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Correlation between population of arthropods and abiotic factors on chickpea

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Abstract
The population of cut worm showed non significant with maximum temperature positive (0.004) and minimum temperature negative correlation (-0.045) respectively while relative humidity (- 0.150) and rainfall (-0.098) showed non significant negative correlation respectively. Nymphal populations of termite showed non significant with maximum temperature negative (-0.083) and minimum temperature positive correlation (0.177) respectively while relative humidity (0.042) and rainfall (0.113) showed non significant positive correlation respectively. Larval populations of Semilooper showed non significant with maximum temperature positive (0.074) and minimum temperature negative (-0.065) correlation respectively while relative humidity negative (-0.243) and rainfall positive (0.225) non significant correlation respectively. Larval populations of pod borer showed non significant with maximum (0.409) and minimum temperature positive (0.320) correlation respectively while relative humidity negative (-0.362) and rainfall positive (0.060) non significant correlation respectively.

Keywords: Abiotic factors, chickpea, correlation and insect-pests

Introduction
Chickpea (*Cicer arietinum* L.) is the third most important pulse crop in the world, after dry beans and field peas. Among all the pulses, the chickpea (*Cicer arietinum* L.) which is commonly known as Gram or Bengal gram is the most important pulse crop of India. Chickpea is grown in tropical, subtropical and temperate regions. Kabuli type is mostly grown in temperate regions while the desi type chickpea is grown in semi-arid and tropics [Nene *et al*., 1978; Muehlbauer and Singh, 1987; Malhotra *et al*., 1987] [7, 6, 5].

In India, total pulse had the area of 8.25 million hectare with production of 7.33 million tones and productivity 889 kg/ha in 2015. It is grown in six major states viz., Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Karnataka and Andhra Pradesh altogether contribute 91 per cent of the production and 90 per cent of the area. In U.P. chickpea is grown an area of 558 thousand hectare with production of 367.70 thousand tones and productivity 659 kg/ha in 2015. Madhya Pradesh is the single largest producer of chickpea in the country accounting for over 40% of total production while Rajasthan, Maharashtra, Uttar Pradesh and Andhra Pradesh contributes about 14%, 10%, 9% and 7%, respectively (Anonymous, 2016) [2].

More than 150 species of insects are known to attack pulse crops in India and out of these, about 25 causes damage winter pulse crops (Bindra, 1968) [3]. Chickpea plant is under threat of many insect pests that attack on its roots, foliage and pods. It is infested by 57 species of insect pests and other arthropods in India; however, the major insect pest of chickpea is the gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) which is the most noxious, polyphagous, multivoltine and cosmopolitan pest has resulted in substantial yield loss (37-50%) and in severe cases up to 90% pod damage (Davies and Lateef, 1975) [4]. This pest starts infesting the shoot/tips few weeks after crop emergence and feed on buds, flowers and pods till harvesting, causing heavy yield losses. Larvae of H. armigera are voracious foliar feeder as early instars and later shift to the developing seeds and fruits leading to drastic reduction in yield. The pod borer H. armigera, is the most serious pest which cause high economic losses to the chickpea crop (Singh and Ali, 2006; Sarwar *et al*., 2009) [10, 8]. An attempt has been made about correlation studies associated with chickpea crop at different growth stages and their nature of damage at Eastern U.P.

Materials and Methods

The observations on correlation studies on chickpea was recorded on three farmers' fields of villages Pandekapurwa, Pithla and Joriumin comes under Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) area jurisdiction during *Rabi*, 2017-18. The seeds of chickpea were sown in plots on the fourth week of November, 2018. Plots were selected Randomized Block Design with three replication. Each plot measure 5 x 4 m2 having apart with spacing of 30 cm between and 10 cm treatments.

Weekly observations on major insect-pests on chickpea starting from germination to harvest of chickpea crop showed that only four insect-pest viz, cut worm (*Agrotis ipsilon* Hufnagel), termite (*Odontotermes obesus* Ramb. or *Microtermes obesi* Holmgren), semi-looper (*Autographa nigrisigna* Walker) and pod borer (*Helicoverpa armigera* Hubner), caused damage to chickpea crop at different stages. The correlation between population of arthropods and abiotic factors *viz*. minimum temperature, maximum temperature, relative humidity and rainfall were worked out by using following formula

$$r = \frac{\sum dn.dy}{N\sqrt{\frac{\sum d^2 xi}{N} \times \frac{\sum d^2 y}{N}}}$$

Where,

r = Correlation coefficient
y = Number of insects
Xi= Weather parameters
n = No. of observations
Σ= Summation

Results and Discussion

Correlation studies

To know the effect of abiotic variables on the population of insects-pests, simple correlation analysis was carried out. The results of the analysis have been presented as under (Table.1and Figure 1)

Table 1: Correlation coefficient between insects-pests and meteorological parameters.

Insects	Max. Temp. (0C)	Min. Temp. (0C)	RH (%)	Rainfall (mm)
Cut worm	NS (0.004)	NS (-0.045)	NS (-0.150)	NS (-0.098)
Termite	NS(-0.083)	NS(0.177)	NS (0.042)	NS(-0.113)
Semilooper	NS (0.074)	NS(-0.065)	NS(-0.243)	NS (0.225)
Pod borer	NS (0.409)	NS (0.320)	NS(-0.362)	NS (0.060

(i) Cutworm

Larval populations of cut worm showed non significant with maximum temperature positive (0.004) and minimum temperature negative correlation (-0.045) respectively while relative humidity (-0.150) and rainfall (-0.098) showed non significant negative correlation respectively.

(ii) Termite

Nymphal populations of termite showed non significant with maximum temperature negative (-0.083) and minimum temperature positive correlation (0.177) respectively while relative humidity (0.042) and rainfall (0.113) showed non significant positive correlation respectively.

(iii) Semilooper

Larval populations of Semilooper showed non significant with maximum temperature positive (0.074) and minimum temperature negative (-0.065) correlation respectively while relative humidity negative (-0.243) and rainfall positive (0.225) non significant correlation respectively.

(iv) Gram pod borer

Larval populations of pod borer showed non significant with maximum (0.409) and minimum temperature positive (0.320) correlation respectively while relative humidity negative (-0.362) and rainfall positive (0.060) non significant correlation respectively.

The findings of the present studies are in conformity of the results of Agnihotri *et al*. (2015) [1] the pest population had significant positive correlation with both minimum and maximum temperature, the correlation coefficient being 0.71 and 0.82, respectively. The correlation coefficient of morning and afternoon relative humidity was -0.66. The rainfall and larval population showed positive correlation coefficient (0.03) but it was non-significant. The wind velocity and sunshine hours showed positive non-significant correlation with the larval population. Similar findings were reported by Singh *et al.*, (2012) [9] The peak population were noticed 3 larva/10 plants on Sidhauna village and 2 larva/10 plants at Pandepurwa, Pithla and Joriumin 10th standard weeks at a minimum temperature of 13.8 degrees C, maximum temperature of 30.1 degrees C, relative humidity 68.0% and no rainfall recorded during crop season.

Conclusion

Larval populations of cut worm, semilooper showed non significant with maximum temperature positive, minimum temperature negative correlation, whereas, Nymphal populations of termite and larval populations of pod borer showed non significant with maximum temperature, minimum temperature and positive correlation respectively.

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