Chapter 51

Evaluation of the use of different lamps in light trap model for insect capture

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ABSTRACT
Aware of the importance that insects have, as well as their influence, both in ecosystems and human activities, the group has always received prominence in several areas of knowledge. In order to enjoy this immense diversity, the first step is to recognize and classify them. For this, a light trap model was elaborated, using three different lights (black, cold white and warm white). The pitfall-style trap, which in addition to the lights contained a container with alcohol and detergent, was properly assembled. Insects were collected, analyzed and identified. These processes allowed analyzing the efficiency of the trap with different lamps in the capture of insects, as well as the Orders to which they belong. In the end, it was observed that the Order of highest index in the analysis was Homoptera, and that the trap whose light source was black light was the most efficient in quantitative capture, with a total of 497 insects, followed by warm cold white light, respectively.

Keywords: fall trap, catching insects, biodiversity.

1 INTRODUCTION

Insects are of inestimable importance for environmental, social and economic sustainability (Pimenta, Vilela, Pelli, 2021). The functioning of ecosystems, as we know it, is only possible thanks to their constituents, including this group with the largest living biodiversity on the planet (Macedo et. al., 2020). To enjoy this immense biodiversity it is indispensable to collect and analyze insects.

The classification of insects has limitations such as great diversity, small organisms, different characteristics during development, biology and location often unknown. The analysis should occur from the external morphological characteristics (Camargo et al, 2015).

Traps are one of the methods for collecting and analyzing insects. This can include any mechanical, physical or chemical method to capture an organism (Nakano & Milk, 2000). They can be based on the dependence of the collector, being active, which present high dependence of the sampler (such as nets, vacuum cleaners, entomological umbrellas, beat cloth, white cloth, tweezers and vials) or passive, which depend little on the researcher (such as light trap, Malaise, fall trap or Pitfall, window trap, berlese funnel) (Camargo et al, 2015).

The present study aimed to verify the efficacy of different types of lights to attract insects in Pitfall light traps.

2 MATERIALS AND METHODS

In this work, a new model of light trap was used, related to Pitfall models. For its construction, lamps with equal shape, power (20 watts) and voltage (127 volts) were used, being: 1) cold white (temperature 6,400k and constancy of light intensity (Iux) of 5,200 candelas); 2) warm white (temperature 2,700k and lux of 2,700 candelas); and 3) black light (temperature 2,700k and lux of 25 candelas).

Transparent plastic containers were used, 39 cm long by 27 cm wide, and 14 cm high, in which there was a screen on the top edge to support the lamp. The plastic containers had a white background, to facilitate the visualization of insects (Fig. 1).

Figure 1. Photo illustrating the luminous trap, in this image, that of black light, showing the layout of the screen made of string and lamp position.

Source: personal collection

The traps were arranged at a distance of approximately 7 meters from each other, forming an equilateral triangle (Fig. 2). They contained inside 70º alcohol solution and detergent, used, respectively, to kill the insect and break the surface tension.

The trap was then installed in Unit II of Univerdecidade/UFTM; located on Av. Randolfo Borges Júnior, 1400, Uberaba, Brazil. The area is of secondary forest with diverse plant formation.

Figure 2: Photo demonstrating arrangement of traps, in triangle, with spacing of approximately 7 meters.

Source: personal collection

Some precautions were taken regarding several characteristics, so that there was success in capturing insects, among them was the climatic condition on the day of collection, time of year, lunar phase, sampling methodology and the correct choice of the type of trap. (Camargo et al, 2015). On the day chosen for sample collection, the moon phase was a new moon and, according to studies, it is more appropriate, because there is less natural light and thus, the artificial light of the traps attracts more insects (Sant'ana and Lozovei, 2001).

The choice of distribution of lamps was random. The trap with the black light lamp became closer to an external light source.

The captured insects were collected from the trap with the help of a pisseta and stored in small plastic jars. After they were identified at the level of Order, separated and quantified by taxonomic category in the laboratory of the Discipline of Ecology & Evolution Nico Niser of the Federal University of triângulo Mineiro. The specimens were identified with the help of Raphael et al. (2012), in stereomicroscope with a maximum magnificence of 100X.

3 RESULTS AND DISCUSSION

The use of the Pitfall capture model is well recognized, as it is a relatively inexpensive alternative and allows to infer relevant data on the fauna of a given region (Gonzaga et al., 2022). Evaluating the light traps proposed and employed in this work, it is possible to observe higher insect capture yield using the black light trap, with a total of 497 insects collected, followed by cold white light,124 insects, and then warm white, with 111 obtained (Table 1). The data indicate a high diversity of the collection site (Nunes Santana et al., 2022).

Among the insects captured, a prominent place for those of the Homoptera Order, unlike what was observed in other studies (Silva et al., 2022). Homoptera is a ubiquitous group, and one of the main groups with agricultural importance, since they make up a large group of crop pests, in all are about 45,000 species described (Rafael et al., 2012).

Regarding the total amounts of insects captured, it is noticed that in this collection, there was a great disparity between black light in relation to warm cold and white white. However, there were no major discrepancies between the number of insects caught between the white lights. Adopting the definition of light intensity: "the total amount of light emitted by a projected source in a given direction, measured in candelas", it is possible to suggest that not necessarily the light source with the highest intensity captures the largest amount of insects. It could also be hypothesis, because with the data of the collection, the black light with the highest amount of organisms with intensity of 25 candelas, followed by warm cold and white white, 5. 200 and 2. 700, respectively, thus indicating that other variables interfere in the orientation of insects (Silva, Pelli, 2019; Silva, Pelli, 2020).

One factor to be considered is that if the capture was carried out in a period that comprises rainy days, which could propitiate a tendency of insects to seek and remain sheltered in their habitats, thus modifying the amount of organisms captured (Santos, Oliveira, Godoy, 2022).

It is still necessary to highlight the presence of the external light source present in the vicinity of the collection site, which could exert important phototaxia for insects, since they are guided by light and external light could cause the orientation to become confused, addicting that place, favoring the capture of more or less insects in that region.

Table 1. Relationship of insects captured with the lamps Cold White, Black and Warm White, in Unit II of Univerdecidade/UFTM, on June 11, 2018, from 17:57 to 21:00.

Insects/Light	Cold White	Negress	Warm White
Collembola Lubbock, 1869	-	1	-
Embioptera Shipley, 1904	-	2	-
Orthoptera (Olivier, 1811)	-	4	-
Thysanoptera Haliday, 1836	1	6	-
Latreille Heteroptera, 1810	-	2	-
Heteroptera/Phytophagus	3	-	-
Homoptera Boisduval, 1829	80	211	81
Homoptera/Aphidae	1	4	1
Neuroptera Linné, 1758			
Crysopidae	-	-	1
Trichoptera Kirby, 1813	1	20	1
Lepidoptera Linné, 1758	3	31	5
Diptera Linné, 1758			
Nematowax	15	98	6
Nematocera/Tipulidae	-	8	-
Nematocera/Culicidae	-	2	-
Brachycera	5	9	3
Cyclorrapha	-	20	-
Coleoptera (Linné, 1758)	6	17	11
Coleoptera/Staphylinidae	6	34	2
Coleoptera/Curculionidae	-	4	-
Coleoptera/Coccinellidae	-	1	-
Strepsitera Kirby, 1813	-	1	-
Linné Hymenoptera, 1758	3	17	-
Hymenoptera/Formicidae	-	5	-
Total	124	497	111

Source: the authors.

4 CONCLUSIONS

Black light proves to be better light source to be used in *pitfall* model light traps. However, further studies are needed, varying the season, as well as with the randomization of the positioning of lamps in front of external sources.

The proposed trap model seems to be efficient and inexpensive, and can be used for the sampling of insects from the peri urban environment, and can provide important information on the distribution and abundance of insects in different environments.

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