LANDSCAPE FABRIC AS A PHYSICAL BARRIER TO NEONATE *DIAPREPES ABBREVIATUS* (COLEOPTERA: CURCULIONIDAE)

C. L. MCKENZIE[1], S. L. LAPOINTE[1] AND L. W. DUNCAN[2]
[1]USDA-ARS, U.S. Horticultural Research Laboratory, 2001 South Rock Road, Ft. Pierce, FL 34945

[2]University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL 33850

There are few options available to Florida producers of citrus and ornamentals for control of root-feeding weevils such as the Diaprepes root weevil, *Diaprepes abbreviatus* (L.). Currently, there is no recommended method for control of the soil-borne larvae of *D. abbreviatus* (Futch et al. 2001). Foliar sprays for control of adults have not been shown to be effective in reducing larval damage. While entomopathogenic nematodes may be effective in reducing larval populations (Bullock et al. 1999), their use is problematic due to complications of formulation, delivery, and application. Increasing damage from *D. abbreviatus* and recent recalls of a defective commercial nematode product underline the precarious situation for growers and the need for new control options.

Adult *D. abbreviatus* and other weevils such as species of *Artipus* and *Pachnaeus*, oviposit by cementing eggs in a layer between leaves or other surfaces. Neonate larvae fall to the ground, burrow into the soil and feed on progressively larger roots as they grow. A physical barrier to prevent neonate larvae from reaching tree roots could be an effective, nontoxic control of root weevils as well as potentially providing a number of collateral benefits to citriculture. If technically viable in groves, a properly designed barrier could offer multiple returns on initial investment over several years including effective, long-term, nonchemical control of root-feeding weevils; reduced use of irrigation water and pump energy; nonchemical weed control; and reduction of soil erosion. In this study we determined the ability of neonate *D. abbreviatus* larvae to penetrate a range of commercially available weed cloth fabrics in controlled laboratory experiments.

Weed cloth was purchased from local retailers and included Weed-X and Weed Proof (Dalen Products Inc., Knoxville, TN), and Weed Block and Commercial Landscape Fabric (Easy Gardener Inc. Waco, TX). Further fabric samples were obtained from Dalen Products Inc. and Synthetic Industries, Gainesville, GA. During the course of the experiment, the Weed-X product name was discontinued by the manufacturer and replaced by the similar Weed Shield and Professional Weed-X products. Organdy cloth (1 mm mesh openings) was used as a control for all trials. Neonate *D. abbreviatus* were obtained from a laboratory colony maintained at the U.S. Horticultural Research Laboratory, Ft. Pierce, FL (Lapointe and Shapiro 1999; Lapointe 2000). All experiments were conducted at a constant temperature of 26 ± 1°C in growth chambers with a photoperiod of 14:10 L:D.

The test apparatus consisted of two plastic containers joined by a plastic collar (Magenta GA-7-3 vessel, Magenta Corp., Chicago, IL). The fabrics to be tested (Table 1) were placed between the chambers and sealed at the edges by the collar. The upper surface of the fabric was covered with 10 mm of sterilized sandy soil. Forty neonates (12-36 h old) were released in the upper chamber and observed at 24 h intervals. Neonates that penetrated the barrier were collected in the lower chamber.

The spun polyester/polyolefin bi-layer products were very effective barriers to neonate penetration (Table 2). These products are continuous films designed to be water permeable but without large pores that would allow neonate passage. The plastic films have varying densities of perforations (0.5 mm diam) equal to or slightly larger than the width of the head capsule of neonates (Quintela et al. 1998) that permitted penetration of 50 to 75% of neonate *D. abbreviatus*. Two prod-

TABLE 1. DESCRIPTION AND SOURCE OF WEED CLOTH PRODUCTS TESTED.

Product Name	Description	Source
Weed-X	Spun polyester/polyolefin film bi-layer	Dalen Products Inc., Knoxville, TN
Weed Proof	Perforated film	Dalen Products, Inc.
Weed Shield	Spun polyester/polyolefin film bi-layer	Dalen Products Inc.
Professional Weed-X	Spun polyester/polyolefin film bi-layer	Dalen Products Inc.
Weed Block	Perforated polyolefin film	Easy Gardener Inc., Waco TX
Commercial Landscape Fabric	Spun-bonded polyester	Easy Gardener Inc.
Lumite 994GC	Woven polyester	Synthetic Industries, Gainesville, GA

TABLE 2. MEAN NUMBER (±SE) AND % PENETRATION BY NEONATE *D. ABBREVIATUS* LARVAE THROUGH 7 COMMERCIALLY AVAILABLE WEED CLOTH FABRICS.

Product	No. of neonates (% penetration)	
	24 h	48 h
Trial 1		
Weed-X	0.1 ± 0.1 (0.3) a	0.1 ± 0.1 (0.3) a
Commercial Landscape Fabric	3.7 ± 1.9 (9.2) a	4.2 ± 2.3 (10.6) a
Weed Proof	17.6 ± 1.3 (43.9) b	21.7 ± 1.7 (54.2) b
Weed Block	29.6 ± 2.9 (73.9) c	30.8 ± 3.1 (76.9) c
Control	26.3 ± 2.2 (65.8) c	32.6 ± 2.0 (81.4) c
Trial 2		
Weed Shield	0.0 ± 0.0 (0.0) a	0.0 ± 0.0 (0.0) a
Professional Weed-X	0.0 ± 0.0 (0.0) a	0.1 ± 0.1 (0.4) a
Lumite 994GC	0.6 ± 0.3 (1.5) a	1.1 ± 0.5 (2.9) a
Control	29.0 ± 2.5 (72.5) b	27.0 ± 2.1 (67.5) b

Means followed by the same letter within trials do not differ significantly at $\alpha = 0.05$ (Ryan-Einot-Gabriel-Welsch Multiple Range Test).

ucts were intermediate in that they reduced penetration compared with the organdy cloth control of the perforated plastic films, but allowed some neonates to pass through them. One of these (Commercial Landscape Fabric) consisted solely of spun-bonded polyester. This product is a mesh of polyester fibers that allowed neonates to burrow through. The second (Lumite 994GC) was a surprisingly efficient barrier compared with the continuous film products even though Lumite 994GC is woven with openings of varying size between the plastic strands.

Issues of cost and methods of field deployment remain to be addressed. These will determine whether landscape fabrics are economically viable alternatives for control of root weevils.

SUMMARY

The spun polyester/polyolefin bi-layer products acted as a physical barrier to *Diaprepes* by preventing downward penetration by neonate larvae in laboratory experiments. If issues of cost and field deployment can be resolved, landscape fabric has potential as a component of an integrated approach to control of root weevils. Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture and does not imply its approval to the exclusion of other products that may also be suitable.

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