OPERATIONAL AND SCIENTIFIC NOTES

A PORTABLE, BATTERY-POWERED TRAP FOR COLLECTING GRAVID *CULEX* MOSQUITOES

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Numerous methods have been used to sample *Culex* mosquitoes in the study and surveillance of arboviral diseases (Service 1976, Bowen and Francy 1980). The choice of a collecting method is usually governed by the number of individuals of the relevant vector species which can be captured. For example, the standard New Jersey light trap (Mulhern 1942) and the CDC miniature light trap (Sudia and Chamberlain 1962) are widely used (with or without a carbon dioxide source) in the study of St. Louis encephalitis (SLE) in the eastern United States. However, as the majority of mosquitoes caught by these traps are nulliparous (Morris and DeFoliart 1971, Magnarelli 1975), they are unlikely to have taken a bloodmeal and therefore have not been exposed to virus (unless by transovarial transmission). Thus, despite the apparent advantage of a large catch, the probability of collecting virus-infected specimens with light traps may be relatively small.

Similar considerations apply to other methods, such as bird-baited traps and resting-site collections. The problem is compounded by wide variations in the age composition of the catches, both between sites and also at the same sites on different days (Centers for Disease Control, unpublished data). Unless the age-composition of every sample is determined, limited reliance can be placed on values given for minimum infection rates.

A convenient way to avoid these problems is to selectively capture gravid females. Several authors (de Meillon et al. 1967, Lewis et al. 1974, Surgeoner and Helson 1978) have designed traps for this purpose, but their methods have not been extensively used. Surgeoner and Helson (1978) compared their trap to light traps and Co_2-baited cone traps and concluded that it was more effective for the surveillance of virus in SLE vectors. However, the device was large and non-portable, and the frequent presence of egg rafts in the oviposition attractant indicated that many mosquitoes were not captured. The trap described below was devised to overcome these limitations.

The design of the trap is based on the observation that, prior to oviposition, *Culex* mosquitoes "examine" the oviposition site in a rapid series of brief landings at many points on the water surface. Mosquitoes are attracted to the trap (Fig. 1) by an oviposition medium contained in pan (E). The trap operates by creating an upward current of air from within the confines of the pan, so that the mosquitoes are blown into the collecting bag during their pre-oviposition behavior.

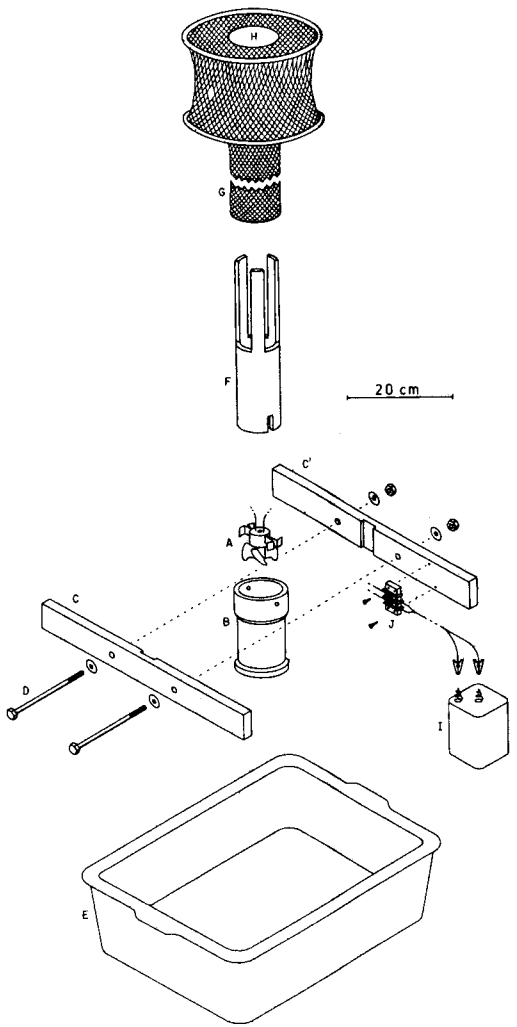

Fig. 1. Diagram of trap for collecting gravid mosquitoes (A) Motor/fan assembly; (B) Inlet tube; (C) & (C') Crossbars; (D) Machine bolts; (E) Oviposition pan; (F) Chimney; (G) Collecting bag; (H) Reinforced support for bag; (I) 6v battery; (J) Connector block.

The trap is powered by a 6-volt electric motor (A) of the type used in the standard CDC miniature light trap (Hausherr's Machine Works, Old Freehold Road, Tom's River, NJ 08753). The motor is mounted in a bracket identical to that used in the light trap except that the bulb assembly is not required. The bracket fits into the wider end of inlet tube (B), a 3-inch polyvinylchloride (PVC) Hub Adapter (a standard plumbing component). The motor drives a four-bladed fan (3-inch, counter-clockwise) with a 0.078 in (0.198 cm) center hole for mounting on the motor spindle (Thorgren Inc., Valparaiso, IN). When the motor/fan assembly is mounted as described, the fan is readily centered in the narrow portion of the inlet tube, with a clearance of about 0.04 in (0.1 cm). (An upward air flow can be produced by reversing the terminals on a standard CDC motor/fan assembly, but this eliminates the aerodynamic features of the fan blades, thereby reducing their efficiency and increasing the number of damaged specimens.)

The inlet tube is clamped between a pair of wooden crossbars (C,C') by two 6-in (15.24 cm) machine bolts (D). The crossbars (16.5 × 1.5 × 0.75 in; 42 × 5 × 2.5 cm) are long enough to span the width of the oviposition pan (E). A shallow groove (1.19 × 0.12 in; 3 × 0.32 cm) at the midpoint of the inner face of each bar enables the inlet tube to be firmly secured with minimal tightening of the machine bolts. Wires from the motor terminals pass through holes in the inlet tube to a 2-terminal connector block (J) which is attached to one of the crossbars.

A 12-in (30.5 cm) chimney (F) cut from 3-in (7.62 cm) PVC tubing fits into the upper end of the inlet tube. The top half of this chimney consists of three equally spaced struts which support the collecting bag (G) from within. A patch of denim cloth (H) serves to reinforce the bag in the area which rests on the struts and also to shield the motor during heavy rain.

The oviposition pan is a black plastic "tote box," a heavy duty tray 18.5 × 14.0 × 6.5 in (47.0 × 36.0 × 16.5 cm) available from suppliers of restaurant equipment. One gal (4 liters) of attractant is used per pan. With the upper end of the inlet tube flush with the top edge of the cross-bar, the lower end clears the water-surface by 2 in (5 cm).

The oviposition attractant is made by adding 1 lb (0.5 kg) of hay and 1 oz (5 gm) each of dried brewer's yeast and lactalbumen powder to 30 gal (114 liters) of tap water, and allowing the infusion to incubate for 5 days. (The black pans and oviposition attractant were suggested to me by J. Haeger.) New oviposition attractant is used for each trap night.

The trap is placed at the desired collecting site at least 1 hr before sunset. Captured mosquitoes are removed by aspirator early the following morning to ensure maximum survival of the insects and any virus that may be present.

In urban Memphis the new trap has proved much more effective for the collection of *Culex* mosquitoes than either light traps or resting site collections. On 13 collection nights (203 trap nights) at a variety of sites (backyards, cemeteries and industrial areas) from March through May 1983, 28,690 *Culex* mosquitoes were captured (141.3 *Culex* per trap night). By contrast, during the same period, an experienced full time operator collected 372 *Culex* mosquitoes from 80 sites in 331 resting site collections (1.1 *Culex* per collection) and 36 New Jersey light traps operating 7 nights per week (requiring another full time operator) collected 968 *Culex* mosquitoes (0.44 *Culex* per trap night).

At least 90% of the mosquitoes caught with the trap were gravid, and on most mornings at least 80% were alive and in good condition. Egg rafts were occasionally found on the attractant, particularly on windy nights, but the number rarely exceeded 2% of the number of mosquitoes in the trap.

In summary, the results indicate that the new trap will be useful in the surveillance and study of arboviral diseases. The following features are especially significant:

(1) More *Culex* mosquitoes are captured than by previously used methods. This enhances the probability of detecting virus, and provides a useful indicator of population levels.

(2) The mosquitoes are mostly gravid and therefore constitute the cohort of the population which is most likely to be infected with virus.

(3) The predominance of *Culex* species in the catch facilitates rapid identification and processing.

(4) The trap is portable, utilizes a standard attractant, and can be set wherever required.

(5) The trap is made from readily available materials and is easy to build. The cost per unit (excluding labor) is less than $30.

These features are also relevant to the study of other *Culex*-borne diseases such as Bancroftian filariasis and Japanese encephalitis. Preliminary trials also indicate that by using alternative attractants (e.g., oak leaf or alfalfa infusions) the trap can be used to collect large numbers of other vector species, such as *Aedes triseriatus* Say and *Aedes aegypti* Linn. Thus it seems likely that the trap will prove valuable in the study of a wide range of mosquito-borne diseases.

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