Biological control of *Lygodium microphyllum*: Updates on Quarantine Host Range Testing and Post-Release Evaluation

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Old World Climbing Fern in Florida
Lygodium in Conservation Areas

Flatford Swamp

Greenswamp Wilderness Preserve

A.R.M. Loxahatchee NWR

Everglades National Park
L. microphyllum reproduction

Propagule pressure:

• Each sorus has ~ 215 spores
• Each fertile leaflet has ~ 133 sori
• 215 X 133 = 28,500 spores per fertile leaflet (Volin et al. 2004)
Biological Control on *Lygodium*

- Program initiated in 1995 (Goolsby & Pemberton)
- Focus on SE Asia & Australia
  - Monthly surveys in QL
- 20 herbivores collected
  - 11 Lepidoptera
  - 4 Coleoptera
  - 1 Hymenoptera
  - 1 Homoptera
  - 1 Hemiptera
  - 1 Thrips
  - 1 Mite
Biological Control on *Lygodium*

Relative abundance of herbivore collections on *Lygodium microphyllum* (Goolsby et al. 2003)
Biological Control on *Lygodium*

Approved Agents:

*Austromusotima camptozonale*
Released 2005 – 2012
Failed to establish

*Neomusotima conspurcatalis*
Released 2008 – Present
Established in South and Central Florida

*Floracarus perrepae*
Released 2009 – Present
Established in South Florida
Biological Control on *Lygodium*

Agents undergoing host-range testing in quarantine:

*Lygomusotima stria*
Colony established in 2010
Testing:
• Multiple generation tests on *Lygodium* congeners (*L. palmatum, L. volubile*)
• Cold-tolerance (for northern viability)

*Neostrombocerus albicomus*
Colony arrived in 2005, reestablished in 2013
Testing:
• Multiple generation tests on *Lygodium* congeners (*L. palmatum, L. volubile*)
Post Release Evaluation

2008 - 2009
Post Release Evaluation

Current CERP releases 2015

Write a description for your map.
Neomusotima in the field
Neomusotima post-release impact

Feeding preference

• Do *N. conspurcatalis* larvae preferentially feed on fertile fronds?
• Effects of fertile frond feeding on spore germination
• Effects of fertile frond feeding on larval development time
Neomusotima research

Feeding preference

- Larvae are either given choice (1 fertile frond + 1 sterile frond) OR no-choice (2 fertile or sterile fronds)
- Record area consumed
  - Instar (head capsule)
Choice Feeding Trial

Leaf

Cm² consumed per individual

Fertile
Sterile

Fertile
Sterile

Fertile
Sterile

Fertile
Sterile

Fertile
Sterile

a*
b*
a*
b*
No-Choice Feeding Trail

Cm² consumed per individual

Leaf

Fertile A
Sterile A
Fertile B
Sterile B
Fertile C
Sterile C
Fertile D
Sterile D
Fertile E
Sterile E

a* Fertile
b* Fertile
a* Fertile
b* Fertile

Fertile
Sterile

Legend:
Oviposition Preference Trial

![Graph showing larval production per female for fertile and sterile leaf types. The fertile leaf type produces significantly more larvae than the sterile leaf type, indicated by the letter 'a*' for fertile and 'b*' for sterile.]
Post-Release Evaluation: Integrated weed management

• Control
• *Neomusotima* only
• Herbicide only
• *Neomusotima* and herbicide
• Future plans:
  – Fire
  – Mites
Neomusotima in Florida communities

- Parasitism
- Indirect effects
  - Parasitoid spillover
- Range expansion
  - Modeled
  - Realized
F. perrepae releases 2008
F. perrepae range 2015

Range surveys planned for 2015
Future Directions

• MORE MITES!
  – Extensive surveys of AU and FL for matching fern haplotypes
  – Recollect mites from AU → rapid screening for release in FL
Future directions: *F. perrepae*

- Re-assess impact *in-situ*
- Develop integrated management plan
  - Mites rapidly/readily recolonize post-fire