

hood, upper section duct, and bait basket, may be removed as a unit. The upper section weighs 20 pounds and the lower section 36 pounds. The dimensions of the trap when assembled are 4.5 feet high by 2.0 feet wide.

An automatic control unit*, consisting of a recycling cam timer (Series CM-5) and B-15 gear and rack assembly, was used to activate and deactivate the blower. The timer has a five-minute periodicity that can be adjusted to provide 0 to 100 percent "on" or "off." The most suitable cycle of operation was two minutes "on" and three minutes "off." This unit and the portable gasoline generator used to furnish power for operation of fan were located approximately 150 feet from the base of the tree in which the fan trap was suspended.

The trap was operated during the summers of 1958-1959 in connection with a program to investigate the feeding habits of biting Diptera in natural and altered bottomland habitats at Beaverdam and Blackwell Swamps near Decatur, Alabama. The fan trap collections were made in hardwood forest canopy to supply information on Diptera attacking avian (chicken) bait. In order to obtain a wider scope of the insect biting population, collections from human bait at ground and different canopy levels were also made. These collections were made using another oak tree approximately 150 yards from the fan trap location. The results are given in Table 1.

TABLE 1.—Record of female mosquitoes and hecids taken at different locations and elevations by two sampling methods using human host and fan-type trap during the crepuscular period, Beaverdam Swamp, Greenbrier, Alabama, June 23, 1958

Method: Collection period:	Fan-type bait trap * 1825-2035	Aspirating on man ** 1845-2015
<i>Species</i>		
<i>Anopheles quadrimaculatus</i>	1	3
<i>Mansonia perturbans</i>	19	35
<i>Culicoides baueri</i>	26	5
<i>C. guttipennis</i>	5	9
<i>C. hinmani</i>	22	0
<i>C. paraensis</i>	0	2

* 35-foot level in forest canopy—avian bait.

** 75-foot level in forest canopy.

SUMMARY

A new trap for collecting biting insects has been made. The unit is virtually a closed system with

a twin centrifugal fan taking in air from the hood above the bait and passing it through the screen cone separator and discharging the blast of air beneath the bait where it is recirculated. Based on two summers' observations, it appears that this trap has sufficient airflow to capture small Diptera such as *Culicoides* and *Phlebotomus*, but an increase in velocity appears essential to sample mosquito populations adequately.

ACKNOWLEDGMENTS

The authors wish to express their sincere appreciation to Dr. G. E. Smith, Chief Biologist, under whose supervision the investigation was carried out, and to Mr. G. S. Christopher, Chief, Malaria Control Branch, for useful comments relative to the construction and operation of the fan trap.

Reference

LUMSDEN, W. H. R. 1958. A trap for insects biting small vertebrates. *Nature* 181:819-820.

A MOSQUITO-TIGHT CAGE

MICHA BAR-ZEEV and RACHEL GALUN, Israel Institute for Biological Research, Ness-Ziona, Israel.

The escape of mosquitoes from breeding and maintenance cages is a great nuisance, especially where genetics and resistance studies are carried out, since escaped mosquitoes may re-enter experimental cages and thus render such experiments futile. In most mosquito cages described (Young & Burgess (1946), Boyd (1949), Barnett (1955), Trembley (1955), Hartzell *et al.* (1958)), a sleeve is used which makes possible all required manipulations inside the cage; this arrangement, however, does not prevent the escape of mosquitoes on those occasions when materials (eggs, food, animals, etc.) are transferred. The construction of a mosquito cage in which all the required manipulations could be carried out without ever opening the cage (except when no adults are present, e.g. for cleaning and introducing the pupae) is described.

The cage (40 x 44 x 40 cm.) (Fig. 1) has a wooden frame and bottom and a 20-mesh metal screen on all sides except the front which is only partly screened and divided into two parts: one part (40 x 15 x 15 cm.) is fixed, the other (40 x 30 x 33.5 cm.) removable by means of screws and snaps (Detail A). This removable part is lined around the inner edge with a strip of rubber sponge and around its outer edge with a metal frame to insure tight sealing.

Larvae reared in any suitable container are filtered after pupation from the rearing medium, put into a plastic dish (31.5 x 23.5 x 8.0 cm.) (Detail D) containing fresh water, and placed on the floor of the cage slightly inclined towards the front. A metal tube (1 cm. in diameter) con-

* Industrial Timer Corporation.

nects the lower part of the dish and protrudes outside the cage through a suitable opening. The tube can be opened and closed by means of a clipped rubber tube (Fig. 1 and Detail D). When all or most of the adults have emerged, the tube is opened to drain the water into a reservoir capable of preventing any escape of mosquitoes that may be drained with the water.

In order to provide food, a wad of cotton soaked with honey, or an inverted small jar filled with a 10 percent sugar solution and closed with cotton, is placed over the screen on the top of the cage. If a blood meal is to be offered to the mosquitoes, two rats, which have had the hair clipped from their backs, are introduced each into a conical cage (23.5 cm. long, 9 cm. high on the

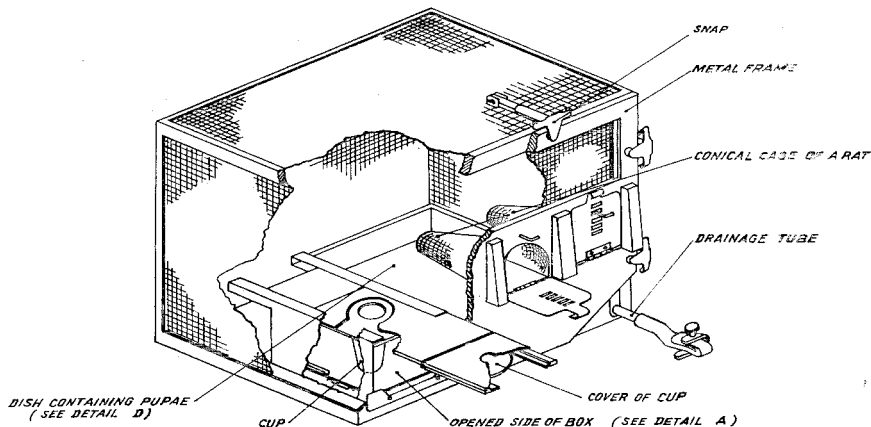
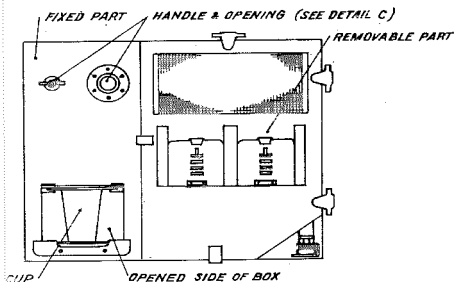
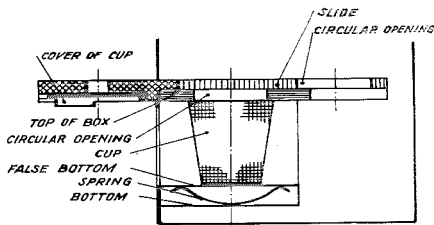


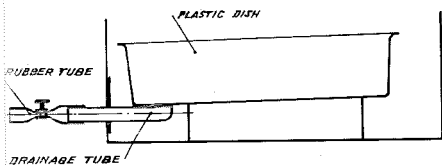
FIG. 1 MOSQUITO CAGE



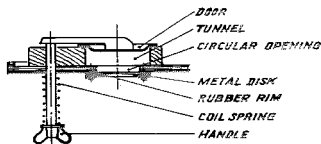
DETAIL A. FRONT VIEW OF THE CAGE



DETAIL B. BOX WITH CUP FOR EGG COLLECTION



DETAIL D. DISH CONTAINING PUPAE



DETAIL C. DEVICE TO OPEN AND CLOSE CIRCULAR OPENING (SEE TEXT)

front end, 3 cm. high on the rear end) through an opening (9 cm. high, 9 cm. wide) on the removable front part of the cage. Each of these conical cages (Fig. 7) consists of a 20-mesh metal screen, a metal platform and a movable metal tray which can be lifted upwards to force the back of the rat against the screen. A door, having slits close to each other along its longitudinal axis, closes the opening, one of the slits on the door being hinged into a pin situated just above the opening to hold the rat against the screen. This method of offering a blood meal is an adaptation of the method used in the laboratories of the C.D.C., Savannah, Ga., and has also recently been described by Pollard (1960).

If eggs are to be collected a cup (9.5 cm. high; 7.2 cm. upper diameter) containing water or, in the case of *Aedes* species, lined with filter paper, is introduced into a metal box (15.0 x 10.5 x 13 cm.) with a plastic top. The box, the front part of which is open, is situated on the lower left hand corner of the cage, below the fixed front part. This box (Detail B) has a false bottom on springs which can be lowered when the cup is introduced. The upper side of the box has a circular opening 7 cm. in diameter, into the rims of which the mouth of the cup is fitted, and tightened by means of the bottom springs. A slide (49 x 10.5 cm.), having a similar circular opening, can slide along the top of the box, thus closing and opening the mouth of the cup. Ordinarily, the slide is so placed that the mouth of the cup is open towards the cage to enable the mosquitoes to lay eggs. When eggs are to be taken out, the mouth of the cup is closed by moving the slide. The cup is then pulled out by sliding it along the box until it reaches a circular cover, 9 cm. in diameter, with a wide rim, 1 cm. high, on its front side, which was placed previously in an appropriate slit in a prolongation of the slide. The cup, thus covered, is removed and placed in a refrigerator for a few minutes in order to inactivate any mosquito which may have reached the cup. These mosquitoes are killed and removed. Another cup is then introduced into the box by the same method.

In order to remove mosquitoes from the cage for experimental purposes, a circular opening (4 cm. in diameter) with a rubber rim (0.5 cm. wide) is located on the upper fixed part of the front cage (Detail C). By pressing and turning the handle, which is fitted with a coil spring and connected to a circular inside door, the opening can be closed and opened. A cavity 2 cm. deep connects the door and the outer opening. An aspirator which fits the entrance of the opening, and which is made mobile by the rubber rim, is introduced into the cavity. The door is then opened, and the aspirator is pushed inside. After mosquitoes are sucked in, the aspirator is pulled back until its end is close to the rim of the opening. The door is then closed, and the aspirator can be removed.

The cage described here has been used successfully in our laboratory as a continuous source of

eggs and mosquitoes of several species and strains, without fear of contamination.

References

1. BARNETT, H. C. 1955. Cage equipment for the study of mosquitoes infected with pathogenic agents. *Mosquito News* 15:43-44.
2. BOYD, M. F. 1949. *Malariaology*, Vol. I. Saunders Co., Philadelphia and London, 787 pp.
3. HARTZELL, A., BURCHFIELD, H. P., and COTTY, V. F. 1958. Improvements in culturing larvae of *Aedes aegypti* L. for use in insecticide bioassay. *Contrib. Boyce Thompson Inst.* 19: 321-326.
4. POLLARD, D. G. 1960. A cage suitable for holding and feeding blood sucking mosquitoes. *Mosquito News*, 20:56-57.
5. TREMBLEY, H. L. 1955. Mosquito culture, techniques and experimental procedures. American Mosquito Control Association, Inc. Bull No. 3, pp. 1-73.
6. YOUNG, M. D., and BURGESS, R. W. 1946. Plastic cages for insects, *Science*, 104:375.

TWO NEW RECORDS OF MOSQUITO SPECIES FOR MINNESOTA

F. E. COOK, Laboratory Technician, Metropolitan Mosquito Control District

During the 1959 season two additional species of mosquitoes were added to the list of 47 species already recorded in Minnesota (Barr, 1958). The two new records were *Psorophora (lanthinsoma) ferox* (Humboldt) and *Psorophora (Grabhamia) confinnis* (Lynch Arribálzaga).

Three collections of *Psorophora ferox* larvae were made: Anoka County, Blaine twp., Sec. 3, B.S.I., IX-1-59; Hennepin County, Bloomington (T116-R21), Sec. 21, B.S. 11, IX-4-59; Hennepin County, Bloomington (T27-R24), Sec. 23, B.S. 10, IX-3-59. The larvae were identified, and some were reared for more positive identification. Identified specimens are now in the University of Minnesota collections. Prior to this time, *P. ferox* has been erroneously reported from light trap specimens taken by Riley and Chalgren in 1938. On subsequent examination these specimens were determined to be *Psorophora horrida*.

Only one collection of *Psorophora confinnis* was made (Washington County, Woodbury twp., Sec. 4, B.S. 3, VIII-29-59). This was a fourth instar larva and is now in the University of Minnesota collections.

The occurrence of *Psorophora horrida* in this state was confirmed by three biting collections: Anoka County, Columbus twp., Carlos Avery Game Farm, VIII-18-59; Scott County, Sand Creek twp., Sec. 19, park, VI-18-59; Scott County, Glendale twp., Sec. 31, B.S. 3, VI-19-59.

In addition to these records for *Psorophora*, the