Biological Control of the Asian Citrus Psyllid in Southern California

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Background of Pest

- *Diaphorina citri* Kuwayama
- Native to Asia from Pakistan to Vietnam
- Introduced to Florida in 1998
- First detected in Texas in 2001
- Detected in California in 2009
- Attack most species of citrus
  - Lemon, Lime, orange, and grapefruit
Asian Citrus Psyllid Lifecycle

- Adults emerge and lay eggs on new flush
- 5 nymphal instars
- In warm weather (> 80 degrees) has a two week life cycle
Citrus Greening Disease

- Huanglongbing (HLB)
  - Yellow Dragon disease
- First discovered in Florida in 2005
- Detected in Texas and Southern California in 2012
- Spread by Asian Citrus Psyllid (ACP)
  - Also spread by grafting infected branches
- Can take years for infected trees to develop symptoms
- Fatal to trees
Citrus Greening disease
Citrus Greening Disease

Economic Costs

- In Florida has led to 3.63 billion dollars in lost revenue
- 6,611 jobs lost by reducing orange juice production
Citrus Industry in California

- Citrus estimate as a 2 billion dollar industry in California
- California produces 80% of the nation's fresh citrus
  - Main source of the nation's fresh market oranges and lemons
- 50-70% percent of homeowners have a citrus tree in their backyard
Biological Control Agent

- *Tamarixia radiata*
- Collected in Pakistan directly from ACP infested foliage
- Transported to Riverside for mass rearing
- Sting late instar nymphs
Rearing of *Tamarixia radiata*

- Rear Asian citrus psyllid nymphs on three host plants
  - Curry leaf (*Murraya koenigii*)
  - Volkamer lemon (*Citrus volkameriana*)
  - Sweet orange jasmine (*Murrya paniculata*)

- Produce late instar nymphs for *Tamarixia* to sting
Rearing of *Tamarixia radiata*

- Rearing conducted to preserve genetic diversity
- Long term rearing in lab can lead to a loss of fitness
- Maintain 17 separate *Tamarixia* lines
- Mix 17 lines together in a mass sting cage prior to release
Mass Rearing

- Use twenty plants per cage
  - Curry leaf (*Murraya koenigii*)
  - Volkamer lemon (*Citrus volkameriana*)
  - Sweet orange jasmine (*Murrya paniculata*)
- Each plant averages 100 nymphs
- Produce approximately 1000 wasps per week
- Variable results
Release of *Tamarixia radiata*

- Parasitoids are released directly onto ACP infested branches
- Parasitism has been witnessed in the field
- To date 22,304 parasitoids have been released primarily in LA County
Monitoring for Establishment
Are populations of *Tamarixia* from adjacent release sites “bleeding” into one another? Or, did just one release establish and spread?

100 *Tamarixia* released once on 1 June 2012 & recovered 21 Sept. 2012


Slide by M. Hoddle)
Possible *Tamarixia* Spread Assuming a 0.25 Mile Dispersal in all Directions from the Two Pico Rivera Release Sites
Next steps: Field Cage Insectaries

- Increase numbers of *Tamaraxia* wasps for mass production
- Use field cages to mass rear insects
- Working on a prototype that will allow *Tamarixia* wasps out but keep ACP adults in
Field Cage Insectaries
Curry plants

- Plant curry plants out in the field
- Caged and uncaged curry plants
- Maintain a constant source of flush for ACP to lay eggs and produce nymphs
- Thus maintaining a consistent supply of *Tamarixia* wasps
Sleeve cage treatments

- Citrus densities are patchy in urban areas
- Consistent densities of ACP are not always available
- Do *Tamarixia* wasps establish better with or without the use of sleevecages?
Movement of *Tamarixia radiata*

- How far do *Tamarixia* wasps disperse in an orchard?
- How far do *Tamarixia* wasps disperse in the urban environment
- Use sticky traps to monitor movement
Ants and ACP

- Recently observed ants tending psyllids in the field
- Observed ants attacking parasitoids
Summary

- Imperative to protect the citrus trees of Southern California
- To date have released over 20,000 wasps in the greater LA area
- Have found establishment of the wasps in several locations
- Need to increase production of *Tamarixia radiata* wasps
- Need to understand the behavior of *Tamarixia* in orchards and the urban environment
- Determine the impact that ants will have on *Tamarixia*
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Questions?