

THE PRACTICAL AND RESEARCH VALUE OF MOSQUITO TRAPS¹

C. H. BATH²

From the Gorgas Memorial Laboratory, Panama

The purpose of this paper is to show that the mosquito trap has great potential value in research work through the capture for the laboratory of the various kinds of insects that are implicated in the transmission of diseases as well as in the control of malaria through the capture of a large percentage of the *Anopheles* that are attracted to populated centers.

I believe that a screened dwelling in a mosquito infested area is not complete unless a mosquito trapping arrangement is included, as a trapless dwelling can become, in itself, a dangerous trap.

I wish to explain what a mosquito trap is, its origin, and how it functions but first I will pass briefly over the history of other so-called mosquito traps. I have traced the term mosquito trap back to the year 1902, when it was first mentioned by Sir Ronald Ross in his book entitled "Mosquito Brigades and How To Organize Them." Dr. Ross wrote that it may be proved that the number of insects caught in houses during the day gives no accurate measure of the number present during the night. He demonstrated this by persuading a native servant to sleep within a mosquito net which has several holes or rents in it. Such a net, he says, acts as a mosquito trap. Dr. Ross goes on to state that "During the night the insect explores every part of the net in the hope of reaching the inmate and many find their way in, but when morning arrives cannot find their way out and can then be killed and counted."

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² Sanitary Inspector, The Panama Canal.

Had Dr. Ross gone a step farther in the same direction and had hung a good mosquito net inside of the torn net he would have trapped the mosquitoes and would have saved his human bait from physical torment. The principles involved in Dr. Ross' observations with the mosquito net and servant are also involved in our mosquito trap, with human scent as a lure, a hole in the house screening instead of in the mosquito net and a trapping arrangement over the hole to prevent the mosquitoes from either reaching the inmates of the house or escaping by the way they came.

Dr. Ross did not follow up the idea of using human scent for mosquito bait for later in 1910 in his book entitled "The Prevention of Malaria" he again mentions a mosquito trap. This time the traps consist of boxes lined with black cloth which were placed inside and outside of houses where mosquitoes might use them as shelters during the day. The human scent idea was not employed.

In 1908 Le Prince, feeling the need for a mosquito trap, had a screened cage set out near the jungle at Porto Bello and had a lantern hung in the cage in an effort to attract *Anopheles* to the light through openings in the sides of the cage. Three years later Le Prince told me that the experiment had proved a failure and gave me the opportunity and facilities to see what I could do in the way of trapping mosquitoes. A small screened house large enough for a man to work in was built at Corozal. The house was wired up for lighting and several 100 watt lights and an arc light were installed, making it the lightest place on the Isthmus at night. I worked there nights after my regular day's work, for it is only during the night that anopheline mosquito flights can be properly studied. Openings were made in the screening through which mosquitoes could pass into the house. The lights were left on nights and the following mornings numerous moths, *Culex* and other mosquitoes were found in the house, but very few were *Anopheles*.

Occasionally I slept in the house at night under a mosquito net and noticed that there were usually more *Anopheles* in the house on the following mornings, even when the lights were turned off

during the last half of the night. It appeared that more *Anopheles* were attracted by human scent than were attracted by any combination of lights. Many different forms of entrances were then made with screening in the sides of the building with a view to developing a form that would allow mosquitoes to enter and yet prevent their biting and their escape. A "V" shaped ridge of screening with a slit cut in the top was found to be fairly efficient for that purpose. A housing of screening was then built to enclose the ridge and the opening, thereby preventing mosquitoes from getting into the house.

In order to try this trapping arrangement on laborers' barracks where the scent was stronger, the present smaller detachable trap was devised in place of the built-in trap and when placed over screened ventilators of the barracks it was found that the stronger scent from the numerous inmates attracted large numbers of *Anopheles*.

A trap containing several hundred live *Anopheles* was then suspended in a closed mosquito net to determine the percentage of escape from the trap and it was found that approximately 9 per cent of the mosquitoes escaped into the net. The trap was then provided with a second or double entrance with a narrower opening, this change reduced the escape on the next test to about 2 per cent. For the purpose of preventing even this small escape the traps were provided with a sliding stick that could be pushed against the openings when the traps were to be taken down.

In Miraflores in 1912, the three largest catches made in one night with one of these traps were 1,018; 473; and 414, all *Anopheles*. As it took too long to enumerate all the catches, an average of six traps were examined daily and the catches enumerated.

The total number of *Anopheles* counted in the sixty days from six traps was over 37,000. Besides the *Anopheles* there were countless numbers of other species of mosquitoes, moths and other insects in the traps. Dr. Clark, Director of the Gorgas Memorial Laboratory, recently had several of these traps made to try them out in the capture of *Anopheles* in unsanitated areas

near Panama city. To date these activities have resulted in a total catch of 49,496 *Anopheles* in the eleven traps in use in thirty-two days. The largest catch made in one trap in one night was 4,973 *Anopheles*. Dr. F. M. Root states in the book entitled "Animal Parasitology" by Hegner, Root and Augustine, dated 1929 in chapter 38, page 513, in reference to killing adult mosquitoes on the Canal Zone, that, "Traps of various sorts have been tried out but neither a satisfactory model for a trap nor an efficient bait has yet been developed." It is regrettable that our mosquito trap and its efficient bait is so little known to the outside world, for its potentialities can well be estimated by its past performances.

Wherever there is a mosquito problem, hand catches are being struggled with a few hours of the day or night in an effort to determine the mosquito density and the figures arrived at are far less valuable than trap collections throughout the night. Our trapping observations have shown us that *Anopheles* in flight arrive at populated centers at various periods during the night according to more or less favorable weather conditions. Under these circumstances there can be no more reliable index than the results of an all night trap catch.

It is a good anti-malarial measure, since nearly all *Anopheles* that are attracted into the traps are females in search of a blood-meal with which to develop her eggs, and considering that as a conservative estimate each female is capable of depositing 100 eggs per batch, if the *Anopheles* captured in the traps recently had lived to deposit one batch of eggs each, an output of 4,949,600 *Anopheles* would have been the result.

The mosquito trap is going to prove of great value in research work and considering the great numbers of *Anopheles* that a few traps have destroyed in a short period of time, I am strongly convinced of its practical value as an important anti-malarial measure, and I believe that mosquito traps will eventually be built into houses as an essential part of the screening on dwellings in unsanitated areas.