tubing. The No. 5 stopper fits into the hole bored in the plastic disc. One No. 6 stopper is attached back-to-back to the No. 5 stopper by the short piece of glass tubing. This No. 6 stopper then fits into the plastic tube. A piece of mosquito netting is stretched across the stopper at this juncture to prevent mosquitoes from passing into the fan. The remaining No. 6 stopper, into which the longer glass tube is inserted, is fitted into the other end of the plastic tube.

Short leads from the terminals of the motor are fastened to brass connectors on the edge of the fan housing for convenient attachment of wires from the battery.

As many as 100 mosquitoes may be collected at one time before it is necessary to discharge them into another container. The collecting assembly can be disconnected quickly from the fan unit and, by blowing gently, the mosquitoes may be discharged into a small cage.

The described aspirator and light trap were used to make collections during the summer with encouraging results. The mechanical aspirator has proved to be superior to the mouth type in that it is less fatiguing to the collector and has greatly increased the number of mosquitoes taken in a given time in biting or resting collections.

The main disadvantage of the trap over the standard New Jersey type is its limited range of mosquito attraction because of its weak light. Most efficient use is made of its light, however, if the trap is placed in wooded areas where lights cannot carry far regardless of intensity and the mosquito populations are more apt to be high. The composition and density of the collections appear to be fairly consistent for a particular area, indicating that the samples obtained may give a reliable index of the light-attracted mosquito population.

For use in primitive areas it is believed that the advantages of the miniature trap outweigh its disadvantages. Its light weight, freedom from dependence upon a power line supply of current, and relatively low cost of operation in view of its portability, make it useful for special operations.

TEMPORARY CONTROL OF ADULT MOSQUITOES AT OUTDOOR PLACES OF PUBLIC ASSEMBLY[1]

W. C. BAKER AND H. F. SCHOOF

During 1953, preliminary studies were conducted at a drive-in theatre in Savannah, Georgia, to determine effective means of achieving temporary nighttime control of several species of pest mosquitoes. Emphasis was placed on the species of mosquitoes present, the relationship of mosquito activity to the efficacy of treatment, and the evaluation of several insecticidal formulations.

The test area was a drive-in theatre (6 acres) located in a lowland surrounded by wooded areas. A nearby field of approximately the same size was used as an untreated check zone.

Treatment of the drive-in theatre area was accomplished by means of a portable jet propulsion fogging unit fitted with a small aperture nozzle. Maximum delivery obtained with this nozzle was 0.135 gallon (512 ml.) of insecticide per minute. At a distance of 20 feet, 51 per cent of the insecticidal particles were in the range of 1 to 19 microns in diameter, 35 per cent

[1] From the Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare, Savannah, Georgia.

in the range of 20 to 39 microns. All treatments were scheduled to begin 15 minutes after infiltration of the mosquitoes had begun. The general procedure was to apply a barrier strip of fog around the perimeter of the field followed by applications in the roadways between the parked vehicles. Some variations were made to utilize wind directions. As a practical measure, most of the treatments were made by employees of the theatre. Complete coverage of the area required 10 to 15 minutes and approximately 1.1 gallons of insecticide.

Each formulation consisted of the toxicant in a solution of No. 2 fuel oil and kerosene (1:1). The formulations tested were 5 per cent and 2.5 per cent DDT; 2 per cent and 1 per cent chlordane; and 0.25 per cent pyrethrins with 2.0 per cent piperonyl butoxide. In addition, a fuel oil-kerosene solution less toxicant was tested. Two to five replicates were conducted with each formulation.

Evaluation of the tests was based upon mosquito landing rates taken at four stations within the treated zone and at four stations in the untreated area. At each station the total number of mosquitoes that alighted on the inspectors' pants within a 3-minute time interval was noted. This total number of mosquitoes represented six separate counts, the resting mosquitoes being disturbed after each count. Observations included a pretreatment count and posttreatment measurements at 30 and at 75 to 90 minutes after the chemical application. Only those tests in which pretreatment landing rates averaged 50 or more mosquitoes are included in the analysis. Additional information on population estimates and composition was obtained from collections at three light trap stations in the theatre area and one in the untreated zone and from biting records taken at 15-minute intervals between 7:30 and 10:00 p.m. in the untreated zone.

RESULTS. As indicated by trap data and hand collections, *Aedes sollicitans* and *Aedes taeniorhynchus* were the principal pest species present in the area during the time of the study. In the 15-minute hand collections *A. sollicitans* was captured three times as frequently as *A. taeniorhynchus* but this proportion was reversed in the light trap collections. In general these two species constituted 96 per cent of the total mosquitoes taken. However, prior and subsequent to the experimental period of July through September, *A. vexans* was numerous and at times the predominant species in the light trap collections.

Initial observations suggested that the major infiltration of mosquitoes into the theatre area occurred over a definite time interval. Subsequent observations and landing rate counts showed that during the summer period this infiltration occurred at dusk, approximately 20 to 30 minutes after sunset. However, on cloudy nights and in the autumn when the temperatures ranged between 68° and 73° F. in the early evening (6:00 p.m.), the influx took place earlier than at dusk.

The maximum level of mosquito activity in an evening occurred during the 20 to 30 minute period following the initial infiltration. Landing rate counts made in the untreated area at 45 minutes and at 90 minutes after infiltration had begun, showed an average decline of 63 per cent in the level of activity as compared to that present at dusk (Table 1).

TABLE 1.—Average landing rates on six nights based on six counts each at four stations in an untreated area beginning at the time of mosquito infiltration and at 45- and 90-minute intervals after infiltration, July 13 to August 5, 1953

Starting Time	Initial average	45-minute average	90-minute average
8:00	92.7	17.7	15.7
7:55	53.0	21.0	18.2
7:55	54.5	36.0	37.0
7:55	134.5	77.0	60.5
7:50	119.5	25.2	29.0
7:45	164.5	50.2	60.5
Mean percentage reduction	....	63	64

On cool autumn evenings, high levels

of mosquito activity occurred during the period of infiltration, but 30 and 60 minutes later the counts dropped to less than 8 per cent of the infiltration count, presumably the result of the drop in temperature.

All formulations tested gave satisfactory control of mosquitoes in the drive-in theatre area (Table 2). The pyrethrum produced slightly better control than either the chlordane or DDT formulations. There was no marked difference between the reductions obtained with chlordane or DDT at the two dosages employed for each insecticide.

Treatment of the area 20 minutes prior to the time of infiltration did not give effective abatement.

As a measure of the toxic value of the solvent against the mosquitoes, fuel oil alone or mixed with kerosene was used in several tests. While a considerable reduction in mosquito density was apparent from the use of either formulation, neither provided effective relief from mosquito annoyance.

DISCUSSION. The marked success achieved with the DDT and chlordane formulations is due in part to the absence of resistance to insecticides in the mosquito population of the Savannah, Georgia, area. Until definite losses in susceptibility occur, the present technique offers an effective and economical method of providing temporary relief from mosquito annoyance to human populations congregating for short periods at night.

Under the conditions of these outdoor experiments, the portable fogging unit proved to be an effective means of dispersing the insecticide. The ready portability of the unit allowed usage on rough terrain and provided good maneuverability.

TABLE 2.—The effect of various insecticidal fogs on adult mosquito populations at a drive-in theatre, Savannah, Georgia, 1953

Formulation	No. of tests	Average landing rates		
		Pretreatment	Posttreatment	
			30 min.	75 min.
Pyrethrins, 0.25 per cent and piperonyl butoxide, 2.00 per cent	4	195.9	0.0	0.4
Chlordane, 2.0 per cent	2	213.7	1.6	2.5
Chlordane, 1.0 per cent	4	107.3	0.6	0.7
DDT, 5.0 per cent	4	59.5	1.3	0.3
DDT, 2.5 per cent	5	126.4	2.5	3.0
Fuel oil, No. 2	2	73.5	7.5	4.0
Fuel oil, No. 2½; kerosene ½	2	106.2	14.0	...

SUMMARY. Single fog applications of 1:1 fuel oil-kerosene solutions containing (a) 2.5 or 5 per cent DDT, (b) 1 or 2 per cent chlordane, or (c) 0.25 per cent pyrethrins plus 2.0 per cent piperonyl butoxide, to a drive-in theatre area near Savannah, Georgia, provided effective relief from annoyance by *Aedes sollicitans* and *Aedes taeniorhynchus* for an entire evening. Infiltration of the mosquitoes into the area occurred at dusk in the summer period. Application of the fog during or after the infiltration of the mosquitoes into the area was a prerequisite for effective abatement. The maximum period of mosquito activity was during the 20 to 30 minute interval following infiltration. A portable jet propulsion fogging unit provided effective dispersal of the insecticide.