Rowley, W. A. 1967. Observations on larval habitats and the winter bionomics of some common species of *Culicoides* (Diptera: Ceratopogonidae). Mosq. News 27:499–505.

AN AIRFLOW APPARATUS FOR SELECTING FEMALE MOSQUITOES FOR USE IN REPELLENT AND ATTRACTION STUDIES[1,2]

K. H. POSEY AND C. E. SCHRECK

Insects Affecting Man and Animals Research Laboratory, Agricultural Research Service, USDA, Gainesville, Florida 32604

An important consideration in our studies of mosquito repellents and attractants has been to minimize handling of the test insects when selecting and transferring them to the olfactometer for bioassays. Methods commonly used for sexing, counting, and transferring mosquitoes and other test insects for experimental purposes include the use of carbon dioxide, cold rooms, chilling tables, anesthetics, and portable electric aspirators. Some of the methods and their advantages and disadvantages have been discussed by Harris et al. (1965), Gjullin and Bevill (1972), and Magnarelli (1975). These techniques usually entail excessive handling, complete incapacitation with CO_2, exposure to chemicals such as chloroform and ether, or subjection of the insect to extreme temperature changes. When mosquitoes that have been handled by these methods are then used in the bioassay of attractants and repellents, one could assume that behavior patterns might be altered and that mortality rates may increase over normal rates (Harris et al. 1965). To avoid these problems when counting and transferring female mosquitoes to the olfactometer, a mosquito-attracting airflow apparatus that encloses a mosquito stock cage was designed that incorporates the operation principles of the olfactometer described by Gouck and Schreck (1965) and Schreck et al. (1967).

METHODS AND MATERIALS

The airflow apparatus (Fig. 1A) is 51.5 cm long, 41.5 cm high, and 40.9 cm wide. Its size is determined by the size of the stock cage (37.5 × 38.5 × 46.4 cm), as shown in Figure 1B, which is placed inside. These dimensions may be adjusted to the size of the stock cage used. The airflow apparatus is constructed from 0.6-cm thick Plexiglas® panels joined with acrylic cement and pan-head screws. After airflow apparatus assembly, a 5.1-cm wide section is cut off the front end to make a door, which is attached with a piano hinge and 2 suitcase latches to secure it shut (Figure 1C). This permits access for insertion and removal of the mosquito stock cage. A 13-cm diameter porthole (Figure 1D) is cut in the center of the

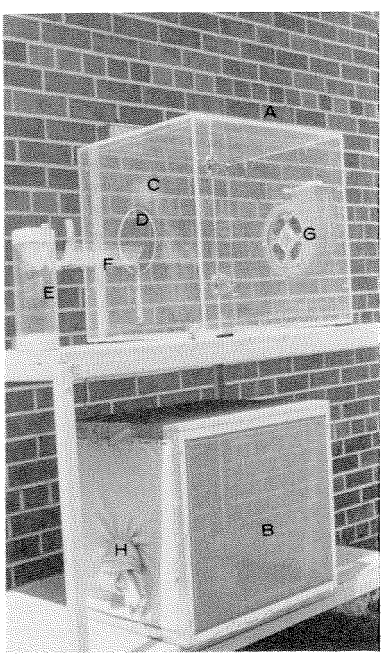

Fig. 1. Airflow apparatus (A), the stock cage (B), and the trap (E).

[1] This paper reports the results of research only. Mention of a commercial or proprietary product in this paper does not constitute an endorsement of this product by the USDA.

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door to accommodate a 20.4 cm long × 8.2 cm O.D. Plexiglas cylinder (trap) (Figure 1E), that has a removable 18-mesh aluminum screen disc in one end and a removable 18-mesh aluminum screen funnel in the rear. A 20.5 cm × 10.5 cm curved Plexiglas cradle (Figure 1F) to support the trap is bolted with an aluminum bracket to the door just under the porthole.

In the center of the back panel of the attraction chamber, a 12.8 cm diameter hole is cut, and a single-speed, shaded-pole (squirrel cage) blower (Figures 1G and 2A) is installed to pull air through the chamber. A 10.7 × 6.2 cm plastic sliding door mechanism (Figure 2B), with a 2.2 cm diameter hole is attached to the blower's exhaust to regulate air flow. An on/off switch is installed on the top of the chamber (Figure 2C) for convenience. The following is a list of materials necessary to build the described apparatus:

2 rings, 7.5 cm diameter × 2 cm, cut from aluminum pipe covered with 18-mesh aluminum screen; one flat and one funnel-shaped

1 Plexiglas tube, 20.4 cm × 8.2 O.D. (trap)

1 sheet of 0.6-cm thick Plexiglas

1 aluminum L-bracket

1 piano hinge (length determined by height of the chamber)

1 115-volt on/off switch and electrical wire

2 latches (suitcase-type)

1 Dayton shaded-pole (squirrel cage) blower, single-speed, 115-volt, 50/60 Hz, 1/100 H.P., 1530 RPM

1 World Health Organization Kit for determining the susceptibility-resistance of adult mosquitoes, plastic sliding door assembly (See WHO Tech. Rep. Ser. 443).

When selecting test specimens, a stock cage containing an unsexed population of the desired mosquito species of a known age is placed in the airflow apparatus, and the door is closed and latched. The stockinette sleeve of the stock cage (Figure 1H) is then pulled through the front porthole of the door and rolled up tightly around the screen-funnel end of the trap (Figure 3A) to prevent mosquitoes from escaping. Air can now flow relatively unimpeded through the trap into the stock cage and out of the blower.

A hand is placed at the front of the trap and the blower switched on. The odor of the hand then drifts through the trap into the stock cage. Female mosquitoes fly upwind following the attractant odor gradient to the source at the screen funnel opening. The flow rate of air through the apparatus is controlled by manipulation of the sliding door on the blower exhaust. Our studies have shown that adjusting the speed to 14 m/min (50 ft/min) or less will slow the rate of attraction to the hand-baited trap, which enables the operator to count the females as they enter the screen funnel.

When the required number of mosquitoes is collected, the air flow is stopped, the sleeve of the stock cage is removed from the end of the trap, and the trap stoppered at the funnel end to prevent mosquitoes from escaping. Mosquitoes are released into the olfactometer, cage, or other test apparatus by removing the screen funnel and gently shaking or blowing the mosquitoes from the trap.

It should be noted that animals such as birds and mammals can also be used as an alternate attractant source. A different size airflow apparatus or source of attraction may require a

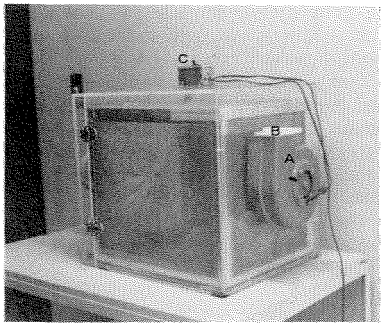

Fig. 2. Rear view of the stock cage containing mosquitoes inside the attraction apparatus.

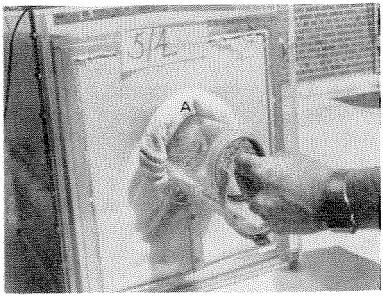

Fig. 3. Trap in position with the hand used as bait attracting female mosquitoes into the trap.

different flow rate. Air speed may also need to be varied according to the speed at which a particular operator is able to make accurate counts of mosquitoes.

The advantages of such a collection method are: (1) Mosquitoes are not handled, (2) They are not anesthetized, (3) They are not subjected to radical temperature changes, (4) They are easily transferred and no waiting period is necessary for recovery from any of the above, (5) The method is relatively inexpensive, simple, and rapid, (6) The most avid female segment of a caged population can be selected, and (7) Hosts other than humans can be used to attract mosquitoes, allowing selection of those individuals most attracted to birds, mammals, or other blood sources.

This method of selecting female mosquitoes has been used successfully with *Aedes aegypti Linnaeus*, *Ae. taeniorhynchus* (Wiedemann), *Anopheles quadrimaculatus* Say, *An. albimanus* Wiedemann, *Culex tarsalis* Coquillett, and *Cx. salinarius* Coquillett.

References Cited

Gjullin, C. M. and V. D. Bevill. 1972. Insect chilling table. J. Med. Entomol. 9:266–267.

Gouck, H. K. and C. E. Schreck. 1965. An olfactometer for use in the study of mosquito attractants. J. Econ. Entomol. 58:589–590.

Harris, Robert L., R. A. Hoffman and E. D. Frazer. 1965. Chilling vs. other methods of immobilizing flies. J. Econ. Entomol. 58:379–380.

Magnarelli, L. A. 1975. A portable battery-powered aspirator for mosquito collection. J. Med. Entomol. 12:308.

Schreck, C. E., H. K. Gouck and C. N. Smith. 1967. An improved olfactometer for use in studying mosquito attractants and repellents. J. Econ. Entomol. 60:1188–1190.

THE COLLECTION OF *HAEMAGOGUS EQUINUS* THEOBALD BREEDING IN HOUSEHOLD CONTAINERS IN TOBAGO W.I.[1]

DAVE D. CHADEE, ASHTON LE MAITRE AND NEVILLE K. CONNELL

Insect Vector Control Division, Ministry of Health,
P. O. Box 556, Port of Spain,
Trinidad, W.I.

Haemagogus equinus Theobald is a known tree hole breeding mosquito (Arnell 1973). However, during an entomological survey in Tobago, larvae and pupae of *Hg. equinus* were collected from household containers and from abandoned used tires. This is the first record of *Hg. equinus* breeding in such habitats.

Haemagogus equinus is a proven laboratory vector of yellow fever virus (Waddell and Taylor 1945, 1947; Waddell 1949; de Rodaniche, Galindo and Johnson 1957). It is distributed in the Botanic Gardens in Scarborough at Pembroke, Crown Point, Caanan, Plymouth, Mt. Irvin, Bon Accord, Speyside and at King's Bay in Tobago, W.I. (Chadee unpublished). This species serves as a potential health hazard to residents because of its distribution pattern and high incidence around highly populated areas of Tobago.

During August–November 1980, 31 larvae and pupae of *Hg. equinus* were collected from houses in Tobago. All specimens collected were sent to Insect Vector Control Division Laboratory, Trinidad, where they were identified.

The following are records of *Hg. equinus* larvae and pupae collected in and near houses in Tobago, W.I.:

Piggott Street, Scarborough, Tobago, W.I. Five, 4th instar larvae from a water barrel on August 8, 1980. Larvae of *Culex quinquefasciatus* Say and *Limatus durhamii* Theobald were also collected.

[1] Published with approval from the Ministry of Health, Trinidad and Tobago, W.I.