Evaluation of Insecticidal Dips for Effectiveness Against *Diaprepes abbreviatus*[1] Larvae Infesting Nursery Stock[2]

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ABSTRACT

A total of 16 compounds was evaluated for control of *Diaprepes abbreviatus* (L.) larvae in nursery stock. Chlorpyrifos and Abate® 2 (*O,O'* (thiodi-*p*-phenylene) *O,O,O',O'*-tetra-methyl phosphorothioate) at 2 and 2.69 lb/100 gal, respectively, were the most effective treatments with no phytotoxic symptoms. Several other compounds were effective but were either phytotoxic or rates were too high for practical use.

Diaprepes abbreviatus (L.), commonly known as the "sugarcane root-stalk borer weevil," was first found in the United States in Apopka, Fla., where a single adult was collected in a citrus nursery (Woodruff 1964). In 1968, eradication measures were implemented. Limited larval control data were obtained with aldrin at a rate of 0.516/acre (Wolcott 1952). Metcalfe (1959) recommended dieldrin at 2 lb AI/acre for larval control in sugarcane in Barbados.

In May 1974, heavy infestation of *D. abbreviatus* was found in an ornamental nursery in the Apopka area. An emergency program was initiated by the Florida Department of Plant Industries and the USDA Methods Development Laboratory to screen insecticides for control of larvae infesting nursery stock.

At the present time, there is no accepted dip or drench method for certifying infested nursery stock for shipment outside the quarantined area. An attempt was made by Simanton and Bullock (1973) to develop an effective nursery stock dip, but none was considered effective or safe for practical use.

MATERIALS AND METHODS.—All tests were performed in the quarantined area. Test larvae were field collected from the infested nursery and used daily. Larvae were identified by the key of Beavers and Woodruff (1971). Five larvae, when available, were used for each test plant. Larvae were placed in a cavity (10–15 cm deep) formed in the soil of each potted plant, covered, and dipped immediately. Five test plants were used unless otherwise indicated. When available, 22 plant species were used for phytotoxic tests.

Phytotoxic test plants were held for a period of 8 wk before final assessment. Soil of test plants was either in ball and burlap or containerized. The root system of each plant was immersed for 5 min in the test insecticide and then placed on a draining bench in a covered greenhouse with open sides. All controls (5 larvae/plant) were handled and dipped in water for 5 min in a separate vat by personnel not involved in chemical testing to prevent cross-contamination.

Mortality was determined at either 2, 5, 7, or 8 days posttreatment depending upon the compound used, based upon previous preliminary data. Mortality was adjusted by Abbott's formula. Insecticides and formulations, all EC, were azinphosmethyl, carbaryl, carbofuran, carbophenothion, chlorpyrifos, dimethoate, endosulfan, methomyl, and naled.

Candidate materials without approved common names were: Abate® EC (*O,O'*-(thiodi-*p*-phenylene) *O,O,O',O*-tetra-methyl phosphorothioate); Dyfonate® EC (*O*-ethyl *S*-phenyl ethylphos phonodithioate); Imidan® EC (*O,O*-dimethyl phosphorothioate *S*-ester with *N*-(Mercapto methyl) phthalimide); Metasystox-R™

Table 1.—Effectiveness of insecticidal dip treatments for control of *D. abbreviatus* larvae in ornamental nursery plants.

Chemical	Rate lb/AI/100 gal	% mortality (corrected)[a] 2 days	5 days
Abate	2.69		100
Abate	2.69		100
Abate	2.69		100
Abate	6		
Dimethoate	2	100	
Dimethoate	4	100	
Dimethoate	6	100	
Endosulfan	2		97
Methomyl	6		64
Methomyl	8		100
Naled	4		0
Naled	6		76
Nemagon	6		64
Nemagon	8		100
Checks[b]			5

[a] Avg of 3 plants; 3 larvae/plant unless otherwise indicated.
[b] Avg of 12 plants; 3 larvae/plant.

[1] Coleoptera: Curculionidae.
[2] Mention of a proprietary product does not constitute endorsement by the USDA. Received for publication Feb. 13, 1975.
[3] USDA, APHIS, Plant Protection, 206 Ave. D., N.W. Winter Haven, FL 33880.

Table 2.—Effectivenes control of *D. abbrevia* plants.

Chemical	Rate lb/AI/100 gal
Azinphosmethyl	2
Carbaryl	2
Carbofuran	3
Carbofuran	4
Carbophenothion	2
Chlorpyrifos	2
Chlorpyrifos	2
Chlorpyrifos	2
Dyfonate	1
Imidan	1
Metasystox-R	0.50
Mocap	0.375
Vydate	2
Controls[b]	

[a] Avg of 5 plants; 5 larvae,
[b] Avg of 23 plants: 5 larva

EC (*S*-[2-(ethylsulfinyl) rothioate); Mocap™ E phorodithioate); Nema ropropane); and Vyda dimethyl-*N*-[(methylca date).

RESULTS AND DISCUSSI tained from dip treatm

Table 3.—Phytotoxic o plants.[b, c]

Plant species
Acer sp
Asparagus sprengeri Regel
Callistemon sp.
Carissa grandiflora Dc.
Cinnamomum camphora N
Cocos australis Mart.
Dizygotheca elegantisima V
Hemerocallis sp.
Ilex cornuta Lindl.
Ilex opaca Ait.
Ilex vomitoria Ait.
Juniperus chinensis L.
Ligustrum lucidum Ait.
Liriope sp.
Nerium sp.
Pinus clausa Vasey
Pittosporum sp.
Podocarpus macrophyllus I
Pyracantha sp.
Ulmus pumila Linn.
Viburnum odoratissimum
Viburnum suspensum Lind

[a] Observations at 8 weeks.
[b] S = Safe, U = Unsafe.
[c] Rates are at the indicated l

Table 2.—Effectiveness of insecticidal dip treatments for control of *D. abbreviatus* larvae in ornamental nursery plants.

Chemical	Rate lb/AI/ 100 gal	% missing larvae	% mortality (corrected) [a] 5-day	7-day	8-day
Azinphosmethyl	2	1.2	79		
Carbaryl	2	0.8	66		
Carbofuran	3				91
Carbofuran	4				87
Carbophenothion	2	1.6	0		
Chlorpyrifos	2		100		
Chlorpyrifos	2			100	
Chlorpyrifos	2			100	
Dyfonate	1	0.8			54
Imidan	1	1.2	70		
Metasystox-R	0.50		33		
Mocap	0.375		75		
Vydate	2	0.8	54		
Controls[b]		0.05			5

[a] Avg of 5 plants; 5 larvae/plant.
[b] Avg of 25 plants; 5 larvae/plant.

EC (*S*-[2-(ethylsulfinyl) ethyl] *O,O*-dimethyl phosphorothioate); Mocap™ EC (*O*-ethyl *S,S*-dipropyl phosphorodithioate); Nemagon™ EC (1,2-dibromo-3-chloropropane); and Vydate® L (oxamyl methyl *N',N'*-dimethyl-*N*-[(methylcarbamoyl) oxy]-1 thiooxamimidate).

RESULTS AND DISCUSSION.—Table 1 gives results obtained from dip treatments where no missing larvae were involved. Table 2 reports results where missing larvae in both treatments and controls were encountered. Missing larvae were considered to be alive although there were indications in treatment tests that they were dead. Most of the time larvae were located where they had been inserted, indicating they were quickly affected by the treatment since no movement had occurred. It was difficult to find decomposed larvae, and those not found were considered alive. Missing larvae from the controls probably escaped from the openings in the container bottoms, since the majority of the live larvae was nearly always found at the bottom of the containers.

Although dimethoate gave the best control at minimum dosage in the shortest time, severe phytotoxic symptoms resulted to the nursery plants (Table 3). Chlorpyrifos proved to be the most effective compound for larval control with no phytotoxic symptoms at minimum rates (Tables 1 and 3). Abate was just as effective at a slightly higher rate with no phytotoxic symptoms on the treated plants (Tables 1 and 3). All compounds tested gave some control except carbophenothion.

Table 3 shows results of the phytotoxic tests with 5 of the compounds tested. Chlorpyrifos, Abate, Mocap, and Metasystox-R proved safe as a dip treatment for those plants tested.

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Table 3.—Phytotoxic observations[a] following insecticidal dip treatments of balled and burlap and container nursery plants.[b, c]

Plant species	Abate 0.25	Abate 1	Abate 2.69	Abate 4	Dimethoate 1	Dimethoate 2	Dimethoate 4	Mocap 0.375	Meta-systox-R 0.50	Chlor-pyrifos 2
Acer sp	S		S	S	U	U	U			
Asparagus sprengeri Regel.	S		S				U			
Callistemon sp.	S									
Carissa grandiflora Dc.		S								
Cinnamomum camphora Nees & Eborm.							U			
Cocos australis Mart.	S		S		U	U				
Dizygotheca elegantisima Veitch.	S		S							
Hemerocallis sp.		S					U			S
Ilex cornuta Lindl.	S	S	S		U	U		S	S	S
Ilex opaca Ait.				S			U	S	S	
Ilex vomitoria Ait.	S		S					S	U	
Juniperus chinensis L.			S	S	S	S	U	S		S
Ligustrum lucidum Ait.		S		S				S		S
Liriope sp.		S		S	U	U	U			S
Nerium sp.							U			
Pinus clausa Vasey				U						
Pittosporum sp.		S		S			S	S	S	S
Podocarpus macrophyllus Don		S				U	U	S	S	S
Pyracantha sp.					S	S	U			
Ulmus pumila Linn.				U	S	U	U	S	S	
Viburnum odoratissimum Ker	S						U			S
Viburnum suspensum Lindl.		S			S		S		S	

[a] Observations at 8 weeks.
[b] S = Safe, U = Unsafe.
[c] Rates are at the indicated lb/AI/100 gal.

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