TWO TRAPS FOR MOSQUITOES ATTRACTED TO SMALL VERTEBRATE ANIMALS[1]

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I. A DOUBLE-BAITED CAGE TRAP.

INTRODUCTION. Causey *et al.* have described the use of sentinel mice for attracting mosquitoes or other flying insects that transmit arthropod-borne viruses (1). The mice are held in cages which are sheltered under light aluminum hoods. In order to collect mosquitoes biting the mice, they have further devised a screened frame that may at any moment be fixed to the bottom of the hood to capture insects, active or resting at the time. However, except for the moment the screen is applied, the exit from the hood is entirely free.

Bellamy and Reeves (2) use a portable "bait-can" for continuous trapping of mosquitoes attracted to restrained chicks or other small vertebrates. This consists of a horizontal cylinder with a funnel entrance at each end. Several other types of baited mosquito trap have been described, but many of them utilize larger animals, are cumbersome to move, and are relatively costly to make, for example the "Egyptian" stable trap of Bates (3).

Published accounts of the construction, operation, and efficiency of these several traps have been valuable sources of basic principles in a series of experiments in Trinidad during which the following successful trap was developed.

DESCRIPTION AND SPECIFICATIONS OF TRAP. The materials for construction of the trap cost next to nothing and are universally available. The trap itself weighs only about 4 pounds and measures 22 inches in its greatest dimension. Hence one man can carry several traps with ease. The design could readily be adapted to make it possible to "nest" the frames into one another for convenience in transporting large numbers of traps.

Construction is likewise a simple matter. While soldering of the wire frame is a desirable feature, it is not necessary. With some ingenuity the entire trap can be bent from one piece of wire. Any sort of stiff wire, preferably galvanized, will suffice. To form each face of the trap the wire is bent into the shape of a "W," with an overhanging semicircle connecting the outer limbs of the W (Figure 1).

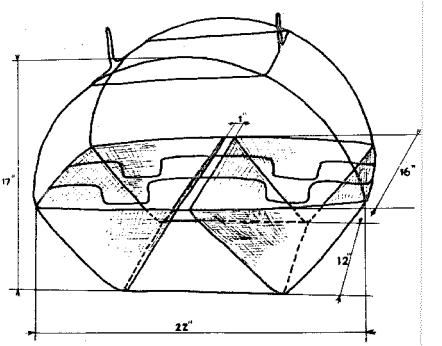

FIG. 1.—Double-baited cage trap, showing animal cage supports on both sides of entrance baffle. Netting and roof removed.

The two faces are linked by cross wires at each point of the two W's and at two places along the respective semicircles. The central peaks of the W's are united by two pieces of wire which are spread apart to any desired width to form the entrance baffle of the trap. Additional

[1] The studies and observations on which this paper is based were conducted in the Trinidad Regional Virus Laboratory with the support and under the auspices of the Government of Trinidad and Tobago, the Colonial Development and Welfare Scheme, and The Rockefeller Foundation.

braces may be used; for example, across the bottom of each W.

The lower part of the trap, 7 inches in height and corresponding to the portion consisting of the W's, is permanently covered with ordinary metal window screen mesh, which can be sewn on by threading it with thin wire. The upper part, composed of the semicircles, is shielded, when the trap is in use, by mosquito netting, cotton, or nylon roughly tailored to fit. This net is kept in place by a rubber belt, made from an old bicycle inner tube and stretched around the trap at the junction of the W's and semicircles. If the walls of the trap are expanded into a slight barrel-shape, a proper fit of the rubber belt will be ensured. Mosquitoes are removed through an aspirator tube inserted under the skirt of the net. The trap can be suspended from the branch of a tree and should be sheltered from rain by a light sheet of metal.

Overall dimensions of the trap are given in Figure 1. Position of supports for cages of bait animals in the trap, above the elbows of the W's at baffle level, are likewise shown.

DISCUSSION. A mosquito trap baited with mice or other small vertebrates should presumably be small so that CO_2 or other emanations from the bait will not be too greatly diluted by distance. Some published studies indicate that the relative concentrations of these attractants are of great importance in the efficiency of traps.

The purpose behind double-baiting of the presently described trap is, at least hypothetically, to surround mosquitoes with positive stimulation once they have entered the bottom of the W. Retreat from this region will lead them to less stimulating areas. On the other hand, when they have entered the trap, the horizontally disposed central baffle is the least likely place for them to seek a route of escape. A few may blunder out, but most of them come to rest on the side walls of the trap.

Preliminary results following use of several of these traps, baited with white mice, in Bush Bush Forest in Trinidad may be summarized by the following comments. At times when an experienced mosquito catcher, using himself as bait, was able to capture about 150 mosquitoes per man-hour, a trap baited with two screened adult mice on one side of the entrance baffle and an unscreened mouse with a newborn litter on the other side caught about 60 per trap-hour. Over a 24-hour period, the maximum yield from one trap has been 1,929 mosquitoes. About 20 species have been caught in the traps, although *Culex* spp. have predominated. Human bait is relatively more attractive to *Aedes* and *Psorophora* spp. than the mouse-baited trap. An unbaited trap, provided with unused mouse cages but supplied with mouse food, was entered by only half a dozen mosquitoes during a trial period of several days. The trap is therefore not significantly attractive simply as a shelter. It was noted also that mosquitoes refused to enter a trap totally covered with green plastic window screen, even when mouse-baited.

II. AN ALARM-CLOCK ACTIVATED FLAP-TRAP.

INTRODUCTION. In Part I we have described a simple cage trap for the continuous capture of mosquitoes attracted to small restrained bait animals such as white mice. To obtain detailed information on activity patterns of various mosquito species during 24-hour cycles, one must visit these traps and remove mosquitoes frequently throughout the day and night. This becomes impractical when the trapping program is extensive and its site relatively inaccessible, and may be disadvantageous if one desires to disturb the environment as seldom as possible. Furthermore, some mosquito species are likely to avoid cage traps or to enter them in numbers that do not represent their true local abundance.

To supplement information provided by our double-baited cage traps, we therefore developed an alarm-clock-triggered flap-trap that provides information on mosquitoes attracted to exposed small animal bait at any chosen instant. A battery of such traps at one locus need be visited only once or twice in 24 hours for re moval of the catch. The intervals betwee springing of successive traps can be se within the limits of the accuracy of th clock's alarm mechanism.

DESCRIPTION AND SPECIFICATIONS O TRAP. The trap consists essentially c

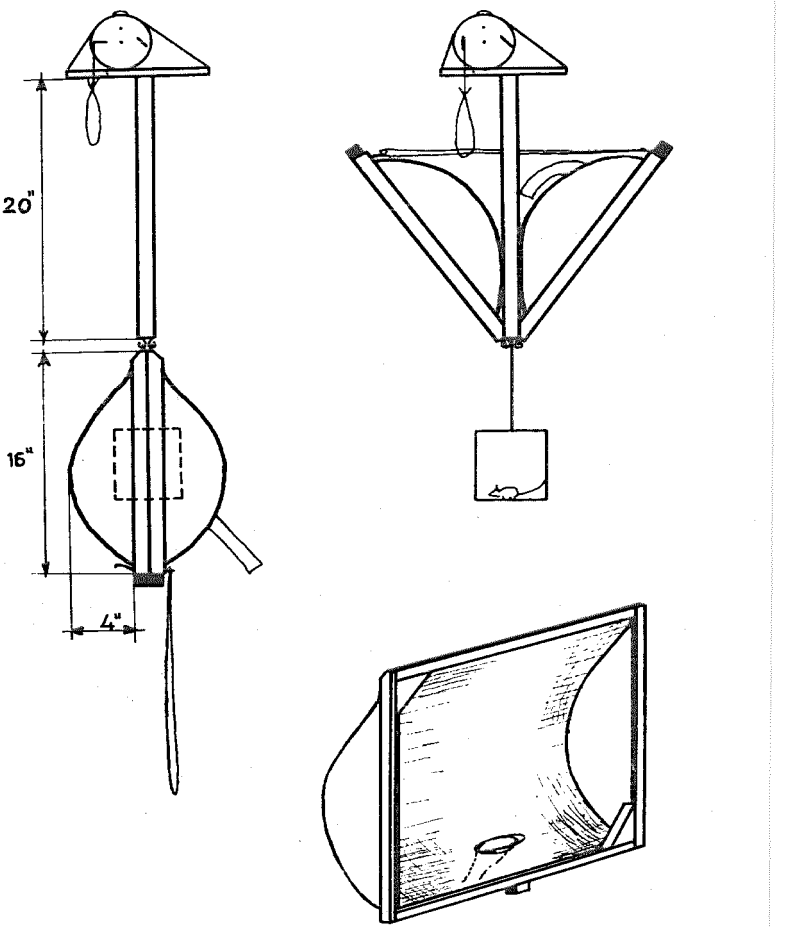

FIG. 2.—Flap-trap shown in open and closed positions. *Upper right:* flaps in "set" or open positio *Left:* flaps enclosing cage (dotted line) after release. *Lower right:* perspective view of one flap wi sleeve for removal of mosquitoes. Note both positions of alarm winding key of clock.

two opposing framed nets, hinged to a rod or bar from which the animal cage also is suspended. When the net flaps are released, they fall and clap together, like two clam shells, enclosing the cage and whatever mosquitoes were attending it at that instant. The entire trap is made of wood for ease of construction, and shellacked to prevent warping. Heavy magnets on the net frames provide momentum when the flaps are released and hold them tightly together after they have met (Figure 2).

Nylon netting was used at first but was found to be too fragile for rough field conditions. We therefore recommend the somewhat cumbersome frame with marine plywood sides, to which copper window screen mesh is stapled, as shown in the figure.

In the "set" position, both flaps are well above the level of the bait cage. Bait animals are therefore as nearly exposed in full as is consistent with their being restrained.

The alarm-clock triggering mechanism is based on the fact that in most alarm clocks, especially cheap ones, the alarm winding key *turns* when the alarm goes off. The power of this movement is used to spring the trigger of the trap. A hole bored in one wing of the winding key is fitted with a piece of wire that ends in a loop through which the trap trigger, a long narrow loop of stiff wire, is fixed to one flap but meets the other flap only by engaging a bent nail. When the alarm-clock winding key moves, its attached loop pulls the horizontal trap trigger upwards, disengaging it from the bent nail, whereupon both flaps fall, the trigger easily sliding through the loop from the clock. Only a slight movement of the winding key is required, its further movement being prevented by its attached loop hitting the clock support, as shown in the figure.

The diagram shows how a superstructure may be devised to anchor the alarm clock above the flap-trap to give it purchase for releasing the trap trigger. A roof of sheet aluminum, detachable for easier transport, is provided to cover the entire assembly in order to protect the clock, the bait animals, and captured mosquitoes from the weather.

Mosquitoes are removed by an aspirator tube inserted through a small hole in one of the flaps to which a sleeve has been attached.

DISCUSSION. This trap has been designed, like the double-baited cage trap, not only for its primary purpose but also for simplicity and convenience of use in situations reached with difficulty. Thus, instead of using permanent hinges to fix the flaps to the central bar, we have employed mutually engaging, open screw-eyes. Traps can therefore be taken apart and transported in sections, numbered so that corresponding parts can be reassembled immediately at new sites of operation. Relatively unskilled field personnel have operated this trap successfully.

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