

## MATERIALS EVALUATED AS ACARICIDES FOR USE ON CITRUS 1968-69

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### ABSTRACT

Seven candidate materials were evaluated in the field against populations of *Phyllocoptruta oleivora* (Ashmead). Five materials gave effective control of the citrus rust mite for 6 weeks compared with 4 weeks control for chlorobenzilate, used as a standard. The 5 materials giving satisfactory control included Acarol®—isopropyl 4,4'-dibromobenzilate; formetanate hydrochloride; 3M MBR-5667—2-methyl-1,3-dithiolane-2-carboxaldehyde *O*-(methylcarbamoyl)oxime; Stauffer R-10044 65W—*N*-[(1,1,2,2-tetrachloro-2-fluoroethyl)thio]methanesulfonanilide; and Upjohn U-27, 415—benzoyl chloride (2,4,6-trichlorophenyl)hydrazone.

Armored scale populations consisting of *Lepidosaphes beckii* (Newman), *L. gloverii* (Packard), *Parlatoria pergandii* Comstock, and *Aonidiella citrina* (Coquillett) ranged from a combined low of 0.24 scales per leaf in the untreated check to a high of 0.80 scales per leaf in the U-27, 415 plots 9 weeks posttreatment. Differences were not significant. Scale parasite populations consisting of *Aphytis lepidosaphes* Compere, *A. hispanicus* (Mercet), *Aphytis* spp., *Prospaltella elongata* Dozier, *P. fasciata* Malenotti, and *Prospaltella* sp. were also apparently normal in all plots at 9 weeks posttreatment.

The citrus rust mite, *Phyllocoptruta oleivora* (Ashmead), is a major pest of citrus in Florida. Chemical treatments are generally applied 2-3 times a year for control. New chemicals are evaluated in a continuing attempt to find more effective materials that have the least possible detrimental effect on the environment. This paper is a report of our tests during 1968-69. This is a report of research results and not a recommendation of any of the materials tested.

### MATERIALS AND METHODS

All chemicals with the exception of Thompson-Hayward 427-I 5G were applied as full coverage dilute sprays. A conventional hydraulic sprayer operated at 600 psi at the pump, and a hand gun were used for spraying. TH 427-I was broadcast on the soil under the tree skirts and raked in. Single tree plots were used in a randomized complete block with a minimum of 6 blocks. Twenty-five leaves/tree were examined using a linen tester with a 1-in.<sup>2</sup> field at each sampling. Leaves were considered infested if 1 or more living rust mites were seen by examining 1 field on the upper or lower surface of each leaf. Field data were converted to percent infested leaves for each plot. These data were transformed into the degrees of an angle for analysis (LeClerg et al. 1962). Differences between treatments were determined by Duncan's multiple range test.

Chemical names for materials used which have no accepted common name are as follows:

Acarol®—isopropyl 4,4'-dibromobenzilate

Stauffer R-10044—*N*-[(1,1,2,2-tetrachloro-2-fluoroethyl)thio]methanesulfonanilide

TH 427-I—*O,O*-diethyl phosphorothioate *S*-ester with *N*-(1-cyano-1-methylethyl)-2-mercaptoacetamide

3M MBR-5667—2-methyl-1,3-dithiolane-2-carboxaldehyde *O*-(methyl-carbamoyl)oxime

Union Carbide UC-34096—4-[[ (dimethylamino)methylene]amino]-*m*-tolyl methylcarbamate monohydrochloride

Upjohn U-27,415—benzoyl chloride (2,4,6-trichlorophenyl)hydrazone

1968, Sept. 17 application.—Materials tested included Thompson-Hayward 427-I 5G at 40 lb granular/acre applied to the soil beneath the skirts of trees, and Union Carbide UC-34096 technical at 4, 8, and 12 oz/100 gal. Chlorobenzilate 4E at 2 oz actual/100 gal was used as a standard treatment. An untreated check series was also included.

1969, Sept. 2-3 application.—Materials and rates (actual)/100 gal tested included Geigy Acarol® 2E at 1 oz, formetanate hydrochloride 95 technical at 1, 1 1/2, and 2 oz, 3M MBR-5667 75W at 4 oz, Stauffer R-10044 1E and 65W at 4 oz, and Upjohn U-27,415 75W at 3 oz. Chlorobenzilate 4E at 2 oz was used as a standard and an untreated check series was also included.

Spider mite populations consisting of *Panonychus citri* (McGregor) and *Eutetranychus banksi* (McGregor) were sampled 9 weeks posttreatment in 1969. Twenty-five leaf samples/tree were brushed using a Henderson-McBurnie mite brushing machine. All 8-legged motile forms of these 2 species were counted.

Armored scale and scale parasites were also sampled from the fall 1969 plots at 9 weeks posttreatment. Twenty mature leaves from each tree were collected and brought into the laboratory. Living 3rd stage female scale and living parasites of this stage of scale were counted on the upper and lower right hand side of each leaf. Scales and their parasites included the following: purple scale, *Lepidosaphes beckii* (Newman), and its parasite *Aphytis lepidosaphes* Compere; Glover scale, *Lepidosaphes gloverii* (Packard), and its parasites *Aphytis* sp. and *Prospaltella elongata* Dozier; chaff scale, *Parlatoria pergandii* Comstock, and its parasites *Aphytis hispanicus* (Mercet) and *Prospaltella fasciata* Malenotti; and yellow scale, *Aonidiella citrina* (Coquillett), and its parasites *Aphytis* sp. and *Prospaltella* sp.

#### RESULTS AND DISCUSSION

1968.—UC-34096 gave excellent control of citrus rust mites throughout the test period of 24 weeks (Table 1). However, toxicology problems relating to animal metabolism prevented further testing. TH 427-I as a soil application failed to control rust mites.

1969.—Acarol®, formetanate hydrochloride, 3M MBR-5667, Upjohn U-27,415, and Stauffer R-10044 65W gave acceptable control of citrus rust mites through 6 weeks (Table 2). Stauffer R-10044 as a 1E formulation controlled mites for only 2 weeks. Chlorobenzilate used as a standard provided acceptable control through 4 weeks.

Spider mites, *P. citri* and *E. banksi*, did not occur in sufficient numbers to determine treatment differences. Armored scale populations consisting of *L. beckii*, *L. gloverii*, *P. pergandii*, and *A. citrina* ranged from a combined low of 0.24 scales per leaf in the untreated check to a high of 0.80

TABLE 1. EFFECTIVENESS OF EXPERIMENTAL MATERIALS AGAINST CITRUS RUST MITE. APPLIED 17 SEPT. 1968.

Treatment	Formu- lation	Actual/100 gal	Percent infested* leaves at weeks posttreatment—									
			2	4	5	7	11	16	24			
UC-34096	Tech	4 oz	1 a	0 a	1 a	0 a	2 a	0 a	0 a	0 a	0 a	
UC-34096	Tech	8 oz	0 a	1 a	1 a	0 a	2 a	0 a	0 a	0 a		
UC-34096	Tech	12 oz	1 a	0 a	0 a	0 a	0 a	0 a	0 a	1 a		
Chlorobenzilate	4E	2 oz	2 a	13 a	19 b	24 b	46 b	26 b	13 b			
TH 427-I	5G	2 lb**	47 b	59 b	57 c	58 c	63 bc	63 c	47 c			
Untreated	—	—	46 b	60 b	59 c	63 c	68 c	56 c	35 c			

\*Treatments followed by same letters are not considered significantly different at the 5% level according to Duncan's multiple range test.

\*\*Actual/acre

TABLE 2. EFFECTIVENESS OF EXPERIMENTAL MATERIALS AGAINST CITRUS RUST MITE. APPLIED 2-3 SEPT. 1969.

Material	Formu- lation	Actual/ 100 gal	% Rust mite infested leaves* at weeks posttreatment—			
			2	4	6	8
Acarol®	2E	1 oz	0.7a	2.7a	6.7a	23.3a
Forfetanate hydrochloride	95 Tech	2 oz	0.0a	4.7a	10.7a	38.0a
Forfetanate hydrochloride	95 Tech	1.5 oz	0.7a	4.0a	10.0a	23.3a
Forfetanate hydrochloride	95 Tech	1 oz	0.7a	4.0a	12.0a	20.7a
3M MBR-5667	75W	4 oz	0.7a	8.0ab	14.7a	36.0a
Upjohn U-27,415.	75W	3 oz	0.7a	2.7a	10.0a	37.3a
Stauffer R-10044	65W	4 oz	0.0a	2.7a	12.7a	31.3a
Stauffer R-10044	1E	4 oz	6.0 b	17.3 b	47.3 b	63.3 bc
Chlorobenzilate	4E	2 oz	4.7 b	5.3a	20.7a	42.0ab
Untreated	—	—	39.3 c	58.0 c	67.3 b	70.0 c

\*Treatments followed by same letters are not considered significantly different at the 5% level according to Duncan's multiple range test.

scales per leaf in the U-27,415 plots 9 weeks posttreatment in 1968. There were no significant differences in scale populations 9 weeks posttreatment. Scale parasite populations consisting of *A. lepidosaphes*, *A. hispanicus*, *Aphytis* spp., *P. elongata*, *P. fasciata*, and *Prospaltella* sp. were apparently unaffected by the treatments also. Five of the 7 materials tested show promise as rust mite control agents.

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#### LITERATURE CITED

*LeClerg, Erwin L., Warren H. Leonard, and Andrew G. Clark.* 1962. Field plot technique. Burgess Publishing Co. 373 p.

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