TESTS OF THE SUSCEPTIBILITY OF FLORIDA MOSQUITOES TO INSECTICIDES, 1967

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Although the more important pest mosquitoes in Florida over the years have been salt-marsh *Aedes* and *Psorophora,* the encephalitis epidemic of 1962 in the Tampa Bay area implicated *Culex nigripalpus* as another species of statewide importance (Chamberlain *et al.,* 1964). *Culex quinquefasciatus,* first incriminated in St. Louis in the 1930's, was also the vector in the recent encephalitis outbreaks in Houston and Dallas, Texas, during 1964 and 1966. These events, together with the recent research on arboviruses, have demonstrated an increased importance of these and many other mosquito species in Florida.

The value of obtaining reliable information on the current status of the effectiveness of various insecticides and that of determining the initial susceptibility or baseline of different mosquito species to certain insecticides is well recognized. The surveillance of mosquitoes in Florida to detect possible development of resistance was initiated in 1963 (Rogers and Rathburn, 1964). A recent study (Rathburn and Boike, 1967) demonstrated resistance of *Aedes taeniorhynchus* to malathion in certain areas of the state and also determined the level of susceptibility for several species of mosquitoes from many areas to several insecticides. This report deals with the further surveillance of Florida mosquitoes for areas of possible resistance and includes original baseline data for many additional species within the state.

METHODS. In general, methods of collecting and handling mosquitoes and testing procedures were as described by Rathburn and Boike (1967). Mosquitoes were collected in Bay County in western Florida; Marion, Polk, and Orange counties in central Florida; Levy and Duval counties

in north central Florida; Volusia and Indian River counties on the east coast; and Lee County on the west coast. Adults were collected by means of CDC portable light traps supplemented with dry ice or chicks and chick-baited lard can traps. They were transported to the laboratory in styrofoam ice chests. Upon arrival at the laboratory, the mosquitoes were placed in 12- by 9- by 8-inch screened cages, supplied with a sugar solution and blood-fed on anesthetized chicks.

With minor modifications, larval tests were conducted according to procedures outlined by the World Health Organization (World Health Organization, 1960). Glass beakers of 600 ml. capacity were used as test vessels; however, during the latter part of the period 400 ml. polypropylene beakers were used. These were compared with glass beakers for any difference between test vessels. Comparative tests were performed between the two types of beakers using malathion and naled

TABLE 1.—Susceptibility of seven species of mosquitoes from various areas of Florida to malathion, 1966–67.

		Lethal concentrations in ppm					
		1966			1967		
County	Area	LC_{50}	LC_{90}	Reps.	LC_{50}	LC_{90}	Reps.
Aedes taeniorhynchus (Wied.)							
Lab. Colony		.025	.050	14	.030	.047	12
Bay	State Park	....	....	..	.028	.047	20
Levy	Cedar Key	....	....	..	.024	.054	14
Duval	Marsh area	....	....	..	.032	.049	16
Lee	Ft. Myers	....	....	..	.260	.700	2
	Sanibel Is.	.220	2.600	8	.086	.280	4
Aedes aegypti (L.)							
Lab. Colony—Savannah strain		....	....	..	.110	.172	16
Lab. Colony—Panama City strain		....	....	..	.120	.196	16
Aedes canadensis (Theo.)							
Bay	High Point	....	....	..	.020	.077	3[a]
Culex nigripalpus Theob.							
Lab. Colony		.045	.074	18	.030	.045	24
Bay	State Park	.038	.070	13	.041	.059	16
	Woodlawn Area	....	....	..	.029	.040	8
	Southport	....	....	..	.037	.052	12
Marion	Orange Springs	.034	.044	21	.022	.033	20
Polk	Bartow	.082	.110	3	....	....	..
	Lake Alfred	....	....	..	.049	.061	6
Lee	Ft. Myers	.054	.084	5	.048	.070	16
	Sanibel Is.	.050	.082	6	.043	.058	4
Volusia	New Smyrna Bch.	.044	.066	16	....	....	..
	Daytona Bch.	....	....	..	.034	.043	2
Indian River	Vero Beach	....	....	..	.033	.052	18
Orange	Orlando	....	....	..	.036	.066	26
Culex salinarius Coq.							
Bay	State Park	....	....	..	.045	.063	12
	Magnolia Bch.	....	....	..	.048	.067	4
	West Fla. Res. Lab.	....	....	..	.045	.061	4
Polk	Lake Alfred	....	....	..	.049	.061	6
Volusia	Daytona Bch.	....	....	..	.043	.060	4
Culex quinquefasciatus Say							
Lab. Colony		....	....	..	.046	.069	12
Culex restuans Theob.							
Bay	High Point	....	....	..	.036	.047	2

[a] Field collected larvae.

against four species of mosquito larvae. No significant difference was detected. Sixteen replications, each consisting of five insecticide dosages plus a check were planned for each species tested. However, owing to variations in the number of larvae available for testing, fewer replications were performed in some instances. The control mortality for all tests averaged less than one percent.

RESULTS. The results of tests with malathion are shown in Table 1. These tests indicate an increase in susceptibility in *Aedes taeniorhynchus* on Sanibel Island in 1967 as compared to 1966. The *Aedes taeniorhynchus* from Fort Myers tested in 1967 exhibit a reduction in susceptibility when compared to tests conducted in 1965 (Rathburn and Boike, *loc. cit.*). All other species tested from comparable areas within the state in 1967 show little change in susceptibility when compared to test results of 1966. After three years of laboratory colonization, *Aedes taeniorhynchus* has shown practically no change in its susceptibility to malathion; the LC_{50} in micrograms per milliliter for 1965, 1966, and 1967 being 0.029, 0.025 and 0.030 respectively. After two years of laboratory colonization, *Culex nigripalpus* likewise has shown little change. The data for *Culex nigripalpus* tested during 1967 from Fort Myers represent an average of adults taken from three areas in Fort Myers. The *Aedes aegypti* colony (Savannah strain) was begun from eggs received from the Public Health Service Laboratory in Savannah, Georgia, while the Panama City strain was established from larvae collected within the city.

Shown in Table 2 are the results of tests with naled. Although only limited comparable data have been obtained from areas within the state, there appears to be no resistance by any species to naled. A possible exception may be the *Aedes taeniorhynchus* from Mayport Naval Air Station in Duval County, where the LC_{50} appears somewhat high in relation to the laboratory colony. Further testing on mos-

TABLE 2.—Susceptibility of five species of mosquitoes from various areas of Florida to naled, 1966–67.

		Lethal concentrations in ppm					
		1966			1967		
County	Area	LC_{50}	LC_{90}	Reps.	LC_{50}	LC_{90}	Reps.
Aedes taeniorhynchus (Wied.)							
Lab. Colony		.103	.185	20	.087	.124	18
Bay	State Park	....	....	..	.107	.145	20
Levy	Cedar Key	....	....	..	.087	.110	4
Duval	Marsh Area	....	....	..	.130	.180	4
	Mayport N.A.S.	....	....	..	.196	....[a]	4
Aedes aegypti (L.)							
Lab. Colony—Savannah strain		....	....	..	.210	.365	28
Lab. Colony—Panama City strain		....	....	..	.162	.240	20
Culex nigripalpus Theob.							
Lab. Colony		.051	.067	12	.074	.091	12
Bay	Southport	....	....	..	.070	.096	12
Lee	Ft. Myers	....	....	..	.076..	.095	12
Indian River	Vero Beach	....	....	..	.067	.080	12
Culex salinarius Coq.							
Bay	State Park	.060	.082	4	.074	.092	20
	Magnolia Bch.	....	....	..	.078	.092	3
	West Fla. Res. Lab.	....	....	..	.082	.097	8
Polk	Lake Alfred	....	....	..	.086	.120	2
Culex quinquefasciatus Say							
Lab. Colony		....	....	..	.084	.111	8

[a] Insufficient data to accurately determine LC_{90}.

quitoes from this area is planned. Comparable tests of laboratory colonies of *Aedes taeniorhynchus* and *Culex nigripalpus* for 1966 and 1967 reveal little change in susceptibility to naled. The colony *Culex nigripalpus* used in these tests originated from a wild population at Vero Beach. The data in Table 2 show that, although colonized for over two years, there is no difference in the susceptibility to naled between the original population (Vero Beach) and the laboratory colony.

DISCUSSION. Although it did not encompass the entire state, these data and the comparable data obtained in 1965 and 1966 form a reasonable picture of the susceptibility of these species to insecticides. Except for the increase in susceptibility to malathion of the *Aedes taeniorhynchus* from Sanibel Island and the somewhat high LC_{50} of naled obtained with the *Aedes taeniorhynchus* from Mayport Naval Air Station, there was little variation between areas in the susceptibility to either malathion or naled.

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