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STUDY OF METHODS AND WAYS OF LIGHT TRAPS FOR INSECTS

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ABSTRACT: Terrestrial insects are the most diverse group of animals and contribute significantly to biodiversity. Sampling using light traps is commonly used in studies of insect biodiversity. A wide variety of light traps of various designs are used. Over the past forty years, numerous light sources have been used to study the photoresponse of various insect species. However, not all light sources have been effective in attracting and collecting all nocturnal insect species in a given habitat. There are many factors that influence the success of light traps. Environmental conditions, trap design, height of the light source, radius of attraction of the light source, surrounding man-made light sources, wavelength, intensity of the light source, timing and duration of the light trap all affect the success of light traps. Therefore, we present an exclusive review of a light trap in a single-window system.

Key words. Insects, trap, light wave, environment, night image, radiation, atmosphere, voltage, mesh, light source.

Introduction. Proper documentation of insects is an important component of studying biodiversity and population dynamics. Low-flying daytime insects are caught using a Malaise trap, while larger ones are caught using the sweeping method. However, there are thousands of species of insects.

Light trap. Most insects are nocturnal. Automatic autonomous light traps can be useful for estimating the quantitative abundance of this group of insect species [1]. Some types of insects use moonlight to navigate. They keep the angle at which the rays of light strike their eyes constant and fly in a more or less straight line. In addition, if they encounter closer and brighter light, they take a spiral path and enter the light source [2]. Appropriate sampling techniques are important because different sampling methods have different propensities for assessing different faunal components, and these components may vary in number of species [3]. Light traps are the most common and regularly nocturnal and cannot be collected by conventional methods. These types of insects are best taken under light conditions. Recently, light sources producing large amounts of UV radiation have, nocturnal arthropods, especially insects, are attracted to artificial light sources [4]. Light traps have been widely used to collect nocturnal insects. Light traps are expensive but very effective for collecting insects. Various light sources are used for lighting, such as mercury lamps, gas lamps and UV fluorescent lamps.

The insects are lured by the light and become victims of the trap in the collection chamber. Ultraviolet light traps are relatively inexpensive and are therefore the most commonly used. Mercury, like black light, attracts more insects than incandescent lamps. Light traps are effective for collecting insects such as moths, beetles, bedbugs, some flies and other active insects [5]. Some species of nocturnal insects can be caught using light traps at certain times of the night. Light trap data provide valuable information on the distribution, abundance and seasonal flight patterns of insects.

Light trap design and insect sampling. Various types of light traps have been developed from time to time. Many researchers have used various valuable light trap designs. Over the past 50 years, numerous light trap designs have been used to capture nocturnal insects. An extensive study of various insect species caught in light traps was conducted in New York City. Vermorel reported the use of acetylene trap lamps in France to sample insects. As new light sources are developed, attractant equipment also begins to change. In Wisconsin, gasoline-powered arc lights were used, secured at a depth of 5 inches with galvanized trays to collect certain types of insects [6]. A specialized light trap was invented to collect cotton pests in Egypt. The wide visibility of the emitted light was the main feature of the trap and carbon tetrachloride as the killing agent. Light traps catch crepuscular and nocturnal insects using a light source of different wavelengths. Certain groups of insects, such as Diptera, are attracted in large numbers by hot traps, while Lepidoptera are strongly attracted to ultraviolet light. Similarly, mercury vapor light traps are effective in capturing other insects. Insects such as insects, beetles and moths are attracted to almost any light source in the tropics.

Setting goals. Light traps that use electric lamps as attractants can be divided into three groups: Electrical network, suction or fan type, and mechanical or gravity trap. The first and second types require a 110V power supply, while the third type operates directly at 110V. However, very few of them are powered by dry cells or rechargeable batteries. The design of a light trap operating on dry cells was reported by Nelson and Chamberlain [7]. A New Jersey-type light trap, powered by a 6-V battery, was described by Sudiya and Chamberlain [8], and a research-type electric insect sampling trap was developed by Hollingsworth and Briggs [7]. A light trap with a self-contained inverter installed with a timer to control light periods was developed by Wagner et al. Various types of light traps for general insect surveillance, namely: CDC miniature light trap: cigarette beetle trap; New Jersey Mosquito Trap; Pink worm trap; The European beetle trap and the Asian garden beetle trap are described by Frost and Hollingsworth et al. The high voltage and electrical grid associated with insect traps actually poses an electrical shock and fire hazard. Hence, this trap is used to kill insect populations, particularly to kill insects around residential buildings. The Akins trap was designed to control certain pests. This trap consists of an inverted funnel-shaped reflector with a socket for illumination, a lamp, iron sleeves, a muslin bag and an electric fan with a motor to draw the insects into the trap. Reed et al. reported an innovative suction light trap consisting of a flange, a cylinder and a cone with a lamp. Another offshoot of the trap was adding a liter jar to the bottom of the funnel to make it more sophisticated [8]. Gries reported a new light trap equipped with four trays to effectively separate insect collections by size. Dirks used light traps to collect data on the life histories of some specific insect species. The traps worked with incandescent lamps with a power of 200 W, 500 W, 1000 W. Inside the frosted types and a solar lamp as an attractant, a pan of water with a kerosene film was used for sampling. Hallock said light with shorter wavelengths near the violet end of the spectrum is most useful for luring the beetle. Insect species vary in attractiveness depending on the specific wavelength of light. Laboratory tests show that the European corn borer has maximum attractiveness near the ultraviolet region of the spectrum [7]. Likewise, species such as Pectinophora gossypiella exhibit an affinity for ultraviolet radiation.

A diametrically opposite theory of the phenomenon of light reaction is demonstrated by nocturnal insects. Nocturnal insects are repelled by the light, but if they fly quickly, they will come close enough to the light to be blinded by it and still be deflected into it.

Figure 1. Funnel-shaped personal mercury light trap.

Problem solving. Low-pressure mercury-arc gas-discharge lamps emit light of predominantly

wavelengths.

253.7 nm black light lamps and black light fluorescent lamps convert the 253.7 nm wavelength into longer ultraviolet wavelengths through the use of a phosphor. However, black-blue lamps work with red-violet lamps to absorb visible radiation, whereas the maximum wavelength of fluorescent solar lamps is 310–340 nm [5]. A combination of blue, violet and near-UV light is generated by an argon incandescent lamp. Mazda branded incandescent lamps operate with tungsten filaments, and the important types are Mazda B (vacuum lamp) and Mazda C (gas-filled lamp). Williams developed a Rothamsted-type light trap that is very effective for sampling insects and still works today. The Robinsons MV Moth Trap uses a gas lamp and requires connection to a generator or mains power. Thus, this trap is useless where the vehicle cannot be controlled. There is a certain type of Robinson light trap, such as the Heath trap, which can be powered by a 12V motorcycle or car battery. Therefore, it can be used in remote areas.

Insect response and wavelength. The 15 W low pressure mercury arc discharge lamp and 6 W black light lamps emit radiant power predominantly at 253.7 nm. Black light blue lamps with a power of 15 W absorb visible radiation. The 40 and 10 W fluorescent solar lamp has a wavelength range of 250 to 460 nm, but peaks at 340 and 310 nm, respectively. However, a low-pressure mercury arc lamp emits visible and UV radiation with wavelengths less than 600 nm, and a mercury arch lamp emits UV energy in the range of approximately 280 to 400 nm. Insect phototaxis is influenced by both physiological and physical factors. Lubbock was the first to notice that ants are unattractive to infrared rays. Glick and Hollingsworth reported the effects of ultraviolet and mercury light on the pink box cutworm. Some insects extend the range of responses into the UV region, more precisely, below 300 nm [6]. However, in many insects the response peaks in the UV region around 365 nm. In other insects, the peak response is observed in the range from 490 to 520 nm [5]. **Radius of attraction**. The radius of attraction for most lights is expected to be between 3 and 250 metres, depending on the survey method and species type.

Factors influencing light trap catch. Weather is an important factor in determining whether a light trap is caught. Light trap catch is influenced by vegetation type, moonlight and weather. Limitations and difficulties with light traps. The problem with light trap data is that it is difficult to determine in which area the trap is effective. In densely populated habitats such as forests, the range of illumination can be very small. Thus, the best part of light trap data is to show the presence and relative abundance of certain species, but this is difficult to quantify [6]. However, Walda, Simon and Linsenmayr noted that they were measuring activity, not relative abundance. One of the problems with light traps is that they are not sure what will be attracted to them and what will be repelled. This depends on the combined effect of behavioral, physiological and environmental factors. Many types of insects do not fly towards light, although there may be large numbers of them nearby. Light trap catch is affected by many variables, such as trap size, trap design, height, bulb type, and environment, and varies among species. The timing of the trap, illumination by moonlight and anthropogenic light sources also determine the capture of insects. Gas-discharge lamps for street lighting have made it possible to reduce the population of insects, especially moths and even predators that hunt these insects at night.

Conclusion. There are many methods for collecting insects, both active and passive. However, nocturnal insects are collected exclusively using light traps, and they play an important role in field sampling of nocturnal insect populations. The rate at which insects are captured by different light sources and designs varies greatly and depends on a wide range of factors. Therefore, when installing a light trap, it is necessary to take into account the environmental conditions, the design of the trap, the height of the light source and the radii of attraction of the light source. The success of a light trap depends on the intensity and wavelength of the light source. Because most insects are attractive to a certain range of wavelengths. Also, a high voltage lamp source can burn important identification marks or parts of the insect's body. Therefore, for successful sampling, a light source with the appropriate voltage should be used.

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