

Seasonal Incidence of Major Insect Pest of Chickpea and their Natural Enemies in Vindhaya Region of Madhya Pradesh

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ABSTRACT

Field experiment carried out at the Entomology Instructional Farm, JNKVV-College of Agriculture Rewa, MP during *rabi* season 2018-19 revealed that incidence of the chickpea pod borer *Helicoverpa armigera*. Population range of pod borer during different weather weeks varied between 0.30 and 1.89 larvae/mrl (April 2nd week and March 2nd week respectively). Peak larval population of *Helicoverpa armigera* was recorded in 2nd week of March (11 standard weeks). A weak negative correlation was observed with the maximum relative humidity and minimum relative humidity correlation, -0.172 and -0.595 respectively and a non significant positive correlation with maximum temperature, minimum temperature and rainfall. The respective r was found to be 0.306, 0.391 and

0.269. In district Rewa, MP, India the insect-pests of chickpea and their natural enemies during *rabi* the total seven species was recorded in Chickpea in which six pests minor in nature and one major pest Chickpea pod borer (*Helicoverpa armigera*). Termite (*Odonotermes obesus* Ram.), White grub (*Holotrichia consanguinea* Bl.), Black aphid (*Aphis craccivora* Koch), Grasshopper (*Chrotogonus trachypterus* Blan.), Semilooper (*Autographa nigrisigna* L.), Cut worm (*Agrotis ipsilon* Huf.) are minor in nature. Seven natural enemies found during field investigation i.e. lady bird beetle (*Chilomenes sexmaculata* Fab.), lady bird beetle (*Coccinella septempunctata* L.), Praying mantis (*Mantis religiosa*), Dragon fly (*Crocothemis servilia* Drury), *Campoletis parasitoid* (*Campoletis chloridae* Uch.), Indian mynah (*Acridotheris tristis* L.), King crow (*Dicrurus macrocerus* Vie.) in chickpea observed in low to medium population on the crop and to help in reduction of pest population.

Keywords Chickpea, *Helicoverpa armigera*, Insect pests, Biotic, Abiotic factors.

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INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the very important pulse crops grown in 10.2 million hectares with an average production of 7.9 million tonnes and an average productivity of 995 kg ha⁻¹, of which about 80% is grown in India FAO (2016). It is also known as gram or Bengal gram and is sometimes known as chana.

The chickpea is a legume of the family Fabaceae. A high protein seed, it is among the oldest cultivated legumes with 7,500-year-old crop remains found in the Middle East (Bell 2014). Per capita availability of pulses in India was 43.0 g per day and 14.4 kg per annum and coming to chickpea per capita availability of chickpea was 14.6 g per day and 5.3 kg per annum (Anonymous 2013). Madhya Pradesh is the largest producer in the country, accounting for over 40% of total largest producer in the contributing an area of 30.76 lakh ha, production 33.98 lakh tonnes and productivity 1105 kg/ha (34.46% and 40.62% of total area and production of country) (Annual Report DPD 2017). In Rewa Division, 0.64 lakh ha area is under this crop and production is 0.64 lakh metric tonnes and productivity is 999 kg/ha (Anonymous 2015). Harvesting chickpeas is attacked by numerous insect species both in field conditions and during storage (Clement *et al.* 2000). Among them, the pod borer is considered to be the main pest. High reproductive rate and short life cycle (Kumar and Singh 2014). Gram pod borer, *Helicoverpa armigera* is a globally important harmful polyphagous pest over 200 cultivated and wild hosts Yadav *et al.* (2011). Use of resistant plant material remains the most effective tool in integrated pest management which is compatible with other methods of control with no additional cost to growers (Nadeem *et al.* 2010).

Based on the above facts, we planned and conducted this study. Aiming to establish one relationship between insect pests and their natural enemies at different stages of the chickpea crop and inhabiting agro ecosystems play an important role in this reduce the number of pests.

MATERIALS AND METHODS

The field experiment was conducted at the Entomology Instructional Farm, JNKVV-College of Agriculture Rewa, MP during *rabi* season 2018-19 conducted research on chickpea variety JG-16. District Rewa is situated at 24.31°N latitude and 88.15°E longitudes and climate is typically semi-humid and subtropical with winter and summer seasons. The average rainfall in this region is 1054.00 mm. Fields were prepared according to recommended packages practice planting in a 3m × 2.7m plot with a planting spacing of 30

cm × 10 cm. *H. armigera* was observed on his five plants randomly selected from the middle four rows of each plot and larvae population recorded per meter row length (mrl) at weekly intervals. The observations of pests and natural enemies are recorded untreated plot area every week to the harvest of crops. The meteorological data were subjected to statistical analysis to find out the correlation coefficients.

RESULTS AND DISCUSSION

The population data of pod borer is presented in Table 1. It is visual from these tables that pod borer infestation in the chickpea, all over *rabi* 2018-19, prevail from 1st standard week (1st week of Jan 2019) to 15th standard week (2nd week of April 2019) in diverse population during various standard weeks.

Population dynamics of pod borer- Chickpea pod borer population in different standard weeks of *rabi* 2018-19 is presented in Table 1 and Fig. 1, which shows the initiation of pest infestation in the 1st standard week (1st week of Jan 2019) with an average population of 0.4 larvae/mrl/week when average weekly maximum and minimum temperature of 24.97°C and 6.42°C was persisting during the week besides 72.85% relative humidity and 0.00 mm rainfall. The average monthly population of the pod borer was recorded, 0.46 larvae/mrl in the month of Jan 2019. An increase in the pest population was continuously noted up to 11th standard week (2nd week of March 2019) with an average population of 1.89 larvae/mrl. During this period, the average maximum and minimum temperature prevailed at 29.37°C and 14.62°C respectively, with an average 74.28% relative humidity and 0.00 mm rainfall.

The correlation of the *H. armigera* population with maximum and minimum temperature, relative humidity and rainfall was worked out to find out relationship exist between them. A weak negative correlation between maximum and minimum relative humidity was observed. Weak positive correlation between relative humidity and maximum and minimum temperatures and rainfall.

The average population of gram pod borer in the entire month was found at 1.69 larvae/mrl.

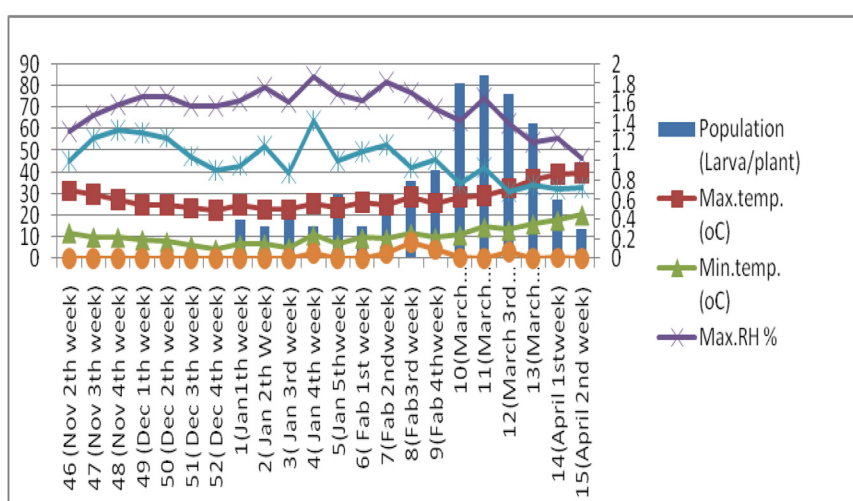


Fig. 1. Population dynamics of chickpea pod borer (*Helicoverpa armigera*) in relation to temperature, relative humidity and rainfall during *rabi* season 2018-2019.

Table 1. Population of chickpea pod borer (*Helicoverpa armigera*) in relation to temperature, relative humidity and rain fall during *rabi* season.

| Standard weeks /name week of month | Population (Larva/mlr) | Max temp (°C) | Min temp. (°C) | Max RH % | Min RH % | Rainfall (mm) |
|------------------------------------|------------------------|---------------|----------------|----------|----------|---------------|
| 46 (Nov 2 nd week) | 0.00 | 31.50 | 11.91 | 59.00 | 45.57 | 0.00 |
| 47 (Nov 3 th week) | 0.00 | 30.05 | 9.94 | 66.28 | 55.85 | 0.00 |
| 48 (Nov 4 th week) | 0.00 | 27.42 | 9.74 | 71.28 | 59.57 | 0.00 |
| Average | 0.00 | 29.65 | 10.53 | 65.52 | 53.66 | 0.00 |
| 49 (Dec 1 th week) | 0.00 | 25.20 | 8.60 | 75.00 | 58.57 | 0.00 |
| 50 (Dec 2 th week) | 0.00 | 24.78 | 7.70 | 75.28 | 56.28 | 0.00 |
| 51 (Dec 3 th week) | 0.00 | 23.45 | 5.92 | 70.57 | 47.57 | 0.00 |
| 52 (Dec 4 th week) | 0.00 | 22.44 | 4.22 | 70.57 | 41.28 | 0.00 |
| Average | 0.00 | 23.96 | 6.61 | 72.85 | 50.92 | 0.00 |
| 1 (Jan 1 th week) | 0.40 | 24.97 | 6.42 | 72.85 | 43.28 | 0.00 |
| 2 (Jan 2 nd Week) | 0.33 | 22.88 | 6.72 | 79.42 | 52.57 | 0.00 |
| 3 (Jan 3 rd week) | 0.60 | 22.85 | 4.82 | 72.57 | 40.00 | 0.00 |
| 4 (Jan 4 th week) | 0.33 | 25.81 | 10.87 | 84.28 | 64.14 | 2.54 |
| 5 (Jan 5 th week) | 0.66 | 23.88 | 6.44 | 76.00 | 45.57 | 0.00 |
| Average | 0.46 | 24.07 | 7.05 | 77.02 | 49.11 | 0.50 |
| 6 (Feb 1 st week) | 0.33 | 26.02 | 9.47 | 73.42 | 50.00 | 0.00 |
| 7 (Feb 2 nd week) | 0.64 | 25.07 | 9.14 | 81.85 | 52.85 | 2.24 |
| 8 (Feb 3 rd week) | 0.80 | 28.68 | 11.65 | 76.71 | 42.57 | 7.60 |
| 9 (Feb 4 th week) | 0.91 | 25.84 | 9.61 | 69.42 | 46.14 | 4.14 |
| Average | 0.67 | 26.40 | 9.96 | 75.35 | 47.89 | 3.49 |
| 10 (March 1 st week) | 1.80 | 28.81 | 10.82 | 63.85 | 34.71 | 0.42 |
| 11 (March 2 nd week) | 1.89 | 29.37 | 14.62 | 74.28 | 42.28 | 0.00 |
| 12 (March 3 rd week) | 1.70 | 32.61 | 13.18 | 62.42 | 31.14 | 3.17 |
| 13 (March 4 th week) | 1.40 | 36.98 | 16.08 | 54.00 | 34.42 | 0.00 |
| Average | 1.69 | 31.94 | 13.67 | 63.63 | 35.63 | 0.89 |
| 14 (April 1 st week) | 0.60 | 39.22 | 17.85 | 56.00 | 32.42 | 0.42 |
| 15 (April 2 nd week) | 0.30 | 39.82 | 20.25 | 46.50 | 33.00 | 0.00 |
| Total | 0.45 | 39.22 | 19.05 | 51.25 | 32.71 | 0.21 |
| Correlation coefficient (r value) | 1 | 0.306 | 0.391 | -0.172 | -0.595 | 0.269 |

Table 2. Qualitative composition of insect of chickpea during *rabi* season.

| Common name | Scientific name | Family | Order | Crop stage | Damaging stage | Status |
|--------------|---|-------------|-------------|-----------------------------|-----------------|--------|
| Termite | <i>Odontotermes obesus</i> (Ram.) | Termitidae | Isoptera | Seedling stage | Nymphs | Minor |
| White grub | <i>Holotrichia consanguinea</i> (Bl.) | Melonthidae | Coleoptera | Seedling stage | Grubs | Minor |
| Black aphid | <i>Aphid craccivora</i> (C.L. Koch) | Aphididae | Hemiptera | Flowering stage | Nymph and adult | Minor |
| Grass hopper | <i>Chrotogonus trachypterus</i> (Blan.) | Acrididae | Orthoptera | Vegetative stage | Nymph and adult | Minor |
| Semi looper | <i>Autographa nigrisigna</i> (L) | Noctuidae | Lepidoptera | Flowering and podding stage | Larvae | Minor |
| Cut worm | <i>Agrotis ipsilon</i> (Huf.) | Noctuidae | Lepidoptera | Seedling stage | Larvae | Minor |
| Pod borer | <i>Helicoverpa armigera</i> (Hub.) | Noctuidae | Lepidoptera | Flowering and podding stage | Larvae | Major |

The decline in the borer population on the crop was observed after the peak incidence in the 2nd week of March 2019 and population of the pod borer was found 0.30 larvae/ml in 15th standard week (2nd week of April 2019). Yadav *et al.* (2024) reported that the highest mean larval populations 4.53 larvae per plant in 2021-22 were observed during 6th std. week and in 2022-23 it was 4.10 larvae per plant were observed during 7th std week. However, lowest mean larval population 0.10 larvae per plant in 2021-22 was observed during 46th std week and in 2022-23 it was 0.07 per plant during 47th std. week. The correlation coefficient with the population of *H. armigera* was positively correlated with minimum (0.733 during 2021-22 and 0.893 during 2022-23) and

negatively correlated with maximum (-0.779 during 2021-22 and -0.330 during 2022-23) temperatures, respectively. However, it was negatively correlated (-0.812) in 2021-22 and (-0.609) in 2022-23 with relative humidity. While, rainfall had a positively correlated (0.569) in 2021-22 and (0.003) in 2022-23.

Weak negative correlations were observed with maximum and minimum relative humidity ($r = -0.172$ and -0.595 , respectively), and weak positive correlations with maximum temperature, minimum temperature, and precipitation. The corresponding r 's were found to be 0.306, 0.391 and 0.269. The temperature (maximum and minimum) and sunshine hours had significant positive correlation with larval population

Table 3. Natural enemies recorded in chickpea during *rabi* season.

| Common name | Scientific name | Family | Order | Host |
|-----------------------|--------------------------------------|---------------|---------------|---------------------|
| Lady bird beetle | <i>Chilomenes sexmaculata</i> (Fab.) | Coccinellidae | Coleoptera | Aphid |
| Lady bird beetle | <i>Crocothemis servilia</i> (Drury) | Coccinellidae | Coleoptera | Larvae of pod borer |
| Praying mantid | <i>Mantis religiosa</i> (L.) | Mantidae | Dictyoptera | Larvae of pod borer |
| Dragon fly | <i>Crocothemis servilia</i> (Drury) | Libellulidae | Odonata | Larvae of pod borer |
| Campoletis Parasitoid | <i>Campoletis chloridae</i> (Uch.) | Ichneumonidae | Hymenoptera | Larvae of pod borer |
| Indian mynah | <i>Acridotheris tristis</i> (L.) | Sturnidae | Passeriformes | Pod borer Larvae |
| King crow | <i>Dicrurus macrocercus</i> (Vie.) | Dicruridae | Passeriformes | Pod borer Larvae |

during *rabi* season. The maximum relative humidity showed significant negative correlation during *rabi* season whereas, minimum relative humidity showed significant negative correlation with larval population during both the seasons. The rainfall showed significant positive correlation (Mehra and Singh 2023).

Among seven species recorded in which one species belong to sucking pests, one species pod borer found gram pod borer, (*Helicoverpa armigera* Hubner) destroy buds, flowers and pods. If flowers and pods are not available, eat the leaves and leave them vein. Due to the invasion of larvae, noticeable holes appear in the pods. Developing and partially mature seeds are usually eaten whole. One species of cutworm damaging symptom chickpea seedling are cut through at or below ground level. Chickpea leaves, inflorescence stalk and young pods covered with black aphid, Honey dew secretion with black ant movement. Choudhary *et al.* (2024) studied that the incidence commenced from first and second week of December i.e. 49th and 50th Standard Metrological Week (SMW) and disappeared in the first fortnight of January. Incidence again started from the third week of January (3rd SMW) which increased gradually and reached peak (6.4 and 5.2 larvae/ m row) in the third and second week of February (8th and 9th SMW) during first and second season. Termite species (*Odontotermes obesus*) attack standing crop of chickpea, termite bores into the roots and stem. Due to the bore chickpea plant soon dry. Semilooper larvae feed on leaflets, tender pods and developing seeds. When pods are attacked, much of the pod wall is eaten and the damage is ragged and irregular.

Seasonal incidence of major insect pest of chickpea and their natural enemies—The diversity of seven insects pests related to chickpea (variety JG-16) was found belonging to four orders i.e. Lepidoptera (3 families), Hemiptera (1 family), Isoptera (1 family), Colioptera (1 family), Orthoptera (1 family) (Table 2). The family Noctuidae, Aphididae, Termitidae, Melontidae and Acrididae were represented each one species.

Seven natural enemies were recorded during observation of fields i.e. Lady bird beetle (*Chilomenes sexmaculata* Fab.) order- *Coleoptera*, Lady bird bee-

tle (*Coccinella septempunctata* L.) order- *Colioptera*, Praying mantid (*Mantis religiosa*) order- *Dictyoptera*, Dragon fly (*Crocothemis servilia*) order- *Odonata*, *Campoletis parasitoid* (*Campoletis chloridae*) order- *Hymenoptera*, Indian mynah (*Acridotheris tristis*) order- *Passeriformes*, King crow (*Dicrurus macrocercus*) order- *Passeriformes* (Table 3).

Seven natural enemies were recorded during observation of fields. Sunanda and Reena (2010) reported that the parasitoid, *Campoletis chloridae* made its presence felt throughout the cropping season, whereas *T. ayyari* and *B. lassus* were also seen parasitizing the pests. These parasitoids, if manipulated might prove to be a potential source of suppressing the population build of *Helicoverpa armigera*.

CONCLUSION

The activity of Gram pod borer (*H. armigera* Hub.) in the crop was recorded from January to April 2019. The maximum population (0.89 larvae/ml) was observed at the second week. Since March 2019, a population decline has been recorded. The pest showed a positive correlation with the maximum and minimum temperature and rainfall. The diversity of insects pests associated with the chickpea seven species of insect pests and seven natural enemies were recorded during observation of fields.

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