chief vector of dengue fever. *Aedes aegypti* breeds principally in artificial containers near human habitations. It is included in the key because of its role in the transmission of dengue and its ability to transmit yellow fever, the introduction of which is a serious and constant threat to the entire Orient.

TESTS WITH GRANULATED BHC AND DIELDRIN FOR CONTROLLING SAND FLY LARVAE

G. C. LABRECQUE, *U.S.D.A., Agr. Res. Adm., Bureau of Entomology and Plant Quarantine,* AND R. L. GOULDING, *Co-Operative Sand Fly Research Unit* [1, 2]

The salt-marsh sand fly, *Culicoides furens* (Poey), breeds abundantly in the densely foliated tidal marshes bordering the Florida Intracoastal Waterway, and often causes severe annoyance to the inhabitants of the adjacent areas. Since preliminary tests with bentonite granules impregnated with an insecticide showed great promise against *furens* larvae, tests were conducted on a practical scale to evaluate the method further.

Recent studies have shown that applications of certain insecticides to marsh breeding areas provide effective control of sand fly larvae for several months (Goulding *et al.* 1953). Treatments may be made with ground equipment, but this is time-consuming and extremely costly where it is necessary to cut extensive access trails through dense mangrove. Treatments may also be applied as aerial sprays, but so much material is lost by impingement on the vegetation, principally red and white mangrove, that excessive amounts must be applied to insure the proper amount reaching the ground. Since similar problems of penetrating vegetation for the control of mosquito larvae in rice fields and salt marshes had been overcome by applying granulated insecticides (Whitehead 1951, Keller *et al.* 1953), it was thought that this method might also be suitable in sand fly control.

On January 16, 1952, 325 acres of marshland infested with sand fly larvae north of Fort Lauderdale, Fla., were treated by airplane with bentonite granules (16/30 mesh) impregnated with BHC (36 percent gamma isomer). The average rate of application was 2 pounds of the gamma isomer per acre. Comparative treatments were made a month later with an oil spray containing sufficient BHC to give 0.5 pound of the gamma isomer per gallon, which was applied to a 24-acre plot at the rate of 4 gallons per acre. An 8-acre plot was treated with 5 percent of dieldrin on bentonite granules at the rate of 1.25 pounds of dieldrin per acre. An isolated, untreated 80-acre plot was utilized as a check.

The granulated BHC was prepared in a cement mixer by spraying melted BHC on the bentonite while the mixer was in operation, adding 2.8 pounds (containing 1 pound of gamma isomer) to 9.7 pounds of bentonite. The granulated dieldrin was a commercial product.

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The hopper of an airplane duster was adapted for use and was set to deliver 25 pounds of granulated insecticide per acre, the plane traveling at a speed of 100 miles per hour. From an altitude of 70 feet 50 percent of the granules fell within an area 27 feet wide, and this swath width was used in applying the granulated insecticides.

The larval population was estimated from soil samples taken at selected stations. In the preliminary survey of the 325-acre area 456 stations were sampled, and 87 that produced the most larvae were selected for subsequent samplings. Fifteen stations were used in the 24-acre plot, 12 in the 8-acre plot, and 27 in the 80-acre check. Beginning in October, each plot was sampled three times prior to treatment. The degree of control was based on differences in counts before and at various intervals after treatment. Large variations occurred in the untreated plot, but since it was not known whether they were representative of the treated plots, no adjustments to correspond with these changes were made by use of Abbott's formula.

The abundance of adult sand flies in the plot treated with granulated BHC was measured by means of two modified mosquito light traps and four animal traps located within or adjacent to it. One animal trap was placed in the check plot, but none were used in the other treated plots. The animal traps were baited with white rats.

The effect of the treatments on the larval populations is shown in table 1.

Excellent control was obtained with granulated BHC during the first 12 weeks, but at 16 weeks there was a sharp increase in larval populations throughout the plot, and at 20 weeks little or no control was indicated. With the BHC spray the initial reduction was only 77 percent, and after 4 weeks little or no reduction was evident. The better results obtained with the granulated BHC were attributed to better penetration of the foliage.

Control with granulated dieldrin ranged from 94 to 99 percent for 24 weeks, when observations were discontinued.

The numbers of adult sand flies taken in light and animal traps declined markedly immediately after treatment and remained at a low level for 2 months. During the third month there was an increase in the catches in the animal traps, and a very great increase in the light traps. Some measure of control was indicated during the fourth month, but by the fifth month populations were higher than before treatment. The treated and check plots both exhibited the same trends in adult abundance throughout the test, the only difference being that the numbers were much greater in the check plot.

SUMMARY.—Aerial sprays have not been effective against larvae of the salt-marsh sand fly, *Culicoides furens* (Poey), in the tidal marshes bordering the Florida Intracoastal Waterway, because they do not penetrate the dense mangrove and other

TABLE 1.—Effect of aerial applications of granulated BHC and dieldrin and of BHC spray on sand fly larvae.

Insecticide and form	Pounds of toxicant per acre	Pretreatment counts (average per sample)	Percent reduction after—						
			2 weeks	4 weeks	8 weeks	12 weeks	16 weeks	20 weeks	24 weeks
BHC (36% gamma):									
Granulated	2	10	97	87	93	91	65	14	..
Oil spray	2	9	77	33	22	+4	..	..	..
Dieldrin, granulated	1.25	20	94	99	95	99	96	..	99
Untreated (check)	..	7	16	+111	+121	30	+246	24	..

vegetation satisfactorily. In recent tests granulated insecticides have been found to give good control.

Granulated BHC applied at the rate of 2 pounds of gamma isomer per acre gave excellent control of the larvae for 12 weeks. A sharp increase in larval abundance occurred after 16 weeks, and little or no control was indicated at 20 weeks.

Granulated dieldrin applied at the rate of 1.25 pounds of dieldrin per acre gave excellent control for 24 weeks.

An aerial spray in which BHC was applied at the rate of 2 pounds of gamma isomer per acre gave some control for weeks but little or none thereafter.

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A GYNANDROMORPH OF *CULEX PIPIENS MOLESTUS* (FORSK.)

NORMAN G. GRATZ

Department of Parasitology, Hebrew University, Jerusalem, Israel

The gynandromorph described was found among a laboratory strain of *Culex pipiens molestus* maintained in the Department of Parasitology of the Hebrew University. The mosquito emerged on 29-IV-1951 and was among a group removed from the cage on 2-V-1951. Following discovery of the gynandromorph, all mosquitoes which had emerged on the previous day and for several days thereafter were examined without finding other aberrant forms. The specimen is pinned and the genitalia mounted on a slide. The left side of the specimen has male, the right female characteristics.

Description: Antennae: male, whorled hairs not quite so dense as in normal male, segmentation normal, female with hairs slightly longer than in normal female, segmentation normal. Palpi: distal hairs on male side slightly longer than on normal male, female palpus normal. Proboscis: almost intermediate but more closely resembling that of female. Female eye larger than male; anterior-posterior distance across the vertex of the head greater on female side than on male. Thorax: dorsum with uniform scaling and chaetotaxy pleurae with equal scaling and chaetotaxy on both sides; tarsi: left front tarsus with two equal sized toothed claws, right front tarsus as in normal female, left mid-tarsus with one large and other smaller toothed claw, right mid-tarsus as in normal female, hind tarsi as in normal male and female respectively; wings: male wing not quite 4mm in length, female wing 4.75mm, width of female wing greater, both wings normally scaled; abdomen: tergites dark brown with pale scales basally, tergites five to eight with the pale scales extending laterally almost to the apical edge of the tergite on the female side, pale scales not thus extended on the male side; genitalia: (see fig. 1) left side nearly as in normal male except that the basal plate is not present in normal form but probably represented by a large rod-like structure displaced below the base of the paraproct, right