FIELD EVALUATION OF ALTERNATIVE LIGHT SOURCES AS MOSQUITO ATTRACTANTS IN THE PANAMA CANAL ZONE [1]

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ABSTRACT. Six alternative light sources designed for use with the CDC trap were evaluated as mosquito attractants in a tropical environment. The average trap index for each light source was as follows: Chemical light—114, radioactive blue—30, radioactive green—27, radioactive yellow—25, blinking light—8, and radioactive white—3. The standard incandescent light bulb attracted an average of 252 mosquitoes per night per trap. Statistically, the standard incandescent light was significantly better than any of the alternative light sources, while the chemical light, although not as efficacious as the standard, significantly outperformed the colored radioactive and blinking lights.

INTRODUCTION

The relatively high cost of operating a CDC miniature light trap has led to numerous attempts at reducing operational expenses. Recently, Johnson *et al.* (1973) modified existing CDC traps to accept standard "D" size carbonzinc flashlight batteries or heavier duty alkaline flashlight batteries, thus, reducing the operating cost of the trap. A previous study by Vavra *et al.* (1974) further reduced cost by demonstrating the feasibility of utilizing alternative light sources not requiring battery power. This paper describes a study conducted during the period 26 October–1 November 1973 in the Panama Canal Zone, where chemical, radioactive, and blinking mosquito light attractants were reevaluated under the extremes of a tropical environment.

MATERIALS AND METHODS

Three different types of alternative light devices were selected for evaluation. Radioactive tritium gas lights were purchased from Self-Powered Lighting Ltd., Pelham, New York, under the commercial name BETALIGHTS. Four different colors of Betalights, green, blue, yellow and white were chosen, each measuring 22 x 25 mm, and providing a brightness ranging from 390–1300 micro-lamberts. Betalights can provide continuous light for about 7–8 years. Approximate cost per source is $25.00). Chemical lights were procured from the Naval Weapons Center, China Lake, California under the trade name CHEMLITES. All Chemlites were green in color, and when activated produced bright light for approximately 8–12 hours depending on temperature. Maximum brightness per source measured 10 foot-lamberts upon activation (equivalent to 9.29×10^9 microlamberts), decreasing to approximately 2 foot lamberts after 10 hours of use. (Approximate cost per Chemlite was $.50.)

Blinking lights were obtained from the Land Warfare Laboratory, Aberdeen Proving Ground, Maryland. Each of these contained a GE glow lamp 6 AC, and when activated produced 2 flashes of low intensity light per second for a period of 1–2 years. (Approximate cost of the blinker was $3.00.)

CDC miniature light traps modified to accept "D" cell batteries were utilized during the course of the investigation. Traps were purchased from Hausherr's Machine Works, Toms River, New Jersey, and contained new Barber-Colman motors capable of providing up to 2000 hours service. All traps, except the standard, utilized 4 "D" cell batteries as power sources.

[1] The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Dept. of the Army or the DOD.

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Six-volt batteries were used to power the standard incandescent light trap.

Farfan Swamp, a tidal salt water swamp, located on the Pacific side of the Canal Zone was selected as the test area. The alternative light sources were compared to the standard incandescent light trap bulb (a GE 47, 6.3 V miniature lamp), and to each other.

Seven CDC traps, each containing a different light source, were placed at random throughout the test area, and rotated nightly in order to reduce the effect of trap sites upon mosquito catches. Trapping was conducted for 7 consecutive nights during which 49 trap nights were recorded. A control trap, utilizing the fan only was operated in random locations on the 1st and 7th nights. All light traps were located 100 meters apart and activated 1/2 hour prior to sunset. Mosquito catches were collected the following morning 1/2 hour following sunrise.

The trap index, including both males and females, was selected as the tool by which to measure the effectiveness of each light source. For statistical purposes, each of the colored radioactive lights was treated as a separate variant. Accumulated raw data were subjected to an analysis of variance utilizing a 7 x 7 Latin Square Design at the 5% level of error (Mendenhall, 1968). The standard error of the mean was then used to calculate Duncan's New Multiple Range Test at the 5% Level of Error (Li, 1964).

RESULTS AND DISCUSSION

Analysis of variance tests revealed a significant difference in performance among the light sources. (See Table 1.) The standard incandescent light outperformed the chemical light, which in turn outperformed radioactive blue, radioactive green, radioactive yellow, radioactive white and blinking lights. No significant difference was noted among the blinking or radioactive lights. The control traps produced no significant mosquito catches. A total of 8 mosquitoes was collected in the controls.

In the opinion of the authors, the chemical light is considered to be a suitable substitute for the standard incandescent light. Although the Chemlite attracted 54.8% fewer mosquitoes than the standard incandescent light, this certainly represents an adequate sample size for purposes of surveillance.

The species composition of the Farfan Swamp Area, as measured by collections taken from standard traps were as follows: *Coquillettidia venezuelensis, Mansonia titillans, Aedes angustivittatus, Culex* (*Melanconion*) sp., *Uranotaenia lowii* and *U. nataliae*. Of those, only *U. nataliae*

TABLE 1. Comparison of light source attractants in the Panama Canal Zone using Duncan's New Multiple Range Test at the 5% level of error.

Variants	Std	Chem	Blu	Gr	Yl	Blk	Wh
Means [1]	252	114	30	27	25	8	3
Relationship	———						
		———					
			———				

[1] Average Trap Indices—average number of male and female mosquitoes trapped per night per light source during the seven day period.

and *A. angustivittatus* were not taken from traps fitted with Chemlites. This is not significant, however, since only 2 specimens of each species were trapped during the course of the study. From the standpoint of species attractancy, the Chemlite performed as well as the standard light.

Based upon this study, none of the radioactive lights, nor the blinking light are considered to be adequate substitutes for the standard incandescent light. As a group, they all performed poorly.

These results differ substantially from those obtained by Vavra *et al.* (1974). In that study, there was no statistical difference in performance among the chemical, radioactive blue, radioactive green, radioactive white and the standard. In fact, the chemical light actually attracted a greater number of mosquitoes than did the standard incandescent light. Perhaps the following accounts for this phenomenon:

1. The relatively moderate population of mosquitoes present during the course of the Panama study, as opposed to the extremely high population levels encountered in the previous study.

2. Differences in behavioral light response by the mosquito fauna in each area.

The 6-volt dry cell and the "D" size carbon-zinc flashlight battery are the 2 types of power sources available in the Army for use with the CDC miniature light trap. (Approximate costs are $1.00 and $.07 respectively.) Although carbon-zinc batteries may be utilized to power both the light and motor, it is often difficult to obtain even one night's operation under extremely hot and humid conditions such as those commonly encountered in a tropical enviroment. The average nightly temperature and humidity during this study measured 81° F and 70% respectively. Therefore, 6-volt dry cells are the batteries of choice when operating the standard CDC trap. If 4 carbon-zinc flashlight batteries are used to operate a trap in which the incandescent bulb has been removed, and replaced by a Chemlite (approximate cost $.50 each), these "D" cells will power the motor for 3 consecutive nights. Using the above data, cost per night for the standard utilizing a 6-volt battery, and the chemical utilizing "D" cells are approximately $1.00 and $.57 respectively.

Literature Cited

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