Journal of Scientific Research and Reports

Volume 30, Issue 5, Page 237-242, 2024; Article no.JSRR.114611
ISSN: 2320-0227

Comparative Efficacy of the Different Power Sources in Light Trap during Rabi Season

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2024/v30i51938

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/114611

Original Research Article

Received: 12/01/2024
Accepted: 16/03/2024
Published: 18/03/2024

ABSTRACT

The present investigation entitled, "Comparative efficacy of different power sources in light trap against major phototactic insect pest of rabi season" was carried out at the BSP (Breeder Seed Production) Farm, Adhartal, JNKVV, Jabalpur (MP) during rabi (mid-November 2022 to mid-April 2023) season 2022-2023.Four light traps design were used in study via. T1 – Solar light trap (with 40 cm funnel diameter, T2 – Solar light trap (50 cm funnel diameter), T3 – Electrical light trap (with 40 cm funnel diameter), T4 – Electrical (with 50 cm funnel diameter). All four light traps were operated every evening and collection was collected every morning for the duration of the investigation for 12 species viz., *Helicoverpa armigera, Agrotis ipsilon, Creatonotus gengis, Spodoptera litura, Gryllus bamaculatus, Gryllotalpa orientalis, Nezara viridula, Amata cyssea, Asota ficus Perina nuda, Thysanoplusia orichalcea* and *Theretra oldenlandiae* analysis daily data were combined into weekly totals, this data was subjected to analysis in paired and two sample t-test. In conclusion, electrical light traps were superior in terms of trapping efficacy compared to solar light

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traps for most of the species collected. The advantage of electrical light traps is in their ability to provide continuous illumination while the power is on, which ensures a higher attraction and capture rate of insects. On the other hand, solar light traps have limitations in providing consistent and sustained light throughout the night, potentially leading to reduced trapping efficiency.

Keywords: Entomology; phototactic; UV LED; light-trap.

1. INTRODUCTION

Light traps are mainly targeted towards Many other insects are also collected with light traps such as mosquitoes and other Diptera. given their strong phototactic behavior [1] and for understanding their important role in ecosystem functioning [2-4]. Light trapping has proven to be a highly effective method for studying moths, enabling the reliable sampling of a diverse range of clades and individual specimens for various research purposes [5,6,4]. There are significant variations among traps, encompassing differences in the types of lamps used, structural designs, trap placement, and trapping mechanisms. While light traps may be relatively costly, they are remarkably efficient for collecting insects [7,8]. Light traps can be used as an effective IPM tool for monitoring and management of phototactic pests. Many nocturnal and even some diurnal species are positively phototropic (phototactic) and are attracted towards light [9].

Studies comparing trap catches have indicated that the use of a 15-watt Ultraviolet (UV) light source yields superior results compared to a 125-watt Mercury Vapor (MV) light source [10]. The solar light trap may be considered as the alternate solution that has several advantages over the electrical light trap [11].

Various authors [12-25] have studies used electrical light traps whereas other [26-28,11] have studied on use of solar light trap. In applied and fundamental entomology, a variety of electric and solar-powered light trap designs are in use for moth capture, but there is a notable absence of comparative assessments that examine the structural designs and power sources utilized in these traps. In the current study different light sources are compared.

2. MATERIALS AND METHODS

The research was conducted at the BSP farm in Adhartal, JNKVV, Jabalpur (MP) from mid-November 2022 to mid-April 2023. Four, light traps were employed for the study and positioned within the farm. These traps were set up at the center of the cultivated field, on a raised board bund near an electric pole. Each day, the traps were turned on and operated, from 6:00 PM to 11:30 PM (a duration of 5.5 hours) [29]. In the morning, the insects captured in the collection chamber were collected by removing the collection tray. The distance between each trap was approximately 100 meters [10]. All four traps were positioned in different directions and arranged to prevent light from spilling along them [30]. To euthanize the trapped insects in the collection chamber, 70% Formalin was placed in the collection tray [4].

The observations were recorded in all four traps with same light source (15-watt UV tube). The pooled data of the solar (40 cm and 50 cm funnel diameter) and electrical (40 cm and 50 cm funnel diameter) traps were subjected to statistical analysis. For analysis purpose, the trap catches were combined into weekly totals [30]. For comparison of efficiency of both the light trap design the observed data were analyzed by paired and two sample t-test for testing the significant difference between two treatments as per the requirement [30].

T_1 = Solar powered

T_2 = Electrical powered

3. RESULTS

Comparison of efficiency of both the funnel diameters, the observed data were analyzed by paired and two sample t-test for testing the significant difference between two treatments. Mainly Data for the 12 species regularly collected in the traps, for a minimum of 12 weeks were analyzed. Results are presented below

Treatments - T_1 = Solar powered light trap
T_2 = Electricity powered light trap

Statistically higher numbers of *Agrotis ipsilon* (66.69%), *Spodoptera litura* (112.38%), *Creatonotus gengis* (57.33%), *Gryllus bamaculatus* (106.30%), *Gryllotalpa orientalis* (191.38%), *Nezaraviridula*(62.34%), *Asota ficus* (73.00%), *Thysanoplusia orichalcea* (93.38%), *Theretra oldenlandiae* (81.04%) were collected in electrical powered light traps as compared to solar powered light traps.

However, for *Helicoverpa armigera, Amata cyssea, Perina nuda,* and *Theretra oldenlandiae* statistically non- significant difference were found between solar and electrical powered light traps although numerically trap catches were higher in electrical light traps. (Table 1 and Fig. 1).

4. DISCUSSION

4.1 Comparative Efficacy of Different Power Sources in Light Traps

Comparing the efficacy of both the power sources (electrical and solar) the numbers of *Agrotis ipsilon, Spodoptera litura, Creatonotus gengis, Gryllus bamaculatus, Gryllotalpa orientalis, Nezara viridula, Asota ficus, Thysanoplusia orichalcea, Theretra oldenlandiae* species were statistically higher in electrical light traps as compared to solar light trap.

However, in case of *Helicoverpa armigera, Amata cyssea, Perina nuda,* and *Theretra oldenlandiae* species statistically non- significant difference was found between solar and electrical powered but numerically trap catches were higher in electrical light trap.

Ahirwar and Vaishampayan, [11] also reported that comparative studies of trap catches revealed that UV 15 watt (model SMV-4 electrical powered) gave a better response than the UV LED 7 watt solar trap (model Rakshak). Solar light source (07watt UV) seems to be very good alternative source to 15watt for operation of light trap as pest control device. But cost wise compared the both models the solar powered light trap is much costlier.

However, the study by Ambulkar [30] on electrical and solar light traps is based on the relative response of the phototactic insect pest species (total trap catches in a week) in Jawahar. The results indicated that statistically, there was non- significant difference in terms of trapping efficiency of Jawahar light trap and solar light trap for trapping the major phototactic insect pest species of vegetable crops.

In contrast with present study [31] reported that solar light trap was more effective, Integrated Pest Management tool for the monitoring of insect pests and their mechanical control in the field of agriculture. They, provide no harm to the nature and also have low-cost involvement so that it can be utilized by most of the farmers.

Also, Maged et al [27] reported that automated solar powered solar power trap for monitoring and mass trapping of major pest of date palm. The designed trap could provide a potential component for future integrated pest management. Similarly, Meshram et al [28] proposed solar light trap was the most effective IPM tool for the monitoring for insect pests and their mechanical control in the field of agriculture, provide no harm to the nature and also have low-cost involvement so that it can be utilized by most of the farmers [30]. It is the most effective IPM tool which provide better safeguard to the nature in comparison with other methods of pest control. Bomale *et.al.*, [26] reported that solar light traps were more efficient [30].

Table 1. Comparative efficacy of different power sources in light traps

S.No.	Name of Insects	T_1 (Solar) Weekly (pooled) mean per trap	T_2 (Electricity) Weekly (pooled) mean per trap	Statistically difference	Increase in trapping efficiency over T1 (%)
1.	*Helicoverpa armigera*	6.04 (2.46)	8.50 (2.86)	NS*	_
2.	*Agrotis ipsilon*	4.44 (2.11)	7.41 (2.71)	S	66.69
3.	*Creatonotos gangis*	8.52 (2.99)	13.41 (3.72)	S	57.33
4.	*Spodoptera litura*	7.34 (2.78)	15.59 (3.96)	S	112.38
5.	*Gryllus bimaculatus*	5.41 (2.39)	11.16 (3.36)	S	106.30
6.	*Gryllotalpa oreintalis*	2.64 (1.66)	7.68 (2.79)	S	191.38
7.	*Nezara viridula*	7.70 (2.74)	12.50 (3.51)	S*	62.34
8.	*Amata cyssea*	8.50 (2.87)	11.14 (3.31)	NS*	_
9.	*Asota ficus*	6.39 (2.51)	11.05 (3.31)	S*	73.00
10.	*Perina nuda*	7.47 (2.73)	12.03 (3.37)	NS*	_
11.	*Thysanoplusia orichlcea*	5.46 (2.35)	10.57 (3.23)	S*	93.38
12.	*Theretra oldenlandiae*	4.46 (2.14)	8.07 (2.81)	NS*	_

*(__) – Figures in parentheses are (X+0.5) square root transform value. * - Analysis by two sample t-test*

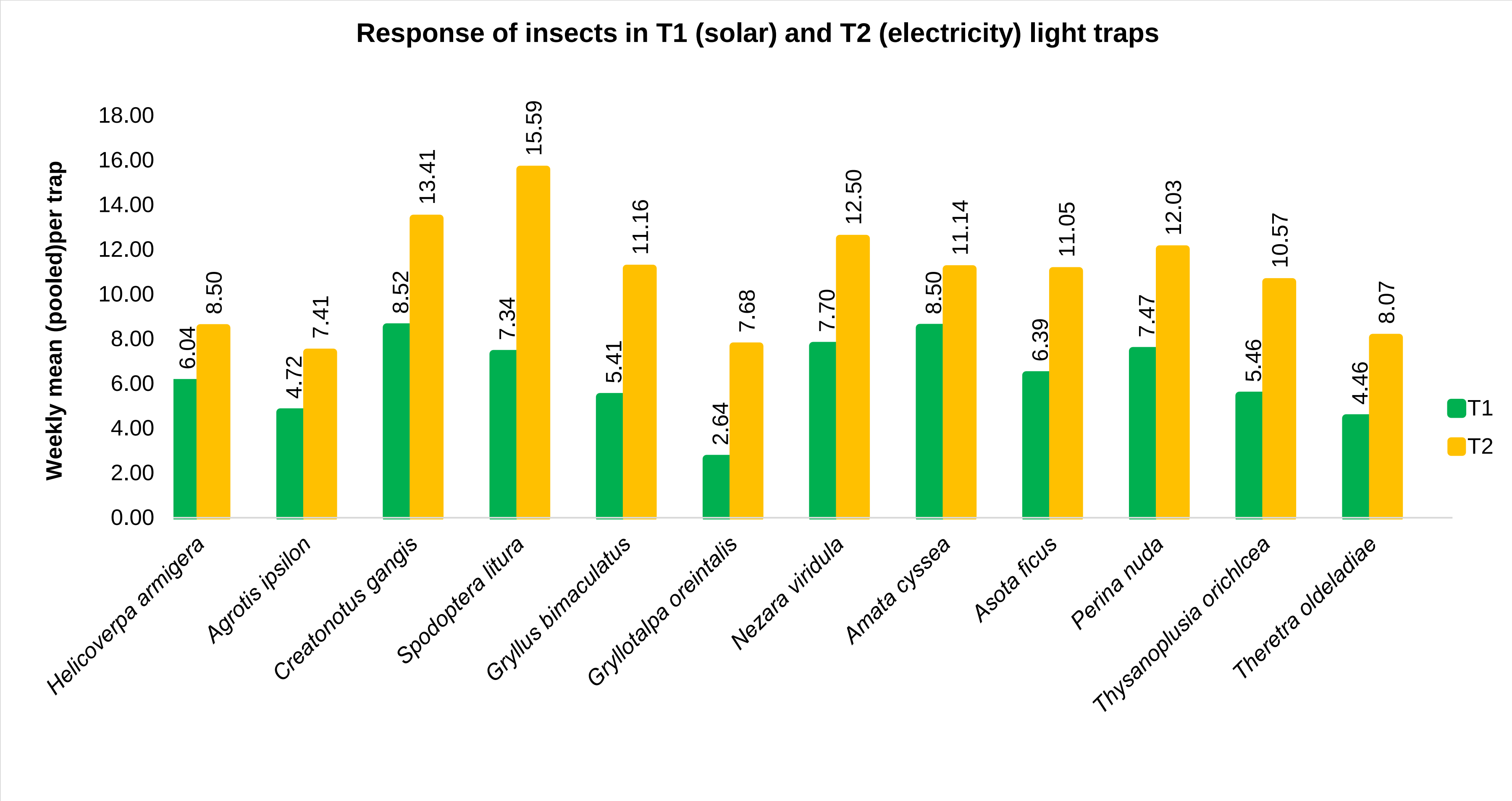

Fig. 1. Comparative efficacy of different power sources in light traps

Based on statistical analysis, it can be concluded that the designs with electrical powered light traps were superior in terms of trapping efficacy for most species compared to solar powered light traps due to continuous and better light illumination in electrical traps. Similarly, [17,14] reported the capture of eight phototactic pest species in paddy fields using light traps equipped with electrical light traps.

5. CONCLUSION

In summary, it can be concluded that electrical light traps were superior in terms of trapping efficacy compared to solar light traps for most species collected. The advantage of electrical light traps are their ability to provide continuous and long-term light illumination, which ensures a higher attraction and capture rate of insects. On the other hand, solar light traps have limitations in providing consistent and sustained light throughout the night, potentially leading to reduced trapping efficiency.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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