Methods Development for Mass Production of *Tamarixia radiata*

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PRODUCTION

• Arthropod Quarantine
  Pakistan Strain

• Lab Production
  Taiwan / Vietnam Strain

• Field Production
  Taiwan / Vietnam Strain
MOVEMENT INTO U.S.

• July 10, 2009 - Leeda Wood (Arthropod Quarantine Officer) contacts Abdul Rehman (Insect Biocontrol Specialist - CABI South Asia)
• July 29, 2009 - Permit P526P-09-02428 approved
• August 8, 2009 - First shipment dispatched
• August 11, 2009 – Shipment received and cleared at Los Indios Plant Inspection Station
TAMARIXIA COLLECTIONS
## SHIPMENTS RECEIVED

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<th>PPQ Receiver’s ID No.</th>
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<th># of Pupae (Mummies)</th>
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ARTHROPOD QUARANTINE

- 12 environmental growth chambers
- 5 greenhouses
- 4 lab areas
- 1 office
- 1 headhouse
- 1 pass-thru chamber
- 1 receiving room
- 1 autoclave pass-thru
QUARANTINE ENTRY

Pass-thru Chamber

Secondary Containment Cage in Receiving Room
COLLECTION VIALS
VARIOUS STAGES
PENNY FOR YOUR THOUGHTS
REARING CAGE IN EGC
ENCYRTIDAE

Diaphorencyrtus aligarhensis
SIGNIPHORIDAE
Chartocerus sp.

- Dr. Michael Gates (USDA / Systematic Entomology Laboratory, Beltsville, MD)
EULOPHIDAE
Aprostocetus sp.

• Dr. Michael Gates (USDA / Systematic Entomology Laboratory, Beltsville, MD)
EULOPHIDAE: *Tamarixia radiata*

- Dr. Gregory Evans (USDA / Systematic Entomology Laboratory, Beltsville, MD)
- Dr. Michael Gates (USDA / Systematic Entomology Laboratory, Beltsville, MD)
- Dr. Norman B. Barr (USDA APHIS PPQ CPHST Mission Laboratory, Edinburg, TX)
ISO-FEMALE LINES
6” Pots
QUALITY CONTROL

- 12-16 cages / EGC x 2 chambers
- Specimens submitted weekly
- Collect and submit 20 adult specimens from 4 random cages (5 / cage)
- Results - 6 haplotypes
MAIN GREENHOUSE
ORANGE JASMINE
ADULT PSYLLID COLLECTIONS
SHADEHOUSE PRODUCTION
ADULT PSYLLIDS
ENVIRONMENTAL GROWTH
CHAMBERS
28°C, 50% RH, 14:10 L:D
PSYLLID COLONY
200-400 PSYLLIDS / CAGE
INFESTED PLANT
PARASITE CHAMBER
TAIWAN / VIETNAM STRAIN
ISO-FEMALE CYLINDERS
EMERGENCE CAGES
ONE PLANT PER CAGE
PARASITOID PRODUCTION
STICKY TRAP ON PETRI-DISH
TOTAL PARASITOID EMERGENCE
HOST FEEDING STUDY
CONE-TAINERS
HOST MORTALITY

- 35.26% ACP
- 23.55% T. radiata females
- 41.19% Host-fed

n=28 Tamarixia radiata females
LARGE ORANGE JASMINE PLANT
PLANT PRUNED TO INDUCE UNIFORM FLUSH
PSYLLIDS EGGING PLANT
~2000 EGGS / PLANT
COLLECTION METHODS
PROJECTIONS

| 400 parasitoids / plant | x 25 plants / week | 10,000 parasitoids / week | X 4 weeks | 40,000 parasitoids / month |

| 1000 parasitoids / plant | X 25 plants / week | 25,000 parasitoids / week | X 4 weeks | 100,000 parasitoids / month |
FIELD PRODUCTION AT USDA CITRUS GROVE
TREE BEING CLIPPED TO INDUCE FLUSH
FRAME INSTALLED
ABUNDANCE OF FLUSH
FIELD CAGE FOR
MASS PRODUCTION
FIELD INSECTARY CAGES
PSYLLID PRODUCTION
PARASITOID RELEASES
CURRENT PRODUCTION

• during the months of October-November
• low-volume release of 20 parasitoids
• 2-3 generations
• parasitism rates of 19.8% were observed
• estimated 2000 parasitoids
• net return of 100X
PROJECTIONS

• increase our yield
• timing - in the spring and summer months
• release numbers - 10 to 50-fold
• inducing 2 to 5-times more flush
• project 40,000 - 200,000 parasitoids per tree
FUTURE GOALS

• Quarantine screening, rearing, and mass production of new strains of *Tamarixia* and any other biological control agents.

• Develop methods and protocols for the easy release of large volumes of biological control organisms.

• Qualify and quantify the impact of large-volume releases of biological control agents in organic groves, commercial groves, and dooryards.

• Transfer technology and/or biological control organisms to federal, state, and other cooperators in affected states for release.
END