Fecundity of Ficus Whitefly, *Singhiella simplex* (Hemiptera: Aleyrodidae), and its predation by *Delphastus catalinae* (Coleoptera: Coccinellidae)

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Introduction

- Recent invasive pest in the United States, first reported in Florida in 2007.
- Infests weeping fig (*Ficus benjamina*), *F. altissima* (lofty fig, false banyan tree), *F. bengalensis* (“banyan tree”), *F. microcarpa* (Cuban laurel), *F. aurea* (strangler fig), *F. lyrata* (fiddle-leaf fig), and *F. maclellandii* (= *F. binnendijkii*) (banana-leaf fig).
- Significant threat to species of ficus in Florida. Infested plants show leaf yellowing and rapid defoliation.

- Development of control programs against ficus whitefly is impeded by our lack of knowledge of its basic biology.
Ficus whitefly and infestation
Ficus whitefly life cycle
Current distribution: Florida Department of Agriculture & Consumer Services, Division of Plant Industry
http://doacs.state.fl.us/pi/enpp/ento/Singhiella%20simplex.html
Objectives

- Determine development and reproductive biology of the whitefly under different temperature conditions.
- Evaluate *Delphastus catalinae* predator as a control agent.
Methods

- Study development and reproductive parameters at 15, 20, 25, 27, 30 and 35 °C

- Measure predation rates of *Delphastus catalinae* on *ficus whitefly* of different age classes
Ficus plant rearing

Commercially-available *Ficus benjamina* plants

Kept for a period of time before using cuttings to reduce effect of systemic insecticides
Ficus whitefly rearing and protocol

Ficus whitefly colony initiated in 2008
Secure building – natural and fluorescent lamps

Development and fecundity test in growth chambers –
14L:10D photoperiod
Constant temperatures
Predation methods

*Delphastus catalinae* lab colony reared on silverleaf whitefly in tomato plants

Adult females starved 24 hrs before feeding experiment

Uniform number of ficus whitefly prey – eggs, 1\(^{st}\) – 3\(^{rd}\) instars, and pupae

24-hr feeding period

Growth chamber – 25 °C, 60% RH, 14L:10D photoperiod
Results

1. No immatures survived 35°C treatment

2. Total duration of immature stages varied from 97.11 d at 15°C to 25.23 d at 30°C

3. Linear functions were used to describe development rates for eggs, instars and pupal stages.
4. Total immature development was also modeled as a non-linear function: \( r(T) = aT(T-T_0) \sqrt{TL - T} \) where \( a = 0.0000146 \), \( T_0 = 7.3120084 \) and \( TL = 45.9512202 \) (constant, lower developmental threshold and lethal temperature, respectively).

5. The thermal requirement for development from eggs to pupae was estimated to be 487.8 degree-days.

6. Ficus whitefly reproduction was highest at 27°C where \( R_0 \), \( GRR \), \( T \), \( r \), \( \lambda \) and \( DT \) were 23.114 ♀/♀, 24.25 ♀/♀, 31.413 d, 0.099 ♀/♀/d, 1.105 ♀/♀/d and 6.93 d, respectively.
Ficus whitefly development rates

A: Eggs

B: Instars

D: Eggs - Pupae

Temperature (°C)

Development Rate (1/d)
Enkegaard surface

Models combined effects of time and temperature on mean fecundity

\[ \text{Egg mean} = (-30.21 + 2.62T) d \exp(-0.034Td) \]; where \( T \) is temperature and \( d \) is days
Female Adult Survivorship

Proportion Survival

Time (d)

0 2 4 6 8 10 12 14 16

0.0 0.2 0.4 0.6 0.8 1.0

Proportion Survival
At 25 and 27°C, lifetime fecundity per female averaged 37.9 and 46.2, respectively.
Duration of female adulthood was 8 d at 15°C, significantly longer than 2.5 to 4.2 d at the higher temperatures.
Delphastus predation

<table>
<thead>
<tr>
<th>Prey Stage</th>
<th>Eggs</th>
<th>Small</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Eaten</td>
<td>0</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>
Conclusions

- Total duration of immature stages varied from 97.11 d at 15°C to 25.23 d at 30°C.

- Duration of female adulthood was 8 d at 15°C, significantly longer than 2.5 to 4.2 d at the higher temperatures.

- Ficus whitefly reproduction was highest at 27°C.

- At 25 and 27°C, lifetime fecundity per female averaged 37.9 and 46.2, respectively.

- *Delphastus* and other predators may be promising control agents.
Future Studies

• Intraguild predation

Parasitoid – *Encarsia protransvena* and predator *Delphastus catalinae*

• Biological control - commercially-available and naturally-occurring predators – green lacewing, *Chrysoperla rufilabris* and a coccinellid, *Curinus coerulus*
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