Evaluating New Control Materials For Root Aphids

Researchers: Stanton Gill[1], Brian Kunkel[2], Virginia Rosenkranz[3], Suzanne Klick[1], Chuck Schuster[4], and Heather Zindash[5]

UNIVERSITY OF MARYLAND EXTENSION

UNIVERSITY OF DELAWARE Cooperative Extension COLLEGE OF AGRICULTURE & NATURAL RESOURCES

ABSTRACT: Root aphids are a rising problem for nurseries growing ornamentals, field hemp stock, field hemp plugs, and other plants grown hydroponically. This group of aphids is frequently overlooked because they feed belowground. Soil dwelling insects and insect pests associated with aquatic situations are difficult to manage with insecticides due to environmental concerns. We investigated the efficacy of chlorantraniliprole, cyantraniliprole, *Chromobacterium subtsugae* strain, *Beauveria bassiana*, and heat-killed *Burkholderia* spp. strain A396 cells, M-306, and MBI-203 compared to pymetrozine, a commonly used insecticide targeting *Rhopalosiphum rufiabdominalis* (Sasaki), in a greenhouse trial with *Juncus affusus* plants. We found that pymetrozine significantly reduced *R. rufiabdominalis* populations at 14 days after treatment. *Chromobacterium subtsugae* and the heat-killed *Burkholderia* spp. strain A396 cells did not significantly reduce aphid populations in our experiment. Chlorantraniliprole and cyantriliprole, *B. bassiana*, M-306, MBI-203, and pymetrozine all significantly reduced aphid populations at 28 days after initial application. Insecticide efficacy against root aphids and potential impact on non-target arthropods should continue to be investigated.

INTRODUCTION

Root aphids are a rising problem in native plant nurseries, herbaceous perennial nurseries, aquatic plant nurseries, and greenhouse grown field hemp stock operations (Cranshaw and Wainwright, 2020). The root aphid involved in our trials in 2020 was the rice root aphid. The rice root aphid (*Rhopalosiphum rufiabdominalis* (Sasaki)) is a pest in North America that survives both indoor and outdoor environments. In our trial, we obtained infested plants from a native aquatic plant nursery. Growers may notice the plants are stunted and not growing well. The wax associated with root aphid becomes noticeable when you take the plant out of the pot. If the population builds up, your customers will notice a problem when they remove the pot and plant the infested plant.

MATERIALS AND METHODS

We obtained 740 *Juncus affusus* from a native plant nursery to use in our experiment. We examined the root system of the 740 and narrowed the numbers down to 162 used in our trials. We selected plants with more than 2 to 3 aphids in the root zones. Some had as many as 30 - 40 aphids.

Four plants of each treatment in a plug tray represented one replicate of our trial. We had four replicates in our randomized complete block designed experiment. We conducted our pre-treatment counts on 23 June 2020 using dissection scopes and portable light sources. Prior to treatment, plants were grouped by relative densities of aphids on root masses. Plants were randomly assigned treatments after this grouping. *Beauveria* treatments were included afterwards as a biological treatment for the experiment; consequently, those plants had fewer aphids on root masses. Our M-306 SE1 and MBI-203SC1 treatments were applied on 23 and 30 June, and 7 and 14 July 2020. The remaining treatments were only applied on 23 June 2020. Plants were moved into a greenhouse after treatment and irrigated as needed to maintain the moist root masses *Juncus* requires. The plants were maintained with a 16:8 L:D cycle.

We took post-treatment counts 14 and 28 days after treatments (7 and 21 July respectively; DAT). Plant were pulled from plug trays and the outside of the root mass was examined for various stages of *R. rufiabdominalis* aphids. We recorded the number of aphids found on the plant tag for each plant. Aphids were counted on all plants again at 14 DAT and were returned to the greenhouse in the same pots until the final count at 28 DAT. Presence of natural enemies and other arthropods found on root masses were noted during the pre- and post-treatment counts. The average number of living aphids found on the root mass were analyzed using ANOVA and Tukey HSD means separation procedures.

Table 1. Insecticides applied to *J. affusus*, to manage the root aphid, *R. rufiabdominalis*, during the 2020 growing season.

Material	Label Rate	Application Rate
Cyantraniliprole (Mainspring)	236.6 mL/ 378.5 L	.63 mL/L
Chlorantraniliprole (Acelepryn)	236.6 mL/378.5 L	.63 mL/L
Pymetrozine (Endeavor)	141.8 g/378.5 L	.37 g/ L
Pymetrozine (Endeavor)	85.0 g/ 378.5 L	.22 g/L
Chromobacterium subtsugae strain (Grandevo WDG)	1.36 kg/378.5 L	3.6 g/L
Heat-killed Burkholderia spp. strain A396 cells (Venerate XC)	3.785 L/378.5 L	10 mL/L
M-306 SE1	189.3 mL/378.5 L	0.5 mL/L
MBI-203SC1	1.892 L/378.5 L	5 mL/L
Beauveria bassiana (Mycotrol)	907.2 g./ 378.5 L	2.4 g/L
UTC		

RESULTS

Juncus root masses were infested with considerably high populations at the nursery and prior to insecticide treatments (Table 1.0; Figure 2.0). Cyantraniliprole and chlorantraniliprole-treated plants had significantly greater populations of root aphids per root mass at the beginning of experiment than other treatments, whereas *Beauveria*-treated plants had significantly fewer. We found an ant associated with the rice aphids in our field trial. These ants were more abundant during our pre-treatment data collection than later in the experiment. We did not observe the ants moving the aphids but did observe them defending and engaging spiders and rove beetles.

We found several soil predators active including mealybug destroyer, *Cryptolaemus montrouzieri,* rove beetle species, and *Stratiolaelaps scimitus*, in the Laelapidae family, which is a small light brown mite that usually lives in the top ½ in layer of soil. It is interesting to note that we found mealybug destroyers actively searching for root aphids in several plugs. After the trial, the grower reported heavy activity from mealybug destroyer in the root zone of the aquatic grasses.

Figure 1. Root aphids *Rhopalosiphum rufiabdominalis* clustered in the root zone and feeding on the roots.
Photos: Heather Zindash, The Soulful Gardener

Table 2. Average number of *R. rufiabdominalis* found on *J. affusus* root masses grown in nursery pots during the 2020 growing season. Treatments with different letters are significantly different at α=0.05 (Tukey HSD).

Treatments	Days After Treatment (DAT)								
	Pre-Treatment			14 DAT			28 DAT		
	Mean	±	Std. Error	Mean	±	Std. Error	Mean	±	Std. Error
Mainspring	23.0	±	3.73a	0.56	±	0.22bc	0.0	±	0.0d
Acelepryn	21.88	±	3.51ab	1.13	±	0.27bc	0.0	±	0.0d
Endeavor (5 oz.)	16.63	±	3.55abc	0.06	±	0.06c	0.0	±	0.0d
Endeavor (3 oz.)	12.63	±	2.55c	0.0	±	0.0c	0.06	±	0.06d
Grandevo	13.0	±	2.81c	6.75	±	1.57a	1.81	±	0.45abc
Venerate	14.31	±	3.22c	1.06	±	0.32bc	2.25	±	0.62ab
M-306-SE1	12.88	±	2.86c	2.31	±	0.53bc	0.31	±	0.12cd
MBI-203SC1	13.1	±	3.48c	2.38	±	0.94bc	0.88		0.34bcd
Untreated Control	12.94	±	3.07c	3.88	±	1.45ab	3.06		0.56a
Beauveria	2.69	±	0.12d	--	±	--	0.06	±	0.06d

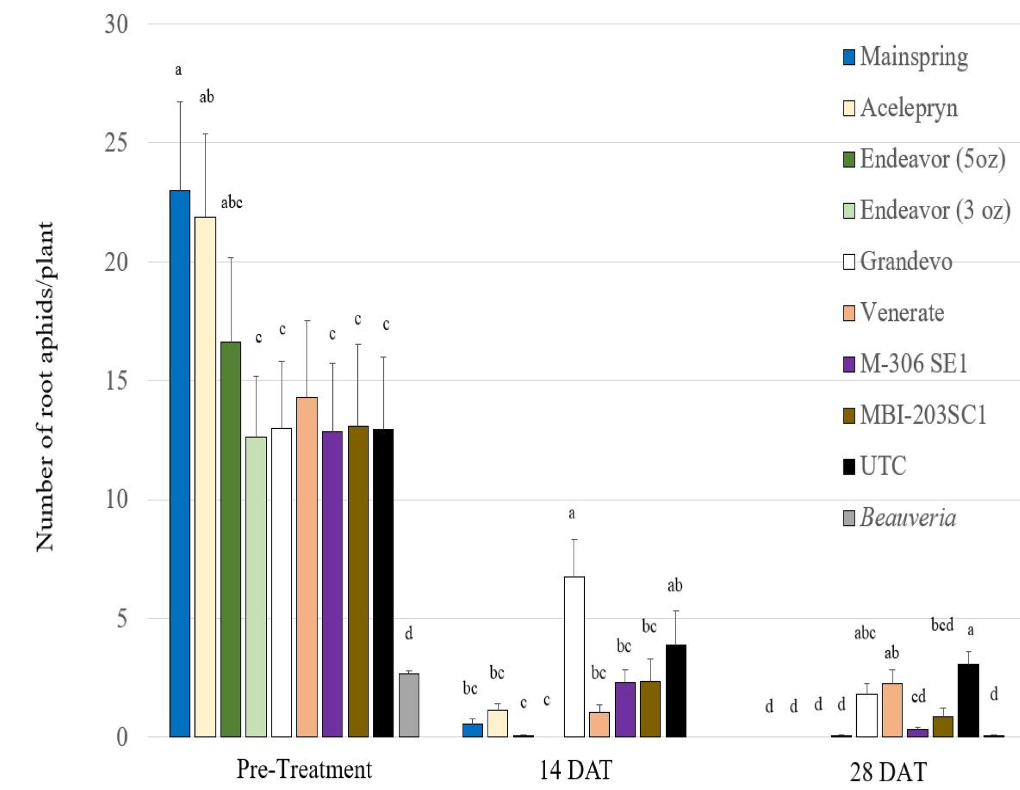

Figure 2. Average number of *R. rufiabdominalis* found on *J. affusus* root masses grown in nursery pots during the 2020 growing season. Treatments with different letters are significantly different at α=0.05 (Tukey HSD).

DISCUSSION

We found that *R. rufiabdominalis* populations declined throughout our experiment regardless of treatment. Some insecticides in our experiment still significantly reduced aphid populations compared to untreated controls. Root aphid populations decreased significantly during the experiment regardless of treatment. Initially, the experiment was going to be conducted in April and May of 2020 when temperatures are typically between 15 – 25 ºC; however, the lock-down associated with the pandemic pushed the dates of the experiment into June 2020 and later. Ambient temperatures during the experiment were above 25 ºC, often exceeding 30 ºC. The nursery supplying our infested plants also experienced population declines during the same timeframe in their hoop houses. We feel the high temperatures during our experiment help explain the drastic reduction of *R. rufiabdominalis* populations infesting our control plants.

Greenhouse and nursery growers continue to struggle to manage soil-dwelling insect pests because they are difficult to detect, may have subtle impacts on the crops, and insecticides can be less effective against soil pests compared to pests feeding on above-ground tissues. Our experiment showed efficacy of a few new insecticides as management options for *R. rufiabdominalis*, the rice root aphid. We feel that applications of pymetrozine will reduce populations within two weeks of application. Chlorantraniliprole, cyantraniliprole, M-306, and MBI-203 all significantly reduced populations by 28 days after treatment. These products are newer insecticides available or soon to be available to growers. Compatibility of these products with natural enemies, such as the mealybug destroyer, should be further evaluated in future studies.

CONCLUSION

Our experiment found that pymetrozine significantly reduced *R. rufiabdominalis* populations at 14 days after treatment. *C. subtsugae* and the heat-killed *Burkholderia* spp. strain A396 cells did not significantly reduce aphid populations in our experiment. Both diamide insecticides, chlorantraniliprole and cyantriliprole, M-306, *Beauveria bassiana*, MBI-203 and pymetrozine all significantly reduced aphid populations at 28 days after initial application. Significant reduction of aphid populations by the numbered products and diamides in this study suggest these products are insecticides that could be incorporated into a management strategy targeting root aphids. These insecticides provide alternate modes of action for grower to use in pest management efforts. Ant management may be necessary for growers that wish to include biological control in a successful management plan. Insecticide efficacy against root aphids and potential impact on natural enemies should be investigated in future studies.

[1]University of Maryland Extension, Ellicott City, MD; [2]University of Delaware Extension, Newark, DE; [3]University of Maryland Extension, Salisbury, MD; [4]University of Maryland Extension (Emeritus), Derwood, MD; and [5]The Soulful Gardener, Gaithersburg, MD