Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue [1] 2017: 209-211

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804
NAAS Rating 4.95

FULL LENGTH ARTICLE **OPEN ACCESS**

A Review on Evaluation of light trap against different coloured electric bulbs for trapping phototrophic insects

Akash Nirmal, Yogesh Kumar Sidar, Rupesh Gajbhiye, Anil Kumar And Jaya Laxmi Ganguli
Department of Entomology,
Indira Gandhi Krishi Vishwavidyalaya, Raipur 492 012, Chhattisgarh.
nirmal.akash648@gmail.com

ABSTRACT
To understand fully the concept of background knowledge of light and insects is essential. Light-trapping is a general term which covers all methods of attracting and/or capturing nocturnal insects with lamps that usually have a strong emission in the ultraviolet range of the spectrum, e.g. mercury vapour lamps, black light lamps or fluorescent tubes. Evaluation of light trap using different coloured lights revealed that ordinary tungsten filament light was found to be most effective followed by yellow, blue and green colour light, whereas red colour light was least effective based on the number of insects caught in the light trap.
Key words: *Evaluation, red, blue, green, yellow, light trap.*

Received 10.07.2017 Revised 11.08.2017 Accepted 29.08. 2017

INTRODUCTION

Exploiting phototrophic response of insects is an important tool in Integrated Pest Management programme for the management of insect pests. In early times (1st century B.C. and 4th century A.D), Roman beekeepers used light traps to control the moth, *Galleria mellonella*. Phototrophic insects are those which get attracted towards a light source. Seven colors in the light spectrum viz; violet, indigo, blue, green, yellow, orange and red fall under visible lights. Each color has a different wavelength and frequency. Red has the longest wavelength and the lowest frequency while violet has the shortest wavelength and the highest frequency. The wavelengths of visible lights range from 400-700 nanometers. As far as temperature is concerned red light is the coolest and blue is the warmest. White light is the combination of all visible colours. It appears white because none of the light is absorbed and all is reflected back to the human eye. Black light consists of long wavelengths of ultraviolet light and is visible to insects, but not to humans. Light becomes visible to insects around the yellow part of the spectrum and ends at ultraviolet light.

REVIEW OF LITERATURE

Dubey (1984) reported seasonal activity of green leaf hopper , *Nephotettix virescence* and *N. nigropectis* revealed that there were 3 broods during the kharif season i.e. 1^{st}, 2^{nd} and 3^{rd} in 32^{th}, 38^{th} and 48^{th} SMW respectively, and also the dominance of *N. virescens* over *N. nigropictus* was noted. Several weather parameters were studied to see their influence on the light trap catch viz. temperature, humidity, rainfall, and wind speed, out of these factors only wind speed was found to negatively correlated. Regarding the influence of lunar cycle it was observed that the insect population was in increasing trend during ascending phase and vice-versa. Regarding the effect of different coloured light yellow colour was observed most effective as compared to other colours.

Pate and Curtis (2001) in an experiment performed at Ashe County, North Carolina was to find out how different insects respond to varying wavelengths of light. They used six colors of light: blue, green, yellow, red, ultraviolet ("black") and white. The lights were arranged in a circular pattern in a parking lot and set on top of soapy trays of water. The lights were on for half an hour. The insects were counted and classified according to their order. The lowest number of insects was in the red light container and the highest number was in the ultraviolet light container. Also, the most common order of insect found among all the colors of light was Trichoptera. The results of the experiment indicated that insects are more attracted to lights with short wavelengths and high frequencies.

Ashfaq *et al.,* (2005) evaluated the response insects to varying wavelengths of light in Faisalabad, Pakistan. Six different colors (blue, green, yellow, red, black and white) were tested, arranged in a line on agriculture land, close to Faisalabad Airport. Tree rows/blocks, forest nursery, fruit garden, wheat, maize and fodder crops were the main vegetative covers in the vicinity. Each selected color light was properly projected on 1m^2 vertical screen (made of white cotton fabric) placed one meter high above the ground. All lights were kept on simultaneously for half an hour and the insects attracted on both sides of the screens were collected in tubs containing soapy water. The highest number of insects was observed in container placed under black light (ultraviolet light), while the lowest in that of red light. Similarly, the common insect orders frequented among all color lights were Diptera, Coleoptera and Lepidoptera respectively. The experimental results indicated that insects are attracted in more number on lights with short wavelengths and high frequencies and vice a versa.

Fayle *et al.* (2007) was compared three Robinson-type trap designs, each of which employs a 125W mercury vapour bulb. The first uses a standard bulb; the second uses the same bulb with the addition of a Pyrex beaker, often deployed to prevent bulbs from cracking in the rain, and the third uses a bulb coated with a substance that absorbs visible wavelengths of light (also known as a black light). The black light trap caught few moths than either of the other traps, and had lower macromoth species richness and diversity than the standard + beaker trap. This lower species richness could be accounted for by the smaller number of moths caught by the black light trap. Furthermore the black light caught a different composition of both species and families to the other two trap types. Electromagnetic spectra of the three trap types showed the black light trap lacked peaks in the visible spectrum present in both of the other traps. We therefore conclude that the addition of a beaker to a Robinson type trap does not make catches incomparable, but use of a black light does. These differences are probably due to lower total emission of radiation in the black light trap, thus catching fewer moths overall, and the lack of visible radiation produced, meaning that moths most sensitive to visible wavelengths are not attracted.

Hogsette (2008) noticed traps that use ultraviolet light as an attractant for flies were widely used in urban situations. To determine the differences in trap efficacy from design and lighting, pairs of traps were compared under laboratory conditions. Comparisons were made between traps with open fronts and with traps with restricted open fronts, black light bulbs, and black light blue bulbs, and glue boards with and without *z*-9-tricosene pheromone. In a windowless laboratory, pairs of traps were placed approximately 90 cm above the floor and 3 m apart. Fifty mixed-sex, 3 to 5 day-old house flies (*Musca domestica*) were released and counts of captured flies were made after 1, 4, 24 hrs. Traps with black light bulbs attracted and captured significantly more flies that those with black light blue bulbs. Black light bulbs increased the catch significantly in traps with open fronts but black light blue bulbs did not.

According to Steiner and Hauser (2009) light-trapping is a general term which covers all methods of attracting and/or capturing nocturnal insects with lamps that usually have a strong emission in the ultraviolet range of the spectrum, *e.g.* mercury vapour lamps, black light lamps or fluorescent tubes. Nocturnal Lepidoptera (moths), Trichoptera and Ephemeroptera were the insect groups which could be collected most efficiently by light-trapping but many nocturnal species in several other orders were rarely recorded with other methods, *e.g.* some Coleoptera.

Ramamurthy *et al.,*(2010) conducted field observations at weekly interval (standard week), in 2007-08 at the Indian Agricultural Research Institute, New Delhi for studying the effect of three light sources in light traps (*viz.,* mercury, black and ultra violet) on insect catch and relationship with weather parameters. Results when analysed revealed that coleopterans dominated the catches, followed by hemipterans, hymenopterans and lepidopterans. The mercury light was more efficient for Lepidoptera, Hemiptera, Hymenoptera, Odonata, and Diptera and black light was more efficient for Coleoptera, Orthoptera, Isoptera, and Dictyoptera. Similar attractiveness to the mercury and black light sources were found for coleopterans. Average temperature showed significant relationship with coleopterans, lepidopterans and hemipterans when all insect traps were considered together.

Dadmal and Khadakkar (2014) investigated the species composition of insect fauna attracted towards the light trap. Observations revealed that order Coleoptera showed a rich population i.e. 41.81% and 35.10% of the total collection for 2011-12 and 2012-13, respectively followed by Hemiptera 16.86% and 21.77% and Lepidoptera 12.96% and 12.89%, respectively. 19 species of scarab beetles belonging to 10 genera were found to be the prominent visitors for both the years. Subfamily, Melolonthinae had rich species diversity with five species of genus *Holotrichia* and *Schizonycha ruficollis.* Amongst Rutelines, *Rhinyptia indica*, *R.nigrifrons*, *Anomala varicolor, A. dimidiata, A. ruficapilla* and *Adoretus bicolor* prevailed. *Onthophagous gazelle* ruled the scarabaeinae fauna. *Protaetia aurichalcea, P. teracea, Oxycetonia jucunda,* *O. versicolor, Clinteria klugi, Heterorrhina micans* of Cetoninae were also found predominant in this vicinity.

Jonson *et al.* (2014) explored the influence of weather, time of year, and light source on nightly catches of macro moths in light traps, and compared four strategies for sampling by estimating observed species richness using rarefaction. They operated two traps with different light sources for 225 consecutive nights from mid-March to the end of October in eastern Germany in 2011. In total, 49, 472 individuals of 372 species were recorded. Species richness and abundance per night were mainly influenced by night temperature, humidity and lamp type. With a limited sample size (<10 nights) it was slightly better to concentrate sampling on the warmest summer nights, but with more sampling nights it was slightly better to sample during the warmest nights in each month (March to October). By exploiting the higher moth activity during warm nights and an understanding of the species' phenology, it is possible to increase the number of species caught and reduce effects of confounding abiotic factors.

REFERENCES

1. Ashfaq, M., Khan, Rashid A., Khan, M. A., Rasheed, F. and Hafeez, S. 2005. Insect orientation to various colour light in the Agricultural biomass of Faisalabad. Pak. Entomol. 27(1): 49-52.
2. Dadmal, S.M. and Khadakkar, S. 2014. Insect found diversity collected through light Trap at akola vicinity of Maharashtra with reference to Scarabaeidae of Coleoptera. Journal of entomology and zoology. **2**(3): 44-48.
3. Dubey, V.K. 1984. Light trap studies on green leaf hoppers of Rice *Nephotettix* Species (Hemiptera: deltociphalidae). M.Sc. Thesis. Indira Gandhi Agricultural University, Raipur. 19-61.
4. Fayle, T. M., Sharp, E. R. and Majerus, M. E. N. 2007. The effect of moth trap type on catch size and composition in Britishian Lepidoptera. BR. J. ENT. NAT. HIST. 20(2): 221-232.
5. Hogsette, J.A. 2008. Ultra violet light traps: Design affects attraction and capture. Proceeding of the sixth International conference on urban pests. 193-196.
6. Jonson, D. Franzén, M. and Ranius, T. 2014. Surveying Moths Using Light Traps: Effects of Weather and Time of Year. PLOS ONE 9(3): 1-3.
7. Pate, J. and Curtis, A. 2001. Insects response to different wavelengths of light in New River state Park, Ash County, North Carolina. Field Biology and Ecology. 12(2): 4-8.
8. Ramamurthy, V.V., Akhtar, M., Patankar, N.V., Menon, P., Kumar, R., Singh, S.K. Ayri, S., Parveen, S. and Mittal, V. 2010. Efficiency of different light Sources in light traps in monitoring insect diversity. Munis entomology And zoology. **5**(1):109-114
9. Steiner, A. and Hauser, C.L. 2009. Chapte-16, Recording insects by light trap. Berlin. 401-406.

CITATION OF THIS ARTICLE

Akash Nirmal, Yogesh Kumar Sidar, Rupesh Gajbhiye, Anil Kumar And Jaya Laxmi Ganguli. A Review on Evaluation of light trap against different coloured electric bulbs for trapping phototrophic insects.Bull. Env. Pharmacol. Life Sci., Vol 6 Special issue 1, 2017: 209-211