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TECHNIQUES FOR SUCCESSFUL COLONIZATION OF MANY MOSQUITO SPECIES[1]

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Although much has been written about the colonization of mosquitoes, most reports refer to the colonization of a single species. Trembley (1955) listed the species that have been colonized and the various techniques used. The purpose of the present paper is to report on a rather simple method of handling that has enabled us to colonize a substantial number of mosquito species at Fresno, California and Lake Charles, Louisiana laboratories without resorting to forced mating.

MATERIALS AND METHODS. Rearing procedures were much the same in the two laboratories. Adult insectaries were maintained at a temperature of about 27° C. and 70–80 percent R.H., and colonies were started from field collections of either late-instar larvae or inseminated adults. The F_1 generations were placed in 18 x 24 x 24 in. or smaller cages.

Adult mosquitoes were provided with raisins, and most species were also offered a host (a guinea pig in Lake Charles and a chicken in Fresno) several times a week. Also some species such as *Culex apicalis* Adams, *C. boharti* Brookman and Reeves, *C. peccator* Dyar and Knab, *C. reevesi* Wirth, *C. territans* Walker, and *Uranotaenia anhydor* Dyar had continuous access to toads maintained in the laboratory by forced feeding with ground meat.

Oviposition containers of many kinds, depending on the mosquito species involved, were kept in the cages. The natural light that entered the adult and larval rearing rooms in Lake Charles was supplemented with about four hours of artificial light during the fall, winter, and spring. At Fresno, about 16 hours of artificial light were provided in both rooms. The larval rearing rooms at both laboratories were maintained at about 27° C. Newly hatched larvae were reared in white enamel pans and most were aerated continuously (Fig. 1); also, the larvae were periodically provided with high protein pellets or rabbit chow (whole or pulverized). *Anopheles* larvae normally were not aerated and were generally fed pulverized food.

RESULTS AND DISCUSSION. As shown in Table 1, 25 species of mosquitoes were colonized from wild material and maintained in colonies for various periods. The first colonization of *Aedes tormentor*,

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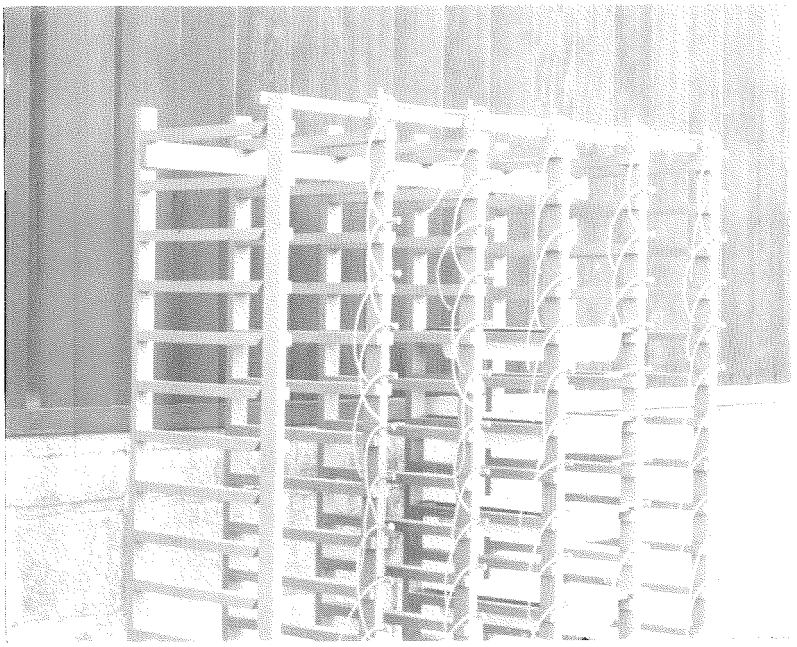

FIG. 1.—Rack and aeration system used for rearing mosquito larvae.

Culex apicalis, C. boharti, C. peccator, C. reevesi, C. territans, and *Culiseta particeps* is reported here.

Psorophora horrida (Dyar and Knab) was maintained for five generations but was eventually lost because of exessive mortality in the larval stage. Most F_1 females of *Aedes thibaulti* Dyar and Knab that were maintained in a one-cubic foot cage produced many viable eggs; however, the obligatory diapause of the eggs of this univoltine mosquito makes it an unsatisfactory colony species. Some ploys such as crowding, the addition to the cage of another mosquito that mates readily, or the use of a plant in the cage undoubtedly aided in the colonization of some species. However, attempts to colonize *Aedes nigromaculis* (Ludlow), *A. vexans* (Meigen), *A. sollicitans* (Walker) and *Psorophora confinnis* (Lynch-Arribálzaga) were unsuccessful.

Aedes tormentor and *Psorophora ferox*. *Aedes tormentor* was serendipitously colonized during the colonization of *P. ferox*. Adults of both species are kept in one-cubic-foot cages where they feed readily on a guinea pig. Their eggs hatch after 5 days, larvae begin to pupate in 6 days, and adults emerge in 2 days.

Culex peccator. *Culex peccator* are kept in a 18 x 18 x 12 in. cage, but since practically every egg raft from the F_1 generation was viable, it undoubtedly could be maintained in a much smaller cage. Mating was observed during the day. *C. peccator* feeds well on a toad or bullfrog and lays most egg rafts on moist paper toweling placed well above the water line. Also, it often deposits rafts on a damp cloth towel kept on the outside top of the cage. The very fragile egg raft is usually almost round, and the egg has no apical droplet. The raft hatches in 2 days, the pupae appear in 10 days, and the adults emerge from pupae in 2 days. *C. peccator* does not have an inordinately long preoviposition period, nor did we observe any tendency for the eggs to delay hatching.

TABLE 1.—List of mosquito species colonized in Fresno, California, and Lake Charles, Louisiana.

Species	Fresno, California			Lake Charles, Louisiana		
	Origin	Years in Colony	Status of Colony [1]	Origin	Years in Colony	Status of Colony [1]
Aedes						
(Stegomyia) aegypti (L.)	?	?	+	Fla.	3	+
(Finlaya) sierrensis (Ludlow)	Calif.	9	+	Calif.	1	+
(Ochlerotatus) taeniorhynchus (Wiedemann)	Calif.	1	—	La.	4	+
(Ochlerotatus) tormentor Dyar and Knab				La.	2	+
(Finlaya) triseriatus (Say)				La.	3	+
Anopheles						
pseudopunctipennis franciscanus McCracken	Calif.	½	—			
freeborni Aitken	Calif.	9+	+			
occidentalis Dyar and Knab	Calif.	½	—			
Culex						
(Neoculex) apicalis	Calif.	½	—			
(Neoculex) boharti	Calif.	4	—			
(Neoculex) reevesi	Calif.	½	—			
(Neoculex) territans				La.	½	+
(Culex) erythrothorax Dyar	Calif.	7	—			
(Culex) peus Speiser	Calif.	7	—			
(Culex) p. pipiens L.	Calif.	4	+			
(Culex) p. quinquefasciatus Say	Calif.	9+	+	La.	3	+
(Culex) salinarius Coquillett				La.	3	+
(Culex) tarsalis Coquillett	Calif.	9+	+	Calif.	½	+
(Culex) thriambus Dyar	Calif.	½	—			
(Melanoconion) peccator				La.	½	+
Culiseta						
(Culiseta) incidens (Thomson)	Calif.	6	—			
(Culiseta) inornata (Williston)	Calif.	7	—	La.	3	+
(Culiseta) particeps (Adams)	Calif.	½	—			
Psorophora						
(Janthinosoma) ferox (Humboldt)				La.	2	+
(Janthinosoma) varipes (Coquillett)				La.	1	+
Uranotaenia anhydor	Calif.	1	—			

[1] + indicates colony is still maintained; — indicates colony is no longer maintained.

Hair (1968) observed these traits in his colony of *Culex (Melanoconion) cedecei* Stone and Hair, and suggested that they might occur in all species of *Melanoconion*.

Culex territans. Adult *Culex territans* maintained in a 18 x 24 x 24 in. cage feed well on a toad or bullfrog. When the oviposition site is a square plastic container lined with paper toweling and half filled with water, about half the egg rafts are laid on the water surface, and the remainder are laid on the moist toweling. The egg raft is not boat-shaped but is usually rectangular with blunt ends; the eggs have apical droplets. Rafts hatch in 2 days, larvae begin to pupate in 8 days, and the pupal stage terminates in 2 days. Viability of the egg rafts appeared to improve when a plant was placed in the cage.

Culex salinarius. *Culex salinarius* was colonized in a 18 x 24 x 24 in. cage but is now being maintained in a one-cubic-foot cage. Egg rafts are always laid on water and hatch in 2 days. Larvae begin to pupate in 7 days, and the pupal stage lasts 2 days. The larval cycle can be greatly lengthened by lack of aeration, paucity of proper food, or crowding. Recently, Wallis and Whitman (1968) reported a minimum larval cycle of 2 weeks and found that the majority of the larvae pupated in 3 weeks.

Psorophora varipes. The only previous colonization of *Psorophora varipes* was recently reported by Aboualy and Horsfall (1968). Our adults are maintained in a

one-cubic-foot cage, and the females feed avidly on guinea pigs. The eggs hatch after 5 days, larvae begin to pupate in 5 days, and adults emerge in 2 days. Since adult females escape through the normal screen used in cages (18 x 16 mesh), it is very important to use a much smaller mesh screen. Pupae are unusual because they turn very black shortly after pupation.

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CAGED INSECT KILLS OF UP TO TWO MILES UTILIZING A NEW LOW-VOLUME AEROSOL GENERATOR[1]

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INTRODUCTION

The method of dispensing high volume low concentrate insecticides which has been the general practice for many years has been to a large extent very limited in its effectiveness. This is because the relatively large size droplets produced would remain air borne for short distances and thus result in a few hundred feet of effective control. Additionally, the equipment generally was heavy, bulky and required large insecticide reservoirs. In some cases, the weight of the dispersal apparatus plus the insecticide amounted to several thousand pounds and could only be transported by special vehicles on well established roads. Permanent mounting of the equipment often limited the transport vehicle for that use only. The new concept in insect control today is the technique involving ultra low volume dispersal of high concentrate insecticides, thereby avoiding the necessity of using heavy, bulky equipment with a large insecticide reservoir.

The need for a compact, light weight apparatus which could be handled by two men and operated from a jeep over rough terrain in combat zones was a prime factor which prompted the development of the ultra low volume aerosol generator.

Several new techniques and procedures in determining droplet size and distribution have been reported recently by other researchers. One such method is the fluorescent particle (FP) spray tracer technique which gives a quantitative measure of spray deposition by suspending a known number of FP's in a known volume of insecticide (Vaughan *et al.,* 1965;

[1] The opinions and assertions contained herein are those of the authors and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

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