 | 17.16 | 11.81 | 24.94 | 18.38 |
| SD± | 6.20 | 4.86 | 4.92 | 1.91 | 3.30 | 2.25 | 4.72 | 13.31 | 8.58 | 4.96 | 10.59 | 7.71 |

SMW - Standard Meteorological Week, SD - Standard Deviation

**Correlation between pest incidence and weather parameters**

The correlation coefficients of different meteorological parameters *viz.*, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, wind speed and sunshine hours, with incidence of pod borer complex of pigeon pea during the years 2017-2018, 2018-19 and pooled are presented in Table 2, 3 and 4 and depicted in Fig. 5, 6 and 7, respectively.

**Table 2:** Correlation between weather parameters and pod borer complex of pigeon pea during *Kharif* 2017-2018

| Pests | Weather parameters | | | | | |
|---|---|---|---|---|---|---|
| | Temp maxi | Temp min | RH-I | RH-II | Wind speed | BSS |
| *M. vitrata* | 0.612* | 0.197 | -0.204 | -0.456 | -0.370 | 0.316 |
| *H. armigera* | -0.549 | -0.391 | 0.171 | 0.036 | 0.553 | -0.740** |
| *E. atomosa* | -0.041 | -0.332 | 0.008 | -0.490 | 0.258 | -0.265 |
| *M. obtusa* | -0.720* | -0.599 | 0.517 | 0.279 | 0.522 | -0.648* |

** correlation is significant at the 0.01 level r value = 0.735

* correlation is significant at the 0.05 level r value = 0.602

During the year 2017-2018, the correlation study revealed that the incidence of *M. vitrata* showed significant positive correlation with maximum temperature, (r = 0.612*) While, the minimum temperature, morning relative humidity, evening relative humidity, wind speed and sunshine hours found to be non- significant.

The incidence of *H. armigera* showed highly significant negative correlation with bright sunshine hours at 1 percent level. (r = -0.740**) While, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and wind speed had non-significant correlation.

The incidence of *E. atomosa* had non-significant correlation with all the meteorological parameters like maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, wind speed and sunshine hours.

The incidence of *M. obtusa* showed significant negative correlation with maximum temperature and sunshine hours (r = -0.720 and -0.648*), While, morning relative humidity, evening relative humidity and wind speed had non-significant correlation.

**Table 3:** Correlation between weather parameters and pod borer complex of pigeon pea during *Kharif* 2018-2019

| Pests | Weather parameters | | | | | |
|---|---|---|---|---|---|---|
| | Temp maxi | Temp min | RH-I | RH-II | Wind speed | BSS |
| *M. vitrata* | 0.462 | 0.273 | -0.124 | 0.109 | -0.437 | 0.645* |
| *H. armigera* | -0.606* | -0.851** | 0.313 | 0.502 | 0.638* | -0.336 |
| *E. atomosa* | 0.326 | 0.332 | -0.174 | 0.373 | -0.257 | 0.041 |
| *M. obtusa* | -0.677* | -0.879** | 0.290 | 0.493 | 0.715* | -0.386 |

** correlation is significant at the 0.01 level r value = 0.735
* correlation is significant at the 0.05 level r value = 0.602

During the year 2018-2019, the correlation study revealed that the incidence of *M. vitrata* had significant positive correlation with sunshine hours, (r = 0.645*), While, the maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and wind speed had non-significant correlation.

The incidence of *H. armigera* showed positive correlation with wind speed (r = 0.638*) and negative significant correlation with maximum temperature (r = -0.606*) and highly significant negative correlation with minimum temperature (r = -0.851**). The morning relative humidity, evening relative humidity and sunshine hours had non-significant correlation.

The incidence of *E. atomosa* showed non-significant correlation with all the meteorological parameters like maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, wind speed and sunshine hours.

The incidence of *M. obtusa* showed significant positive correlation with wind speed (r = 0.715*) and negative significant correlation with maximum temperature (r = -0.677*) and highly significant negative correlation with minimum temperature (r = -0.879**). The morning relative humidity, evening relative humidity and sunshine hours had non-significant correlation.

**Table 4:** Correlation between weather parameters and pod borer complex of pigeon pea (pooled)

| Pests | Weather parameters | | | | | |
|---|---|---|---|---|---|---|
| | Temp maxi | Temp min | RH-I | RH-II | Wind speed | BSS |
| *M. vitrata* | -0.161 | 0.010 | -0.399 | -0.546 | 0.313 | 0.530 |
| *H. armigera* | -0.544 | -0.682* | -0.324 | -0.102 | -0.469 | -0.555 |
| *E. atomosa* | -0.467 | -0.293 | -0.608* | -0.620* | 0.174 | -0.027 |
| *M. obtusa* | -0.531 | -0.686* | -0.266 | 0.040 | -0.562 | -0.520 |

** correlation is significant at the 0.01 level r value = 0.735
* correlation is significant at the 0.05 level r value = 0.602

Pooled correlation study revealed that the incidence of *M. vitrata* showed non-significant correlation with all the meteorological parameters like maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, wind speed and sunshinehours.

The incidence of *H. armigera* showed negative significant correlation with minimum temperature, (r =-0.682*), While, the maximum temperature, morning relative humidity, evening relative humidity, wind speed and sunshine hours had non-significant correlation.

The incidence of *E. atomosa* showed negative correlation with morning relative humidity and evening relative humidity (r = -0.608* and -0.620*), While, maximum temperature, minimum temperature, wind speed and bright sunshine hours had non-significant correlation.

The incidence of *M. obtusa* showed negative correlation with minimum temperature (r = -0.686*), While, maximum temperature, morning relative humidity, evening relative humidity, wind speed and bright sunshine hours had non-significant correlation.

The results of the present study are more or less similar with the results of Bhoyar *et al.* (4b) who found non-significant effects of weather parameters on larval population of *H. armigera* in pigeon pea. Kumar and Nath [8] also reported that the weather factors did not show significant effect on the borer's population. Kumar and Nath [9] also reported that maximum and average relative humidity and wind velocity had non-significant negative correlation, while maximum temperature, minimum temperature, relative humidity, and bright sunshine, showed non-significant positive correlation with the plume moth. Pawar *et al.* [13] also observed that the non-significant correlation and regression coefficient of larval population of *H. armigera* on pigeon pea with maximum and minimum temperature and maximum and minimum relative humidity. Subharani and Singh [17] reported that the majority of the pod borers were negatively correlated with temperature,

relative humidity, rainfall and wind speed and positive correlated with sunshine hours. Kumar and Durairaj [10] also reported that the emergence of *H. armigera* adults had significant negative association with minimum temperature while, maximum temperature, relative humidity, rainfall and rainy days had no influence on *H. armigera* activity. Bisane *et al.* [6] also reported that larval incidence of *H. armigera* had significantly negative correlation with minimum temperature and evening relative humidity in pigeon pea.

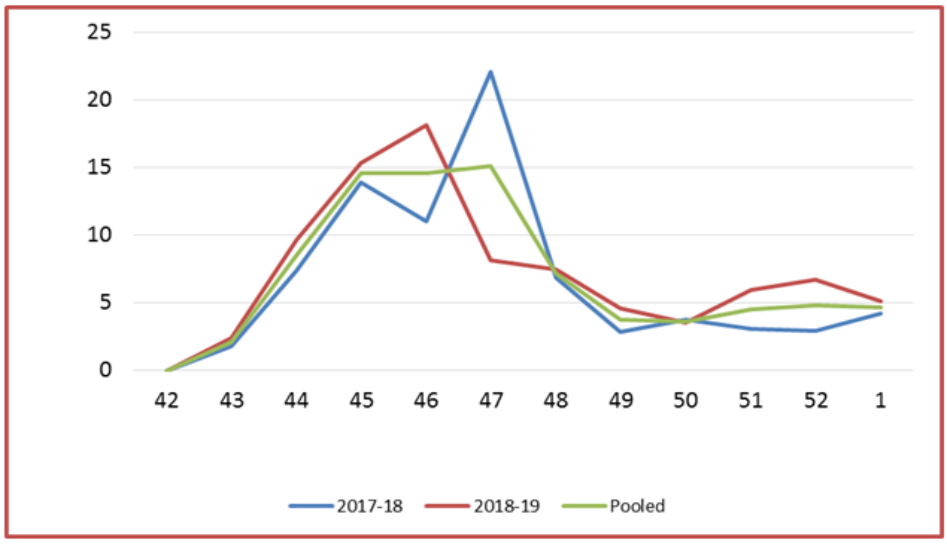


**Fig 1:** Seasonal incidence of *M. vitrata* infesting pigeon pea during *Kharif* 2017-2018,*Kharif* 2018-2019 and pooled

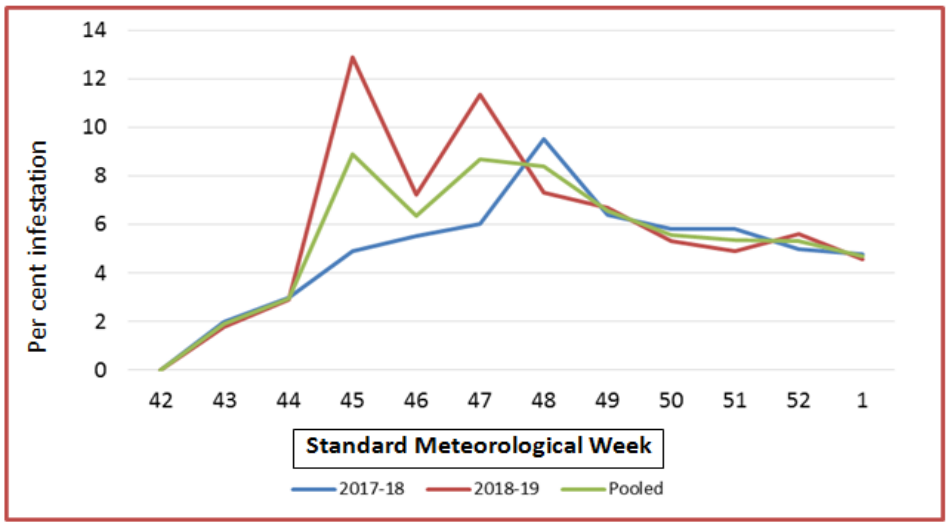


**Fig 2:** Seasonal incidence of *E. atomosa* infesting pigeon pea during *Kharif* 2017-2018, *Kharif* 2018-2019 and pooled

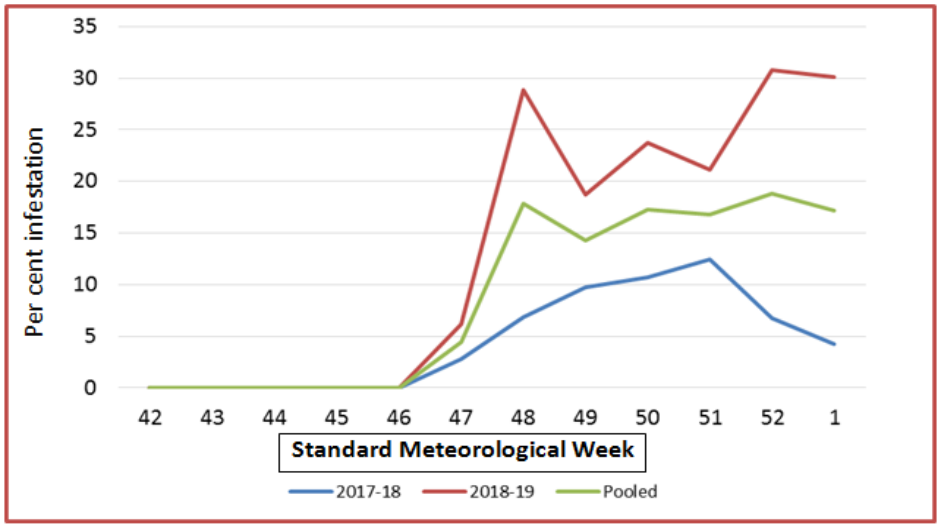


**Fig 3:** Seasonal incidence of *H. armigera* infesting pigeon pea during *Kharif* 2017-2018, *Kharif* 2018-2019 and pooled

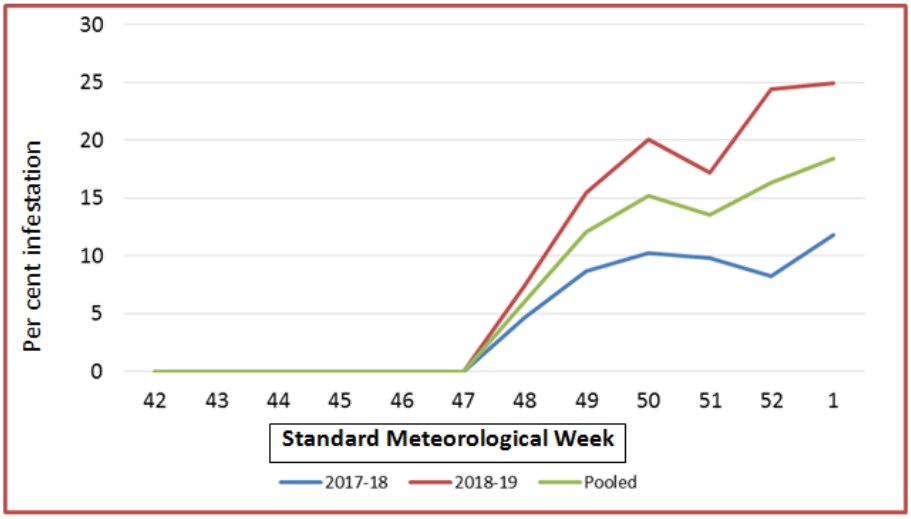


**Fig 4:** Seasonal incidence of *M. obtusa* infesting pigeon pea during *Kharif* 2017-2018, *Kharif* 2018-2019 and pooled

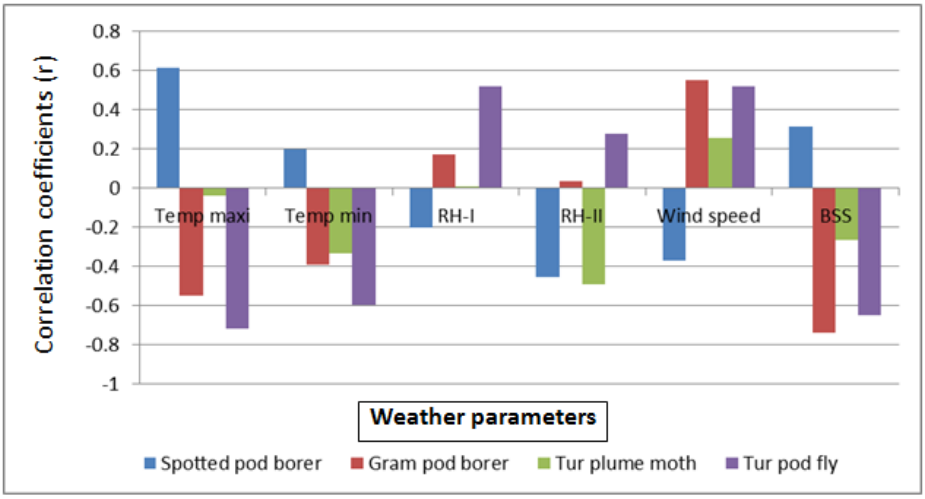


**Fig 5:** Correlation between weather parameters and pod borer complex of pigeon pea during *Kharif* 2017-2018

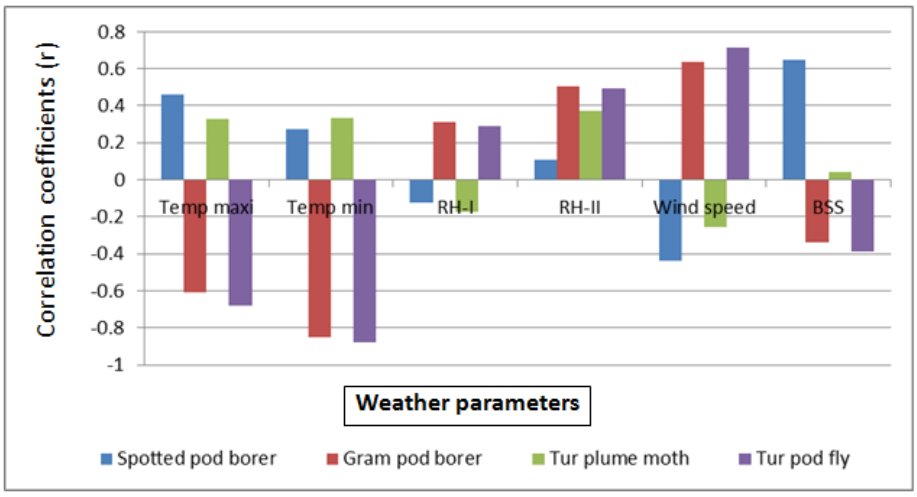


**Fig 6:** Correlation between weather parameters and pod borer complex of pigeon pea during *Kharif* 2018-2019

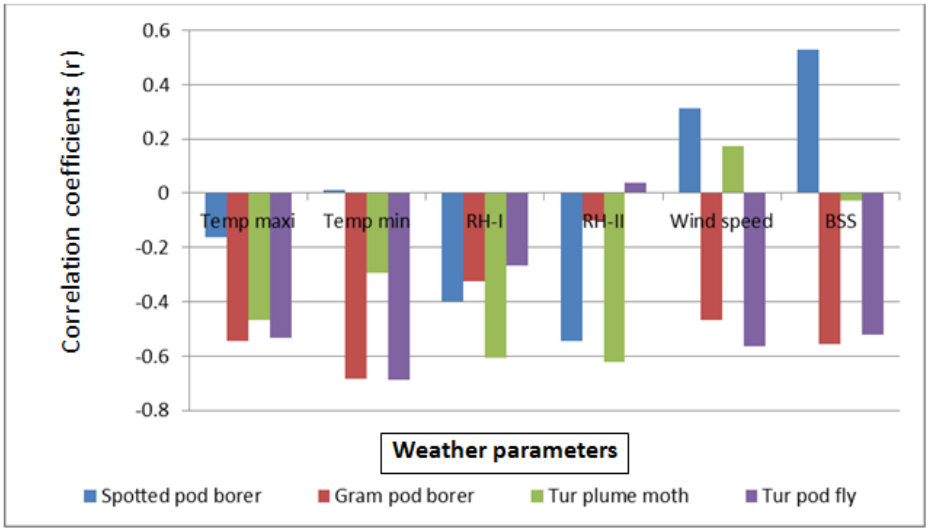


**Fig 7:** Correlation between weather parameters and pod borer complex of pigeon pea (pooled)

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