A SIMPLE ARTIFICIAL TREE-HOLE FOR RECOVERING MOSQUITO EGGS, WITH A NOTE ON THE RECOVERY OF *AEDES AEGYPTI* EGGS FROM RAIN FORESTS IN PUERTO RICO

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The Puerto Rico Nuclear Center has been studying the effects of gamma radiation on a section of montaine tropical rain forest. One section of this study was directed towards those factors which might play a part in the alteration of natural virus cycles. An important part of this investigation was a study of the mosquitoes in the forest (Weinbren). To this end, adult catches have been made using light traps of various design, baited traps, and human volunteer catchers; immature stages have been obtained for laboratory rearing from plastic bowls, plant axils and tree-holes. The accessible tree-holes and plant axils were not very productive, and, although better yields were obtained from bromeliads, this source could not be exploited in the study area because the only really effective method of insect recovery involved plant destruction and it was mandatory to cause the least possible physical disruption of the area. The plastic bowls, which were set out to collect falling fruits, etc., fill with rain water and form a good source of larvae and pupae, though those species which are normally tree hole breeders can not be recovered from the bowls with any regularity.

In order to study flight range and pattern it was intended to release for subsequent trapping imagoes of all commonly occurring species which had been tagged in the larval stage with Strontium 89. The device described below was designed as an artificial tree hole or oviposition at-

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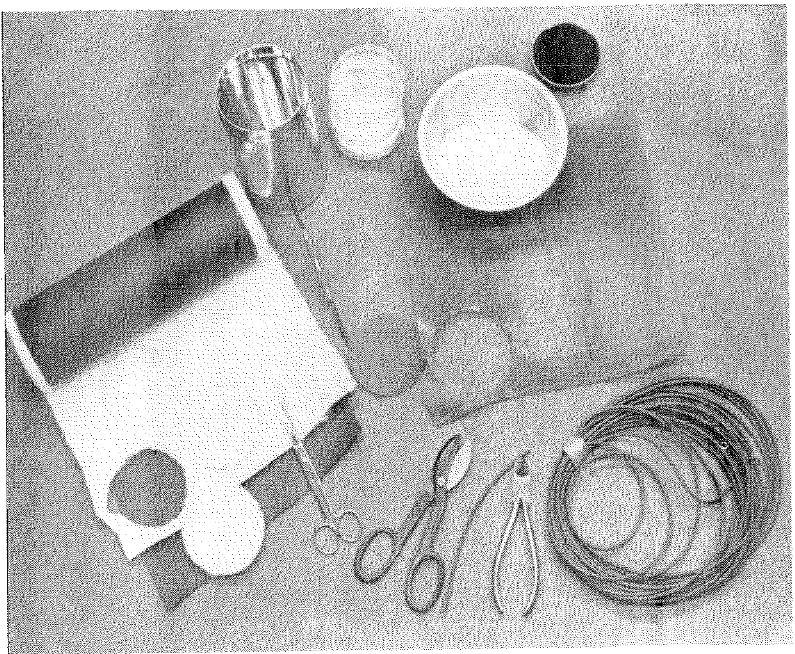

FIG. 1.—Materials—tools required for artificial tree-hole.

tractant container in order to provide supplies of eggs from the tree-hole breeding species in the forest, and also to seek evidence of additional species which had not been revealed by other procedures. Field trials of the device have proven it to be highly effective in our study area and we are regularly recovering eggs of *Aedes* (*Stegomyia*) *aegypti* (Linn.) from it (a species not taken by either light trap or baited trap in the same area). For these reasons the device is deemed worthy of reporting in sufficient detail to enable construction by any group that may wish to test it.

The design of the device was influenced by a desire to exclude, wherever possible, such variables as the method and degree of maturation of a bamboo pot (Muspratt, 1956) while at the same time catering to both the appetent and consummatory drives in the oviposition behaviour. It has been found that olfactory and visual stimuli and the degree of humidity influence the appetent, while tactile and chemotactile stimuli influence the consummatory act (O'Gower 1955, 1957a, b, 1958, 1962, Haddow & Gillett 1957, Gillett & Haddow 1957, Christophers 1960). An attempt was therefore made to achieve an adequate combination of olfactory, visual, tactile and chemotactile stimuli in a situation where there was a high humidity gradient towards the laying target, to avoid the incorporation of repellent features, and to use only relatively inexpensive and readily available materials.

MATERIALS. The materials and tools required are shown in Figure 1. For the body of the device we employed a heavily tinned lidless can, 4¼″ in diameter and 6¾″ deep and for the cover a circular aluminum pie dish, about 2″ deep with sloping sides. This should have a base 5½″ in diameter and a flat ⅜″ brim of 7¼″ outside diameter. For suspension a 1½″ eyebolt (with ¼ x 20 thread and 2 nuts) is fitted through the pie dish. Number 12 P.V.C. insulated solid copper electrical conductor is used to attach the cover to the can and for making the egg collector support. To act as both a platform and as a screen to prevent the mosquito from by-passing the egg collector, a 4⅛″ circle is cut from stainless steel wire cloth.[3] The egg collector consists of a disc of filter paper which has been dyed black with Tintex dye. In order to provide a surface of suitably rough texture, Standard Gray Sugar filter paper #5267[4] was chosen. To maintain the desirable degree of dampness in the paper, a disc is cut to size and laid on a layer of non-absorbent cotton held in the lid of a plastic Petri dish (90 mm.). Before use, the circle of cotton is dipped in water and lightly squeezed out; the attractant substance used is 2-week old horse manure infusion. After construction the device is spray-painted with matte black stove enamel. Tools required are: wire cutters, pliers, tinsnips, scissors and an ice-pick or other sharp-pointed instrument suitable for piercing holes in the can.

CONSTRUCTION. Figures 2 and 3 show completed devices; in Figure 2 one of the black filter papers has been replaced with white for better photographic demonstration of the general construction. The procedure is as follows: Holes large enough to accommodate the insulated wire are punched as follows: In the can: On a circumferential line 1¾″ from the bottom of the can 2 holes are punched 2″ apart, and 2 holes are punched diametrically opposed to them. On a line ¼″ below the brim of the can 3 equally spaced holes are made. In the pie dish: Three equidistant holes are punched in the flat brim. In the center of the pie dish a hole is made that is large enough to allow the eye-bolt to be fixed to it by means of the nuts. A smaller hole (about 1/16″ diameter) is made in the side of the can 1¼″ from the bottom—this is to prevent the level of the attractant horse manure infusion from rising above the desired point. It should be noted that this hole must be small enough to prevent a mosquito having access to the attractant through it.

After the holes are made, a 15″ length of the wire is cut and bent into a U shape with the arms of the U 2″ apart; these are then passed through the holes 1¾″ above the floor of the can to form two parallel supports for the circle of wire cloth and the egg collector. Three pieces of wire about 5″ long are then used to fasten the can to the inverted pie-dish. All of these wires are firmly fixed to the can by looping and twisting but only 2 are so fixed to the pie dish, the third being left as a hook to allow opening and easy access for topping up the attractant or replacing the egg collector.

A NOTE ON THE SIGNIFICANCE OF RECOVERING *A. aegypti* FROM THE TROPICAL RAIN FOREST AT EL VERDE. Writing on the arthropod vector of yellow fever, Whitman (1951) states: "Great interest attaches to the fact that the ecology of *A. aegypti* is not constant for the species in its geographic habitats. In South America it is an intensely domestic species rarely captured at any distance from human habitation, and its peridomesticity sets it off markedly from other members of the genus. This behavior pattern is true for the species not only in South America, but in all the Americas and throughout large parts of its essentially worldwide range. In contrast, *A. aegypti* in East Africa has such a divergent ecology that it is not only of no signicance in the transmission of yellow fever (in man), but can only with difficulty be captured with human bait. In Africa, therefore, this species must be considered as having a variable ecology dependent on locality."

In his studies in the forest in Bwamba County, Uganda, Haddow (1945) found *A. aegypti* breeding in tree holes rather than in artificial containers. In 422 tree holes *A. aegypti* larvae accounted for 6 percent of those recovered and was fifth most abundant of 21 species found, while

[3] W. S. Tyler Co., 3615 Superior Ave.., Cleveland, Ohio, 35 mesh type 304, 0.010″ wire diameter 0.0186″ width of opening.

[4] Manufactured in Great Britain by Eaton Dikeman, and available in the USA through Arthur H. Thomas Co.

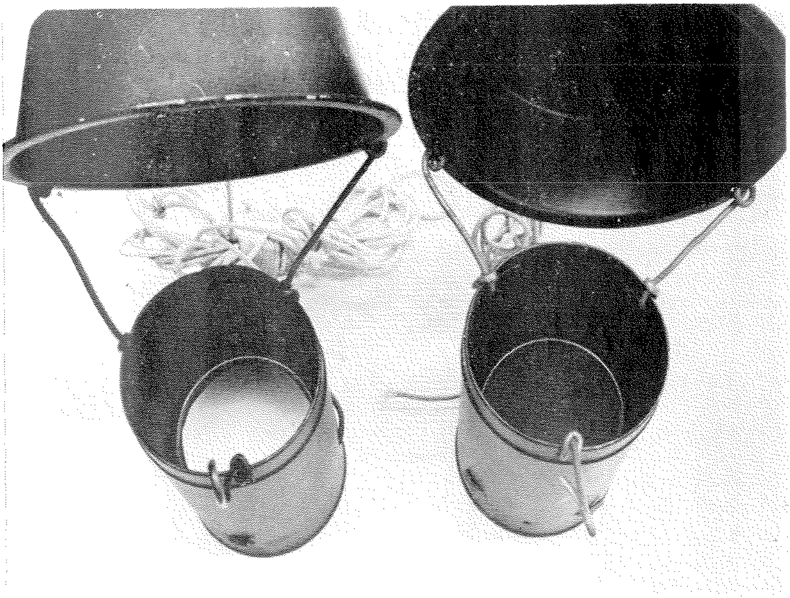

FIG. 2.—Completed device with white filter paper substituted for black for better demonstration.

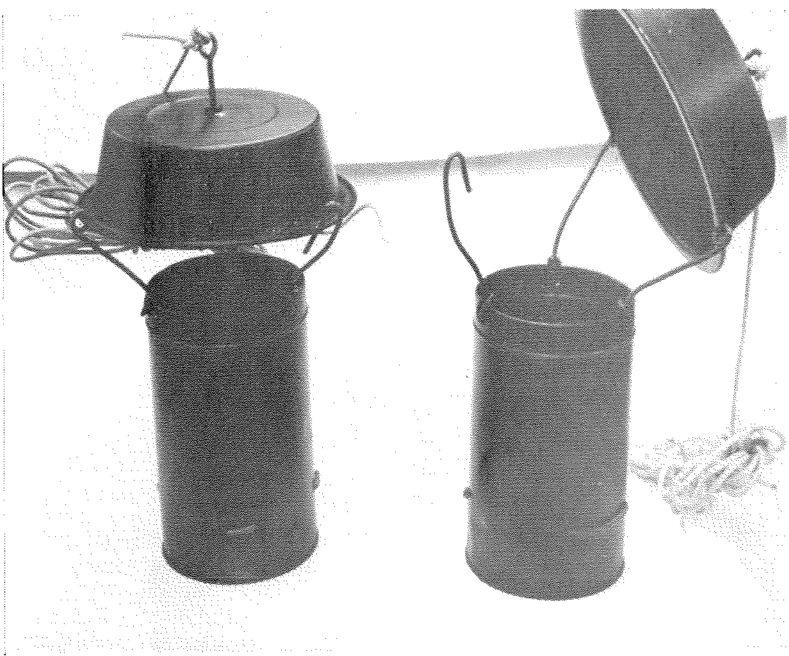

FIG. 3.—Completed device, as used.

A. aegypti larvae were found in only 1 of 34 artificial water containers examined. Haddow emphasized the failure to capture the adults of the species in this area; in spite of the relative abundance of larvae, only 5 adult *A. aegypti* were encountered in 50,000 mosquitoes identified during an 18-month-long study.

During our studies at El Verde, the findings are similar to those reported by Haddow, in that we failed to recover adult *A. aegypti* from light traps or using human bait catches, or immature forms from the 50 plastic bowls in the area. As mentioned above, our sampling of readily accessible natural tree holes was unproductive, but, in the period between September 1965 through January 1966, using 12 of the described devices set in groups of 6, 160 meters apart, we have consistently reared *A. aegypti* from eggs laid in them. The study area is approximately two miles from the nearest village but this is far removed from the direction from which the prevailing wind blows. From the direction of the prevailing wind, it is several miles to a village, with an intervening mountain ridge. Further studies are currently being planned to investigate this situation which, although to be expected in Africa, is at variance with all previous experience in the New World.

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The third annual Nebraska program on "Selection and Handling of Pesticides" will be held April 3–4, 1967, at the Nebraska Center for Continuing Education, University of Nebraska, East Campus, Lincoln. The program is aimed primarily at commercial and municipal applicators as well as others interested in pesticide application. Topics will include Legal Aspects of Pesticide Usage, Ways to Avoid Damage, How to Calculate Damages and current pesticide recommendations.