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Citrus Blackfly: Chemical Control on Nursery Citrus

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ABSTRACT

Candidate pesticides were evaluated for efficacy against citrus blackfly (CBF), *Aleurocanthus woglumi* Ashby, on nursery citrus trees. Orthene® 75S (acephate), Talstar® 10WP and 80F (bifenthrin), Danitol® 2.4EC (fenpropathrin) and Orthene 75S plus Danitol 2.4EC treatments all gave 90% CBF mortality through 21 days postspray. Dursban® 4E (chlorpyrifos) provided only limited control and Sunspray 6N petroleum oil treatments were ineffective against CBF. None of the pesticide sprays were phytotoxic to nursery citrus.

RESUMEN

Se evaluó la eficacia de diferentes pesticidas en contra de la mosca negra de los cítricos (MNC), *Aleurocanthus woglumi* Ashby, en árboles de cítricos en viveros. Todos los tratamientos de Orthene® 75S (Acefato), Talstar® 10WP y 80F (bifentrin), Danitol® 2.4 EC (fenpropatrin) y Orthene 75S mas Danitol 2.4EC produjeron al 90% de mortalidad de la MNC durante los 21 días después de la aspersión. Dursban® 4E (cloropirifos) proporcionó sólo control limitado y los tratamientos de aceite de petroleo Sunspray 6N fueron inefectivos en contra de la MNC. Ninguna de las aspersiones de los pesticidas fue fitotóxica a los árboles de cítricos en viveros.

A serious outbreak of citrus blackfly (CBF), *Aleurocanthus woglumi* Ashby, in Lower Rio Grande Valley (LRGV) citrus was halted by a severe freeze in December 1989. CBF had escalated to economically damaging levels in orchards in central and eastern LRGV areas during the 1988 and 1989 seasons. Releases of two hymenopterous parasitoids, *Encarsia opulenta* Silvestri (Aphelinidae) and *Amitus hesperidum* Silvestri (Platygasteridae) begun in mid season 1989, had not achieved biological control of CBF at the time of the freeze (French 1990; French et al., 1990; and Meagher et al., 1991)

A survey conducted in LRGV citrus nurseries in early 1990, raised industry concerns that CBF would be reintroduced into orchards on new replant trees. CBF infestations were identified in 7 of 12 nurseries surveyed, both on container grown and balled and burlapped trees (French, 1990). The latter trees grown in field nurseries, were dug prior to and protected through the freeze period.

Chemical spray treatment of young trees was determined to be the most expedient method of CBF control, since nursery stock would be moved rapidly into the field for planting. We conducted trials in several citrus nurseries to screen candidate pesticides for efficacy against CBF (Fig. 1). Emphasis was on identifying pesticides either labelled or with potential for labelling, having the following characteristics: high toxicity against CBF life stages; non-phytotoxic to commercial citrus varieties; and that could be used both on indoor and outdoor nursery stock with minimal risk to workers. Results of these experiments are presented herein, with certain of these data previously reported elsewhere (French and Meagher, 1991, a,b)

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MATERIALS AND METHODS

Three separate pesticide screening trials were conducted in two different nursery locations, utilizing container grown citrus trees of several varieties heavily infested with CBF. **Trial 1** — was conducted on 'Marrs' orange, *Citrus sinensis* (L.) Osbeck at Monte Alto, Texas. **Trial 2 and 3** — were conducted on 'Ortanique' and 'Satsuma' mandarin, *Citrus reticulata* Blanco at Edinburg, Texas.

The pesticides and rates varied in the different screening trials, and in some cases pesticide combinations or different formulations of the same pesticides were compared.

Chemical Formulations and Rates. The pesticides tested included: Danitol 2.4 EC (fenpropathrin) (RS) - -Cyano-3-phenoxybenzyl-2,2,3,3-tetramethylcyclopropanecarboxylate), at test rates of 0.09-0.14 kg(ai)/379L (0.2-0.3 lb(ai)/100 gal.) (Valent USA Corp. Walnut Creek, CA); Dursban 4E (chlorpyrifos) 0,0-diethyl 0-(3,5,6-trichloropyridin-2-yl)-phosphorothioate, at a test rate of 0.68 kg(ai)/379L (1.5 lb(ai)/100 gal.) (DowElanco, Indianapolis, IN); Orthene 75S (acephate) 0,S-Dimethyl acetylphosphoramidothioate, at test rates of 0.23-0.45 kg(ai)/379L (0.5-1.0 lb(ai)/100 gal.) (Valent USA Corp. Walnut Creek, CA); Talstar 10WP, 80F and 15% Tablet (bifenthrin) (2 methyl (1,1'-biphenyl)-3-yl) methyl 3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate, at test rates of 0.04-0.10 kg(ai)/379L (0.08-0.2 lb(ai)/100 gal.) (FMC Agric. Chem., Philadelphia, PA)

Sunspray 6N petroleum oil was used as a standard treatment in one trial and has the following specifications: with emulsifier and unsulfonated residue rating of 95% minimum; A.P.I. gravity at 16°C (60°F) of 34.8 minimum; 50% distillation point at 10 mm Hg reduced pressure 213°C (415°F) and 10-90% range of 27°C (80°F) maximum, at a test rate of 1% vol/vol (Sun Oil Co. Philadelphia, PA).

Evaluation Procedure: CBF-infested trees, 2-4 ft tall, were selected and each chemical treatment replicated 4 times on groups of 4-6 trees in each trial. Trees were sprayed to foliar runoff, utilizing a TQ-40 Koke Kap Backpack CO_2 Sprayer (R & D Sprayers Inc., Opelousas, LA.) equipped with a TeeJet 8004E nozzle. Sprayer pressure was maintained at a constant 30 PSI. Control trees received a water spray.

At intervals pre- and posttreatment young fully developed leaves (20-24/treatment) were randomly sampled from inside the tree canopy and examined microscopically at 15X in the laboratory. CBF were recorded as dead by absence of body fluid when probed with a teasing needle. Percent mortality of all CBF immature stages was determined for each treatment. Data were transformed by arcsin $y^{1/2}$ for analysis and means separated by Tukey's HSD, P=0.05.

RESULTS

In **Trial 1,** Orthene 75S, Dursban 4E and Talstar 10WP and Sunspray 6N oil were compared for efficacy against CBF. In this trial, the Orthene 75S and Talstar 10WP treatments provided equally effective CBF control (90% mortality of 1st-4th stage CBF) and both were superior to Dursban 4E, which gave only limited suppression of CBF (Table 1). The Sunspray 6N oil treatment was ineffective in controlling CBF.

In **Trial 3,** Talstar 80F (Flowable) formulation was compared to Talstar 10WP and to Danitol 2.4EC applied at two different treatment rates. In this trial both Talstar formulations and the two treatment rates of Danitol were equally effective in controlling CBF, with percent mortality exceeding 90% at all postspray count dates (Table 3).

No phytotoxicity was observed following any treatments in any of the screening trials.

DISCUSSION

These screening trials identified several pesticides effective against CBF, that are non-phytotoxic to young citrus and easily applied, for use in the citrus nursery. The pesticides included: Orthene 75S, Talstar (10WP and 80F) and the experimental compound, Danitol 2.4EC. Spray mixtures of Orthene and Danitol (each at reduced rates) were also found to be efficacious against CBF. Dursban 4E provided only limited control of CBF and Sunspray 6N petroleum oil was ineffective against CBF.

The need for effective pesticides labelled for CBF control on nursery stock and supported by these test data, promoted pursuance of a federal registration for both Orthene and Talstar. These labels were applied for jointly by Texas Citrus Mutual, Valent U.S.A. Corporation (manufacturer of Orthene) and FMC Corporation (manufacturer of Talstar). The label requests were made through the Texas Department of Agriculture. Orthene 75S was granted (March 5, 1990) a section 24 (C) registration by the Environmental Protection Agency for CBF control on nursery citrus trees. Subsequently in December 1990, Talstar 10WP was granted a section 24 (C) registration for CBF control on non-bearing citrus.

Only limited success has been obtained with pesticide spray treatments once CBF has become established on residential or commercial citrus. The first CBF outbreak in Texas occurred in 1955 on residential citrus in Brownsville and was successfully

Table 1. Mortality of 1st - 4th stage citrus blackfly on nursery 'Marrs' orange trees sprayed with different chemical treatments, Monte Alto, TX 1990.

			% Mortality of 1st - 4th stage CBF[1]			
			date and (days) post spray:			
Treatment	kg. ai /379L	lb. ai /100 gal.	19 Mar. prespray	27 Mar. (+7)	3 Apr. (+14)	10 Apr. (+21)
Orthene 75S	0.45	1.0	10.4	99.0 a[2]	99.2 a	100.0 a
Talstar 10 WP	0.10	0.2	10.4	94.6 ab	100.0 a	90.4 ab
Dursban 4E	0.68	1.5	10.4	83.3 b	78.2 bc	67.4 c
Sunspray 6N oil	---	1.0%	10.4	53.3 c	58.0 c	75.0 bc
Control (water spray)	---	---	10.4	5.7 d	4.1 d	11.3 d

[1] Minimum of 500 CBF examined / treatment at each count date.

[2] Means within a column followed by the same letter are not significantly different at P=0.05, Tukey's HSD. Data transformed by arcsin $y^{1/2}$ for analysis.

In **Trial 2,** Orthene 75S and a Talstar (15% ai) Tablet formulation were compared to Danitol 2.4EC alone and Danitol 2.4EC tank mixed with Orthene 75S, both at reduced rates. All Orthene and Danitol treatments gave excellent knockdown and residual control of CBF through 21 days postspray (Table 2). The Talstar 15% Tablet treatment failed to provide adequate control of CBF. However, it should be noted that the Talstar 15% Tablet rate was less than half that of the Talstar 10WP rate 0.04 vs 0.10 kg(ai)/379L (0.08 lb vs 0.2 lb ai/100 gal.) used in the earlier trial. Moreover, considerable difficulty was encountered in dissolving the Talstar 15% Tablets in water.

Table 2. Mortality of 1st - 4th stage citrus blackfly on nursery 'Satsuma' orange trees sprayed with different chemical treatments, Edinburg, TX 1990.

Treatment	kg. ai /379L	lb. ai /100 gal.	% Mortality of 1st - 4th stage CBF [Z] date and (days) post spray: 27 Mar. prespray	4 Apr. (+7)	11 Apr. (+14)	18 Apr. (+21)
Orthene 75S	0.45	1.0	18.9 a [Y]	100.0 a	100.0 a	99.6 a
Talstar 15% Tablet	0.04	0.08	22.3 a	81.3 b	65.6 b	72.4 b
Danitol 2.4 EC	0.14	0.3	17.2 a	98.8 a	99.7 a	100.0 a
Danitol 2.4 EC + Orthene 75S	0.09 O.23	0.2 0.5	28.6 a	96.1 ab	100.0 a	100.0 a
Control (water spray)	---	---	5.4 a	8.6 c	7.1 c	7.3 c

[Z] Minimum of 500 CBF examined / treatment at each count date.

[Y] Means within a column followed by the same letter are not significantly different at P=0.05, Tukey's HSD. Data transformed by arcsin $y^{1/2}$ for analysis.

eradicated with a program of malathion sprays (Smith et al., 1964). However, against a second CBF outbreak on dooryard citrus in Brownsville in 1971, malathion and subsequent spray applications of Cygon© (dimethoate) failed to contain the pest and it spread to commercial citrus (Reinert and Neel, 1977; Hart et al., 1978). Control of CBF was achieved biologically in the mid 1970's, through the release and establishment of the wasp parasitoids, *E. opulenta* and *A. hesperidum* (Summy et al., 1983; Hart et al., 1978). The most recent CBF outbreak began in 1987, with the heaviest infestations developing in commercial citrus orchards in the central and eastern LRGV. After repeated orchard spray applications of Supracide© (methidathion) and/or Lorsban (chlorpyrifos) failed to control CBF, an intensive parasitoid release program was begun in 1989 to reestablish biological control of CBF (French et at., 1990). The latter program was halted when a severe freeze occurred in late December 1989.

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Table 3. Mortality of 1st - 4th stage citrus blackfly on nursery 'Ortanique' mandarin trees sprayed with different chemical treatments, Edinburg, TX 1990.

Treatment	kg. ai /379L	lb. ai. /100 gal.	% Mortality of 1st - 4th stage CBF [Z] date and (days) post spray: 23 Apr. prespray	30 Apr. (+7)	7 May (+14)	14 May (+21)
Talstar 80F	0.10	0.2	8.5 a [Y]	94.4 a	100.0 a	99.5 a
Talstar 10 WP	0.10	0.2	5.0 a	91.0 a	97.7 a	100.0 a
Danitol 2.4 EC	0.09	0.2	13.8 a	99.0 a	99.6 a	99.4 a
Danitol 2.4 EC	0.14	0.3	11.6 a	99.9 a	99.0 a	100.0 a
Control (water spray)	---	---	7.9 a	5.0 b	9.2 b	8.8 b

[Z] Minimum of 500 CBF examined / treatment at each count date.

[Y] Means within a column followed by the same letter are not significantly different at P=0.05, Tukey's HSD. Data transformed by arcsin $y^{1/2}$ for analysis.

Fig. 1 A) Citrus trees dug from a field nursery and held indoors during the freeze of December 1989. B) Citrus blackfly adults on new flush leaves. C) Yellow sticky trap used to monitor for citrus blackfly adults. D) Spraying nursery trees for citrus blackfly and other pests.

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