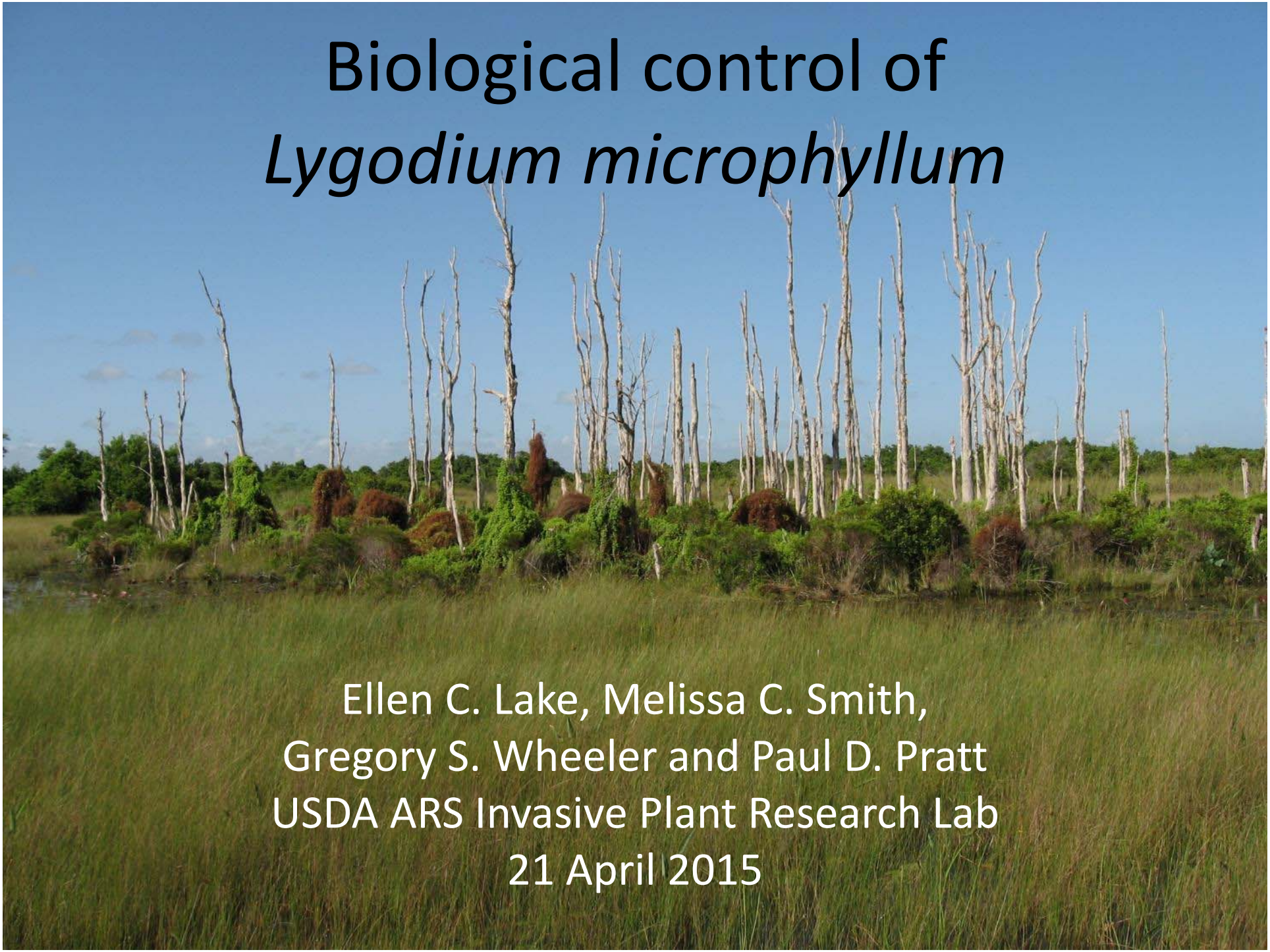


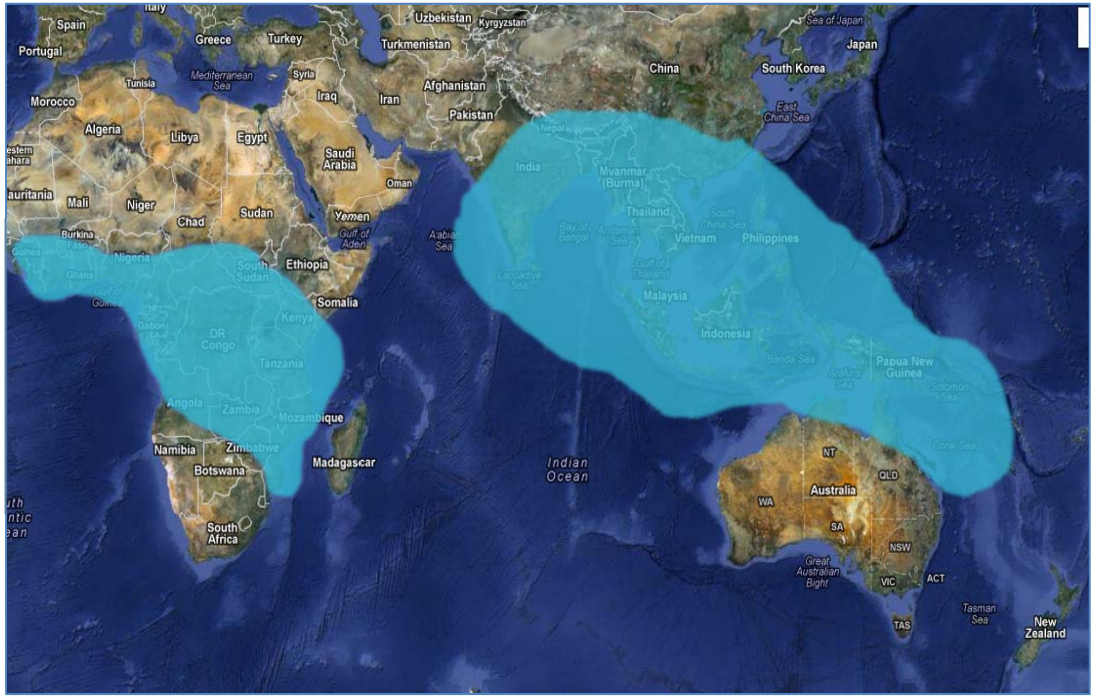
Biological control of *Lygodium microphyllum*

Ellen C. Lake, Melissa C. Smith,
Gregory S. Wheeler and Paul D. Pratt
USDA ARS Invasive Plant Research Lab
21 April 2015

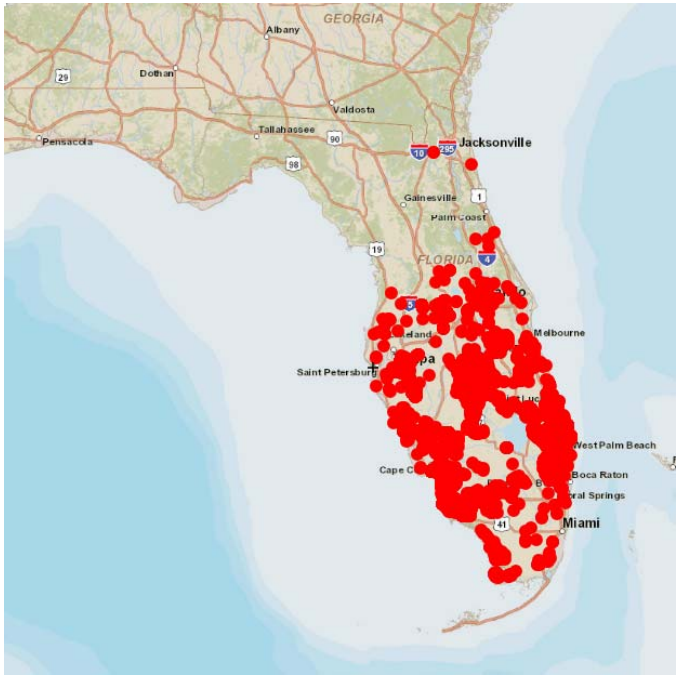
Lygodium microphyllum

Lygodium microphyllum

Native range



Introduced range



Lygodium in conservation areas

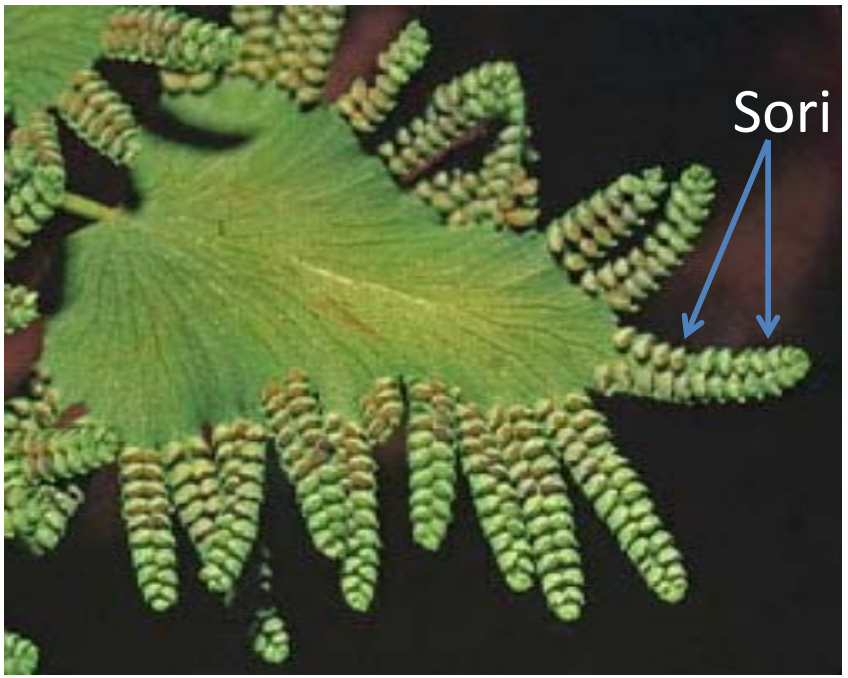
Flatford Swamp

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)


Tony Pernas, National Park Service
UGA5276001

Photo credit: Amy Ferriter

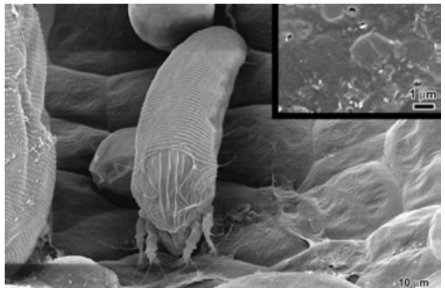
Biological Control of *Lygodium microphyllum*

- 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***

Approved biological control agents

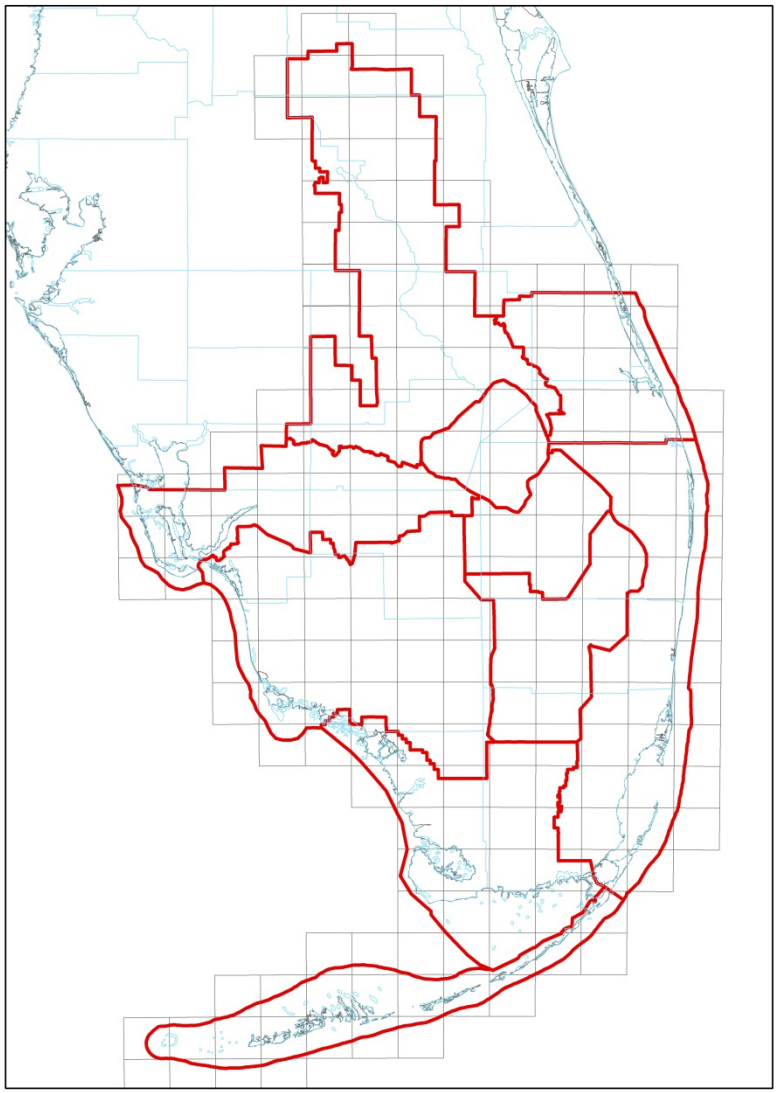
Austromusotima camptozonale
Lepidoptera: Crambidae
Released 2005 – 2012
Failed to establish

Neomusotima conspurcatalis
Lepidoptera: Crambidae
Released 2008 – Present
Established in South and Central Florida



Floracarus perrepae
Acariformes: Eriophyidae
Released 2009 – Present
Established in South Florida

Invasive Plant Research Lab and the Comprehensive Everglades Restoration Plan (CERP)



Biological control of:

- Old World climbing fern
- Air potato
- Waterhyacinth

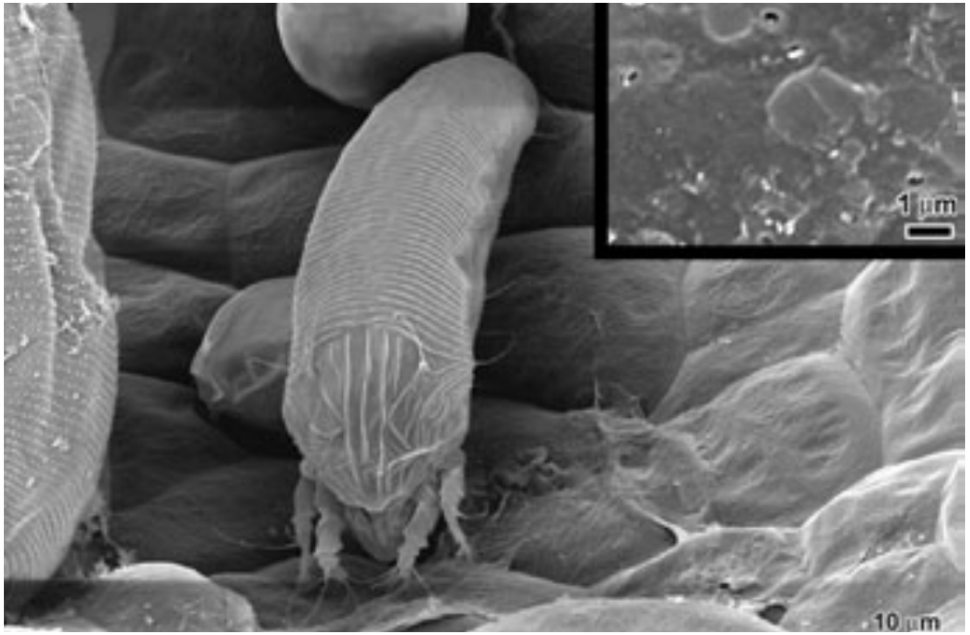
2014-2015 CERP Releases

Neomusotima conspurcatalis

N. conspurcatalis damage in the field

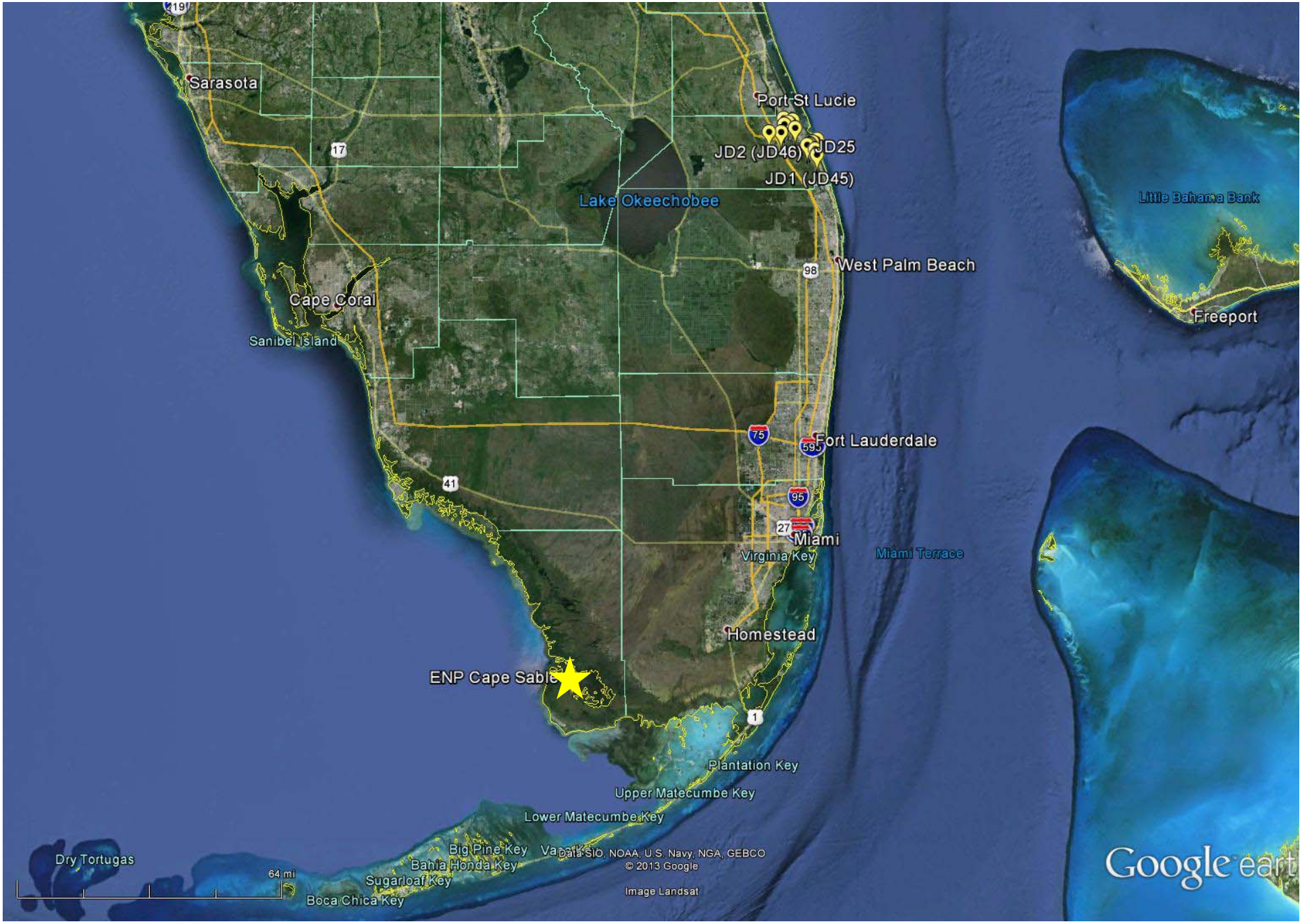
Are predators and parasitoids limiting the efficacy of *N. conspurcatalis*?

Floracarus perrepae



- Transfers of galled material 2008 – 2010
- Very low establishment success measured in 2011

Freeman et al. 2005

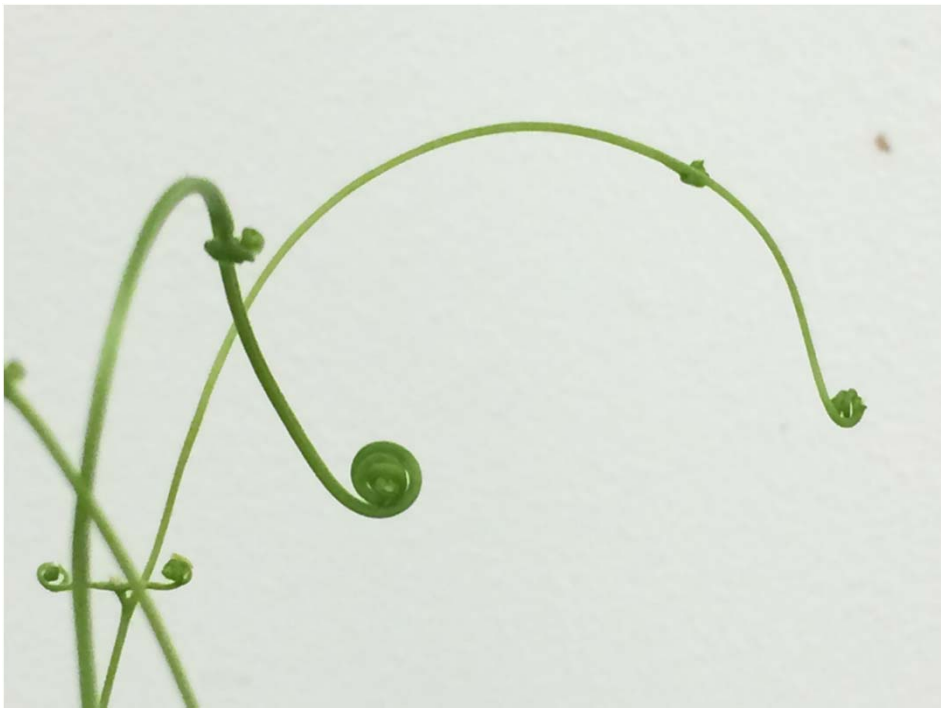

Sarasota
Port St Lucie
JD2 (JD46)
JD25
JD1 (JD45)
Lake Okeechobee
Little Bahama Bank
West Palm Beach
Cape Coral
Sanibel Island
Freeport
Fort Lauderdale
Miami
Virginia Key
Miami Terrace
Homestead
ENP Cape Sable
Plantation Key
Upper Matecumbe Key
Lower Matecumbe Key
Big Pine Key
Bahia Honda Key
Sugarloaf Key
Boca Chica Key
Dry Tortugas
64 mi
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Google
Image Landsat
Google earth

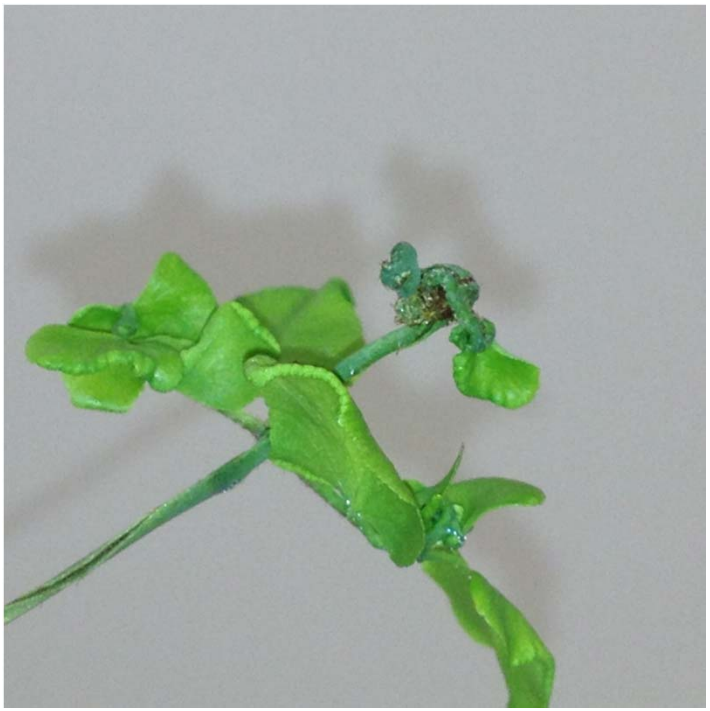
F. perrepae damage

Goolsby et al. (2004)

- Reduced aboveground biomass by 49%
- Reduced belowground biomass by 35%

Can *F. perrepae reduce* Lygodium's ability to climb? recover from herbicide or prescribed burns?





Survey of genetic diversity of *L. microphyllum* in Florida

- Approximately 50% of *L. microphyllum* plants exposed to mites do not develop galls
- Is there more than one *L. microphyllum* haplotype in Florida?
- Are some haplotypes resistant to galling?

Potential agents undergoing host-range testing

Lygomusotima stria (Lepidoptera: Crambidae)

- The most damaging of the leaf-feeding crambids in the native range
- Colony established in 2010

Testing:

- Multiple generation tests on *Lygodium* congeners (*L. palmatum, L. volubile*)
- Cold-tolerance (for northern viability)

Neostrombocerus albicomus (Hymenoptera: Tenthredinidae)

- Causes large defoliation events in the native range
- Colony arrived in 2005, reestablished in 2013

Testing:

- Multiple generation tests on *Lygodium* congeners (*L. palmatum, L. volubile*)

Foreign exploration for potential agents

Stem boring moths (4 species)

- 4 species
- Bore low on rachis and may kill all growth above the feeding point
- Also able to continue feeding within the rhizome, depleting the plant's nutrient supply
- Extremely difficult to colonize

Acknowledgments