Ovicidal Effect of Thompson-Hayward TH 6040 in *Diaprepes abbreviatus*[1] on Citrus in Florida[2,3]

W. J. Schroeder, J. B. Beavers, R. A. Sutton,[4] and A. G. Selhime
U. S. Horticultural Research Laboratory, Agric. Res. Serv., USDA, Orlando, FL 32803

ABSTRACT

In field tests, Thompson-Hayward TH 6040 (*N*-(4-chlorophenyl)-*N'*-(2-6-difluorobenzoyl)urea) applied by air at a rate of 283 g AI/acre was effective for at least 26 days in reducing the reproductive potential of *Diaprepes abbreviatus* (L.). Egg hatch was reduced from 71 to 15% when weevils were continuously exposed to a 0-, to 26-day-old residue in the grove. Exposure of 3 days or less was not effective in reducing total egg hatch.

In preliminary tests at the Citrus Root Weevil Laboratory, Plymouth, Fla., the insect growth regulator Thompson Hayward TH 6040 (*N*-(4-chlorophenyl) *N'*-(2,6 difluorobenzoyl) urea) had an ovicidal effect on *Diaprepes abbreviatus* (L.), a sugarcane rootstalk borer weevil. The effect was similar to that reported by Moore and Taft (1975) for the boll weevil, *Anthonomus grandis* Boheman. Eggs from treated weevils had embryonic development but failed to hatch. We were therefore interested in whether TH 6040 applied by air would be useful in eradicating or controlling *D. abbreviatus*. This weevil has a wide host range in the West Indies (Martorell 1945, Wolcott 1948), was first observed in Central Florida in 1964, and presently is found in ca. 4500 acres of citrus in that general area.

Materials and Methods.—In the 1st field test, we used a hand-pressure unit to spray 8 citrus trees each to runoff with a water suspension of TH 6040 at either a rate of 57 g AI/100 gal or 114 g AI/100 gal. Then 8 cages of field-collected adult weevils, 5 ♀ and 2 ♂/cage, were confined on the treated foliage, one cage/tree. The cage was a cloth screen sleeve cage ca. 20 cm diam and 50 cm long. A strip of folded wax paper was placed in the cage as an oviposition site. Eggs were sampled for the 1st time after 5 days exposure by removing the wax paper, replacing it with fresh paper. This procedure was repeated at intervals until all weevils had died. Eggs were held a minimum of 10 days in the laboratory at 27±5°C, and hatch was determined by counting neonate larvae and unhatched eggs. The residual activity of the test material was evaluated by caging weevils on each tree at 10 and 16 days posttreatment and determining hatch.

In the 2nd field test, a 5-acre weevil-infested citrus grove was treated aerially Oct. 2, 1975, with a water suspension of TH 6040 delivered at rates of 283 g

[1] Coleoptera: Curculionidae.
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[3] This paper reports the results of research only. Mention of a pesticide does not constitute a recommendation for use by the USDA, nor does it imply registration under FIFRA as amended. Also, mention of a commercial or a proprietary product does not constitute an endorsement by the USDA.
[4] The authors thank Mr. J. O. Phillips, Citrus Central, Plymouth, Fla., who made a citrus grove available for this study.

Total 51
Check 14

AI/acre and 1134 g AI/
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rate of 475 ml/3.76 lit
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Table 2.—Percent egg
6040-free diet for a mini

Days adults exposed in grove	Rate g AI/acre
1	283
	1134
2	283
	1134
3	283
	1134
Control	—

Table 1.—Percent egg hatch for a one-month period for weevils continuously exposed to a residue of TH 6040 on citrus foliage.

Introduction of adult weevils to the grove days post-treatment	Rate g AI/acre	Total eggs ×10³	% Egg hatch: Eggs deposited after 1–5 days exposure	Eggs deposited after 5 days exposure	Total
0	283	8	34	3	10
	1134	8	10	5	6
5	283	7	6	5	5
	1134	8	100	20	40
11	283	4	1	18	16
	1134	6	60	10	16
19	283	3	12	3	9
	1134	3	18	14	16
26	283	2	9	—	9
	1134	2	41	—	41
Total		51			15
Check		14	—	—	71

AI/acre and 1134 g AI/acre. Pinolene was added to the suspension as an extender sticker spreader at a rate of 475 ml/3.76 liters of finish spray. The aircraft boom was fitted with sixty D8-45 nozzles, and the spraying system was pressurized at 75 lb/in.² to deliver at a rate of 5 gal/acre. Several hours after treatment, caged weevils (7/cage: 2 ♂ + 5 ♀) were placed on each of 10 trees treated at each rate. Eggs were collected to determine hatch as previously described. Also, other weevils were caged on treated trees at 5, 11, 19, and 26 days posttreatment to determine residual effectiveness. (Native weevils were collected in the treated grove at 5 days posttreatment and caged on foliage in the grove; these eggs, too, were collected and hatch was determined.)

In a 3rd field test made to determine the ovicidal effect of a limited exposure to TH 6040, 20 cages each containing 3 ♀ and 2 ♂ were placed on the foliage of trees treated by aerial application of 283 or 1134 g AI/acre (10 cages/rate). Weevils were removed after 1, 2 or 3 days of exposure and placed on bean plants at the laboratory for oviposition. Three days later, a wax paper strip was added as an oviposition site, and eggs were collected thereafter until all weevils had died. The effect of a 4-day exposure period to a 10-day-old residue was evaluated in the same way.

Controls for the 3 field tests were weevils that were caged and placed on foliage in an untreated grove. Thus, eggs were collected at intervals by removing and replacing the wax paper strip, and fertility was determined by counting egg hatch.

RESULTS AND DISCUSSION.—In the 1st field trials with TH 6040, the total egg hatch of weevils exposed to 0-day-old residues of either treatment was significantly reduced. Hatch of eggs deposited by weevils exposed to the low rate, 57 g AI/100 gal, averaged 24% compared with 72% for the check. Also, hatch of eggs of weevils exposed to the high rate averaged less than 5%. When the 2nd group of weevils was placed on the 10-day-old residue of TH 6040, the hatch of more than 7000 eggs produced was not significantly affected (hatch 68%). Egg hatch for weevils exposed to a 16-day-old residue was comparable to that for the check, 67 and 68%, respectively.

In test 2, hatch of the 51,000 eggs collected from weevils exposed for one month to TH 6040 in the sprayed grove was 15% compared with 71% for eggs from check weevils (Table 1). The high rate of 1134 g AI/acre apparently was less effective in reducing fertility than the low rate, possibly because TH 6040 is a stomach poison, and the high rate caused the weevils to stop feeding. The 26-day-old residue of the low rate was very effective in reducing adult fertility (9% hatch). The studies were terminated after 33 days because of cold weather. Also, hatch of the more than 8000 eggs collected from native weevils in the sprayed grove was less than 10%.

Initial egg hatch in test 3 from weevils confined 1–3 days on foliage aerially treated with TH 6040 and then fed for 3 days on untreated bean plants in the laboratory was significantly reduced (Table 2). However, it returned to normal in ca. 2 weeks. Therefore, the effect on total egg hatch was not appreciable. When adult weevils were exposed for 4 days to a

Table 2.—Percent egg hatch for weevils with a limited exposure to 0-day residue of TH 6040, then fed on a TH 6040-free diet for a minimum of 3 days.

Days adults exposed in grove	Rate g AI/acre	Total eggs ×10³	% Egg hatch: Eggs collected at indicated days after adult exposure 3–4	5–11	12–20	22–28	Total % hatch
1	283	7.1	14	14	46	93	53
	1134	7.2	24	23	33	81	45
2	283	7.0	1	3	67	71	55
	1134	8.7	20	9	34	87	47
3	283	6.6	27	46	88	—	51
	1134	7.4	27	59	79	—	57
Control	—	14	—	—	—		71

10-day-old residue in this same grove and then fed beans for 3 days, total egg hatch was not reduced (74%).

TH 6040 applied by air to citrus was thus effective in reducing the reproductive potential of weevils continuously exposed, and residues were effective for at least 26 days. This insect growth regulator is a potential tool in the eradication or control of *D. abbreviatus* in Florida.

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