

escape during the blood-feeding procedure. To determine the effect of the gauze intervening between the flies and the membrane on the percentage of females taking a blood meal, we conducted several comparative tests. The data (Table 1) indi-

TABLE 1.—The effect of gauze intervening between the flies (males and females present) and the membrane on the percentage of females taking a blood meal.

Test	Exposure time (hours)	Type of feeding cage	Percentage of females taking blood meal	
			Range	Average
1	2	Open	60-78	68
1	2	Gauze	80-87	83
2	1	Open	80-84	82
2	1	Gauze	77-78	77

cate that any reduction in blood-feeding that occurs because of the intervening gauze is negligible.

We have also fed several species of mosquitoes successfully with this apparatus. The dimensions of the feeding compartments did not allow us to use as large a feeding cage as we have normally used for mosquitoes, so we used cages made from 1/2-pint ice-cream cartons.

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AN ANIMAL-BAITED TRAP FOR THE COLLECTION OF *CULICOIDES*¹ SPP. (DIPTERA: CERATOPOGONIDAE)

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ABSTRACT. An animal-baited trap to collect *Culicoides* spp. is described. In preliminary trials eight species were collected. The advantages

of this trap are that it can operate unattended and it can be suspended at different elevations in the forest canopy.

Animal-baited traps are widely used in studies of the feeding activities of adult *Culicoides* spp. (Diptera: Ceratopogonidae). Snow (1955), Snow and Pickard (1954), Jamnback and Watthews (1963), Kettle and Linley (1967, 1969) and numerous other workers have used man as the bait animal in studies to determine the effect of environmental factors on the feeding habits of these biting midges.

Fallis and Wood (1957), Bennett (1960) and Hair and Turner (1968) used various wild and domestic animals in bait traps in host preference experiments. The animals were restrained and exposed. After a known period of time, an insect-proof cage was placed over the animals to trap the biting insects. DeFoliart and Morris (1967) and Nelson (1965) devised other types of traps in which dry ice was used instead of animals to attract *Culicoides*. These traps were effective, but they had to be attended regularly during the trapping period or needed an artificial attractant. It was desired that an animal trap be designed that could capture *Culicoides*

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adults in reproducible numbers, and could also operate unattended. It was further desired that such a trap be designed to capture biting midges at various elevations in the forest canopy.

Hair and Turner (1968) used traps similar to those described by Bennett (1960). Using these traps, Hair and Turner observed that entrapped flies clustered near the top side and usually in a corner nearest the setting or rising sun. This indicated a strong positive phototropism after originally being attracted to the animals and entrapped. Engorged females were observed to fly to the sides of the cage and to crawl up to the top. Using these observations, a trap was devised that has been reasonably satisfactory in achieving the above objectives.

MATERIALS.

Animal Cages—Welded wire screening (1 inch square)

Small size hog rings

Traps—Two Nalgene® funnels (size dependent on size of trap)

1 Nalgene wide-mouth bottle
1 inch square (planed) wood strips

Saran® cloth (44 mesh)

Black muslin cloth (enough to cover the top third)

Exterior plywood ($\frac{1}{2}$ inch thick, enough for the top plate)

Epoxy glue; 8–10 inch square cellulose acetate; plastic electrician's tape

CONSTRUCTION OF ANIMAL CAGES. The animal cages are constructed using the 1-inch welded wire which is held together with clamped hog rings. The dimensions are dependent on the size and shape of the animal being used as bait. The cage should be small enough to restrict movement, but large enough to allow the animal to sit or stand in a natural position. A door is placed at one end of the cage and tied shut with a piece of flexible wire.

CONSTRUCTION OF THE TRAPS. The exact dimensions of the traps will depend on the size and shape of the restraining cages. They should be slightly larger than the restraining cages in order to fit over them when the trap is in operation (Fig. 1). A hole is drilled in the side of funnel A ("exterior funnel") and funnel B is attached by welding the two Nalgene® funnels together by means of a propane burner (Fig. 2). The function of the exterior funnel is to hold the jar of liquid preservative (e.g. alcohol) in a vertical position. Care should be taken in the welding operation since the plastic melts rapidly and will collapse. A hole is drilled into a wide mouth Nalgene bottle top. It is then welded onto the base of the funnel A. Epoxy glue is also used to reinforce this latter weld. The top of funnel A is covered with clear cellulose acetate taped in place with electrician's tape. The funnels are mounted on a plywood plate. A circular opening is cut in the plate at a 15° angle by means of an electric saber saw with the outer edge being slightly smaller than the exterior diameter of the funnel. The funnel assembly is pushed through the opening and then held in place by using three, small revolving "chocks" of wood which are screwed to the inner edge of the plate opening. The remainder of the cage frame is constructed with 1-inch fir strips. A center brace is attached from the center of the back cross-piece to the top center of the funnel plate. The top $\frac{1}{3}$ of the cage is covered with black muslin attached by means of a staple gun tacker or with carpet tacks. Saran® cloth is used to cover the remaining portion of the cage. The bottom is not covered. Vertical slits about 1 inch wide are cut on the sides and back of the Saran covered portions.

The trap and cage are placed on a plywood base. For studies in which the trap will be elevated above ground, the base is held to the trap by means of screw hooks and spring clips. They can then be suspended at any elevation desired by means of a pulley.

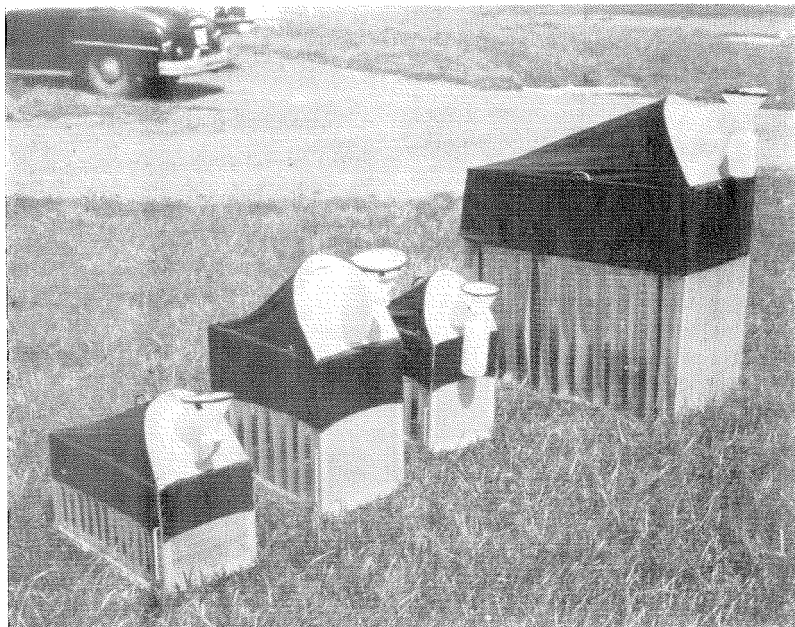


FIG. 1.—Animal-baited traps.

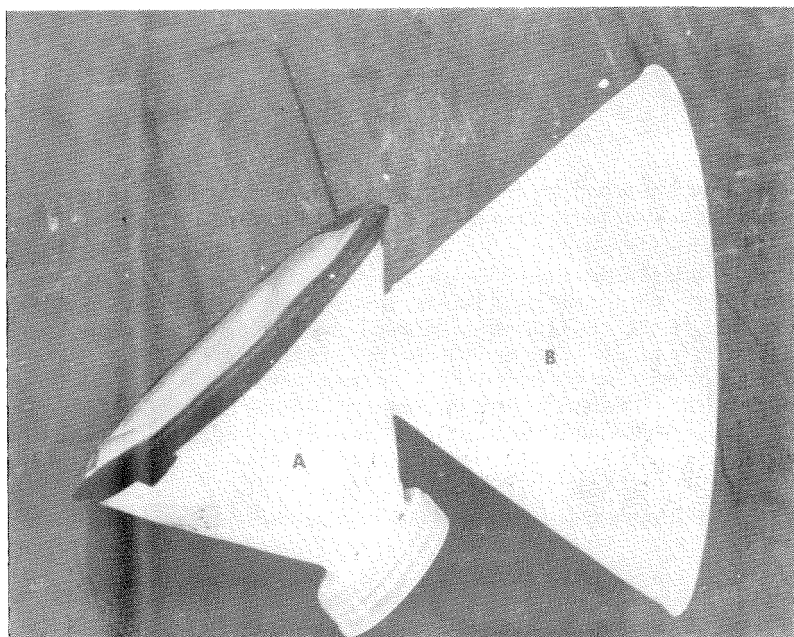


FIG. 2.—Funnel assembly of animal-baited trap. A. Exterior funnel. B. Internal funnel.

DISCUSSION. Collections in 1969 and 1970 indicated that at least eight species of *Culicoides* could be collected using this trap. The traps were left unattended for several hours and the changing of samples merely required the changing of bottles under the funnels. The traps were also suspended in trees at various elevations for studies on the occurrence of *Culicoides* at various levels in the forest canopy.

It is possible that this trap could be used to collect other biting flies and midges. However, the traps were not used in conditions or areas where other biting Diptera were collected in large numbers.

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We have had several inquiries lately along the lines of the following letter, and would like to know where copies of Carpenter and LaCasse could be obtained.—Editor

"I have recently started work with mosquito control in Virginia. I have heard from several sources that the standard work on mosquitoes of my area is *The Mosquitoes of North America* by Carpenter and LaCasse. However, after checking with several book companies, friends, and Col. Carpenter himself, I am still unable to locate a copy. Would it therefore be possible for you to run a short notice in *Mosquito News* to the effect that a young biologist just beginning work in mosquito control would very much like to obtain a copy of this book? Thank you very much."—Stuart McCausland, Kempsville-Bayside Mosquito Control Comm., 5140 Princess Anne Road, Virginia Beach, Va. 23452.