Pilot Study on Management Strategies of Hibiscus Bud Weevil

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ABSTRACT

Hibiscus is a shrub that produces flowers that come in a rainbow of colors and represents a major ornamental crop for many nurseries in Florida. Chinese hibiscus (*Hibiscus rosa-sinensis*) is very popular and commonly available in garden centers and landscapes. Demand for this tropical ornamental is high with cultivation statewide, particularly in south Florida. Hibiscus is a crop that is already affected by common diseases and pests, such as bacterial leaf spot, two-spotted spider mite, among others. However, more recently, a newly introduced pest has become the major concern for nursery growers. The hibiscus bud weevil (*Anthonomus testaceosquamosus*) has been reported as a pest of hibiscus in Texas and Mexico for several decades, but was not detected in Florida until May of 2017 when it was found in the Miami-Dade area. Currently, the hibiscus bud weevil has been also reported in Broward, Hernando, Collier, Seminole, and Duval Counties. Most of the infected plants originate from wholesale nurseries.

OBJECTIVES AND METHODS

The objective of this study is to perform a pilot study for the development of management strategies for the hibiscus bud weevil. Before a large scale pilot test can be completed, individual management strategies need to be evaluated which include insecticides and potential entomopathogens. Results from tests using entomopathogenic nematodes and fungi are included in this report. Subsequent work with both foliar applied and systemic insecticides are included in a different FNGLA 2019 Final Report (Mannion and Schall).

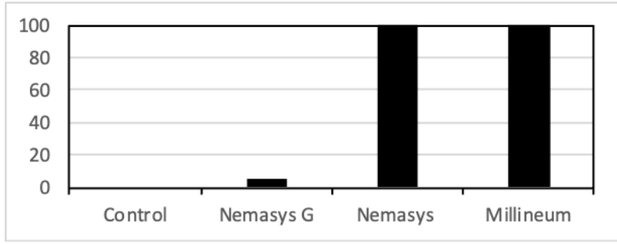
Entomopathogenic nematodes

Three entomopathogenic nematode products were tested under laboratory conditions for larval control on Hibiscus rosa-sinensis 'painted lady'. These products included Nemasys G (*Heterorhabditis bacteriophora*), Nemasys (*Steinernema feltiae*) and Millineum (*Steinernema carpocapsae*). All three nematode products show promise as a management tool for this weevil. In all the laboratory tests, Nemasys and Millineum provided 100% mortality and Nemasys G provided 90% control in one of the tests. This demonstrates that the nematodes can kill the larvae and are capable of getting into a bud where the larvae reside and feed. However, in a foliar test in which the nematodes were sprayed onto the buds simulating a field application, the results were not as good. How these nematodes are applied will be essential to their success in killing weevil larvae and studies will continue to examine this issue.

Laboratory Procedure – Test 1

- Opened buds slightly
- Placed two 20ul droplets with nematodes on bud (approximately 200 nemas/bud)
- Four days later, buds were opened to determine live and dead larvae

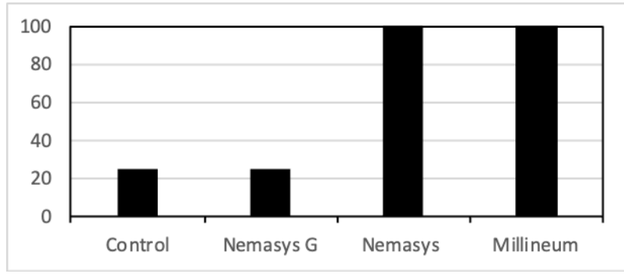
Percent Larval Mortality



Laboratory Procedure – Test 2

- Larvae were removed from the buds
- Nematodes were placed directly on the larvae (approximately 200 nemas/larva)

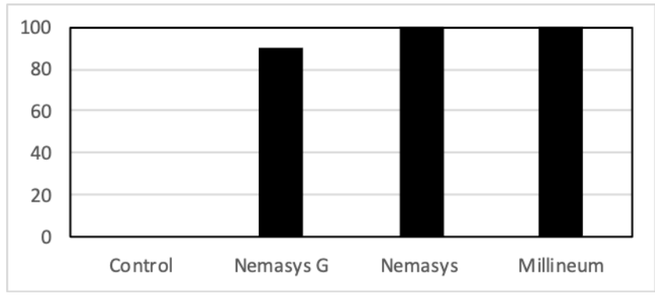
Percent Larval Mortality



Laboratory Procedure – Test 3

- Closed buds
- Placed two 20ul droplets with nematodes on bud (approximately 200 nemas/bud)

Percent Larval Mortality



Foliar-applied nematode test:

- Infested 20 plants within a large screen cage for one week
- Plants were removed from the cage and nematode applications were made (5 plants per treatment)
- Nematodes – *Steinernema feltiae* (Nemasys) and *Steinernema carpocapsae* (Millineum)
  - Applied approx. 800,000 nemas to 5 plants (160,000 per plant) which is very high rate (2-3 times recommended rate)
  - Nemas were applied in 1 gal water to the 5 plants
- All buds were removed 4 days after application and examined for live/dead larvae

	# Buds	# Holes	# Eggs	# Larvae	# Live Larvae	# Dead Larvae	% Dead
Control	44.8	17.8	0.8	9.2	9.2	0	0
Nemasys	44.6	28.0	3.6	10.4	8.6	0.6	6.9
Millineum	45.4	14.2	0.4	4.4	3.6	0.6	13.6

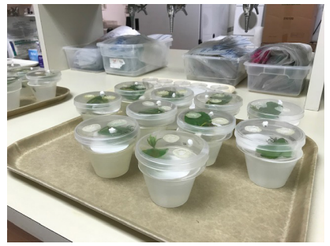
Entomopathogenic fungi

Five entomopathogenic fungi products were tested under laboratory conditions for adult weevil mortality feeding on *Hibiscus rosa-sinensis* 'painted lady'. All but one product provided good control (>70%) when the weevil was sprayed directly and moderate to low mortality (10-40%) when the weevil was placed on foliage/buds that had been sprayed with the product.

Treatment	Active ingredient	Rate	Solution (SI)
Botanigard 22WP	*Beauvaria bassiana* Strain GHA	2 lbs/100 gal	2.4g/L
Botanigard ES	*Beauvaria bassiana* Strain GHA	2 qt/100 gal	5ml/L
BioCeres WP	*Beauvaria bassiana* Strain ANT-03	3 lbs/50 gal	7.2/L
NoFly	*Isaria flumosorosea* strain FE 9901	16 oz/100gal	1.2g/L
Velifer	*Beauvaria bassiana* strain PPRI 5339	900ml/1000L	900ul/L
Control (water)	NA	NA	NA

Residual/feeding test:

One hibiscus plant (6-inch pot) was sprayed with a treatment solution with a hand-held pump sprayer for complete coverage of the buds and leaves of the plant (approximately 250 ml). Ten stems with at least one bud and leaf were removed from each plant one hour after application. The stem was placed in a deep petri dish (100 x 40 mm) with a hole to insert the stem. The petri plate was placed on top of a cup of water so that the stem remained in water. Two adult weevils were placed in each petri dish.



The weevils were able to move freely within the petri plate walking and feeding on the leaf and bud. 10 replications (bud/leaf stem) with 2 weevils per replication; completely random.

Direct contact test:

10 randomly selected weevils were placed in a deep petri dish (100 x 40 mm) with 2 pieces of filter paper. The filter paper absorbs excess solution, so no weevils were sitting in "puddles" of solution. The dish was briefly opened, and 3-4 pumps of a treatment solution was sprayed directly on the weevils within the petri dish. Ten adults were directly sprayed so each weevil was completely covered by the product solution. The weevils remained in the petri plate until death. One or two hibiscus leaves were placed in each plate for food and moisture. 10 replications; completely random.

Weevils were monitored 2, 4, 7, and 10 days after treatment for mortality and signs of infection. Any dead weevils were held in moist chambers to determine if cause of death was due to the fungal product.

RESULTS

Most of the products tested, provided good control **if the product came into direct contact** with the weevil when it was sprayed (70-100% mortality) (**Figure 1**). The exception with NoFly. However, the rate of mortality was less when the adults were exposed to leaves and buds sprayed with the products and contact was from the interaction on the plant and not a direct spray (**Figure 2**). Also note, that the conditions of this test provided a desirable, humid environment for the products to work so results in the field may differ.

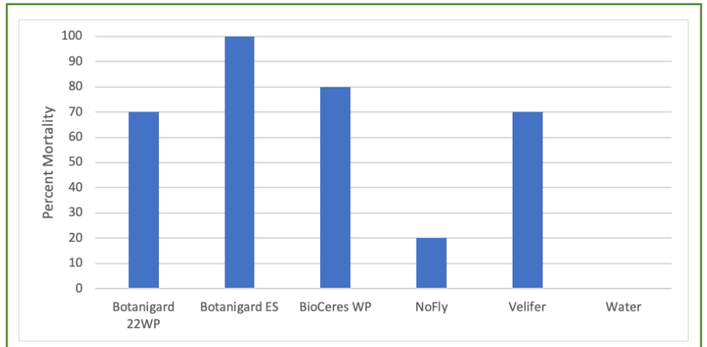


Figure 1. Mortality of adult weevils sprayed directly with the product and held in a humid environment.

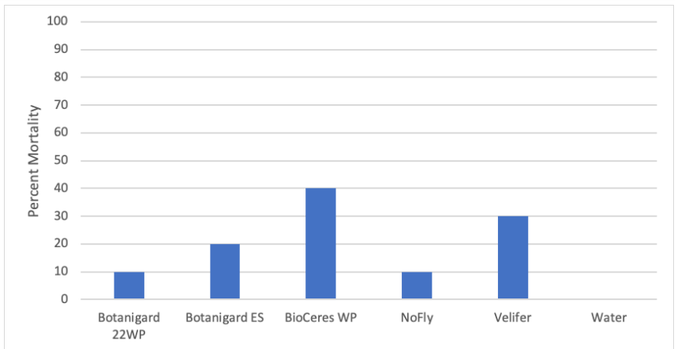


Figure 2. Mortality of adult weevils exposed to sprayed foliage/buds.