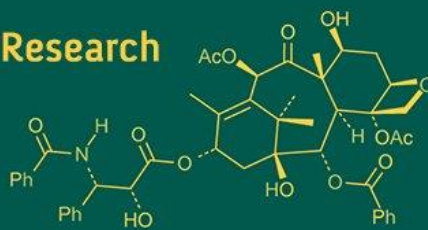


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Assesment of nocturnal insects diversity using a solar light trap in relation to weather parameters in pulse ecosystem of Dhanalakshmi Srinivasan University

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Abstract

The present study carried out in Dhanalakshmi Srinivasan University, Samayapuram to evaluate the performance of solar light trap for monitoring nocturnal insects in pulse ecosystem in relation to weather parameter during 2025-2026. Nocturnal insects belonging to orders such as Lepidoptera, Orthoptera, Hemiptera, and Coleoptera were monitored and collected. The collected insect specimens were preserved in 70% ethanol for further identification and analysis. Pearson correlation analysis revealed that nocturnal insect positively and statistically significant correlation with maximum temperature ($r = 0.542$, $p = 0.013$). The minimum temperature ($r = 0.111$), relative humidity ($r = 0.102$) and evaporation ($r = 0.081$) showed very weak positive correlations. In contrast, rainfall ($r = -0.261$), sunshine hours ($r = -0.262$), and wind speed ($r = -0.209$) exhibited weak negative correlations. Among the weather parameters evaluated, maximum temperature was the only parameter that showed a statistically significant association with nocturnal insect abundance ($p < 0.05$), indicating that warmer conditions were associated with increased nocturnal insect activity.

Keywords: Light trap, pulse ecosystem, pest population, weather parameters, insect abundance, pest forecasting

Introduction

Nocturnal insects are an important part of agricultural ecosystems. They contribute to several ecological processes, including herbivory, pollination, predation, decomposition and nutrient cycling. Although they are active mainly at night, their role in maintaining the balance of agroecosystems is considerable. However, compared with insects active during the daytime, nocturnal insects have received relatively less attention. Agricultural fields provide suitable food, shelter and breeding sites for many nocturnal insects, including members of Lepidoptera, Coleoptera, Hemiptera and Orthoptera. Some of these insects are serious crop pests, while others are beneficial as predators, pollinators and decomposers.

Pulse crops are important for food and nutritional security because they are rich in protein and other essential nutrients. They also improve soil fertility through biological nitrogen fixation. At the same time, pulse crops are attacked by several insect pests that can reduce crop yield and quality. Many of these pests are active during the night and may not be easily noticed during routine daytime field observations. Therefore, monitoring nocturnal insects is important for understanding their occurrence, seasonal abundance and possible effects on pulse production. Light traps provide a simple and useful method for monitoring nocturnal flying insects. They attract insects towards an artificial light source, allowing their abundance and diversity to be recorded over time. The effectiveness of a light trap can vary depending on factors such as light intensity, wavelength, trap design, duration of operation and insect behaviour (Van Langevelde *et al.*, 2011) [7].

Weather conditions also have a strong influence on nocturnal insect activity. Temperature affects insect metabolism, development and flight, while relative humidity can influence survival and reproduction. Rainfall and wind may reduce flight activity and affect insect movement and trap catches. Other factors, such as moonlight and photoperiod, can also influence the movement and response of nocturnal insects to artificial light (Shimoda and Honda, 2013) [4].

Garris and Snyder (2010) ^[1] reported that phototactic behavior toward ultraviolet light varies among nocturnal flying insects. The study of monitoring pest population dynamics of the phototactic insect pests is important for effective management (Khadse, 2017) ^[2]. Light trap is an effective, bias-free monitoring tool of insect pest, it has often been used in the ecological studies of Lepidopterous insect in paddy ecosystems. Sinu *et al.* (2013) ^[5] suggested that light trap is an important tool for minimizing the insect pest damage without any toxic hazard

The present study, entitled Assessment Of Nocturnal Insects Diversity Using A Solar Light Trap In Relation To Weather Parameters In Pulse Ecosystem Of Dhanalakshmi Srinivasan University was undertaken to monitor nocturnal insects in a pulse-based agroecosystem and study their relationship with prevailing weather conditions. The study focuses on recording the diversity, abundance and seasonal occurrence of nocturnal insects and assessing the influence of important meteorological factors on their activity. The findings of this study have important implications for understanding the influence of weather conditions on nocturnal insect activity in agricultural ecosystems. The information generated from the study may help in early pest detection, weather-based pest forecasting, Light-trap-based surveillance and the development of effective integrated pest management practices.

Materials and Methods

Installation of Light Trap

The study was conducted at Experimental Farm of Dhanalakshmi Srinivasan University (DSU) during 2025-26. A solar-powered light trap was installed in an open field of the pulse crop ecosystem to ensure effective attraction of nocturnal insects. Seasonal activities of major insect pests were recorded on daily basis by operating the Solar light trap. The trap consisted of a solar panel, rechargeable battery, LED light source and insect collection chamber. The solar panel had a capacity of approximately 10 W, with a 12 V operating system and a 5 W LED light. The trap was installed at a height of approximately 1.5-2.0 m above ground level. The trap was operated daily from 6:30 PM to 6:00 AM, covering the main period of nocturnal insect activity. Divisions of week were based on standard meteorological week described by procedure of Vaishampayan and Shrivastava (1977) ^[6]. Observations of weather data (maximum temperature, minimum temperature, relative humidity, rainfall, Sunshine hours, evaporation and number of rainy days etc.) were recorded on daily basis from DSU meteorological observatory. The collection chamber was checked every morning, and the trapped insects were carefully removed for observation and preservation. The chamber was cleaned before each observation to avoid mixing specimens from previous collections.

Collection of Nocturnal Insects

Insects were collected every morning between 6:00 AM and 7:00 AM from the light-trap collection chamber. The collected specimens were carefully removed, sorted according to their external morphological characters and preserved for further identification. Soft-bodied specimens were preserved in 70% ethanol, while suitable hard-bodied specimens were pinned when required. The weekly average of collected insect was recorded separately to determine

their abundance and seasonal occurrence. Pearson's correlation coefficient (*r*) was used to determine the relationship between nocturnal insect abundance and different weather parameters. The analysis included minimum temperature, maximum temperature, relative humidity, rainfall, sunshine hours, wind speed and evaporation.

The Pearson correlation coefficient was calculated using

$r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{[\sum(X - \bar{X})^2 \sum(Y - \bar{Y})^2]}}$ where, X represents the weather parameter and Y represents the number of insects collected. A positive correlation indicated that insect abundance increased with the weather parameter, whereas a negative correlation indicated an inverse relationship. Pearson correlation coefficients were calculated, and significance was assessed at $P \leq 0.05$. The analysis was used to identify the weather parameters most closely associated with variations in nocturnal insect abundance.

Results

The observed insect orders are Lepidoptera, Coleoptera, Hemiptera, Diptera, Hymenoptera, Orthoptera and Neuroptera. The relationship between nocturnal insect abundance and the prevailing meteorological parameters was analysed using Pearson's correlation coefficient and presented in Table 1. Pearson correlation analysis was performed to determine the relationship between nocturnal insect abundance and the meteorological parameters recorded during the study period. The results showed that the direction and strength of association varied among the weather parameters. The strongest relationship was observed between maximum temperature and nocturnal insect abundance ($r = + 0.542$, $p = 0.013$). This indicates a moderate positive and statistically significant correlation, suggesting that insect abundance tended to increase with increasing maximum temperature during the observation period. Minimum temperature ($r = + 0.111$, $p = 0.643$) and relative humidity ($r = + 0.102$, $p = 0.670$) showed very weak positive relationships and were not statistically significant. Rainfall ($r = -0.261$, $p = 0.266$), sunshine hours ($r = -0.262$, $p = 0.264$) and wind speed ($r = -0.209$, $p = 0.376$) showed weak negative relationships with insect abundance, but these associations were statistically non-significant. Evaporation showed a very weak positive correlation ($r = + 0.081$, $p = 0.733$) and was also non-significant (Table 2). Among the various insect collected tobacco caterpillar (*Spodoptera litura*) was the major damaging pest and first recorded during 20th SW in light trap. The highest peak was observed in 24th SW, during this period maximum and minimum temperature were 38.88 °C and 28.43 °C, Pearson correlation analysis revealed that nocturnal insect abundance had a moderate positive and statistically significant correlation with maximum temperature ($r = 0.542$, $p = 0.013$). Minimum temperature ($r = 0.111$), relative humidity ($r = 0.102$) and evaporation ($r = 0.081$) showed very weak positive correlations. Rainfall ($r = -0.261$), sunshine hours ($r = -0.262$) and wind speed ($r = -0.209$) showed weak negative correlations. Among the weather parameters studied, only maximum temperature exhibited a statistically significant association with nocturnal insect abundance ($p < 0.05$). It was supported by Akhtar *et al.* (2024) observed that temperature was an important factor influencing nocturnal moth catches,

although the response varied according to environmental conditions. Sharma *et al.* (2020) ^[3] reported the correlation studies revealed that maximum temperature, minimum

temperature, sunshine, wind velocity, morning vapor pressure and evaporation showed significant positive correlation with *S. litura* catches.

Table 1: Correlation analysis of weather parameter and trapped insect population on pulse ecosystem using solar light trap

Meteorological Week	Light trap catches (Weekly average)	Maximum Temperature (°C)	Minimum Temperature (°C)	Relative Humidity (%)	Rainfall (mm)	Sunshine Hours (h)	Wind Speed (km h ⁻¹)	Evaporation (mm)
14	3.29	36.43	24.14	79	0.43	9.23	8.86	3.20
15	5.00	38.71	29.28	76	0.43	9.41	8.14	4.30
16	8.90	39.71	28.29	68	0.29	8.60	7.57	6.50
17	9.87	38.62	26.25	73	0.37	8.79	7.86	4.60
18	6.78	37.71	28.85	74	0.00	9.50	10.07	5.50
19	4.56	35.86	28.85	75	0.00	9.11	9.21	7.10
20	6.78	37.41	8.43	80	0.29	9.11	10.29	5.20
21	6.54	36.50	28.60	79	0.29	9.19	8.29	4.20
22	5.34	35.66	25.63	76	0.00	8.47	8.10	5.20
23	7.23	36.00	26.57	78	0.43	8.41	7.99	4.50
24	15.89	38.88	28.43	78	0.00	8.14	8.36	3.20
25	13.24	38.57	26.29	79	0.00	7.86	8.10	5.90
26	11.25	35.14	28.43	75	0.29	8.00	8.69	6.10
27	4.57	3.57	27.86	76	0.14	8.13	8.06	7.10
28	5.20	33.29	27.29	72	0.00	8.14	8.10	3.20
29	4.86	33.57	27.29	76	0.29	7.13	8.36	4.50
30	4.89	35.43	27.70	75	0.00	7.57	7.97	3.90
31	5.45	35.14	28.71	76	0.43	7.70	8.51	4.10
32	7.45	36.43	27.43	74	0.29	8.30	7.27	3.0
33	12.00	37	28	75	0.00	7.50	7.45	5.90
Pearson coefficient		+ 0.54	0.11	0.10	-0.26	-0.26	-0.20	+ 0.08
p value (0.005)		0.013	0.643	0.670	0.266	0.264	0.376	0.733

Table 2: Pearson coefficient and p values

Weather parameter	Pearson's r Coefficient	p-value	Interpretation
Maximum temperature (Tmax) (°C)	+ 0.54	0.013	Moderate positive, significant
Minimum temperature (Tmin) (°C)	+ 0.11	0.643	Very weak positive, non-significant
Relative humidity (RH) (%)	+ 0.10	0.670	Very weak positive, non-significant
Rainfall (mm)	-0.26	0.266	Weak negative, non-significant
Sunshine hours (h)	-0.26	0.264	Weak negative, non-significant
Wind speed (km h ⁻¹)	-0.20	0.376	Weak negative, non-significant
Evaporation (mm)	+ 0.08	0.733	Very weak positive, non-significant

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