

Comparative evaluation of different baffle plates in light traps to lure major phototactic insect pests of *rabi* season

Abstract

The present investigation was carried out at the BSP (Breeder Seed Production) Farm, Adhartal, JNKVV, Jabalpur (MP) during *rabi* (15th November 2023 to 15th April 2024) season of 2023-2024. Two light trap designs were used in study viz. Electrical light trap with acrylic transparent sheet baffle plates (T2) and Electrical light trap with galvanized iron sheet baffle plates (T3). Light traps were operated every evening and insect pest collection was observed every morning for the duration of the investigation for 12 species viz., *Helicoverpa armigera*, *Agrotis ipsilon*, *Cretonotus gongis*, *Spodoptera litura*, *Gryllus bamaculatus*, *Gryllotalpa orientalis*, *Nezara viridula*, *Amata cyssea*, *Asota carica*, *Perina nuda*, *Thysanoplusia orichalcea* and *Theretra oldenlandiae*. Analysis of data revealed that electrical light trap with acrylic transparent baffle sheet plates outperformed the galvanized iron baffle sheet plates in terms of trapping efficacy for most of the pest species tested. The acrylic transparent plates with larger illumination area resulted in a higher capture rate, making them a superior design of light trap for insect collection.

Keywords: Light trap, Phototactic Insect – Pest and Integrated Pest Management, *rabi* season

1. INTRODUCTION

Light traps offer an effective, safe and environmental friendly method of controlling flying insect pests in a wide range of settings. In the field of applied and basic entomology, light trapping has a history that extends back over 130 years [1]. One of the most apparent behaviors of insects is flying towards a light source at night, known as Phototaxis. It is traditional in Integrated Pest Management (IPM) to control insect pests by exploiting their phototactic responses. The use of light trap was a common practice and indigenous technology during the early 20th century, mostly for the control of insect pests. The detailed effects of light trapping on agro-ecosystems and biodiversity is not fully understood. In recent years, as a non-chemical method for insect pest control, light trap has been widely used to control agricultural pests in developing countries such as India [2]. Light trap is a very important tool to reduce the insect pest population non-toxic hazard to beneficial insect, ecofriendly and has very low health hazards.[3], light trap has been accustomed to contribute the data about the pest fauna of a specific area, geographical distribution and their seasonal activity etc. [4]. Light trap has come into widespread use in the recent years as an entomological survey device and have been extremely helpful in the insect monitoring program and survey [5]. Similarly, some other researchers viz. [6,7,8,9,10,11,12,13,14,15,16,17,18,19] have also studied on the various aspects of light traps.

In general, light illumination in most of the light trap models is obstructed up to some extent by galvanized iron or plastic baffle plates. In order to resolve this problem acrylic transparent baffle plates can be used to increase the light illumination of light trap, the present comparative evaluation was put forth to study the luring efficiency of light traps with different baffle plates towards phototactic insect pests of *rabi* season.

MATERIALS AND METHODS

The study was conducted at the BSP farm in Adhartal, JNKVV, Jabalpur (MP) from 15th November 2023 to 15th April 2024. Two separate light traps were used for the study and traps were placed in the Breeder seed production (BSP) Unit Adhartal, JNKVV Jabalpur (MP). The traps were installed at the center of the cropped field on a board bund near the electrical pole. The traps were operated by switching on the power to illuminate the 15 W Ultra violet, light source, every day from sun set to sunrise. Insects trapped in the collection chamber were collected by removing the collection tray at the end of each quarter of night. The distance between each trap is 100 m approximately [20]. Two traps were installed in different direction and placed in such way to avoid light illumination along them [21 and 22]. To kill the trapped insects in the collecting chamber, Formalin 70% (as a fumigating agent) was placed in the collection tray [23].

To assess the effectiveness of different baffle plates in light traps for observing major phototactic insect pest species, two treatments were compared to test the relative efficacy of different baffle plates in light traps. on the basis of major phototactic insect pest species observed. The observation was recorded in two traps with the same diameter and light source. For analysis purpose, the trap catches were adjusted to weekly total of 7 day computed in experiment [21 and 22].

The observed data was analyzed by paired and two sample t- test for testing the significant different between two treatments as per the requirement [22].

T2 - Electrical light trap with acrylic transparent sheet baffle plates.

T3 - Electrical light trap with galvanized iron sheet baffle plates.

RESULTS AND DISCUSSION

Comparison of efficiency of different baffle plates, revealed significant difference between two treatments. Mainly 12 species data were analyzed that were regular occurrence in light trap minimum 12 weeks. Results are presented below –

Response of different insect pests towards in electrical light trap with acrylic transparent sheet baffle plates and with galvanized iron sheet baffle plates:

In case of *Helicoverpa armigera* (11.55%), *Agrotis ipsilon* (15.85%) *Spodoptera litura* (14.57%), *Cretonotus gengis* (13.48%), *Gryllus bamaculatus* (12.04), *Nezara viridula* (12.98%), *Asota carica* (8.48%), *Gryllotalpa orientalis* (11.36%), *Theretra oldenlandiae* (10.76%) and *Amata cyssea* (12.59%) species has given statistically higher response in electrical light trap with acrylic transparent sheet baffle plates (increase in trapping efficiency given in parenthesis) as compared to electrical light trap with galvanized iron sheet baffle plates (Table 1)

However, in case of *Perina nuda* and *Thysanoplusia orichlcea* species statistically non-significant difference was observed between electrical light trap with acrylic transparent sheet baffle plates and electrical light trap with galvanized iron sheet baffle plates.

Table 1: Comparative efficacy of different baffle plates in light traps

S. No.	Name of Insects	T2 (Electrical with AT) Weekly mean per trap	T3 (Electrical with GI) Weekly mean per trap	Significant difference	Increase in trapping efficiency over T3 (%)
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1.	<i>Helicoverpa armigera</i>	10.72 (3.35)	9.61 (3.18)	S	11.55
2.	<i>Agrotis ipsilon</i>	9.06 (3.09)	7.82 (2.89)	S	15.85
3.	<i>Cretonotos gangis</i>	15.32 (3.98)	13.5 (3.74)	S	13.48
4.	<i>Spodoptera litura</i>	16.82 (4.16)	14.68 (3.90)	S	14.57
5.	<i>Amata cyssea</i>	13.77 (3.78)	12.23 (3.57)	S	12.59
6.	<i>Asota carica</i>	12.14 (3.56)	11.19 (3.42)	S	8.48
7.	<i>Perina nuda</i>	12.7 (3.63)	12.11 (3.55)	NS*	–
8.	<i>Thysanoplosia orichlcea</i>	12.4 (3.59)	11.53 (3.47)	NS	–
9.	<i>Theretra oldenlandiae</i>	9.67 (3.19)	8.73 (3.04)	S	10.76
10.	<i>Gryllus bimaculatus</i>	13.95 (3.80)	12.45 (3.60)	S	12.04
11.	<i>Gryllotalpa oreintalis</i>	9.41 (3.15)	8.45 (2.99)	S	11.36
12.	<i>Nezara viridula</i>	12.27 (3.57)	10.86 (3.37)	S	12.98

(_) – Figures in parentheses are ($\sqrt{x + 0.5}$) transform value. * - Analysis by two sample t-test.

Treatments T2 - Electrical light trap with acrylic transparent sheet baffle plates.
T3 - Electrical light trap with galvanized iron sheet baffle plates.

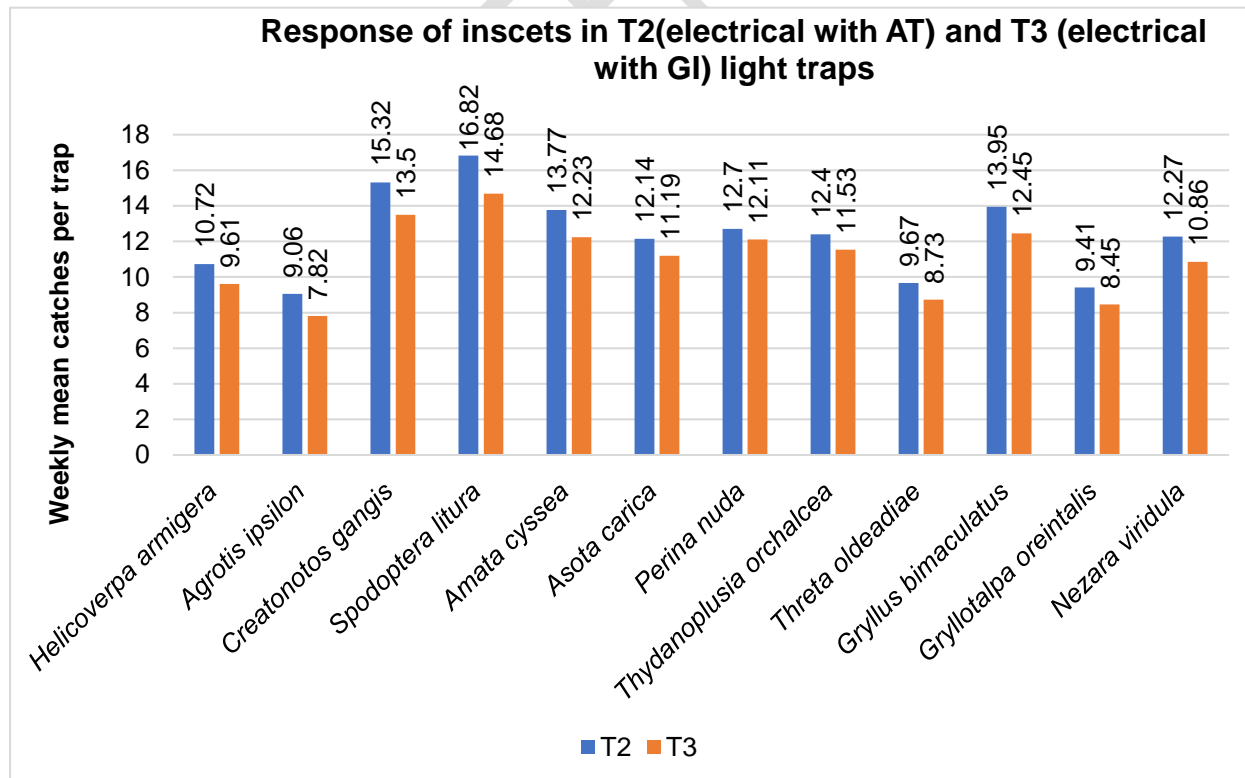


Fig.1: Comparative efficacy of different baffle plates in light traps

Based on statistical analysis, it can be concluded that electrical light trap design with acrylic transparent sheet baffle plates was superior in terms of trapping efficacy in most of the species as compared to electrical light trap with galvanized iron sheet baffle plates due to the increase light illumination in acrylic transparent baffle plates as compared to galvanized iron baffle plates which some or other way obstruct the light illumination which further reduces the light illumination area around trap. However, there is no information available in the literature regarding comparing between acrylic transparent and galvanized iron sheet baffle plates in light traps. **Therefore, this seems to be the pioneer study in this related field.**

Ambulkar *et al.*, [21] also supported the present study when solar light trap designs and Jawahar light traps with three baffle plates (24-gauge GI sheet, 45 x 12 cm each) for insect collection **were compared**. Similarly, **Patidar *et al.*, [20]** also compared the effectiveness of electrical light traps with different funnel diameters (40cm and 50cm) using three baffle plates (24-gauge GI sheet, 45 x 12 cm each) for insect collection **and supported the present study.**

CONCLUSION

Electrical light trap with acrylic transparent baffle sheet plates **were found superior to** galvanized iron baffle sheet plates light trap in terms of trapping efficacy for most of **the insect pest** species tested. The acrylic transparent plates with larger illumination area resulted in a higher capture rate, making them a superior design for insect collection studies. Therefore, it may be recommended that using electrical light traps with acrylic transparent baffle sheet plates will improve trapping efficiency.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

REFERENCES

1. Wilkinson RS. 1969. Townend glover (1813-83) and the first entomological light trap. The Michigan Entomologist, 2(3-4): 55–62.
2. Srivastava VK, Diwakar MC, Pawar AD. 1992. Light trap and rice pest management. Plant Protection Bulletin (Faridabad); 44:39-41.
3. Sharma AK, Barche S and Mishra PK. 2004. Scope of light trap as IPM tool for sustainable cultivation of rice. Modern Biotechnology and its Applications, New India publishing agency, 303-312.
4. Verma R and Vaishampayan SM. 1983. Seasonal activity of major insect pests on light trap equipped with mercury vapor lamp at Jabalpur. Insect Ecology and Resource Management, 173-180p.
5. Prajapati M. 2010. Studies on the major insects trapped in different traps associated with same *Rabi* vegetable crops at Jabalpur. M.Sc. Thesis, JNKVV, Jabalpur, 1-163p.
6. Singh S and Sharma AK (2018) Population dynamics of major insect pests of rice. Indian Journal of Entomology 80(4): 1700-1702.
7. Singh S, Sharma AK, Saxena AK, Panday AK and Kakade S. 2018. Taxonomic analysis of phototactic beneficial insects as biocontrol agents (Predators and parasites) collected in light trap in rice ecosystem at Jabalpur. Journal of Entomology and Zoology Studies, 6(3): 850-853.
8. Kurmi A, Pachori R, Bhowmick AK, Sharma AK, Thomas M and Sharma HL. 2019. Bio-diversity of phototactic hemipteran insects in the rice ecosystems Jabalpur district, Madhya Pradesh, India. Journal of Entomology

and Zoology Studies,7(3): 1359-1362.

9. Mishra Y, Sharma AK, Bhowmick AK, Saxena AK and Kurmi A. 2019. Seasonal Incidence of Insect Pest Species of Paddy Collected through Light Trap. International Journal of Current Microbiology and Applied Sciences, 8(4): 381-393.

10. Meena SK, Sharma AK and Aarwe R. 2018. Seasonal incidence and population dynamics of major insect pest species of paddy collected in light trap in relation to weather parameters. International Journal of Current Microbiology and Applied Sciences, 7 (08): 1705-1715.

11. Sharma AK, Yadav KN, Tare S, Nayak S and Seervi S. 2023. Phototactic Response and Taxonomic Distribution of Predaceous Species of Paddy Ecosystem. Biological Forum – An International Journal, 15(3): 91-94.

12. Ambulkar P.L, Sharma AK, Bhowmick AK and Saxena AK. 2020. Taxonomic documentation of phototactic insect pests species collected from light trap during Rabi season vegetable ecosystem at Chhindwara (M.P.). The Pharma Innovation Journal 10(4): 347-351.

13. Sharma AK, Mandloi R, Saxena AK, Thakur AS, Sharma R and Ramakrishnan R.S. 2020. Biodiversity of Phototactic insect pests of chickpea ecosystem and records on population dynamics of *Helicoverpa armigera* (Hubner) and *Agrotis ipsilon* (Hufnagel). Journal of Pharmacognosy and Phytochemistry 9(1): 824-829.

14. Bhargava Megha, Sharma A.K., Shukla A. and Mishra Yogendra Kumar 2019. Taxonomic documentation of total insect fauna of medicinal plants collected through light trap in Jabalpur district. Journal of Entomology and Zoology Studies 7(6): 642-647.

15. Sharma AK, Mandloi R, Bhowmick AK and Thakur AS. 2019. Study on biodiversity of phototactic hexapod fauna by light trap in soybean (*Glycine max* L.) ecosystem Journal of Entomology and Zoology Studies 7 (2): 641-646.

16. Kakade SH, Sharma AK, Shukla A, Pachori R. and Singh S. 2018. Studies on insect fauna collected in light trap during Rabi season in vegetable fields at Jabalpur. Journal of Entomology and Zoology 6(5): 286-291.

17. Sharma AK, Mandloi R and Pachori R. 2017. Study on Biodiversity of Phototactic Fauna Collected in Light Trap in Chickpea (*Cicer aritenum* Linn.). International Journal of Agriculture Sciences 9 (12): 4037-4041.

18. Sharma AK, Pachori R, Thakur AS and Mandloi R .2015. Population Dynamics of Major Phototropic Insect Pests of Medicinal Crops with Special Reference to Effect of Ecological Factors on *Helicoverpa armigera* Hub. and *Agrotis ipsilon* Huf. The Ecoscan 8 (Special issue): 921-927.

19. Patil R, Sharma AK, Das SB, Kumar N, Choudhary P & Patel DK. 2024. Comparative Efficacy of different Funnel Diameters in Light Traps against Major Phototactic Insect Pests of rabi Season. Uttar Pradesh journal of zoology, 45(6), 191-196.

20. Patidar S, Vaishampayan S and Band SS. 2019. Comparative efficiency of 125-watt Mercury lamp and 15-watt UV (Black light) tube against the major insect-pest in paddy ecosystem. Journal of Entomology and Zoology, 7(5): 1163-1167.

21. Ambulkar PL, Sharma AK, Bhowmick AK and Saxena AK. 2021. Taxonomic documentation of phototactic insect pest species collected from light trap during Rabi season vegetable ecosystem at Chhindwara (M.P.). The Pharma Innovation Journal, 10(4): 347-351.

22. Patil R. 2023. Comparative efficacy of the different funnel diameter and different power sources used in light trap against major phototactic insect pests of rabi season at Jabalpur. M.Sc. Thesis, JNKVV, Jabalpur, 1-130p.

23. Singh RP, Böttger D and Brehm G. 2022. Moth light traps perform better with vanes: A comparison of different designs. Journal of Applied Entomology, 146, 1343–1352. <https://doi.org/10.1111/jen.13068>