Mite Genotype vs. Fern Genotype

John A. Goolsby
USDA-ARS
Weslaco, TX

Formerly: USDA-ARS, Australian Biocontrol Lab
CSIRO - Entomology
Long Pocket Laboratories
Indooroopilly, Queensland
Australia
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Biological Control of *Lygodium microphyllum*
Old World climbing fern

- Native to Old World wet tropics (Australia, Africa, Asia, Oceania)
- Introduced into Florida as ornamental plant in the 1890’s
- Became serious weed in the 1990’s
- Biological control program started 1999
Rapidly spreading across tree islands of the Everglades
Native habitats

Queensland

Northern Territory

Malaysia

Lygodium - NOT Weedy
Does not dominant landscape
In a matrix with other plants

USDA-ARS
Exploration in native range of *Lygodium microphyllum* from 1998-2004
Bungle Bungles, WA
Purses made from Lygodium - Thailand
India, Tamil Nadu
22 *Lygodium* Herbivores

![Eriophyid mite image]
Floracarusus perrepaee (Eriophyidae)

- Widespread, collected throughout Australia, Asia, Oceania
- Subtle, but debilitating effect on plant
Adult mite feeds on leaf margin

Mite induces leaf rolling

Feeding leads to leaf necrosis

Mite Damage
Biology

- Egg, larva, 2 nymphal instars, adult
- 16 day life cycle at 22° C
- 60 eggs per female
- Mite feeding stimulates development of large nutritive cells - curls
- Induction of leaf rolling limits host range
Predictive Studies

- Can we use studies in native range to estimate impact of *Floracarus perrepaee*?
- No dramatic successes yet from eriophyids

(Briese & Cullen, 2001)
Chemical Exclusion Studies

- Field plot block design
- Biomass production with and without mite
- Agrimec® to control mite
- Harvested 4 pairs each quarter
- 2 year study
Impact Studies

- Greater than 50% reduction in biomass over 2 year period

- Florida *L. microphyllum* not acceptable to local Queensland mite
Discovery of Mite Genotypes

- Characterization of *F. perrepae* from throughout its distribution revealed several distinct genotypes
- Nuclear D2 and mitochondrial CO1 genes
- Developed mobile field lab to screen genetic diversity for acceptability of Florida fern genotype
Genotypes of *Floracarus perrepaee*

- D2 nuclear gene &
- CO 1 mitochondrial
In Country Mite Screening

Mobile Field Lab
<table>
<thead>
<tr>
<th>Mite Genotype</th>
<th>Queensland Fern</th>
<th>Florida Fern</th>
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What is *Lygodium microphyllum*?

- Chloroplast introns trnL (550 base pairs) and rps4-trnS (690 base pairs) used to characterize genotypes and match Florida population with origin.
Genotypes of *Lygodium microphyllum* • chloroplast intron genes

Florida = 6

Africa = 7
Source of Invasive *Lygodium microphyllum*?

- **J. G. Veitch collects** *L. microphyllum* in Somerset, Cape York - 1867
- Veitch provides *L. microphyllum* to Charles Darwin for 1875 study of Twining Plants
- Reasoner Bros. offer *L. microphyllum* for sale in Florida, 1888
- J. G. Veitch collects *L. microphyllum* Somerset, Cape York - 1867
Expedition to Cape York
Knowing the origin of the *Lygodium* really matters

Origin leads us to the most co-evolved *Floracarus perrepae* genotype.
• *Floracarus perrepaee* prioritized based on host range and impact

• *F. perrepaee* from Cape York is best adapted to FL genotype of fern

• Host range test show that Cape York *F. perrepaee* is specific to *L. microphyllum*
Conclusion

- *Floracarus perrepae* mite established in Florida
- Other *Lygodium microphyllum* genotypes may be limiting its success
- *Lygodium* moth, *Neomusotima conspurcatalis* doing very well
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THANK YOU