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Section L: Laboratory Bioassays

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(L) Hydrangea: *Hydrangea paniculata* (Siebold), 'Limelight'

Bioassays Comparing Different Insecticides Against *Systena frontalis* Adults on *Hydrangea paniculata*, 2022

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The objective of this study was to compare the most common insecticides used by nursery growers to spray for control of *Systena frontalis*, often referred to as the red headed flea beetle (RHFB), against others that have yet to be tested against this pest. In discussions with growers in eastern Virginia, commonly used insecticides included carbaryl, acephate, permethrin, and imidacloprid.

RHFB adults and mature tissue leaves were collected from untreated potted hydrangeas grown at the Hampton Roads Agricultural Research and Extension Center (HRAREC) in Virginia Beach, VA. Discs were cut out of the leaves to fit inside 59-ml plastic cups. Insecticide solutions were prepared in which the leaf discs would be dipped. Solutions of each insecticide comprised 200 ml of tap water and the respective, indicated amount of insecticide. Maximum label rates for use in ornamentals against leaf beetles were selected (see Table 1). The rates given in the labels were scaled down from the per 100 gallons in which they were given. The insecticides were then measured using a micropipette or scale and stirred into the water under a fume hood. After mixing, 10 leaf discs were submerged into the solution for 1 min. Bacteriological agar was prepared and about 10 ml was poured into each plastic cup and left to solidify. Meanwhile, the leaf discs were removed from the insecticide solution and set to dry briefly on a paper towel. When the agar was almost solid, leaf discs were placed into their respective cups, so that the leaf would set in place in the agar and prevent leaf desiccation. After all the treatments had been completed, a set of 10 leaves dipped only in distilled water was used as an untreated check.

The RHFB adults were collected at the HRAREC on 29 August 2021, 26 June 2022, 11 July 2022, 25 July 2022, 8 August 2022, then placed individually in each cup and sealed with a lid. The experimental units were then placed in a growth chamber. Conditions in the chamber were set at 26°C, 40% RH and 14:10 L:D. After 24 h, the units were temporarily removed from the growth chamber to record mortality data. If the mortality was not clearly visible, the lid was opened and the beetle poked with a pin. Beetles with impaired motor coordination such as inability to walk or move without falling over, were marked as moribund. The pin was sterilized with 70% ethanol between uses to avoid contamination. Mortality was checked additionally at 48 h, 72 h, 96 h, and 7 d (168 h) after treatment placement. Each treatment had 10 replicates and was repeated three times for a total of 30 beetles tested. A one-way ANOVA was performed using SAS, and means separated post-ANOVA by Tukey's HSD test with $\alpha = 0.05$.

The mortality at maximum label rate is recorded in Table 1. The insecticides with the highest adult mortality across all days were Sevin and ISM-555. The lowest mortality overall was among those treated with Acelepryn. Apta had low mortality for the 48 h and slightly increased at 72, 96, and 168 h without more than half of the adults dead. Mainspring had no mortality until 96 h and slightly increased at 168 h after treatment. Merit and Orthene had similar mortality at 24 h after treatment and mortality continued to increase with Orthene being more lethal by 168 h after treatment. Permethrin had high mortality across all checkup time frames, similarly to ISM-555 and Sevin.[1]

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Table 1. Mortality rates of *Systena frontalis* adults at each checkup time frame after being exposed to experimental insecticides under controlled conditions

Treatment	Active ingredient	IRAC group	Rate/100 gal (fl. oz or oz)	Mortality rates				
				24 h[a]	48 h[a]	72 h[a]	96 h[a]	168 h[a]
Acelepryn	Chlorantraniliprole	28	16	0.0333c	0.0333c	0.0333c	0.1333bc	0.2000cd
Apta	Tolfenpyrad	21A	27	0.2333b	0.2333b	0.3000b	0.3333b	0.4667bc
ISM-555	Isocycloseram	30	3.08	0.9000a	0.9667a	1.0000a	1.0000a	1.0000a
Mainspring	Cyantraniliprole	28	8.11	0.0000c	0.0000c	0.0000c	0.2667b	0.5667b
Untreated check	N/A	N/A	—	0.0000c	0.0000c	0.0000c	0.0000c	0.0333d
df				4, 145	4, 145	4, 145	4, 145	4, 145
F				71.43	102.16	110.08	40.72	29.16
P				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Merit	Imidacloprid	4A	1.66	0.3667b	0.5667c	0.5333b	0.6667b	0.8000b
Orthene	Acephate	1B	16	0.6500b	0.3000bc	0.2000ab	0.1000ab	0.0500ab
Permethrin	Permethrin	3A	8	0.7333a	0.8333ab	0.8333a	0.8667ab	0.9000ab
Sevin	Carbaryl	1A	32	0.9667a	1.0000a	1.0000a	1.0000a	1.0000a
Untreated check	N/A	N/A	—	0.0000c	0.0000d	0.0000c	0.0000c	0.0333c
df				4, 135	4, 135	4, 135	4, 135	4, 135
F				30.61	36.32	36.29	53.60	67.09
P				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

[a]Means within columns followed by a common letter are not significantly different.