Reduced-risk Strategies for Control of Caribbean Fruit Flies and other Tephritids

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Caribbean Fruit Fly: Economic Significance

- Caribbean Fruit Fly, *Anastrepha suspensa* (Loew) is an important quarantine pest for fruit crops in Florida and the Caribbean Islands.

- Remains a threat to the export of citrus to Arizona, Texas, California and Japan due to Quarantine regulation.

- Nearly 100 hosts have been recorded for CFF including citrus, grapefruit, guava, mango, carambola.
Life Cycle of *A. suspensa*

1. Females oviposit in host fruit
2. Egg hatches and feeds on fruit
3. Fruit drops and larvae pupate in soil
4. Pupae rest in soil during development
Goals & Objectives

- The ultimate goals were to identify reduced-risk strategies/insecticides that can be used in an *A. suspensa* IPM program.

Specific objectives

- To evaluate conventional and reduced-risk insecticides for control of *A. suspensa*.
- To investigate behavioral responses of *A. suspensa* to novel insecticides and compare them with conventional insecticides.
Methodology

✅ Four insecticide treatments were evaluated
  1) SpinTor
  2) GF 120
  3) Malathion + NuLure
  4) Untreated Control (Water)

✅ Experimental design was completely randomized block with four replicates

✅ Insecticide treatments were applied at manufacturers labeled rate using a laboratory atomizer
16 unsprayed citrus trees were selected randomly from our greenhouse nursery stock and placed outdoor.

Plants were then sprayed with their respective insecticide treatments and then air-dried for ~ one hour.

Plants were then placed into Gerber screen cages and 50 *A. suspensa* consisting of 25 males and 25 females were released onto citrus trees.
Effects of conventional and reduced-risk insecticides on *A. suspensa*

Laboratory Experiments

![Bar chart showing the effects of different pesticides on the mean number of flies killed.](chart.png)

- **Malathion**
- **GF 120**
- **Spintor**
- **Control**

Mean % of flies killed

**Pesticides**

- *P* = 0.0062
Alightment of *A. suspensa* on orange fruit sprayed with various compounds

![Bar chart showing mean number of flies alighting on fruit treated with different insecticides: Spintor, GF 120, Malathion, and Control. The chart indicates statistically significant differences between treatments.](image)

- **Spintor**
- **GF 120**
- **Malathion**
- **Control**

Mean # of flies alighting on fruit

Insecticides

*P* = 0.0005
Alightment of *A. suspensa* males and females on orange fruit and branch sprayed with various insecticides.

![Bar chart showing alightment of A. suspensa males and females on orange fruit and branch sprayed with various insecticides.](chart.png)

Sex and place for landing:

- **Fruit Female**
- **Fruit Male**
- **Branch Female**
- **Branch Male**

*P* = 0.0016
What does this mean?

In terms of controlling Caribbean fruit flies, there are no disadvantages of using reduced-risk pesticides such as SpinTor to control *A. suspensa*.

Females are more likely to alight on plants sprayed with SpinTor or GF 120 as opposed to conventional Malathion + NuLure; subsequently, a higher percentage of flies may be killed.

SpinTor, GF120 or Entrust are likely candidates for our new attract & kill device.
Insecticide-treated Sphere

Bait Stations

Major Ingredients
Sugar
Starch
Cayenne pepper
Insecticide

- Minimal pesticide residue on fruit
- Compatible with biological control agents
- Safe for the applicators and other farm personnel
Objectives

- Conduct laboratory assays to explore the potential of using bait stations in the form of insecticide-treated spheres
  - for management of Caribbean fruit flies
  - explore the effects of insecticide-treated spheres on *Diachasmimorpha longicaudata* a key parasitoid of CFF
Experimental Protocol

- No choice screen cage test with five replicates.

- Starch/sugar spheres were brush painted florescent yellow paint containing 10% sucrose solution with varying amounts of imidacloprid.

- Four treatments with 3 different rates of A.I. of imidacloprid evaluated.
  - 2%
  - 4%
  - 8%
  - Untreated control
Experimental Protocol (Cont’d)

- *A. suspensa* and *D. longicaudata* provided by the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville

- Each cage had 25 male and 25 female *A. suspensa / D. longicaudata*

- Mortality observations recorded at -2, 4, 12, 24 and 48 hrs

- Test temp. range -78-86 °F, RH-70 % and 14/10 LD regime

- Water was provided for the flies in each treatment
## Results - Laboratory assays for *A. suspensa*

<table>
<thead>
<tr>
<th>% A.I. Imidaclid.</th>
<th>Mean ± SEM % of <em>A. suspensa</em> killed on spheres</th>
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<tbody>
<tr>
<td></td>
<td>Hrs post treatment</td>
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<tr>
<td></td>
<td>2</td>
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<tr>
<td>0 Ctr.</td>
<td>0.1 ± 0.1b</td>
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<tr>
<td>2</td>
<td>5.7 ± 0.9a</td>
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<tr>
<td>4</td>
<td>6.6 ± 1.2a</td>
</tr>
<tr>
<td>8</td>
<td>7.3 ± 1.0a</td>
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</tbody>
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Means within column followed by the same letter are not significantly different. 

*P* = 0.05 LSD test
Effects of imidacloprid-treated spheres on male and female *A. suspensa*

- *A. suspensa* males seem to be more susceptible to 4% A. I. imidacloprid-treated spheres.
**Susceptibility of *Diachasmimorpha longicaudata***

<table>
<thead>
<tr>
<th>% A.I imidaclld.</th>
<th>Mean ± SEM % <em>D. longicaudata</em> killed on spheres</th>
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<tr>
<td></td>
<td>Hrs Post treatment</td>
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<td>0 Ctr.</td>
<td>0.0 ± 0.0b</td>
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<tr>
<td>2</td>
<td>1.2 ± 0.5ab</td>
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<tr>
<td>4</td>
<td>4.4 ± 1.8a</td>
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Means within column followed by the same letter are not significantly different \( P = 0.05 \) LSD test.
Conclusion

- Sugar/starch imidacloprid-treated spheres were effective in killing CFF at 2, 4 and 8% A. I.

- Among the conc. evaluated, 2% A. I. – less negative impact on the parasitoid (*D. longicaudata*).

- These traps can be used on small farms as attract and kill systems where it is difficult to use conventional spray programs.
Remarks / Future Studies

- First study documenting the effects of insecticide-treated spheres on a key CFF parasitoid

- This was a no choice cage study and the effects of insecticide-treated spheres on the parasitoids/CFF in the field may be different

- Future tests will target Entrust (organic formulation of SpinTor)
New Trap Design

- The sugar/starch spheres that were tested in these experiments are susceptible to rodent and deer feeding.

- New sphere designs consisting of plastic sphere with sugar cap are being developed.
Acknowledgements

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