Using Horticultural Oil, Pruning, and Acephate Banding to Reduce the First Generation of Crapemyrtle Aphid[1]

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Abstract

The crapemyrtle aphid, *Tinocallis kahawaluokalani* (Kirkaldy) is the primary insect pest of crapemyrtle, *Lagerstroemia spp.* Aphids excrete honeydew that serves as a source of nutrients for various sooty mold fungi. Sooty molds form a black film on the leaves that reduces plant vigor and aesthetic quality. Reduction of the first generation of crapemyrtle aphids might delay production of sooty mold, reduce mid-season pesticide applications, and decrease pesticide injury to aphid predators. Two experiments were conducted to reduce the first generation of crapemyrtle aphids without using conventional contact pesticides. Both experiments utilized *Lagerstroemia indica* L. 'Acoma' as the host plant. To create infestations on the experimental plants, adult and immature crapemyrtle aphids were captured and placed on all crapemyrtles throughout July 1994. In the first experiment, treatments included a 2% and 4% (by vol) application of horticultural oil and pruning 33% of branch terminals. Treatments were initiated prior to aphid egg eclosion in April 1995. The second experiment was intiated after eclosion when a treatment of acephate:water (3:1 by vol) slurry was painted on crapemyrtle trunks. Horticultural oil and acephate banding treatments reduced the number of first generation aphids compared to untreated controls.

Index words: *Tinocallis kahawaluokalani*, *Lagerstroemia indica*, integrated pest management, resistance management, insect management, crapemyrtle.

Significance to the Nursery Industry

The crapemyrtle aphid, *Tinocallis kahawaluokalani* (Kirkaldy) is the primary insect pest of crapemyrtle. Feeding aphids excrete honeydew that serves as a source of nutrients for various sooty mold fungi resulting in reduced aesthetic quality and plant vigor. Current management practices usually consist of spraying crapemyrtle aphids with an insecticide only when the sooty mold becomes a problem. Reduction of the first generation of crapemyrtle aphids might delay sooty mold, reduce pesticide applications, and decrease pesticide injury to aphid predators. Horticultural oils and acephate banding can be used as tactics in an integrated crapemyrtle aphid management program to suppress first generation aphids and delay acquisition of resistance to conventionally used pesticides.

Introduction

Crapemyrtle (*Lagerstroemia* spp.), a small landscape tree frequently used in southern landscapes, requires little maintenance and is relatively pest free. The crapemyrtle aphid, *Tinocallis kahawaluokalani* (Kirkaldy) is the primary insect pest. Crapemyrtle aphids are host specific and exist as parthenogenetic adults giving birth to live young throughout the spring and summer months (1). Feeding aphids excrete honeydew (mainly water and carbohydrates) that serves as a source of nutrients for various sooty mold fungi. Sooty molds form a black film on the leaves that reduces plant vigor and aesthetic quality. Heavy infestations of crapemyrtle aphids also cause a foliar chlorotic mottling.

The widespread use of pesticides in aphid management has resulted in 18 species resistant to insecticides which increases the need for modified strategies for their control (5, 22). Currently, there are no references to resistance in the crapemyrtle aphid. Current management practices consist of spraying crapemyrtle aphids with an insecticide when the sooty mold becomes a problem. Should a resistant crapemyrtle aphid appear, parthenogenetic reproduction favors a rapid shift from susceptible to resistant aphids (6). There is also evidence that aphids surviving treatment with organophosphorus insecticides (8, 15) or pyrethroids (6) produce nymphs more rapidly than untreated aphids (5). Pesticides such as pyrethroids may also affect predators more than the targeted pest (7).

Resistance management needs to be incorporated into aphid management programs to delay or prevent adaptation to insecticides and plant defense mechanisms (17). Resistance management includes tactics such as selective pesticide treatments, treating the most sensitive life stages, alternating pesticides across time or space, and using mixtures of compounds that show negative cross resistance (14). However, minimizing pesticide applications is the most effective way to manage resistance (20).

Other resistance management tactics include host resistance (13), cultural practices such as fertilization and pruning (9, 19, 21), and the use of horticultural oils. Alverson and Allen (1) demonstrated that late winter pruning can reduce the first generation of crapemyrtle aphid. Horticultural oils kill by penetrating the aphid egg and interfering with vital metabolic processes, or by preventing respiration through egg shells or respiratory passages (tracheae) of both immature and mature insects (12). Oils are a class of pesticides to which resistance has yet to develop, and is not expected to develop (11). Phytotoxicity of plants to oils was once a concern, however, recent research using highly re-

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fined horticultural oils demonstrated phytotoxicity is not a problem for most landscape plants (2, 3, 16, 18). Objectives of these studies were to determine if horticultural oil, pruning, and acephate banding could be used to reduce the first generation of crapemyrtle aphid.

Materials and Methods

Experiment 1. On May 20, 1994, *Lagerstroemia indica* 'Acoma' trees previously grown in 3.8 liter (#1) containers were transplanted into 12 liter (#3) pots containing a pine bark:sand (8:1 by vol) substrate amended per m^3 (yd^3) with 1.8 kg (4 lb) dolomitic limestone and 0.9 kg (1.5 lb) micronutrient fertilizer (MicroMax, The Scotts Co., Marysville, OH). Fifty-five g (2 oz) of 24N–1.7P–5.8K (Osmocote High N 24–4–7, The Scotts Co.) was surface-applied to each container after potting. Trees were arranged in a randomized complete block design of six blocks with two trees per treatment per block (total of 12 trees per treatment). Two liters (67.6 oz) of water per day were supplied via spray stakes (Robert's Spray Stakes, Robert's Irrigation Products, San Marcos, CA). To create infestations on the experimental plants, adult and immature crapemyrtle aphids were captured and placed on all crapemyrtles throughout July 1994. Trees were placed in a white co-polymer overwintering structure on December 6, 1994.

Trees were removed from the overwintering structure on March 27, 1995. The distribution and abundance of overwintering crapemyrtle aphid eggs as a function of distance from terminal bud were determined by removing the four longest shoots at the main stem from two trees randomly chosen from each block (total of 48 shoots). Lateral branches were removed from each shoot. Each shoot was sectioned into 10 cm (4 in) lengths beginning at the terminal bud, and aphid eggs were counted microscopically on each 10 cm (4 in) section. Shoot mean diameter was measured at the center of each 10 cm (4 in) section. Surface area of each shoot section was calculated using shoot mean diameter and shoot length. Of the 48 shoots, 43 (90%) were greater than 60 cm (24 in) in length.

At treatment initiation (March 27, 1995), crapemyrtles were 76 to 91 cm (30 to 36 in) tall and terminal buds were beginning to elongate. Treatments consisted of a 2% and 4% (by vol) horticultural oil (SunSpray Ultra-Fine Spray Oil, Sun Company Inc., Philadelphia, PA), pruning, and an untreated control. Oil sprays were applied with a backpack sprayer as a fine mist from a single hollow cone nozzle at 420 kPa (60 psi) until tree surfaces were wet. Two percent and 4% represent the upper and lower recommended range of many horticultural oils. Pruning consisted of a 33% reduction of shoot length back to a bud or lateral branch (heading back cut) resulting in about 25 to 30 cm (10 to 12 in) being removed. Treatments were applied in late winter since susceptibility of overwintering eggs to oil treatments increases the closer the eggs are to eclosion (4), and cold hardiness increases in crapemyrtles pruned in late winter (10). Emerging immature aphids were counted in mid-April approximately two weeks after bud break. Twenty lateral branches with each branch containing six to eight leaves were randomly removed from each plant to estimate number of aphids. Aphid counts were completed before immature aphids reached the winged adult stage. Leaves and shoots were visually inspected for phytotoxicity when aphid counts were taken. Data were subjected to analysis of variance (ANOVA) and treatment means were compared using least significant difference with P = 0.05.

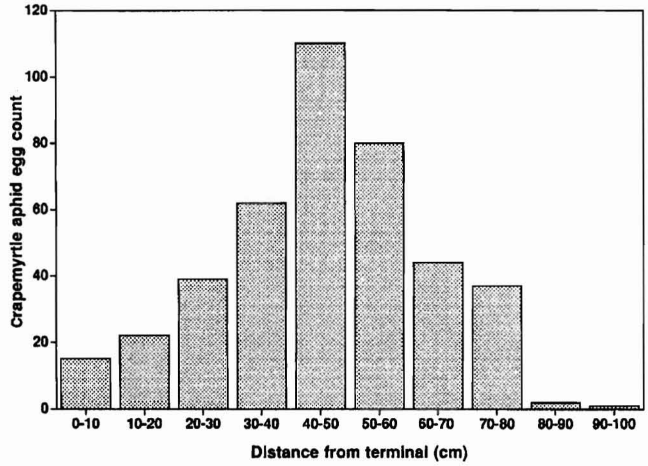

Fig. 1. Number of crapemyrtle aphid eggs in 10 cm increments from terminal of branches. Mean SEs were < 1 for all data.

Experiment 2. Twenty-four 'Acoma' crapemyrtles were grown as previously outlined in experiment one. Treatments of acephate banding and untreated controls were initiated when the first adult aphid was observed on April 18, 1995. Acephate (Orthene Turf, Tree & Ornamental Spray, Valent USA Corp., Walnut Creek, CA) was applied as a acephate:water (3:1 by vol) slurry to 12 trees. Main stem diameters were measured 15 to 20 cm (6 to 8 in) from the soil line where the slurry was applied with a paint brush. Width of the acephate band around the main stems equaled twice the diameter of the main stems. (Application of a acephate:water banded slurry is a labeled use of this product.) Each crapemyrtle was inspected weekly for crapemyrtle aphids for 11 weeks following treatment initiation. Leaves and shoots were visually inspected for phytotoxicity concurrently. The experiment was a randomized complete block design with 12 single plant replications. Data were subjected to analysis of variance (ANOVA). Voucher specimens of the crapemyrtle aphid and various predators have been placed in the North Carolina State University arthropod collection.

Results and Discussion

Experiment 1. By September 1, 1994, leaves of the crapemyrtles were covered by honeydew excreted by the feeding aphids. In mid-September, leaves began dropping presumably due to sooty mold coverage. By the end of October, about 33% of the crapemyrtle leaves had dropped.

Sexuparae (males and egglaying females) were first observed on August 21, 1994. The aphid population began to decline the first week in October, and by October 30, crapemyrtle aphids were in egg form only (no adults or immatures visible).

Crapemyrtle aphid eggs are oval shaped, shiny, and black. Eggs were primarily attached around buds, under sloughing bark and in crevices on the stem surface, although, some were fully exposed on the surface of the bark. Most eggs were found singularly, but occasionally there was a grouping of two or three. On stems examined, 61% of eggs were 30 to 60

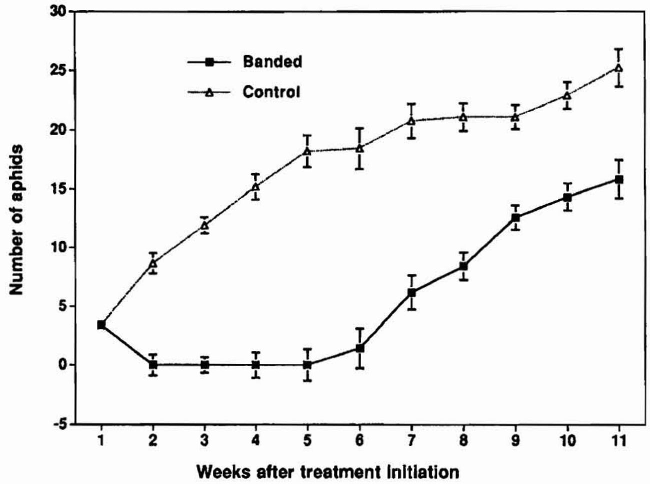

Fig. 2. Number of crapemyrtle aphids counted on entire plants. Acephate was applied in a band around trunk. Control plants received no acephate. (Means ± SE)

cm (12 to 24 in) from the terminal of the stem, whereas only 18% were within 30 cm (12 in) of the terminal (Fig. 1). This is in contrast to Alverson and Allen (1992) working with 'Carolina Beauty' crapemyrtle who reported 35% of crapemyrtle aphid eggs were within 20 cm (8 in) of stem terminals and 54% were within 40 cm (16 in). This difference could be due to the uniformity of our container grown trees compared to the confluence of branches of field-grown nursery stock sampled by Alverson and Allen (1). However, similar to the green peach aphid, *Myzus persicae* (Sulzer), oviposition may also vary depending on population size in the fall (22).

Horticultural oil treatments reduced aphid populations compared to the untreated control (Table 1). There was no difference between the 2% and 4% oil treatments. In addition, no visual damage to leaves or shoots occurred as a result of using the horticultural oil. The pruning treatment was not different from the control or oil treatments. Pruning removed 25 to 30 cm (10 to 12 in) from the stems of each tree which, based on egg counts, was not enough to reduce the aphid population. Pruning may not be a viable option for reducing overwintering aphids on young or small crapemyrtles since a large percentage of the tree would have to be removed in order to remove most of the eggs. These data in conjunction with Alverson and Allens' (1), however, suggest that a 30% heading back of crapemyrtles larger than 2 m (6.5 feet) might reduce the number of first generation aphids. This may be useful in situations where complete coverage of a spray may be difficult or unwanted.

Table 1. Number of crapemyrtle aphids after pruning and horticultural oil treatments to eggs.

Treatment	Number of aphids
Untreated	3.25 ± 0.73a[z]
Pruned	2.00 ± 0.31ab
2% Oil (by vol)	1.33 ± 0.22b
4% Oil (by vol)	0.75 ± 0.26b

[z]Mean ± SE. Means followed by the same letter are not significantly different as determined by LSD, P = 0.05.

Winter control methods such as oil treatments offer options for reducing the number of first generation crapemyrtle aphids. Such reduction does not harm predator populations so the reduced aphid population might be eliminated by natural causes or aphid population may peak later in the season. In addition, there is no selective pressure for insecticide resistance.

Experiment 2. No aphids were found on acephate banded trees until four weeks after treatment initiation, even though the trees were close to numerous aphids on untreated trees (Fig. 2). Acephate banding appeared to eliminate the first generation of aphids on treated trees and to prevent immigration for four weeks. No phytotoxicity was observed on the acephate banded trees.

Continued use of acephate banding throughout the summer could heighten selection for pesticide resistance in the aphids. Alternatively, if used in late summer or fall as the first sexual forms of aphids appear acephate banding may also reduce the number of overwintering eggs, and thereby reduce the first generation of aphids the following spring. Crapemyrtle aphid resistance to acephate may also be delayed by selective fall usage of the acephate banding. Horticultural oils and acephate banding can be used as tactics in an integrated crapemyrtle aphid management program to suppress aphids and delay acquisition of resistance to conventionally used pesticides.

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Effects of Nursery Container Type on Root Growth and Landscape Establishment of *Acer rubrum* L.[1]

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Abstract

Trees of red maple (*Acer rubrum* L.) were planted into seven container types evaluated for their ability to reduce number of roots deflected by the container wall. Seedlings were grown 70 weeks (production phase) in seven container types to a mean trunk diameter of 3.9 cm (1.5 in) and were transplanted into a sandy soil and grown with frequent or periodic irrigation for 24 weeks (landscape phase). There was no effect of container type on total root mass, trunk diameter or height during the production phase. Total deflected root length was less in low-profile plastic containers, chemical root pruning containers, air root pruning containers (ARPC), and wood boxes than in standard black plastic containers (SBPC). Trees produced in the SBPC had the most horizontally-oriented deflected root length while the ARPC and SBPC had the most vertically-oriented deflected root length. Trees grown in the ARPC had less roots on the inside of the root ball than all other container types. Container type did not influence root and shoot growth, but impacted stem water potential in the first five months after transplanting to the landscape. Trees frequently irrigated during the landscape phase had greater trunk diameter, height, and generated more new root mass than those which were infrequently irrigated.

Index words: container production, container design, root modification, deformed roots, circling roots, air root pruning, chemical root pruning, root morphology, transplanting, root growth, *Acer rubrum*.

Significance to the Nursery Industry

Red maple trees produced in a variety of container production methods grew shoots at the same rate in the nursery. Roots also grew at a similar rate but the amount of circling roots was reduced by growing in low-profile containers, chemical root-pruning containers, air root-pruning containers, or in wooden boxes. Trees irrigated more frequently after planting in the landscape grew larger trunks, were taller, and produced more new roots into the soil than infrequently irrigated trees regardless of container type. Low profile air root pruning containers and containers with copper compounds were more stressed than other container types at various stages after planting into the landscape. Growing trees in alternative containers designed to reduce circling roots produces a better quality root system than the standard plastic container without sacrificing post-transplant growth.

Introduction

Plants grown in standard plastic containers often have deflected roots, which are kinked or grow along the sides of the root ball. These roots can contribute to long-term tree growth problems in the landscape such as instability (14) and restricted growth (11).

The type of nursery container used during production can have a dramatic impact on root morphology of container-grown plants (23). Copper compounds applied to the interior surface of plastic containers reduce root deflection on many woody species (19), and caused an increase (5, 16), decrease (3, 5), or no effect (5, 13) on root to shoot ratios. Shoot growth was increased for some species and decreased for other species when grown in copper-treated containers

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