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Effectiveness of Two Biorational Substances (Neem and Abamectin) Against Citrus Leaf Miner

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In southeastern Florida, citrus trees serve both as fruit trees and ornamentals. Recently, I tested two biorationals, azadirachtin and abamectin, both of which are essentially non-toxic to mammals, for effectiveness against the citrus leaf miner [*Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae)], a pest that is native to Asia and new to Florida.

Materials and Methods

Seedlings of sweet lime (*Citrus limettioides* Tanaka) were kindly supplied to us by Charles Youtsey of the Florida Department of Agriculture and Consumers Services, Winter Haven. These were about 0.3 m tall and with about 30 leaves each, growing in a medium of equal parts of muck, sharp and cypress sawdust in 15 cm dia plastic containers. They were initially kept in a screen cage to protect them from attack by citrus leaf miner. Each plant was fertilized on September 1, 1993, with a soil application of 5 g 18N-6P-8K Osmocote and removed from the cage and placed near an orange tree [*C. sinensis* (L.) Osbeck] infested with citrus leaf miner.

Twelve plants each were assigned at random to either of 2 different treatments or an untreated control. The treatments were: (1) Avid (abamectin 0.15 EC)(MSD Agvet, Merck & Co., Rahway, New Jersey) at 0.312 ml / l H₂O (4 fl.oz. / 100 gal.), (2) Azatin (Agridyne Technologies, Inc., Salt Lake City, Utah) at 2 ml / l H₂O (60 ppm azadirachtin) + 0.5 ml /

1 H2O Triton B-1956 spreader-sticker (Rhom & Haas Co., Philadelphia, PA). The treatments were applied weekly for 4 weeks beginning September 9. Upper and lower leaf surfaces were sprayed to run-off using a 2-liter handsprayer.

Plants were examined for leaf miners on September 17 (one week after the first spraying) and weekly thereafter for four weeks. The number of leaves with mines per plant was determined. For comparing the treatments, only the leaves with well-developed mines and which were curled due to the leaf miner damage were counted. Mines in initial stages that did not cause significant damage or curling of leaves were noted separately. Numbers of leaves with advanced mines per plant were transformed with the $x + 0.5$ transformation before analysis by ANOVA and the means tested for significance with the Waller Duncan t-test.

At the end of the four week period, leaves with mines were removed from the plants and examined under the microscope to determine the fate of leaf miners in the different treatment groups.

Results

Citrus leaf miner damage was observed on newly flushed leaves, but not on hardened-off leaves. About 50 % of the plants in each treatment group and the control flushed during the 4-week period of the experiment and thus were susceptible to attack by leaf miners. During this period, leaf miners did not complete mines in leaves of the plants treated with Avid or Azatin. By comparison, at the end of the 4-week period, 58.3 % of the plants in the control group had well-developed leaf miner damage accompanied by leaf curl. There was a mean of 2.84 leaves with well-developed mines per plant in the control compared to 0 leaves with well-developed mines in the Avid- and Azatin-treated group ($P < 0.05$).

Examination in the laboratory of leaves from plants in the control group revealed several empty pupal cases rolled in leaf edges, indicating that leaf miners had completed development to adult. Some late instar larvae were also seen.

The plants treated with Avid remained completely free of

leaf miner damage. By October 1, 33 % of the plants treated with Azatin had 1 to 7 incipient mines. By October 8, 50 % of the Azatin-treated plants had incipient mines, and the incipient mines observed on October 8 had not progressed. These mines were observed again on October 15 and had not progressed and there was no leaf curl. Thus, although leaf miners initiated mines in the leaves, the Azatin treatment protected the leaves from being damaged significantly.

These results indicate that the 2 biorationals tested prevent damage by citrus leaf miners when sprayed on leaves prior to oviposition by this insect. Thus sprays must be timed just as trees are flushing, which may be expected to be different for different species and varieties of citrus and, as in the case of our test plants, for different individual plants. Further information is needed to determine the minimum effective dosage, maximum intervals between applications, and other parameters. Alternating treatments with azadirachtin and abamectin and possibly other compounds in the interest of insect resistance management needs to be investigated, as well as the potential effect of these compounds on beneficial insects.

Azadirachtin and abamectin products are potentially useful for controlling citrus leaf miner.