

FIPRONIL FOR DIAPREPES ABBREVIATUS (COLEOPTERA: CURCULIONIDAE) LARVAL CONTROL IN CONTAINER-GROWN CITRUS

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Abstract. Fipronil, incorporated into potting soil at 25 ppm, controlled root weevils following three inoculations of 10 *Diaprepes abbreviatus* neonate larvae to sour orange seedlings over 90 days. Root weights were significantly less in seedlings with larvae and no fipronil compared to controls with larvae only and seedlings with larvae and fipronil. Control plants with larvae had only tap roots after 90 days. From these data, 25 ppm fipronil incorporated into plastic pots of potting soil would provide control of this insect.

Diaprepes abbreviatus (L.) (= the West Indian sugarcane root-stalk borer weevil or Apopka weevil) is an insidious pest of citrus, sugarcane and economic crops of the tropics and subtropics (Simpson et al., 1996). Life cycle hosts include citrus, sorghum, corn, dragon tree, sweet potato and sugarcane. Larvae have been found feeding on more than 40 plants species in 20 plant families (Simpson et al., 1996).

Originally discovered as an introduced pest to Florida in 1964, *D. abbreviatus* has spread to 20 Florida counties and at least 94 citrus and ornamental nurseries (Woodruff, 1968; Beavers et al., 1979; Hall, 1995; Anonymous, 1997). A quarantine on the movement of untreated nursery plants was imposed on nurseries with a *D. abbreviatus* infestation in 1968. This quarantine has remained in effect until today. Wide area treatment with heptachlor, dieldrin and chlordane was in effect from 1968 to 1979. Heptachlor and dieldrin were the insecticides first used for soil incorporation in nurseries to control *Diaprepes*. Today bifenthrin or Talstar® is recommended (required) at 25 ppm in nursery soil(s) to control *Di-*

aprepes larvae. There are no IPM strategies to control this weevil (McCoy and Simpson, 1994).

Fipronil (5-amino-1-[2,6-dichloro-4-(trifluoromethyl)phenyl]-4-[(1R,S)-(trifluoromethyl)sulfinyl]-1H-pyrazol-3-carbonitrile) is a member of a new class of insecticides known as phenyl pyrazoles. Fipronil is somewhat systemic with reported activity against citrus leafminer (*Phyllocnistis citrella*), citrus thrips (*Scirtothrips aurantii*), citrus thrips (*Scirtothrips dorsalis*) and citrus aphid (*Toxoptera* spp.).

The purpose of this experiment was to determine the soil activity of 25 ppm fipronil against *D. abbreviatus* larvae.

Materials and Methods

Fipronil, 25 ppm active ingredient (0.1% A.I. granular), was mixed into a peat-perlite based potting soil (Fafard citrus mix B) and sour orange seedlings (*Citrus aurantium* L.) were potted in 6 inch plastic pots in this mixture. Twenty-eight seedlings were potted in untreated soil and 30 seedlings were potted in treated soil. There were 4 treatments: 15 seedlings in fipronil-treated soil with *D. abbreviatus* larvae, 15 in treated soil without larvae, 14 in untreated soil with *D. abbreviatus* larvae, and 14 in untreated soil without larvae. Trunk diameters were measured 1 inch (2.54 cm) above the soil with a micrometer. Ten 1-day-old neonate larvae from adult weevils collected at Homestead, Florida were scattered on the soil surface at 0, 30 and 60 days. These larvae were observed for 10 min by which time all had entered the soil.

After 90 days, trees were removed from their pots, washed free of soil and the soil was sieved with a #10 sieve and then with a #20 sieve for detection of larvae. Trees were cut 1 inch (2.54 cm) above the first root, blotted with paper towel and allowed to air dry for 1 hr before weighing. After weighing, root systems were placed individually into #3 paper bags and were further dried in a Fisher Scientific isotemp oven model 650G at 60°C for 60 hr. Individual root system weights were again determined.

Results and Discussion

Trunk diameter showed inconsistent differences among treatments (Table 1). Wet and dry root weights were significantly less for plants receiving larvae and no fipronil compared to any other

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Table 1. Average trunk diameter, root weight and number of larvae recovered from 14 or 15 (m) trees after 90 days.

Treatment	n	Trunk diameter (mm)			Root weight (g)		Larvae
		0 days	90 days	Difference	Wet	Dry	
1. Fipronil, no larvae	15	5.35 ± 0.69* a,b	9.14 ± 0.92 a	3.80 ± 0.70 a	71.75 ± 28.04 a,b	16.93 ± 8.01 a	0 b
2. Fipronil, larvae	15	5.53 ± 0.51 a	9.44 ± 0.63 a	3.91 ± 0.90 a	89.67 ± 24.31 a	18.45 ± 5.41 a	0 b
3. Larvae, no Fipronil	14	4.64 ± 0.45 b	7.12 ± 0.89 b	2.48 ± 0.86 b	18.60 ± 19.66 c	4.03 ± 2.67 b	4.3 ± 1.8 a
4. No larvae, no Fipronil	14	4.66 ± 1.09 b	7.87 ± 1.13 b	3.22 ± 1.39 a,b	57.20 ± 32.46 b	13.86 ± 9.90 a	0 b

*Means ± SD followed by the same letter are not different at α = 0.05 by ANOVA and Tukey's HSD test.

treatment. Larvae were recovered in all pots which received larvae and did not contain fipronil. No larvae were recovered in pots with fipronil. Talstar® (bifenthrin) at 25 ppm incorporated into soil pro-

vided 100% control of 20 larvae applied every 30 days at 90, 180 and 360 days post treatment (McCoy et al., 1995; Simpson and McCoy, 1996). Our experiments showed that fipronil provided

100% control of 10 larvae applied every 30 days at 90 days post treatment. In addition, fipronil appears to have stimulated root growth in citrus plants (Fig. 1) but differences were not statistically significant (Table 1). A positive effect on growth has been seen in many other crops and effects have included increased yields (Rhone-Poulenc, 1996). Our data indicate that 25 ppm fipronil incorporated into soil would provide control of *D. abbreviatus* larvae. It should be noted that this material is not currently registered for use on citrus.

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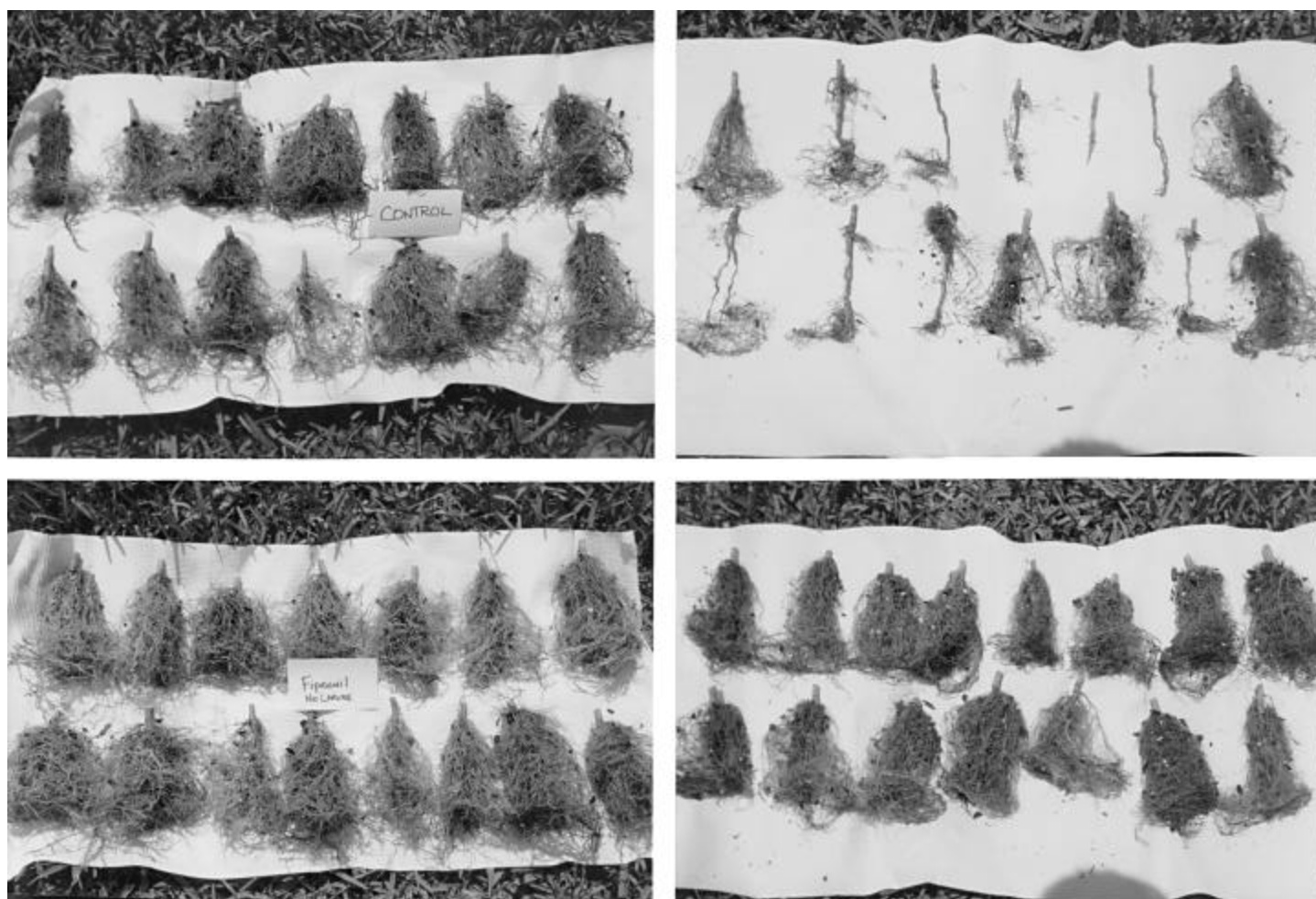


Figure 1. Roots of experimental seedlings in Table 1. Upper left, no fipronil without larvae (control); upper right, no fipronil with larvae treatment; lower left, 25 ppm fipronil without larvae; lower right, 25 ppm fipronil with larvae.