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Systemic Insecticides Reduce Staining Caused by Caterpillar Frass and Eriophyid Mite Galls of Oxhorn Bucida ("Black-Olive") Trees

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The oxhorn bucida tree is sometimes attacked by eriophyid mites and caterpillars. These two arthropod pests create by-products (caterpillar frass and mite galls) which cause severe staining of hardscapes and vehicles beneath the tree canopy. This staining is so objectionable that unhappy homeowners cut the trees down to resolve the issue. In an effort to reduce staining and save trees, field tests were initiated in two locations to evaluate systemic insecticide treatments. In 2014, in Naples, FL, trees treated with a dinotefuran soil-root drench or with acephate trunk injections had less staining due to caterpillar suppression. In 2015, in Coral Gables, FL, trunk injections of abamectin provided noticeable reduction in mite galls and staining.

The oxhorn bucida (commonly referred to as the "Black-Olive" tree, *Bucida buceras* L. Combretaceae) is a common shade tree in many neighborhoods and used along city streets in South Florida. However, one negative aspect associated with this tree is a dark, rusty staining on objects within its drip line (Fig. 1). This severe staining is caused by plant chemicals, presumably tannins, concentrated in the frass of the bucida caterpillar, *Garella* (*Characoma*) *nilotica* (Rogenhofer): Nolidae. The caterpillars also create a nuisance as they habitually swing down from the canopy on silken strands in great numbers and annoy pedestrians, thus the local nickname of "bungee" caterpillar (Caldwell, 2008, 2011). The second pest, a mite, *Eriophyes buceras* Cromroy: Eriophyidae, causes a slender, 4- to 8-inch long fruit (ovary) gall which resembles a green bean. These galls, when wet, exude a rusty, oily staining substance. The galls may be straight or curled. The curled galls are the inspiration for the common name, oxhorn bucida (Nelson, 1994). The bucida caterpillars frequently tunnel into the galls in the Naples area, but this behavior is infrequently observed in Coral Gables. The staining caused by these arthropods can be so severe that homeowners have the trees removed to avoid the unattractive staining mess to driveways and vehicles. Two field studies were conducted to compare the effects of various systemic insecticide treatments on bucida caterpillar feeding and eriophyid gall formation on bucida trees.

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Materials and Methods

2014 in Naples. This study was conducted on the smaller statured 'Shady Lady' bucida street trees in a gated, residential community. Trees averaged 11 inches trunk diameter, breast height (dbh) and about 25 feet in height. Treatments were either trunk injections or soil drenches around the root flare. Trunk-injected insecticides were delivered using both the Q-Connect™ harness system and the Q-Gun™ by Rainbow Treecare Scientific Advancements (Minnetonka, MN). The harness system allows for concurrent injections into multiple holes, whereas the Q Gun is used for single injections into predrilled holes. All injections were made at about 35 pounds per square inch (psi)

Fig. 1. This picture shows what many would consider to be an objectionable degree of staining under an oxhorn bucida [*Bucida buceras*] tree canopy in Naples, FL. The intensity of staining varies from year to year and is, in Naples, primarily due to caterpillar, *Garella* (*Characoma*) *nilotica* frass accumulation, not the leaves nor the fruit of the bucida tree.

pressure. Each hole was drilled with a 15/16 inch, high helix drill bit, about 2 inches deep. Holes were spaced about 6 inches apart around the trunk circumference and 18 inches above the soil. No plugs were used to seal the drill holes and the holes closed within a few months. The dinotefuran treatments were mixed in 2 gallons of water and applied as soil drenches within 12 inches of the trunk using a watering can. The following treatments were applied on 6 Feb. 2014: 1) CVG-700 Infusible (proprietary) at 0.3 oz. (10 mL) per inch trunk dbh, trunk injected; 2) Lepitect™ (97% acephate, Rainbow Treecare, Minnetonka, MN) at 0.4 oz. (11.3 gm) + 8.3 oz. (250 mL) water per inch dbh, soil drench; 3) Transtect™ 70 WSP (dinotefuran, Rainbow Treecare) at 0.6 oz. (17 gm) per 5 inches dbh, soil drench; 4) Lepitect Infusible™ (97% acephate, Rainbow Treecare) at 0.5 oz. (15 gm) + 3.3 oz. (100 mL) water per 10 inches dbh, trunk injected; and 5) untreated control.

Gall density was very light and variable from tree to tree and was not included in the analysis. Evaluations of feeding damage and staining were conducted on 2 May (12 WAT, weeks after treatment) and 30 May (16 WAT) 2014 by two observers. Feeding damage was a visual estimate, measured as percent browning of the canopy's foliage due to caterpillar feeding. Staining was rated on driveways and sidewalks beneath tree canopies on a scale of 0–5 with 0 = none; 1 = very light staining; 2 = light staining; 3 = moderate; 4 = heavy and objectionable to 5 = severe and objectionable. Experimental design was a randomized complete block with 4 replications (1 tree per replicate) per treatment. Data were analyzed with ANOVA (ARM6, Gylling Data Management Systems, Brookings, SD).

2015 in Coral Gables. This study was conducted on mature oxhorn bucida street trees in Coral Gables, FL. The City of Coral Gables has 12,000 mature bucida trees. This testing was initiated because the city management staff is inundated year after year with complaint calls due to the staining. Trees selected for the study had been considered as high staining in the past. Trees averaged 21 inches dbh and about 35–40 feet in height. Trunk injections were made with a Q-Gun (Rainbow Treecare Scientific Advancements) and soil drenches (2 gallons per tree) were applied within 12 inches of the trunk with a watering can.

The following treatments were applied 3 Mar. 2015: 1) Transtect™ 70 WSP, high at 17 gm per 5 inches dbh, soil drench; 2) Transtect 70 WSP, low at 17 gm per 10 inches dbh, soil drench; 3) Zylam® Liquid (10% dinotefuran, PBI-Gordon Corp., Kansas City, MO), high at at 114 mL per 5 inches dbh, soil drench; 4) Zylam® Liquid (10% dinotefuran) low at 114 mL per 10 inches dbh, soil drench; 5) Aracinate™ Tree Injection (2% abamectin, Rainbow Treecare) at 5 mL per 2 inches dbh; 6) Transtect high (drench) + Aracinate (injection at same rate as above); 7) Zylam Liquid high (drench) + Aracinate (injection at same rate); and 8) untreated control.

Evaluations of feeding damage, staining and gall formation were conducted on 6 May (8 WAT), 15 June (14 WAT), 6 August (22 WAT), and 9 Sept. (26 WAT) 2015. Staining was rated on driveways and sidewalks immediately under the trees on a scale of 0–5. Gall formation was rated on a scale of 0–10 with 0 = none; 1 = 10% of canopy with galls; 2 = 20% of canopy with galls; and 10 = profuse or 100% of canopy with galls. The experimental design was a randomized complete block with eight replications (one tree per replicate) per treatment. Because the trees were located on several streets, the blocks consisted of trees as close together as possible. Data were analyzed with ANOVA (ARM6, Gylling Data Management Systems, Brookings, SD).

Results and Discussion

2014 in Naples. Overall, caterpillar damage levels did not exceed 25% defoliation. Infestations in previous years were more damaging, causing up to 90% browning and defoliation. However, no feeding damage was observed in trees receiving the soil drench Transtect (dinotefuran) treatment, but there were no statistical differences in damage between any of the treatments.

Trees receiving Transtect or Lepitect Infusible (acephate) treatments showed statistically less staining at 12 WAT (Fig. 2). This trend continued at 16 WAT with the Lepitect Infusible treated trees having the least amount of staining and the Transtect the next least staining. Stain ratings have some variability due to heavy rain or homeowners sporadically power-washing their sidewalks, both of which may result in a subtle reduction of the stain intensity.

Acephate trunk injections provided better results than the acephate soil drench. In general, results with trunk injections are more efficient and not prone to the variables with soil drench treatments such as uncertain root interception and soil binding. Less material is lost in trunk injecting since it all goes directly into the tree trunk, making it more acceptable from an environmental standpoint.

Trunk injections of acephate provided good suppression of staining. Results with the soil drench applications of dinotefuran were erratic but promising. The Transtect label targets some caterpillar species only if the product is trunk injected. Foliar applications of neonicotinoids such as dinotefuran are not known to be effective at controlling external feeding caterpillars, but are reputed to be more effective on internal feeding caterpillars such as stem borers.

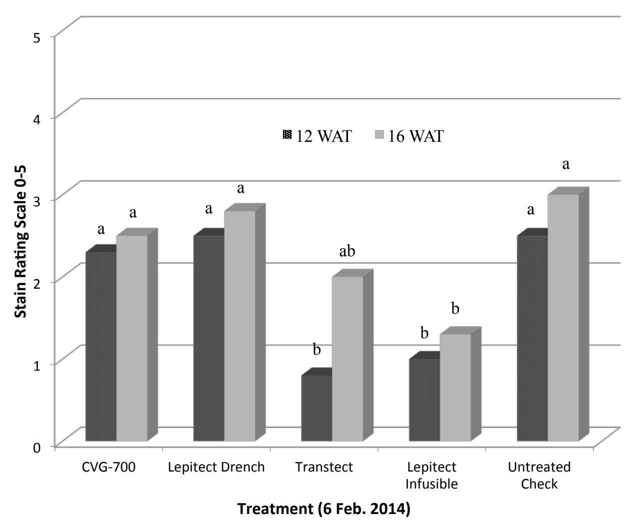

Fig. 2. Bucida 'Shady Lady' staining levels due to feeding by the bucida caterpillar, *Garella* (*Characoma*) *nilotica* in Naples, FL, in 2014. Staining was rated on driveways and sidewalks beneath tree canopies on a scale of 0–5 with 0 = none; 1 = very light staining; 2 = light staining; 3 = moderate; 4 = heavy and objectionable to 5 = severe and objectionable. Means (n = 4) were analyzed within each date. Bars with the same letter do not differ significantly ($P = 0.05$, Student-Newman-Keuls).

2015 Coral Gables. Aracinate (abamectin) trunk injections alone, or in combination with Zylam (dinotefuran) high soil drench, resulted in the least amount of staining (Fig. 3) and statistically significant only at 22 WAT. Treatments containing Aracinate resulted in the least amount of eriophyid mite gall formation (Fig. 4). No phytotoxicity was observed with any of the treatments. Neither dinotefuran formulation (Transtect and Zylam) appeared promising for reducing staining as was the case in the Naples study. The Aracinate, trend-wise, looks promising even though the results were not statistically significant. The Aracinate label includes caterpillar species as well as mites. There may have been some caterpillar reduction too; however, specific data were not collected on caterpillar population levels. None were observed dangling on silken threads and very few galls had evidence of caterpillar tunneling. All injection holes callused over within 6 months after treatment.

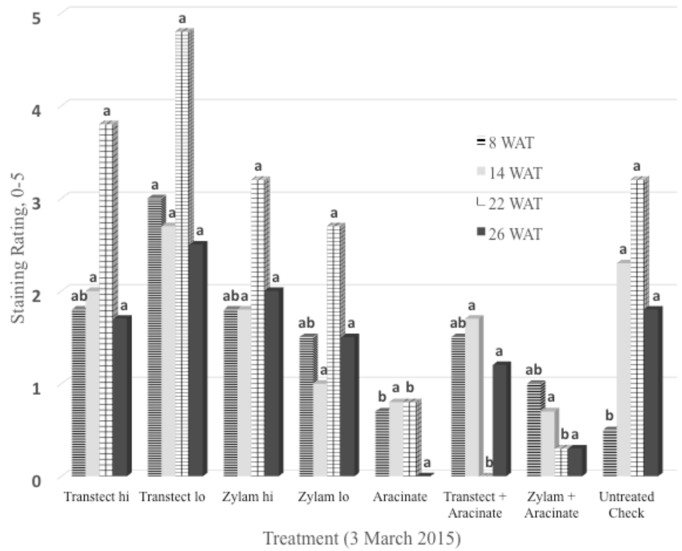

Fig. 3. Bucida staining levels as a result of galls attributed to a mite, *Eriophyes buceras*, and feeding by the bucida caterpillar, *Garella* (*Characoma*) *nilotica* in Coral Gables, FL. in 2015. Staining was rated on driveways and sidewalks beneath tree canopies on a scale of 0-5 with 0 = none; 1 = very light staining; 2 = light staining; 3 = moderate; 4 = heavy and objectionable to 5 = severe and objectionable. Means (n = 8) were analyzed within each date. Bars with the same letter do not differ significantly (P = 0.05, Student-Newman-Keuls).

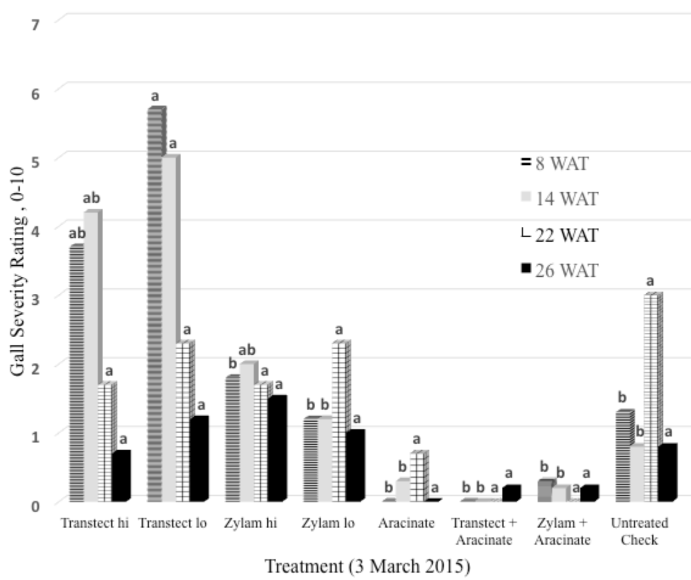

Fig. 4. Bucida gall density attributed to a mite, *Eriophyes buceras* on *Bucida buceras* trees in Coral Gables, FL. in 2015. Gall formation density was rated on a scale of 0–10 with 0 = none; 1 = 10% of canopy with galls; 2 = 20% of canopy with galls; to 10 = profuse or 100% of canopy with galls. Means (n = 8) were analyzed within each date. Bars with the same letter do not differ significantly (P = 0.05, Student-Newman-Keuls).

Conclusion

There is considerable variation in the occurrence of galls and staining from tree to tree and from year to year. Some trees flower at different times and some are repeat bloomers in the same year. Some trees did not have galls while others were full of galls. These variables make for a difficult test situation. The other consideration is how much staining will homeowners tolerate? It is doubtful that any treatment will ever reduce staining by 100%.

In an attempt to reduce homeowner complaints and minimize potential of tree removal as a technique to eliminate the staining, we suggest, especially on Florida's southeastern coast, abamectin trunk injections to reduce staining caused by the mite galls. For caterpillar suppression, primarily on Florida's southwestern coast, dinotefuran soil drenches and acephate trunk injections as well as abamectin should be considered as options until more experience elucidates the best approach.

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