

FIELD TESTING OF INSECTICIDAL AEROSOL AGAINST TWO SPECIES OF *CULEX* MOSQUITOES ON OKINAWA¹

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Malathion was used as an adulticidal fog and for larviciding against mosquitoes on the island of Okinawa from 1959 through 1964. In field tests by Gahan *et al.* (1965) conducted in the summer of 1963 and by Lofgren *et al.* in the summer of 1964, it was shown that satisfactory control of *Culex tritaeniorhynchus* (Giles) adults could not be obtained with malathion fog when applied at the rate of 6 or 12 ounces of active material per gallon. Beginning in the spring of 1965, malathion was replaced with fenthion as a fog material. Malathion continued to be used for larviciding.

Field tests were conducted during September and October 1965 to evaluate three insecticides against *Culex tritaeniorhynchus* (Giles) and *Culex quinquefasciatus* (Say). These tests were part of the continuing program to evaluate insecticides used in routine control operations on Okinawa and other materials which have shown promise as possible substitutes in case of resistance in routinely used materials.

These tests complemented previous tests conducted on Okinawa under a cooperative program between military entomologists and personnel of the Insects Affecting Man and Animals Branch, Entomology Research Division, U. S. Department of Agriculture.

The studies presented in this report were similar to those conducted by Gahan *et al.* (1965) except that a non-thermal aerosol generator was used instead of a thermal generator. The insecticides used in these studies were Sumithion (*O,O*-dimethyl *O*-4-nitro-*m*-tolyl phosphorothioate), fenthion, and malathion.

METHODS. The area selected for the test was a level area with close-cut grass and no wind obstruction located at the end of an Army airfield adjacent to the China Sea. The tests were conducted in the evening from soon after sundown to two hours after sundown. The wind velocity varied from 2 to 9 miles per hour but was most often between 4 and 7 miles per hour blowing from inland toward the sea.

Mosquitoes for the test were collected as larvae and pupae in the field and were allowed to emerge in wire screen cages in the laboratory. The adults were provided 10 percent sugar water and held for at least three days before being used in the test. Adults over 12 days of age were discarded. Twenty-five female mosquitoes were aspirated from emergence cages and placed in cylindrical exposure cages the afternoon prior to the test. The exposure cages were made of 16 mesh wire screen and were 3 inches in diameter and 8 inches long.

The test plot consisted of a 300-foot line marked by flag stakes placed perpendicular to the direction of the wind. These stakes served to mark the route to be transversed by the aerosol generator. Stands 6 feet high with a 2-foot cross arm were used to hold the exposure cages in the field. These stands were arranged in two rows 100 feet apart. The rows ran perpendicular to and down wind from the route of the generator. Each row

¹ Mention of a proprietary product does not necessarily imply endorsement of this product by the U. S. Army.

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consisted of three stands placed at intervals of 100, 200, and 300 feet from the route to be traveled by the generator. Just before a test, mosquitoes of each species were placed on each stand in both rows. In some tests only one species was used. The aerosol generator was then driven along the predesignated route and the fog allowed to drift past all of the cages. Wind direction and velocity were checked prior to and during each test.

After the fog had cleared the area, the exposed cages were removed and replaced with untreated cages in preparation for the next test. When half of the tests scheduled for one evening had been completed (approximately one hour after starting), the exposed cages were transported to the laboratory (a distance of one mile) and transferred to clean holding containers. The remaining cages exposed during the last half of the evening were transferred after completion of the evening's testing. The exposed mosquitoes were held in 6 oz. hot drink cups covered with organza

cloth held in place with a rubber band. A cotton ball saturated in 10 percent sugar water was placed on top of each cup to provide nourishment and moisture. Post treatment mortality counts were made the following morning 14 to 15 hours after exposure.

The aerosol was produced by a non-thermal generator developed by the U. S. Army Engineer Research and Development laboratories. The generator was calibrated to deliver 40 gallons of material per hour and was operated at a speed of 5 miles per hour. All formulations were water emulsions prepared from commercial emulsion concentrations.

RESULTS. A summary of the results is presented in Table 1. The results show that Sumithion was more effective against *Culex tritaeniorhynchus* than fenthion. Sumithion produced an average mortality of 93.5 percent and 99.6 percent at concentrations of 1 and 2 oz of active material per gallon respectively, as compared to 89.2 percent and 98.6 percent mortality

TABLE 1.—Summary of results of insecticidal fogging tests, Okinawa, 1965.

| Insecticide | oz./gal. | Percent mortality at distance indicated | | | | No. of reps. |
|--------------------------------|----------|-----------------------------------------|---------|---------|------|--------------|
| | | 100 ft. | 200 ft. | 300 ft. | avg. | |
| <i>Culex tritaeniorhynchus</i> | | | | | | |
| Sumithion | 1 | 95.0 | 96.8 | 88.7 | 93.5 | 9 |
| | 2 | 100 | 100 | 98.9 | 99.6 | 9 |
| | 3 | 100 | 100 | 99.5 | 99.8 | 9 |
| | 4 | 100 | 100 | 100 | 100 | 3 |
| Fenthion | 1 | 89.6 | 94.3 | 83.8 | 89.2 | 11 |
| | 2 | 100 | 100 | 96.0 | 98.6 | 2 |
| | 3 | 100 | 100 | 100 | 100 | 9 |
| | 4 | 100 | 100 | 100 | 100 | 3 |
| Malathion | 6 | 31.7 | 37.2 | 13.4 | 27.4 | 8 |
| | 12 | 51.6 | 47.4 | 29.6 | 42.9 | 12 |
| <i>Culex quinquefasciatus</i> | | | | | | |
| Sumithion | 1 | 98.3 | 98.0 | 99.4 | 98.6 | 9 |
| | 2 | 100 | 100 | 100 | 100 | 5 |
| | 3 | 100 | 100 | 100 | 100 | 6 |
| | 4 | 100 | 100 | 100 | 100 | 2 |
| Fenthion | 1 | 99.7 | 98.6 | 96.8 | 98.4 | 11 |
| | 2 | 100 | 100 | 100 | 100 | 8 |
| | 3 | 100 | 100 | 100 | 100 | 10 |
| | 4 | 100 | 100 | 100 | 100 | 2 |
| Malathion | 6 | 94.5 | 98.3 | 73.8 | 88.8 | 8 |
| | 12 | 99.4 | 98.3 | 95.5 | 97.7 | 8 |

with fenthion at the same concentrations. There was no significant difference in the effectiveness of Sumithion and fenthion against *Culex quinquefasciatus*. Both gave 98 percent and 100 percent mortalities at 1 and 2 oz./gal. respectively. Malathion was very ineffective against *Culex tritaeniorhynchus*, producing an average mortality of only 42.9 percent when applied at 12 oz./gal. (approximately 9 percent). Malathion was much more effective against *Culex quinquefasciatus*, giv-

ing average kills of 88.8 percent and 97.7 percent at 6 and 12 oz./gal. respectively. However, it failed to approach Sumithion or fenthion in effectiveness.

References

GAHAN, JAMES B., WILLIAM W. YOUNG, NEIL E. PENNINGTON, and G. C. LABRECQUE, 1965. Thermal aerosol and larvicide tests with new insecticides to control two species of *Culex* mosquitoes on Okinawa. *Mosquito News* 25(2): 165-69.