Field Tests of Insecticides for Control of Adult *Diaprepes abbreviatus*[1] on Citrus[2,3]

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ABSTRACT

A series of field tests was made in Puerto Rico in 1972 for control of adult *Diaprepes abbreviatus* (L.) on citrus. Of 21 chemicals tested, Sevin®-4-oil formulation of carbaryl (1 oz AI/tree) gave 100% control for at least 26 days after foliar application. Azinphosmethyl (0.8 lb AI/100 gal of water), dicrotophos (1 lb AI/100 gal), and dieldrin (0.5 lb AI/100 gal) gave excellent control for at least 11 days. Carbaryl, carbofuran, and phenamiphos provided good control but had less than 1 wk residual activity.

The so-called sugarcane rootstalks borer weevil, *Diaprepes abbreviatus* (L.), is an important pest of citrus and sugarcane in the West Indies. The adults feed on the young foliage of a variety of plants. Martorell (1945) listed 41 plant species as adult hosts in Puerto Rico. The larvae are root feeders, and Wolcott (1948) stated that they feed on any kind of live roots or tubers that are available. Information concerning the bionomics of *D. abbreviatus* in the West Indies was summarized by Wolcott (1936).

In Florida, *D. abbreviatus* was first found near Apopka (Orange County) in 1964 (Woodruff 1964). By 1968, several citrus groves and nurseries in this area were infested with the weevil (Woodruff 1968). Because of the economic importance of this pest, chemical control tests were conducted. Preliminary tests of foliar sprays on citrus for control of adult weevils were reported by Bullock (1971); among 24 pesticides tested, he found 4 that provided 1 wk of control and 2 that provided control for ca. 2 wk. The tests reported here were made to find materials that would have longer residual activity because the adult weevils are generally found throughout the entire year.

MATERIALS AND METHODS.—Three tests were conducted from May to November 1972 in a 5-acre block of 8-year-old orange trees (varied from 5 to 8 ft) of unknown varieties at the Fortuna Agricultural Substation of the University of Puerto Rico near Ponce, Puerto Rico. Test 1 (May 25) was an evaluation of some insecticides recommended for use on citrus as suggested by the Florida Citrus Spray and Dust Schedule (Anon. 1972). Test 2 (Aug. 28) was a preliminary screening of a large group of pesticides. Test 3 (Sept. 21) was a comparison of the most effective treatments from the 2 previous experiments.

The chemicals tested, their formulations, and active ingredients, were: aldrin EC 4 lb/gal (Shell Chemical Co.); azinphosmethyl WP 62.5% (Chemagro Corp.); Biotrol® (contains crystalline toxin produced by *Bacillus thuringiensis* Berliner in the fermentation process, Nutrilite Products, Inc.); carbaryl WP 80% (Union Carbide Corp.); carbofuran F, 4 lb/gal (Niagara Chemical Div. of FMC Corp.); carbophenothion WP 25% (Stauffer Chemical Co.); chlordane EC 4 lb/gal (Velsicol Chemical Corp.); demeton EC 2 lb/gal (Chemagro Corp.); diazinon WP 50% (Geigy Chemical Corp.); dicrotophos EC 2 lb/gal (Shell Chemical Co.); dieldrin EC 1.5 lb/gal (Shell Chemical Co.); dimethoate EC 2 lb/gal (American Cyanamid Co.); ethion EC 6 lb/gal (Velsicol Chemical Corp.); heptachlor EC, 2 lb/gal (Velsicol Chemical Corp.); Phosphet® WP 50% (*N*-(mercaptomethyl) phthalimide *S*-(*O*,*O*)-dimethylphosphorodithioate, (Stauffer Chemical Co.); malathion WP 25% (American Cyanamid Co.); methidathion 2 lb/gal (Fisons Pest Control Ltd.); phenamiphos 2 lb/gal (Chemagro Corp.); oxydemeton-methyl 2 EC 2 lb/gal (Chemagro Corp.); Sevin®-4-oil (a commercial formulation of 4 lb carbaryl in 1 gal of oil (Union Carbide Corp.); and oxamyl 2 lb/gal (E. I. DuPont de Nemours and Co.).

Test 1 consisted of 6 single-tree replicates/treatment; Tests 2 and 3 consisted of 5 single-tree replicates/treatment. Sprays were applied with a compressed-air hand- or back-pack sprayer. Aqueous dilutions of chemical sprays except Sevin-4-oil treatments were applied to entire trees to runoff at a rate of 2 gal/tree in Tests 1 and 3 and at a rate of 1 gal/tree in Test 2. In Test 2, Sevin-4-oil was applied at rates of 2 fl oz (1 oz AI)/tree, and in Test 3 at rates of 1 or 2 fl oz (0.5 or 1 oz AI)/tree. In addition, 8–9 fl oz of Florida Citrus (FC) 412-66 oil, as recommended by Simanton and Trammel (1966) were added to the Sevin-4-oil that was applied to each tree.

The weevils were collected from plants growing adjacent to sugarcane plantings. After weevils were collected, 1–2 days before each test, they were held in a large screened cage containing young citrus foliage. At the time of each test, 1 terminal ca. 20 in. long and bearing young foliage was randomly selected on the test trees and covered with a sleeve cage holding 10 of the weevils. These cages were made of 2×2 ft fine-mesh nylon netting folded and sewn together to provide a double wall. In Tests 1 and 3, sprays were applied directly onto caged weevils as well as onto other parts of each tree. In Test 2, additional weevils were caged on the terminal at various intervals after application.

[1] Coleoptera: Curculionidae.
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[3] This paper reports the results of research only. Mention of a pesticide or a proprietary product does not constitute a recommendation or an endorsement by the USDA.
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Table 1.—Evaluation of insecticides for control of adult *D. abbreviatus*.

		% mortality after indicated exposure					
		Test 2					
		Trial 1 (1-day-old residue)		Trial 2 (5-day-old residue)		Trial 3 (10-day-old residue)	
Material	Lb AI/ 100 gal	1-day exposure	4-day exposure	1-day exposure	4-day exposure	1-day exposure	4-day exposure
Azinphosmethyl	0.8	92	100	44	100	50	86
Carbofuran	1.0	98	100	32	92	34	58
Dicrotophos	0.5	82	100	20	98	0	82
Dieldrin	0.5	52	100	16	86	0	90
Phenamiphos	0.8	80	100	30	90	14	64
Sevin-4-oil	[a]	94	100	64	100	86	94
Check (water)		8	26	0	4	10	20

		Test 3				
		Trial 1 (7-day-old residue)		Trial 2 (15-day-old residue)	Trial 3 (22-day-old residue)	
Material	Lb AI/ 100 gal	1-day exposure	4-day exposure	5-day exposure	1-day exposure	4-day exposure
Azinphosmethyl	0.8	70	94	68	22	90
Carbaryl	2.0	16	38			
Dicrotophos	0.5	28	88	46	0	0
Dicrotophos	1.0	36	96	72	0	2
Dieldrin	0.3	4	54			
Dieldrin	0.5	4	92	84	0	40
Sevin-4-oil	[b]	100		100	50	98
Sevin-4-oil	[a]	96	100	100	80	100
Check (water)		0	8	0	0	4

[a] 1 oz AI carbaryl + 8 fl oz FC 412-66 oil/tree.
[b] 0.5 oz AI carbaryl + 9 fl oz FC 412-66 oil/tree.

Mortality counts were made at 1 and 4 (or 5) days after application. At the end of each test, weevils and cages were destroyed.

RESULTS AND DISCUSSION.—In Test 1, azinphosmethyl (0.4 lb AI/100 gal) was effective (caused 97% mortality) at least 9 days after application; carbaryl alone (1 lb AI/100 gal) was ineffective within 1 wk (75% dead). Carbophenothion (0.4 lb AI/100 gal), diazinon (0.5 lb AI/100 gal), ethion (1 lb AI/100 gal), and malathion (0.8 lb AI/100 gal) were ineffective.

The following materials (lb AI/100 gal) evaluated in Test 2 killed less than 80% of the weevils when they were exposed 5 days after the application and examined 4 days later: aldrin (1.0), azinphosmethyl (0.4), Biotrol (4.0), carbaryl (1.0), carbaryl (2.0), carbofuran (0.5), chlordane (1.0), demeton (0.5), dimethoate (0.5), heptachlor (0.5), phosphet (0.8), oxydemeton-methyl (0.5), methidathion (0.5), and oxamyl (0.5).

Table 1 lists the most promising insecticides in Test 2. Although both Sevin-4-oil, the special formulation of carbaryl, and dieldrin were similarly effective when exposed to 10-day-old residues for 4 days, only Sevin-4-oil was effective after 25 days (95% dead). In addition to this residual activity, Sevin-4-oil was outstanding in knockdown (86–95% kill in 1 day at 10 and 16 days after treament).

The results of Test 2 were in agreement with those of Test 1: carbaryl alone and azinphosmethyl were effective but had relatively short residual activity. (The residual effect of the higher rate of azinphosmethyl (0.8 lb AI/100 gal) in Test 2 was similar to that of the lower rate in Test 1 because the total amount AI applied per tree was equal in both tests.)

Test 3 (Table 1) was a test of the residual activity of insecticides found most promising in Test 1 and 2. Again, carbaryl alone was ineffective but carbaryl formulated as Sevin-4-oil showed a high percentage of quick kill and a residual activity of at least [illegible] days. However, the higher rate of azinphosmethyl (0.8 lb AI/100 gal at a rate of 2 gal/tree) had longer persistence in Test 3 than the 2 previous tests.

Dicrotophos had short residual activity and also caused serious injury to the foliage of orange trees; leaf drop began 1 day after spray application, and nearly ½ the foliage had dropped after 1 wk. Phenamiphos caused a less severe leaf drop. However, injuries produced by both materials seemed to be temporary since new leaves appeared on the trees by the end of the test. The other chemicals caused no apparent phytotoxicity.

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ADDENDUM

We have had inquiries to provide an additional series of equations for use with the data presented in the article "Influence of Defoliation and Depodding on Yield of Soybeans" by G. D. Thomas, C. M. Ignoffo, K. D. Biever, and D. B. Smith, Vol. 67 (5) : 683–685, 1974. In an effort to meet these requests and those of future readers, additional information is available from the authors. This information includes tables of additional regression equations, which use zero as the origin, and coefficients of determination for these equations.