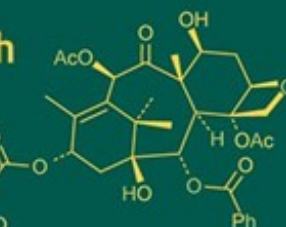


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Population build-up of black cutworm, *Agrotis ipsilon* (Hufnagel), on linseed crop in North Bank Plain Zone of Assam, India

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ABSTRACT

The population build-up of black cutworm, *Agrotis ipsilon* (Hufnagel), on linseed crop (var. Sekhar) was studied at the experimental farm of All India Coordinated Research Project for Dryland Agriculture (AICRPDA), BNCA, Assam Agricultural University, during rabi 2023–24. Larvae of *A. ipsilon* were first observed at a low population density of 0.33 larvae/m² during the 47th Standard Meteorological Week (SMW), 2023, when the crop was at the seedling stage. The population increased sharply to 2.67 larvae/m² on 27 November 2023 and subsequently increased gradually, reaching a peak of 6.33 larvae/m² on 11 January 2024 (2nd SMW), coinciding with the late vegetative stage of the crop. Thereafter, the population declined with minor fluctuations until the 7th SMW, 2024. Correlation analysis revealed a significant negative relationship between minimum temperature and larval population ($r = -0.596$, $P < 0.05$), whereas maximum temperature showed a non-significant negative relationship ($r = -0.439$). Average relative humidity, total rainfall and sunshine hours showed non-significant positive relationships with larval population. Multiple regression analysis indicated that the combined effect of maximum temperature, minimum temperature, average relative humidity, rainfall and sunshine hours accounted for 57.40 per cent of the variation in larval population. The findings indicate that minimum temperature was an important abiotic factor associated with the seasonal abundance of *A. ipsilon* on linseed under the agro-climatic conditions of Assam.

Keywords: Pest biology, Seasonal abundance, Abiotic factors, Rabi season, Noctuid larva

Introduction

Linseed (*Linum usitatissimum* L.) is an important oilseed crop belonging to the family Linaceae. It is the second most important rabi oilseed crop in India after rapeseed-mustard in terms of area and seed production. Linseed oil has traditionally been used as a drying oil, and its oil content generally ranges from 33–45 per cent (Gill, 1987) [1]. The crop is also valued for its fibre and other value-added products (Paliwal *et al.*, 2023) [2]. In Assam, linseed is cultivated in pockets of Nagaon, Morigaon, Barpeta and Dhubri districts.

Insect pests are among the major constraints affecting linseed production. Several insect pests have been associated with the crop in India (Malik *et al.*, 2001) [3]. The linseed budfly, *Dasyneura lini* Barnes, and linseed thrips, *Caliothrips indicus* Bagnall, are among the important insect pests of linseed. In Assam, black cutworm, *Agrotis ipsilon* (Hufnagel), has also been reported as an important pest of linseed (Borah *et al.*, 2005) [4]. The larvae damage young plants by cutting them near the ground surface, making the crop particularly vulnerable during the early stages of growth.

Although the occurrence of *A. ipsilon* in Assam has been documented, information on its seasonal population dynamics in relation to abiotic factors in linseed remains limited. Therefore, the present study was undertaken to determine the seasonal population build-up of *A. ipsilon* on linseed and to assess its relationship with major meteorological factors under the agro-climatic conditions of the North Bank Plain Zone of Assam.

Materials and Methods

The field observations on *A. ipsilon* were conducted in a 300 m² plot selected from a field experiment on linseed (var. Sekhar) at the experimental field of AICRPDA (26°30'–27°01' N latitude, 92°16'–93°43' E longitude, and 848 m above sea level), Biswanath College of Agriculture, Assam Agricultural University, Biswanath Chariali, Assam, during rabi 2023–24. The crop was sown on 2 November 2023. The crop was raised following the recommended agronomic practices for Assam (Anonymous, 2015) [5]. No pesticide was applied during the entire observation period.

The larval population of *A. ipsilon* was recorded at weekly intervals beginning one week after sowing. On each sampling date, three quadrats of 1 m² each were selected randomly from different parts of the field. The

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larvae present within each quadrat were examined and counted manually. Since the larvae generally remain curled near the base of plants or a few centimetres below the soil surface during the daytime, the soil around the plant base was carefully examined during sampling.

Larvae collected on each sampling date were brought to the laboratory for determination of parasitism. Individual larvae were reared on potato pieces in ventilated transparent plastic containers measuring $20 \times 10 \times 8$ cm until emergence of either parasitoids or adult *A. ipsilon*. The percentage of parasitism was calculated based on the number of parasitoids emerging from the collected larvae.

Daily meteorological observations, including maximum temperature, minimum temperature, average relative humidity, total rainfall and sunshine hours, were obtained from the relevant meteorological records for the experimental location. The relationship between larval population and meteorological parameters was assessed using correlation analysis. Multiple regression analysis was performed to determine the combined influence of the abiotic variables on *A. ipsilon* population following Gomez *et al.* (1984) [6].

Results

Seasonal population build-up

The seasonal variation in the meteorological parameters recorded during the crop season is presented in Figure 1, while the seasonal population build-up of *A. ipsilon* is presented in Figure 2.

Larvae of *A. ipsilon* were first observed during the 47th SMW, 2023, with an initial population of 0.33 larvae/m². The population increased

sharply during the following week and reached 2.67 larvae/m² on 27 November 2023. Thereafter, the larval population increased gradually and reached a maximum of 6.33 larvae/m² on 11 January 2024 (2nd SMW), corresponding to the late vegetative stage of the crop.

After attaining the peak population, the larval density declined gradually, with minor fluctuations, and the declining phase continued until the 7th SMW, 2024. Representative pest photographs are presented in Figures 3.

Relationship with abiotic factors

Correlation analysis revealed a significant negative relationship between minimum temperature and *A. ipsilon* larval population ($r = -0.596, P < 0.05$). Maximum temperature also showed a negative relationship with larval population ($r = -0.439$), although the relationship was not statistically significant.

Average relative humidity ($r = 0.182$), total rainfall ($r = 0.284$) and sunshine hours ($r = 0.275$) showed non-significant positive relationships with larval population. The correlation and multiple regression results are presented in Table 1.

No parasitoids emerged from the larvae reared during the study period.

Multiple regression analysis

The multiple regression equation obtained for the relationship between *A. ipsilon* population and the five meteorological variables was:

$$Y = -163.71 + 2.53X_1 + 3.72X_2 + 0.19X_3 + 0.38X_4 + 0.31X_5; R^2 = 0.574$$

where Y represents the larval population of *A. ipsilon*; X_1 represents maximum temperature; X_2 , minimum temperature; X_3 , average relative humidity; X_4 , total rainfall; and X_5 , sunshine hours.

The coefficient of determination ($R^2 = 0.574$) indicated that the combined effect of the five meteorological variables accounted for 57.40 per cent of the variation in larval population during the study period.

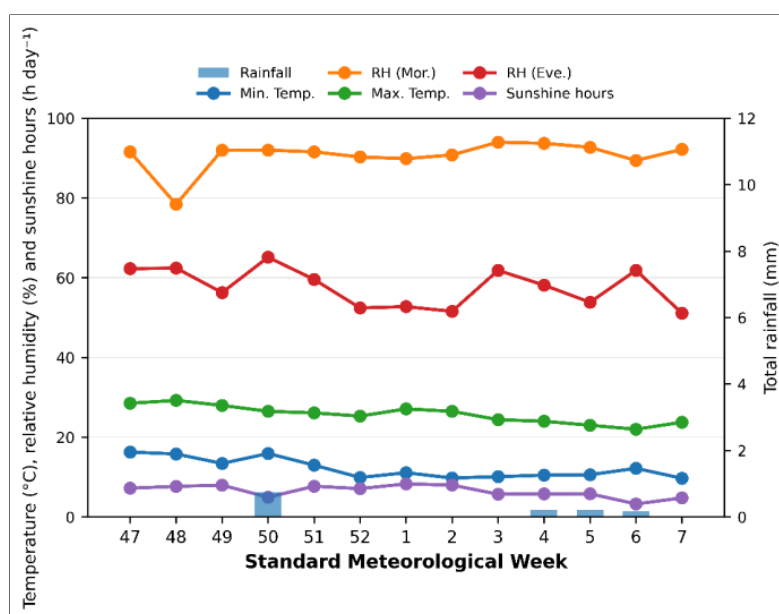


Figure 1. Weekly variation in meteorological parameters during the crop period in relation to *Agrotis ipsilon* (Hufnagel) population build-up.

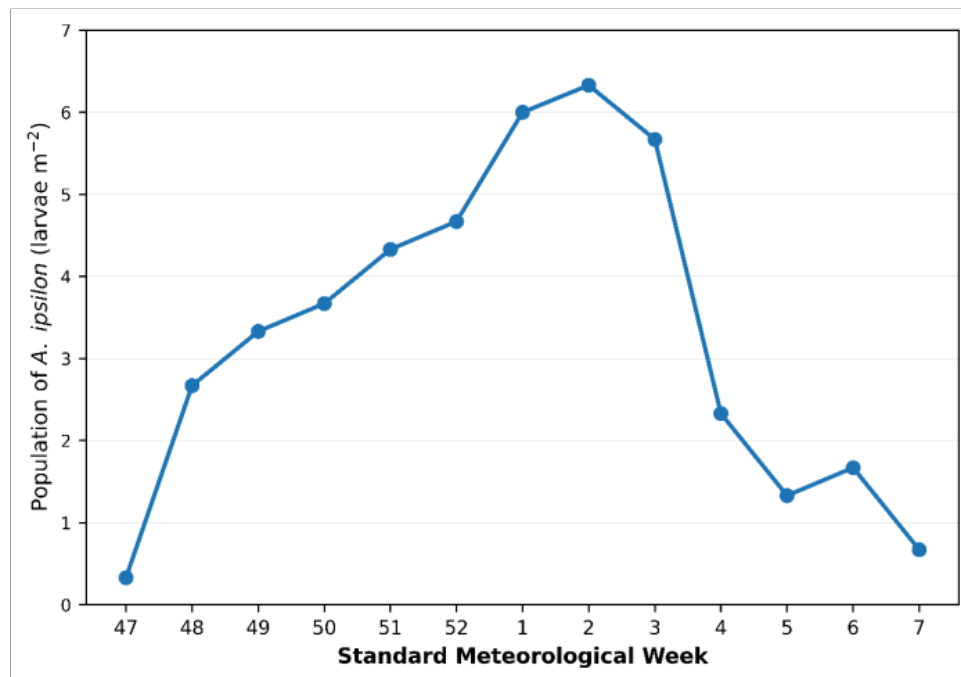


Figure 2. Seasonal population build-up of *Agrotis ipsilon* (Hufnagel) on linseed.



Figure 3. Linseed crop during the study period.



Figure 4. *Agrotis ipsilon* (Hufnagel): (A) larva on linseed plant; (B) collected larvae.

Table 1. Correlation and multiple regression between *Agrotis ipsilon* (Hufnagel) and abiotic factors during 2023-24.

Correlation particulars	Correlation co-efficient (r)
<i>A. ipsilon</i> vs.	-0.439 NS
Max. temperature (X_1)	
Min temperature (X_2)	-0.596*
Average RH (X_3)	0.182 NS
Total rainfall (X_4)	0.284 NS
Sunshine (X_5)	0.275 NS
Regression equation	$Y = -163.71 + 2.53X_1 + 3.72X_2 + 0.19X_3 + 0.38X_4 + 0.31X_5$, $R^2 = 0.574$

*Significant at 5%, **significant at 1%, NS= Non-Significant

Discussion

The seasonal population of *A. ipsilon* showed a distinct increasing phase followed by a declining phase during the rabi season. The pest first appeared during the 47th SMW at a low density of 0.33 larvae/m² and subsequently increased sharply. The population reached its maximum density of 6.33 larvae/m² during the 2nd SMW in early January. A similar seasonal pattern of *A. ipsilon* activity was reported by Yadav *et al.* (2025) [7] in chickpea, where peak pest activity occurred during the 52nd and 1st SMW of the rabi season. The occurrence of peak activity during the cooler winter period in both studies suggests an association between seasonal temperature conditions and the population dynamics of *A. ipsilon*. The present observations are also in agreement with the findings of Ram *et al.* (2001) [8] and Borah *et al.* (2011) [9].

The significant negative correlation between minimum temperature and larval population indicates that higher larval abundance was associated with lower minimum temperatures during the winter period. Similar negative relationships between *A. ipsilon* population and temperature variables have been reported by Borah *et al.* (2022) [10] in chickpea under Assam conditions and by Yadav *et al.* (2025) [7] in chickpea during the rabi season. These findings collectively indicate that cooler winter conditions may favour increased activity of *A. ipsilon*.

Maximum temperature also showed a negative relationship with larval population, although the relationship was not significant. In contrast, average relative humidity, rainfall and sunshine hours showed positive but non-significant relationships with larval population. Thus, among the meteorological variables considered in the present study, minimum temperature showed the clearest association with seasonal pest abundance.

The multiple regression analysis showed that the five meteorological variables together explained 57.40 per cent of the variation in larval population. This indicates that weather conditions contributed substantially to the observed seasonal fluctuation, although a consider-

able proportion of the variation remained unexplained and may be associated with other environmental or biological factors.

A limitation of the present study is that the observations were conducted during a single crop season and at one experimental location. Therefore, the observed relationship between minimum temperature and *A. ipsilon* abundance should be validated through multi-season and multi-location studies before developing reliable forecasting models.

Conclusion

The present study revealed a distinct seasonal pattern in the population build-up of *Agrotis ipsilon* on linseed (var. Sekhar) during the rabi season of 2023–24 under the agro-climatic conditions of Assam. The larval population was first recorded during the 47th SMW at 0.33 larvae/m² and subsequently increased, reaching a peak of 6.33 larvae/m² during the 2nd SMW, corresponding to the late vegetative stage of the crop, followed by a gradual decline. Among the meteorological factors studied, minimum temperature showed a significant negative relationship with larval population, while maximum temperature showed a non-significant negative relationship and relative humidity, rainfall and sunshine hours showed non-significant positive relationships. The combined effect of the five meteorological variables accounted for 57.40 per cent of the variation in larval population. No parasitoids emerged from the larvae collected during the study period. Thus, the study provides baseline information on the seasonal occurrence and weather-associated population dynamics of *A. ipsilon* on linseed in the North Bank Plain Zone of Assam, which can contribute to its monitoring and further investigation of management strategies.

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