Plant Archives Vol. 26, No. 1, 2026 pp. 499-502 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.1.069

POPULATION DYNAMICS OF MAJOR INSECT-PESTS OF FIELD PEA IN RELATION TO ABIOTIC PARAMETERS

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(Date of Receiving-27-11-2025; Date of Revision-10-01-2026; Date of Acceptance-14-02-2026)

ABSTRACT

The present investigation was carried out during the *Rabi* season of 2022–23 at the Agricultural Research Farm of B.R.D. P.G. College, Deoria (Uttar Pradesh) to study the population dynamics of major insect pests of field pea in relation to abiotic parameters. Weekly observations were recorded on pea leaf miner (*Chromatomyia horticola*), pea aphid (*Acyrthosiphon pisum*), pea pod borer (*Etiella zinckenella*), blue butterfly (*Lampides boeticus*) and gram pod borer (*Helicoverpa armigera*) under field conditions. Pea leaf miner first appeared during the 2nd standard meteorological week and reached a peak population of 3.80 maggots' plant^{-1} in the 5th SMW. Aphids attained maximum population of 4.36 aphids' plant^{-1} during the 6th SMW. The peak populations of *E. zinckenella* (1.23 larvae plant^{-1}) and *H. armigera* (0.63 larvae plant^{-1}) were also recorded in the 6th SMW, while *L. boeticus* reached its maximum (0.41 larvae plant^{-1}) during the 7th SMW. Heat map correlation analysis revealed that pea leaf miner and aphid populations showed positive correlation with relative humidity (r = 0.20–0.50) and negative correlation with temperature (r = –0.02 to –0.21). In contrast, pod borers exhibited positive correlation with temperature (r = 0.15–0.35) and negative correlation with relative humidity (r = –0.09 to –0.32).

Key words: *Pisum sativum*, insect pest complex, seasonal incidence, correlation analysis, temperature, relative humidity.

Introduction

Field pea (*Pisum sativum* L.; Fabaceae) is an important cool-season grain legume crop cultivated extensively in India during the Rabi season. It is commonly known as dry pea and locally referred to as "matar." The crop is grown for fresh green seeds, tender pods, dry seeds and foliage, and plays a significant role in human nutrition as well as soil fertility improvement through biological nitrogen fixation. Dry pea seeds are used as dhal, boiled peas as snack food and as a supplement to wheat flour for the preparation of nutritious food products.

Field pea is a rich source of nutrients, containing about 22.5% protein, 62.1% carbohydrates and 1.8% fats, along with appreciable amounts of minerals such as calcium (64 mg/100 g) and iron (4.8 mg/100 g), and vitamins including vitamin B_1 (0.72 mg/100 g), vitamin B_2 (0.15 mg/100 g) and vitamin B_2 (2.4 mg/100 g). In India, the major field pea–growing states include Uttar Pradesh, Madhya Pradesh, Jharkhand, Assam, West Bengal and Bihar. The crop is cultivated over an area of about 5.91 lakh ha with an annual production of 9.10 lakh tonnes and an average productivity of 1222 kg ha^{-1} (MA & FW, 2025).

Despite its nutritional and economic importance, the productivity of field pea remains low, mainly due to severe infestation of insect pests. The crop is attacked by a complex of insect pests such as pea leaf miner (*Chromatomyia horticola*), pea aphid (*Acyrthosiphon pisum*), pea pod borer (*Etiella zinckenella*), gram pod borer (*Helicoverpa armigera*), blue butterfly (*Lampides boeticus*) and grasshopper (*Hieroglyphus banian*). Among these, *E. zinckenella* is considered a major pest causing up to 50.9% pod infestation and 77.64% seed damage, resulting in about 23.9% yield loss (Yadav *et al*., 2000). *Helicoverpa armigera*, a highly polyphagous insect, and *Lampides boeticus* are also important pod borers of field pea (Ganapathy and Durairaj, 2000). Singh

et al. (2004) reported maximum leaf damage (40%) by *C. horticola* in early maturing varieties of pea.

The pest complex of field pea mainly includes pea stem fly (*Melanagromyza phaseoli*), pea leaf miner (*C. horticola*), pea aphid (*A. pisum*) and pod borers such as *H. armigera* L. *boeticus* and *E. zinckenella*, which together cause considerable damage at different growth stages of the crop. On an average, insect pests are responsible for an annual loss of about 2.5 to 3.0 million tonnes of pulses in India (Reddy, 2009). Pod borers inflict severe damage to flowers and developing pods, leading to poor pod setting, seed damage and substantial yield reduction.

The population dynamics of insect pests are strongly influenced by abiotic factors such as temperature, relative humidity, rainfall and sunshine hours. Variations in climatic conditions across regions and seasons significantly affect the occurrence, abundance and activity of insect pests, thereby influencing the extent of crop damage and yield loss (Sharma *et al*., 2024). Understanding the relationship between pest population and weather parameters is essential for predicting pest outbreaks and developing timely and effective management strategies.

Therefore, generation of information on the seasonal incidence and population fluctuations of major insect pests in relation to abiotic parameters is crucial for devising eco-friendly and need-based pest management practices. Keeping in view the economic importance of field peas and the losses caused by insect pests, the present investigation was undertaken to study the population dynamics of major insect pests of field pea in relation to abiotic parameters.

Materials and Methods

The experiment was conducted during the *Rabi* season of 2022–2023 at the Agricultural Research Farm of B.R.D. P.G. College, Deoria (Uttar Pradesh), under the Department of Agricultural Entomology. Field pea (*Pisum sativum* L.) variety N-P-04 was grown in 10 × 5 m² plots with a spacing of 30 × 10 cm. All recommended agronomic practices were followed, and no insecticides were applied throughout the crop period.

Population of major insect pests, *viz*., pea leaf miner (*Chromatomyia horticola*), pea aphid (*Acyrthosiphon pisum*), pea pod borer (*Etiella zinckenella*), blue butterfly (*Lampides boeticus*) and gram pod borer (*Helicoverpa armigera*), was recorded weekly from pest appearance to harvest on ten randomly selected plants.

Leaf miner incidence was assessed by counting healthy and damaged leaves per plant. Aphid population was recorded as number of adults and nymphs per plant from three leaves (upper, middle and lower canopy). Larval population of pod borers was recorded per plant by visual observation. Weekly meteorological data on temperature, relative humidity and rainfall were used to study the effect of abiotic factors on pest incidence, and correlation coefficients were computed.

Results and Discussion

The results revealed that during the Rabi season of 2022–23, major insect pests of field pea, *viz.*, pea leaf miner (*Chromatomyia horticola*), pea aphid (*Acyrthosiphon pisum*), pea pod borer (*Etiella zinckenella*), blue butterfly (*Lampides boeticus*) and gram pod borer (*Helicoverpa armigera*), were observed at different crop growth stages. The population dynamics of major insect pests are presented in Table 1 and Fig. 1, while the correlation analysis with weather parameters is illustrated in Fig. 2.

Incidence of pea leaf miner (*Chromatomyia horticola*)

The infestation commenced during the 2nd standard meteorological week (SMW) with a mean population of 0.80 maggots plant^{-1}. The population increased gradually and reached its peak during the 5th SMW (3.80 maggots plant^{-1}), followed by a gradual decline thereafter. Similar trends were reported by Mane and Singh (2025), who observed peak incidence in the last week of January (4th SMW), and by Yadav and Arya (2022), who recorded maximum population during the 2nd SMW. Correlation analysis (Fig. 1) indicated a positive association with relative humidity (r = 0.50 and 0.30) and a negative association with temperature (r = –0.21 and –0.20). These results corroborate the findings of Mane and Singh (2025), who reported a significant positive correlation with relative humidity and rainfall and a negative correlation with temperature and sunshine hours.

Incidence of pea aphid (*Acyrthosiphon pisum*)

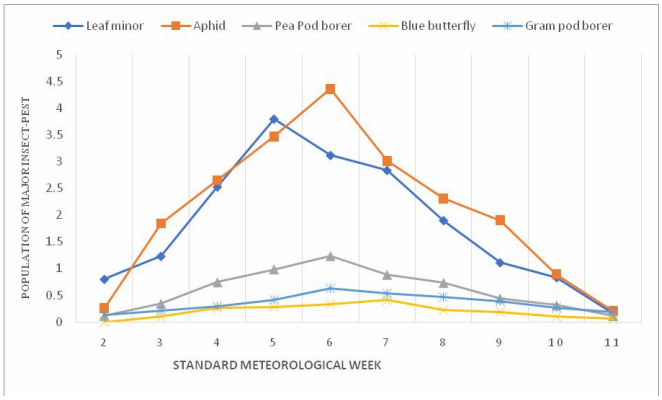

Fig. 1: Population dynamics of Major insect-pest of Field pea

Table1: Mean population of major insect-pest of field pea with abiotic parameters during *Rabi* 2022-2023.

SMW	Mean Population of Major Insect-pests of field pea					Temperature °C		Relative Humidity (%)	
	Leaf minor/plant	Aphids/plant	Pea pod borer/plant	Blue butterfly/plant	Gram Pod borer/plant	Max.	Min.	Max.	Min.
2	0.80	0.26	0.11	0.00	0.13	14.00	09.58	85.71	65.57
3	1.23	1.84	0.34	0.10	0.21	19.14	11.28	84.14	45.85
4	2.53	2.65	0.74	0.26	0.29	20.42	15.42	85.71	56.85
5	3.80	3.47	0.98	0.28	0.41	19.00	14.28	87.71	55.42
6	3.12	4.36	1.23	0.33	0.63	22.57	15.85	81.40	38.71
7	2.84	3.01	0.88	0.41	0.53	24.57	16.42	86.28	42.42
8	1.90	2.31	0.73	0.22	0.47	27.00	19.57	81.00	36.57
9	1.11	1.90	0.44	0.19	0.39	27.42	20.71	76.00	33.71
10	0.83	0.89	0.31	0.10	0.27	27.86	20.85	81.23	33.54
11	0.15	0.20	0.11	0.06	0.19	26.23	19.84	81.11	32.11

*SMW= Standard Meteorological Week

The aphid population appeared in the 2nd SMW (0.26 aphids plant^{-1}) and persisted throughout the crop season. The population gradually increased and attained its maximum during the 6th SMW (4.36 aphids plant^{-1}), after which it declined. Similar observations were reported by Rien and Shukla (2021), who recorded peak population during the 4th SMW. Correlation analysis revealed a positive relationship with relative humidity (r = 0.20 and 0.03) and a negative relationship with temperature (r = –0.02 and –0.06). These findings are in agreement with Rien and Shukla (2021), who reported a positive influence of relative humidity on aphid population.

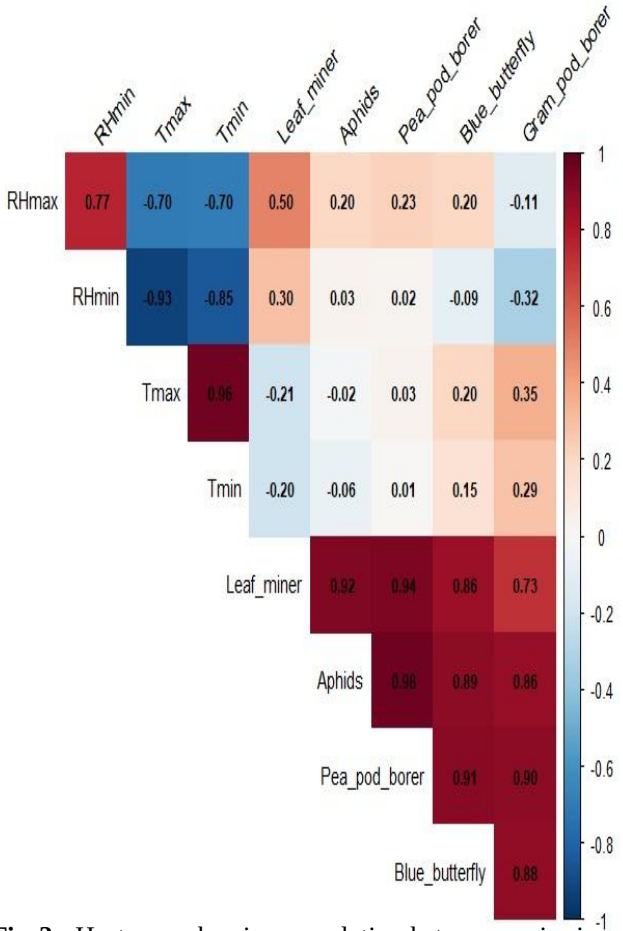

Fig. 2: Heat map showing correlation between major insect pests of field pea and abiotic parameters during Rabi 2022–23.

Incidence of pea pod borer (*Etiella zinckenella*)

The infestation of pea pod borer started during the 2nd SMW with a mean population of 0.11 larvae per plant. The population increased gradually and reached its peak during the 6th SMW (1.23 larvae plant^{-1}), followed by a decline in subsequent weeks. These findings are supported by Mane and Singh (2025), who recorded maximum infestation during the 6th SMW, and by Dubey *et al*. (1993), who reported peak activity during February–March.

Incidence of blue butterfly (*Lampides boeticus*)

The larval population of blue butterfly commenced during the 3rd SMW (0.10 larvae plant^{-1}). The population increased steadily and attained its maximum during the 7th SMW (0.41 larvae plant^{-1}), followed by a gradual decline. Similar results were reported by Manisha *et al*. (2018), who observed peak population during the 9th SMW, and by Kaushik and Singh (1982), who recorded severe pod damage during the pod formation stage. Correlation analysis showed a positive association with temperature (r = 0.20 and 0.15) and maximum relative humidity (r = 0.20), while a negative association was observed with minimum relative humidity (r = –0.09). These results are in conformity with Dhaka *et al*. (2011), who reported a non-significant positive correlation of *L*.

boeticus population with temperature and humidity. Correlation analysis indicated that the population of pea pod borer (*Etiella zinckenella*) showed a positive correlation with temperature, being moderately associated with maximum temperature (r = 0.20) and minimum temperature (r = 0.15). In contrast, its population exhibited a negative correlation with relative humidity, showing weak negative association with maximum relative humidity (r = –0.09) and minimum relative humidity (r = –0.02).

Incidence of gram pod borer (*Helicoverpa armigera*)

The larval population of *H. armigera* first appeared during the 2nd SMW (0.13 larvae plant^{-1}) and persisted throughout the crop period. The population increased gradually and reached its peak during the 6th SMW (0.63 larvae plant^{-1}), followed by a decline thereafter. These findings agree with Kharibam *et al*. (2025), who reported peak infestation during the 8th SMW. Correlation analysis revealed a positive relationship with temperature (r = 0.35 and 0.29) and a negative relationship with relative humidity (r = –0.11 and –0.32). This is in accordance with Kharibam *et al*. (2025), who reported a positive correlation with temperature and a negative correlation with relative humidity.

Conclusion

The study revealed distinct seasonal incidence and peak activity of major insect pests of field pea during the *Rabi* season 2022–23. Pea leaf miner peaked in the 5th standard meteorological week, aphids and pod borers in the 6th week, and blue butterfly in the 7th week. Correlation and heat map analyses indicated that pea leaf miner and aphid populations were positively associated with relative humidity and negatively associated with temperature, whereas pod borers showed a positive relationship with temperature and a negative relationship with relative humidity. These findings confirm the significant role of abiotic factors in regulating pest population dynamics. The results provide a scientific basis for weather-based pest forecasting and for implementing timely and need-based integrated pest management strategies in field pea.

Acknowledgement

The authors express their sincere gratitude to Dr. Rajnish Kumar, Professor & Head, Department of Agricultural Entomology, B.R.D., P.G., College, Deoria, for his valuable guidance, constant encouragement and for providing necessary facilities to carry out the present investigation.

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