ARTICLES

BETTER RESULTS WITH MOSQUITO LIGHT TRAPS THROUGH STANDARDIZING MECHANICAL PERFORMANCE [1]

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A great deal of effort has been put forth over the years by many workers in developing methods of measuring mosquito populations in an effort to satisfy the obvious need for accurate representative measures of the prevalence or density of the larval and adult forms. The methods now in use fall in several categories: 1. *Egg counts,* on the water surface, or in soil. 2. *Larval counts,* by the dipper method, by netting, by drawing all the water from the breeding source into a suitable vessel for a complete count, or by the "plastic sleeve" method. 3. *Adult counts,* by human operators including biting collections, aspirator collections, net sweepings, flag counts, counts in resting stations, or counts in animal-baited traps. 4. *Mechanical trap collections* made as a means of sampling the mosquito populations which are present in areas where they may constitute human annoyance.

All of the methods which depend upon human skill and training are correspondingly subject to wide variations. Even the same person will obtain widely varying results over time. Although very definite procedures have been suggested for guiding hand-collecting techniques, there still are no universally accepted standards for hand collecting.

The literature cited to accompany this paper sets forth in considerable detail a full historical account of the development and evolution of the trap which is presently in wide use among mosquito control and research agencies.

As early as 1927, intensive research was undertaken to develop a mechanical device to measure the prevalence of mosquitoes on the wing in communities where they were causing human annoyance (1). The trap was designed to serve as a more uniform collector than the human, and was intended to replace "biting" collections. A number of experimental traps were built and tested. By 1932, the trap known as the New Jersey Mosquito Light Trap had evolved. This trap with relatively few changes has been widely used with good results. There have, however, been some disappointing reports of its performance.

Other users have compared it against biting collections (3, 4, 5), coming to the conclusion that it very adequately represented the prevalence of the mosquitoes which were present in the area and causing human annoyance. In seeking an explanation, reports of variance in results with light traps were investigated whenever possible. It soon became apparent that some users were not operating the mechanical traps in the manner which had been intended, so in 1942 a circular describing the trap and its method of use was prepared (7).

It had frequently been found that the fans and motors with which the traps were equipped had, through lack of adequate maintenance or through damage suffered in operation or handling, lost their ability to move a sufficient quantity of air to enable them to catch an adequate sample of the mosquitoes on the wing. The shortage of mechanical items which was brought about by the demands for war material greatly intensified this problem,

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for old traps with badly worn motors continued in service, while the inability to get the motors which were originally specified often resulted in the substitution of sub-standard motors and fans. There are today a wide variety of electric motors powering the traps which are in operation, and their air-sampling ability varies greatly. This is very important, for the ability of the trap to catch mosquitoes is dependent to a large degree upon the rate at which air flows through the trap. As early as 1937, the New York City Health Department had a number of traps built, employing high capacity exhaust fans instead of standard fans. These were reported to catch 97% more mosquitoes than old traps operated at the test locations over an entire season. Unfortunately, we have no accurate record of the volume of air which was actually moved by these fans. It is interesting to note that "the relative abundance of the various species in the total catch was found to be quite similar for the new and the old traps; this was true also of the proportion of male to female mosquitoes caught" (4).

Our own experiences led us to the conclusion that not nearly enough attention had been paid to the mechanical performance of the light traps, while the numbers in use had tremendously increased during the war years. Therefore, in 1948 a report was prepared describing a measuring instrument to determine accurately the displacement of air and consequently, the mechanical efficiency of the New Jersey Mosquito Trap (10). This paper has evidently escaped the attention of many of the users of light traps, for there are still in operation many traps which are mechanically sub-standard.

A search of the available sources of supply was made in an attempt to find a more suitable and more durable motor and fan which would require less maintenance and be subject to less variations in operation. A heavy duty type motor and fan with a completely sealed enclosed case was located * and used to power a new trap.

* G.E. #3K967—8¾" blades, W. W. Graniger Inc., San Francisco, Calif., & Newark, N. J.

These motors were originally designed for refrigerators and other heavy duty service and are built with an enclosed pool of oil for lubrication purposes, so they need never be re-oiled throughout their life period. Since the motor case is completely enclosed, with no openings for ventilation such as were present in most of the other motors used, there is no opportunity for dirt, dust and insects to penetrate to the interior of the motor to interfere with its operation. The fans are 8¾" in diameter, thereby requiring a 10"-diameter trap tube, compared with the 9"-diameter tubes used to accommodate the 8" fans originally used.

The trap has been re-designed to accommodate the more durable motor referred to and at the same time, consideration has been given to the other mechanical features which interfered to some extent with the normal performance of the traps. The new "American" model is shown in fig. 1.

Some of the changes may be enumerated as follows:

1. The ¼" wire mesh screen has been moved from its original position over the mouth of the trap tube to a new position around the tube and top supports, in which position it not only excludes large insects but also prevents birds from building their nests in the space between the top of the tube and the hood.

2. The motor is suspended by a three-point support instead of a one-point support which was originally specified.

3. Instead of having a rigid hanging bracket above the hood of the trap, a chain has been substituted. This change permits the hood to be "nested" when removed from the traps for storage or transportation purposes.

4. A new method of fastening the interior funnel-shaped screen has been devised. This facilitates removal for cleaning or maintenance purposes.

5. A hole in the cyanide jar top at the apex of the interior funnel-shaped screen has been enlarged. This change prevents clogging of the interior screen at this point.

6. The trap tube has been lengthened to

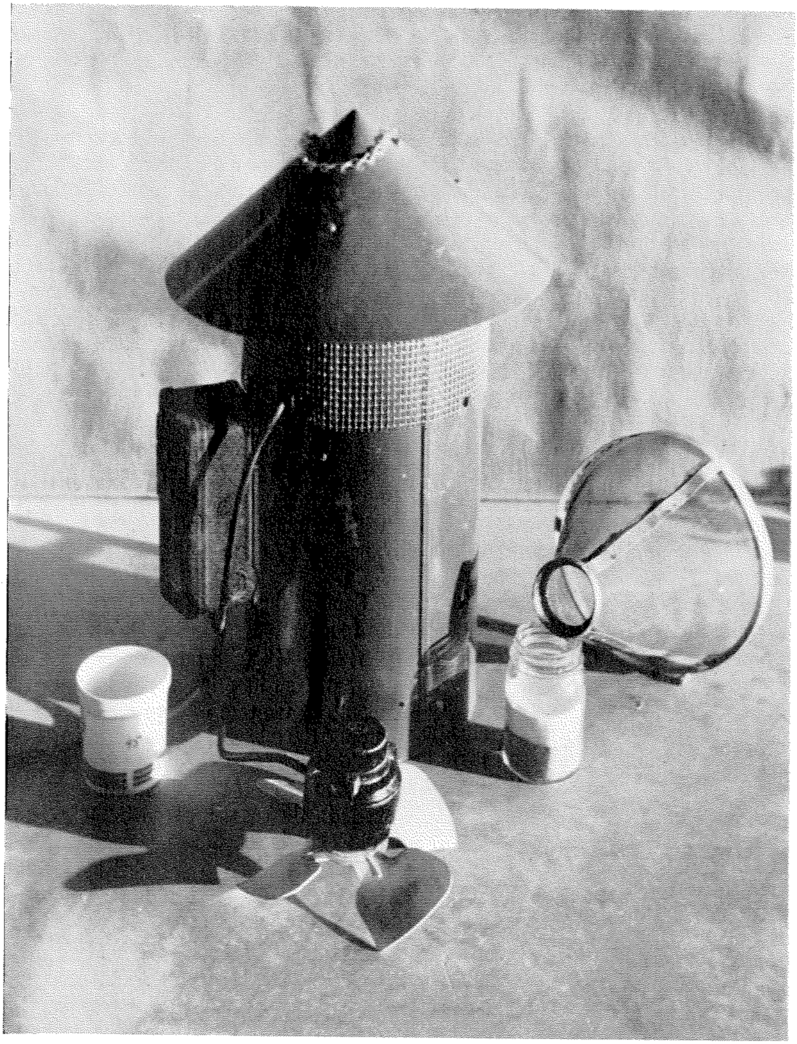

FIG. 1. "American" Model Mosquito Light Trap and principal parts: Fan, interior screen, cyanide jar, and carton for storing collected insects.

permit the complete elimination of legs. This change allows the traps to be stored in a much smaller space and generally facilitates the handling of them.

7. Two holes are drilled in one side of each trap at a standard spacing to facilitate mounting the traps upon standard brackets.

8. The wiring of the trap is better insulated to reduce the likelihood of electrical difficulties.

Preliminary testing of the new design trap has shown that it has an air moving capacity of 450–500 cu. ft./minute. Measurements of 25 of the old, non-standard traps ranged from 67 to 287 cu. ft./minute.

Improved mechanical performance of these traps appears to be assured and we may anticipate that with it more reliable collecting results may be achieved. The preliminary field tests have shown collections substantially above those taken with old traps. In due course of time it should be possible to calibrate its performance in collecting mosquitoes against the old standard trap so as to work out conversion factors which will permit the comparing of records taken with the old traps against this new light trap. It is strongly recommended that wherever light traps are used for critical collecting purposes, a condition of the experiment be the frequent measurement of the rate of air movement through the trap and that this air rating be recorded, together with the records of the conditions under which the trap was operating.

Many users of light traps have contributed information which has been considered and has contributed to the development of this new model. To them I extend my appreciation, and particularly to Joseph Tausta of New Jersey, who has offered a great many suggestions for changes which contribute to ease of servicing, and to James Holten of California, who constructed the new traps which we are now testing and which are here described.

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