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Spray Oil Effects on *Diaprepes abbreviatus*[1] on Citrus in Florida[2,3]

W. J. Schroeder, R. A. Sutton, and A. G. Selhime[4]

U.S. Horticultural Research Laboratory, Agric. Res. Serv., USDA, Orlando, FL 32803

ABSTRACT

The feeding of *Diaprepes abbreviatus* (L.) on citrus foliage was significantly affected by an aerial application of Florida citrus oil (FC 435-66) at a rate of 23.5 liters/ha. Also, reproductive potential was significantly reduced, though fecundity and fertility were not affected, because the oil physically impaired the bond between eggs and foliage, and wind and rain caused eggs to become mechanically unattached. Unattached eggs were removed by predators. The resulting physical, mechanical, and biological increase in mortality of eggs for one month after the spray application resulted in a 72% loss of weevil eggs.

Diaprepes abbreviatus (L.), is an important pest of sugarcane, citrus, and other agricultural crops in the West Indies. It was 1st observed in central Florida in 1964 (Woodruff 1964). By 1976, *D. abbreviatus* was infesting ca. 20,000 ha in central and south Fla. The adults feed on new foliage, the larvae feed on roots, and often cause damage that leads to host decline. Eggs, ca. 100/mass, are deposited between mature leaves that the female cements together. The leaves provide protection for the egg mass and usually remain together until after egg eclosion (7 days).

Spray oil FC 435-66 (Simanton and Trammell 1966) is a pesticide recommended for Florida citrus. Application is usually made June through July as a dilute spray. The rate per ha varies with tree size but should not exceed 94 and 140 liters/ha for full-bearing orange trees, *Citrus* sp., and grapefruit trees *C. paradisi* Macf., respectively (Anon. 1976).

When 23.5 liter oil/ha were applied by air in a 50/50 spray oil-water formulation, the physical bond between the citrus leaves and the eggs of *D. abbreviatus* was observed to be impaired (unpublished data). Subsequently, the weevil egg mass was exposed or completely unattached from the foliage (Fig. 1). Also, in the laboratory, oil had an effect on weevil feeding. We therefore conducted field tests to determine the effect of oil residues on weevil feeding and reproduction.

Methods and Materials.—The citrus grove used for the field test was 4 ha, 15 yr old, and contained 173 trees/ha (7.6 m between trees and rows). Average tree height was 4.0 m. The grove was disced in Aug. to reduce weed growth. An aerial application of 50/50 spray oil-water was made Sept. 3, 1976, with a Piper Pawnee Brave® equipped with 60 D8-45 nozzles on the sprayboom. The spraying system was pressurized at 5.27 kg/cm^2 to deliver at 47 liter/ha. Rainfall and temperature were recorded during the application and for 2 wk after the application.

Prior to spray application, citrus branches with new growth were removed from the area. Immediately after spraying, a 2nd group of branches was removed. Measurements of the foliage were made with a Lambda® Portable Area Meter model LI-3000. The new growth from sprayed and unsprayed branches (totals of 3482 and 3592 cm^2, respectively) was divided into 14 vials (7 sprayed and 7 unsprayed) and held in an outdoor cage (cage size 0.6 m^2) that contained 25 ♀ and 15 ♂ weevils. After 1 wk, the area (cm^2) of leaf area remaining per vial was determined. The data were analyzed by Student's t-test. This study was repeated at 10 days posttreatment to determine whether there was any residual effect of the spray.

The effect of spray oil on weevil fecundity and fertility was determined by setting up 8 cages (cage size 0.6 m^2) with 25 ♀ and 15 ♂/cage. Four cages had unsprayed foliage, and 4 had foliage from the sprayed grove. Waxpaper strips were placed in each cage as an oviposition site. The total number of eggs and egg hatch was determined by cage, and data were analyzed.

The physical attachment of weevil eggs was studied by placing 5 potted (1.0 m high) calamondin, *C. reticulata* Blanco var. *austera* X *Fortunella* sp. Swing., in the grove before aerial spraying. After application, trees were individually caged (cage size—0.6×0.6×1.35 m) and each cage was stocked with 10 ♀ and 3 ♂ weevils. Five unsprayed trees with an equivalent number of weevils in cages served as checks. Eggs were collected from each tree once a week. Eggs were considered viable if the mass was attached to foliage.

The possibility that larvae would hatch from an unattached egg mass was determined by placing egg masses on the ground under the citrus tree (5 locations) and in the open (5 locations). Observations were made 24 h later. The test was replicated 3 times.

Results and Discussion.—Rainfall for the 4 wk following spray application was 4.49, 1.47, 2.1, and 2.24 cm, respectively. The range of ambient temperature in the grove was 13°–37°C. Temperature on the soil surface in the grove was 15°–20°C above ambient in full sun.

The area of treated leaf surface (253 cm^2) and

[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.
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Table 1.—Mean number of attached eggs recovered from 10 ♀ and 3 ♂ weevils/tree (5 treated and 5 untreated trees), Plymouth, FL, 1976.

	Mean no. of eggs/tree ±SE[a]					
	Weeks after treatment					
Treatment	1	2	3	4	5	% reduction (3 wk)
Oil-spray trees	311± 72 a	623±189 a	296±140 a	33± 9 a	246±70 a	72
Check trees	1996±250 b	1397±173 b	989±135 b	47±13 a	135±23 a	

[a] Means followed by the same letter are not significantly different at the 5% level.

untreated foliage (949 cm^2) consumed by the weevils differed significantly ($P < 0.05$) immediately after the application. When the test was repeated at 10 days posttreatment, there was no significant difference (1692-1677 cm^2 treated-untreated). Thus oil applied at a rate of 23.5 liter/ha by air did affect weevil feeding.

Totals of 38,114 and 31,391 eggs were collected from the 4 cages each of weevils fed oil-treated and untreated foliage, respectively. Egg hatch was >60%

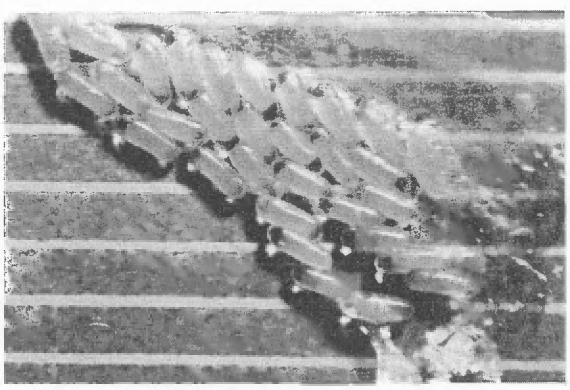

FIG. 1.—An unattached *D. abbreviatus* egg mass with material used by adult to cement eggs to foliage. Lines on background are 1 mm apart.

for both groups. Thus, oil had no significant effect ($P > 0.05$) on weevil fecundity or fertility.

Table 1 gives mean numbers of attached eggs per tree per week for treated and untreated trees. Oil residues had no effect on weevil fecundity. The difference in mean number of eggs on treated and untreated trees can be attributed to physical loss.

None of the unattached egg masses placed on the ground in the grove were recovered after 24 h. Ants were the primary predators, but eggs exposed to high soil temperature were destroyed by desiccation.

Therefore, the oil physically impaired the bond between eggs and foliage, but factors such as wind and rain increased the actual sluffing of the egg mass mechanically. High soil temperature and predators then eliminated the detached eggs as a source of weevil reproduction. The combined physical, mechanical, and biological increase in egg mortality following an application of oil thus provides a method of weevil control.

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