

## SUSCEPTIBILITY LEVELS OF SOME *Aedes aegypti* (Linn.) LARVAE TO DDT AND DIELDRIN

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There is always need to study periodically the results of measures used for mosquito control. The authors thought it advisable, therefore, to establish a base line of the susceptibility of *Aedes aegypti* (Linn.) larvae to the insecticides at present used by various control groups, one of which is the *A. aegypti* detection and control program conducted by the Public Health Service Quarantine Stations in international traffic areas.

During 1959 tests were made by personnel of the New Orleans, Louisiana, and Miami Beach, Florida, Quarantine Stations to determine the susceptibility levels of *aegypti* larvae to DDT. Additional tests at New Orleans were made to study the susceptibility levels of dieldrin. World Health Organization larval test kits were used in these studies.

Confirmed resistance to DDT in *aegypti* has been reported in several parts of South America and the Caribbean area; these include Haiti, Venezuela, Colombia, Dominican Republic, and Trinidad. Schoof (1959) reported that a Trinidad strain had an LD<sub>50</sub> of 4.00 p.p.m. of DDT. Gilkes and others (1956) found that a colony of *aegypti* established from a local Trinidad area had only a 66.5 percent mortality of larvae in 10.00 p.p.m. of a DDT emulsion. These local *aegypti* had been exposed to DDT for about 9 years. No resistance to DDT has been reported for *aegypti* in the United States.

No reports to date have been found of *aegypti* resistance to dieldrin.

The Communicable Disease Center was reported to have used DDT for the con-

trol of *aegypti* larvae in New Orleans during 1945-46. This material has been used by the City Health Department as a general larvicide and adulticide from 1949 to date. Some of these applications were made by helicopter in 1951 (Gardner and Winklmeir, 1960). The PHS Quarantine Station in New Orleans has used DDT as an *aegypti* larvicide in its control program in international dock and airport areas since 1958.

DDT has been used generally as an adulticide and larvicide in Miami, Florida, and the surrounding metropolitan area since 1946 (Stutz, 1960). During this time it is doubtful if over half of the city has been regularly exposed (i.e. during pest mosquito outbreaks) to aerial distribution of DDT. Larviciding with emulsifiable DDT for the control of *aegypti* is an established adjunct to the Mosquito Division, Dade County, Florida; this material is also used by the PHS Quarantine Station in Miami Beach.

Dieldrin apparently has not been used in mosquito control work in New Orleans or Miami (Gardner and Winklmeir, 1960; Stutz, 1960).

**METHODS AND MATERIALS.** The World Health Organization larval resistance kit was used according to its recommendations (WHO, 1958; WHO, 1959). A total of 16 replicates with 10 to 15 larvae for each concentration was used with DDT and dieldrin for *aegypti* larvae from New Orleans. A total of 46 replicates with 10 to 25 larvae for each concentration was used with DDT for *aegypti* from Miami. Water temperatures ranged within the acceptable limits of 20° to 30° C. Tests with controls having over a 20 percent mortality or a 10 percent pupation were discarded. Where the control mortality was between 5 and 20 percent, the percentage mortalities were corrected by Abbott's formula:

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$$\frac{\% \text{ test mortality} - \% \text{ control mortality}}{100 - \% \text{ control mortality}} \times 100$$

The *aegypti* larvae in New Orleans were collected from fire barrels in a cotton warehouse in the international dock area. The first eight replicates using DDT were from field-collected larvae; the last eight replicates came from a colony established from the field collections since enough larvae in the field were not available to complete the tests. All of the larvae for the dieldrin tests came from this colony.

The use of a colony should usually be avoided where possible due to unknown factors in selectivity. The use of the colony in this study through about ten generations is believed not to have appreciably affected the results since there was little change in susceptibility during the tests. The LD-50 from the first four DDT replicates and the last four had a difference of .003 p.p.m. The fifth through about the tenth generation of the *aegypti* colony was used to complete the 16 dieldrin replicates. The LD-50 from the first and

last four replicates had a difference of only .0009 p.p.m.

The *aegypti* larvae in Miami were field-collected from the Miami River waterfront area for the first ten replicates. Larvae from the same general area were reared in the laboratory for one generation for each of the last 36 replicates.

The percent mortalities recorded in the tables were used on a probit log chart for determining the LD-50 (Swaroop and Uemura, 1956).

RESULTS. In Tables 1 and 2 the results of the resistance tests on *aegypti* from New Orleans and Miami using DDT and dieldrin are summarized. The WHO indicates that from the small amount of data available at present, where the LD-50 for DDT exceeds .1 p.p.m. for *Aedes* larvae, resistance should be suspected (WHO, 1959).

The New Orleans *aegypti* had an LD-50 of 0.013 p.p.m. for DDT, and an LD-50 of 0.002 p.p.m. for dieldrin from the data recorded on Table 1. From the percent

TABLE 1.—Susceptibility levels of *Aedes aegypti* larvae from New Orleans, Louisiana, to DDT and dieldrin after 24 hours

Concentration of insecticide in test suspensions	Total no. of larvae used		Total no. of dead and moribund larvae		Percent mortality	
	DDT	Dieldrin	DDT	Dieldrin	DDT	Dieldrin
.0008 p.p.m.	—	213	—	29	—	14
.0024 p.p.m.	—	176	—	101	—	57
.004 p.p.m.	172	210	51	178	25	85
.02 p.p.m.	166	212	92	210	52	99
.1 p.p.m.	175	—	169	—	95	—
.5 p.p.m.	182	—	182	—	100	—
Control	168	210	10	7	5.9	3

TABLE 2.—Susceptibility levels of *Aedes aegypti* larvae from Miami Beach, Florida, to DDT after 24 hours

Concentration of insecticide in test suspensions	Total no. of larvae used	Total no. of dead and moribund larvae	Percent mortality
.004 p.p.m.	1005	27	3
.02 p.p.m.	1003	101	10
.1 p.p.m.	1003	620	62
.5 p.p.m.	1009	941	93
Control	1004	9	0.9

mortalities recorded on Table 2 for Miami Beach *aegypti*, an LD-50 of 0.07 p.p.m. was found for DDT.

On the basis of these studies, the New Orleans *aegypti* larvae were highly susceptible to DDT and to dieldrin. No resistance to these chemicals is indicated.

The Miami *aegypti* appear to have a very low susceptibility to DDT. It took more than five times as much insecticide in Miami to get an LD-50, as it did in New Orleans. Even with .5 p.p.m. of DDT only 93 percent of the population was killed. This suggests that 7 percent of the population may be resistant to this concentration of DDT. While the Miami *aegypti* are not declared resistant to DDT, there is some evidence that resistance may be developing.

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