SIMULATED FIELD EVALUATION OF PROMISING INSECTICIDES FOR USE AGAINST *AEDES AEGYPTI* [1]

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INTRODUCTION. Simulated field studies along the lines of those of Brooks and his coworkers in 1965 (Brooks *et al.*, 1967) were continued during 1966 at Savannah, Georgia. Suspensions of the test compounds were evaluated as larvicides and adulticides for use in treatment of junk or trash-pile harborages of *Aedes aegypti*. Several of the insecticides were also compared as suspensions and emulsions under weathering conditions.

METHODS AND MATERIALS. In the larvicide tests, quarter sections of rubber tires and rusty No. 10 size tin cans were treated in triplicate with 1.25 and 2.5 percent suspensions of Abate,[2] Bayer 69047, bromophos, Dursban, fenitrothion, malathion, OMS-868, OMS-958, Schering 34615 and SD-8447 ("Gardona"). Dursban also was sprayed as a 0.625 percent suspension. A 2-gallon compressed air sprayer with an 8002 teejet nozzle and a pressure of 40 psi was used to apply the target dosages of 0.5, 1.0 and 2.0 g/m². The tires and tin cans were treated in place in an open field where they were subject to full weathering (Fig. 1).

In a second series, bromophos, Dursban, fenitrothion, Schering 34615 and Gardona treatments were applied to tire sections

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[2] References to commercial materials, equipment, and processes are for identification purposes only and do not constitute endorsement by the Public Health Service.

FIG. 1.—Treated tin cans and rubber tire sections under weathering conditions.

and tin cans as suspensions and emulsions. Each 2.5 percent suspension concentration was applied with an 8002 nozzle while the 5 percent emulsions were applied with an 8001 nozzle. The target dosage was 2 g/m^2.

For the adulticide tests, 2.5 percent suspensions of Abate, bromophos, Dursban, fenitrothion, Schering 34615 and Gardona were applied to 1 sq. ft.[3] tin and rubber panels in triplicate (Fig. 2) and to 3-foot plants of Japanese Plum (*Eribotrya japonica*) (Fig. 3). The panels were sprayed and evaluated as described by Jakob and Schoof (1963); the plants were sprayed to the point of run-off.

The chemical names of proprietary and coded compounds are as follows:

[3] Prior to treatment, the panels were cut into 3 x 12-inch sections and strung together for assembly into an exposure chamber.

Abate®—*O,O,O′,O′*-tetramethyl *O,O′*-thiodi-p-phenylene phosphorothioate.

BAY 69047—*O,O*-dimethyl-*O*-(4-nitro-3-isopropyl-mercaptophenyl)-thiophospate.

Dursban®—*O,O*-diethyl-O-(3,5,6-tri-chloro-2-pyridyl) phosphorothioate.

OMS-868—S-1349—*O,O*-dimethyl-*O*-(3-chloro-4-N,N-diethyl-sulfamoylphenyl) phosphorothioate.

OMS-958—GS-12968—O,O-Dimethyl-S-[5-ethoxy-1,3,4-thiodiazol-2(3H)-on-3-yl-methyl]-dithiophosphate.

Schering 34615—3-methyl-5-isopropyl-phenyl-N-methylcarbamate.

Gardona®(SD-8447)—2-chloro-1(2,4,5-tri-chlorophenyl) vinyl dimethyl phosphate.

Larvicide tests were conducted biweekly by introducing 25 late third instar larvae of the Charlotte Amalie strain of *Ae. aegypti* (DDT-dieldrin resistant) into the

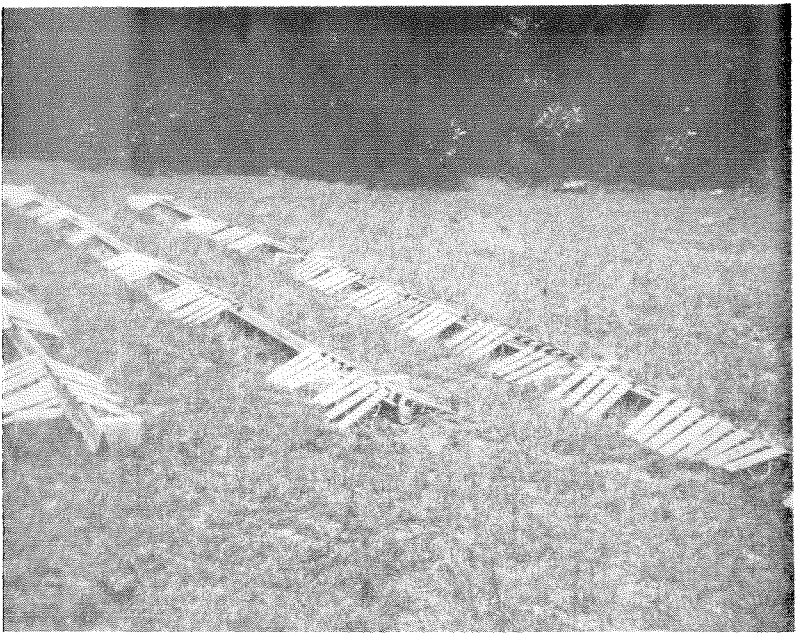

FIG. 2.—Treated tin and rubber surfaces under weathering conditions.

treated containers. Twenty-four-hour mortality counts were recorded. The larvae were contained in a 2¼ by 2¼ by 2¼-inch wide mesh cage.

All formulations were made up from either wettable powders or emulsifiable concentrates provided by the manufacturer or the World Health Organization. The active ingredients of the insecticides were as follows: Abate (25 percent WP), BAY 69047 (40 percent WP), bromophos (25 percent WP, 25 percent EC), Dursban (25 percent WP, 4 lb./gal. EC), malathion (50 percent WP), OMS-868 (50 percent WP), OMS-958 (40 percent WP), Schering 34615 (50 percent WP, 25 percent EC), Gardona (75 percent WP, 2 lb./gal. EC), and fenitrothion (25 percent WP, 25 percent EC).

Adulticide evaluation began 1 week after treatment and consisted of a 1-hour exposure of 3-day-old *Ae. aegypti* (CA strain) to the tin, rubber, and foliage surfaces in a test chamber; foliage taken from the plants was stapled to plywood panels which were formed into the exposure chamber. After exposure the mosquitoes were transferred to holding cages and 24-hour mortality counts were made.

RESULTS. Ten compounds applied as suspensions to rubber tires and tin cans (Table 1) showed Abate and Dursban at a dosage of 1 g/m^2 to give 90 percent kills of the larvae for 18[4] weeks. Bayer 69047 at 1 g/m^2 and Dursban at 0.5 g/m^2 each gave 90 percent kills for 18 weeks on tin cans but for only 12 and 10 weeks, respectively, on rubber tires. OMS-868, OMS-958 and Schering 34615 at 1.0 g/m^2 gave 90 percent kills on rubber tires for 18 weeks but on tin cans for 16, 6, and 4 weeks, respectively. At a dosage of 2 g/m^2 the only materials giving

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[4] Eighteen weeks was the maximum period of evaluation.

FIG. 3.—Treated foliage (Japanese plum) under weathering conditions.

less than 10 weeks of 90 percent kill on both surfaces were malathion and Gardona. Suspension-emulsion comparisons (Table 2) showed emulsions to give 1 to 5 weeks less residual life than suspensions under these test conditions.

None of the suspensions applied as adulticides to tin panels were effective after 1 week's weathering (Table 3). Dursban on rubber panels gave 70 percent kills for 3 weeks and on foliage for 2 weeks. Fenitrothion gave 70 percent kill on rubber and foliage for 1 week. All other materials were ineffective on rubber but

TABLE 1.—Weeks of 90-percent kills of third instar *Aedes aegypti* larvae introduced into weathered containers treated with suspension formulations.[1]

Insecticide	1 g/m² Tin Cans	1 g/m² Rubber Tires	2 g/m² Tin Cans	2 g/m² Rubber Tires	Acute Oral LD_{50}-female rats [2]
Abate	18	18	18	18	8000
Bayer 69047	18	12	18	18	1000
Bromophos	10	6	18	10	3000
Dursban [3]	18	18	18	18	135
Malathion	4	4	4	4	1000
OMS-868	16	18	18	18	317
OMS-958	6	18	14	18	443
Schering 34615	4	18	10	18	135
Gardona	14	8	14	8	3000

[1] Test terminated at week 18.
[2] In mg./kg.
[3] Dursban at 0.5 g/m² gave 18 and 10 weeks on tin cans and rubber tires, respectively.

Table 2.—Weeks of 90-percent kills of third instar *Aedes aegypti* larvae introduced into weathered containers treated with suspension and emulsion formulations[1] at a dosage of 2 g/m^2.

Insecticide	Suspensions		Emulsions	
	Tin Cans	Rubber Tires	Tin Cans	Rubber Tires
Bromophos	15	..	10	..
Dursban	16	16	14	15
Fenitrothion	14	16	6	8
Schering 34615	10	16	9	16
Gardona	..	11	..	8

[1] Test terminated at week 16.

Table 3.—Weeks of 70-percent kills of 3-day-old *Aedes aegypti* adults exposed to weathered residues.

Insecticide	Tin	Rubber	Foliage
Abate	<1	<1	1
Bromophos	<1	<1	1
Dursban	<1	3	2
Fenitrothion	<1	1	1
Schering 34615	<1	<1	1
Gardona	<1	<1	<1

gave at least 70 percent kills on foliage for 1 week with the exception of Gardona which did not give 70 percent kill on any of the surfaces.

Cumulative rainfall during the test period amounted to 21.3 inches with fairly even distribution (1.42 inches/week). Air temperatures at ground level averaged 89° F., while the average relative humidity was 74 percent.

Discussion. Abate, Dursban and OMS-868 gave the longest overall residual life as larvicides applied to tin cans and rubber tires. When Dursban was tested by Brooks *et al.* (1967) in the previous year as an emulsion, it produced comparable results. That work also pointed out that rainfall was not the only factor limiting the residual life of the test materials. Dursban-treated containers protected from rainfall and under full weathering conditions gave similar results. The effectiveness of other test compounds, however, was greatly reduced under full weathering.

It would therefore appear that the loss in effectiveness of the residues was due not only to the washing action of the rainfall but to high temperatures and other physical and chemical factors as well. The washing action that did occur probably tended to concentrate the insecticide in the bottom of the containers, particularly in the case of suspensions. This action probably enhanced the residual life of some materials. Panels and leaf surfaces that allow run-off are particularly subject to erosion by rainfall; therefore the possibility of extended residual adulticidal activity of surface treatments as opposed to container treatments appears to be negligible.

Summary. Eleven compounds were evaluated under simulated field conditions to determine their relative residual life as larvicides and adulticides against *Ae. aegypti*. In larvicidal evaluations, suspension formulations of Abate and Dursban applied to tin cans and rubber tires were found to be the superior materials at the dosage of 1 g/m^2 giving 90 percent kills of the larvae for 18 weeks. At the dosages of 2 g/m^2 only malathion and Gardona were relatively poor residuals under full weathering conditions. These compounds gave less than 10 weeks of 90 percent kill in both types of containers.

Emulsions showed 1 to 5 weeks less residual life than suspensions under these test conditions.

There appeared to be little residual adulticidal effect of these materials on tin, rubber and foliage surfaces. Dursban was the only compound giving as much as 3 weeks effective adult kills.

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