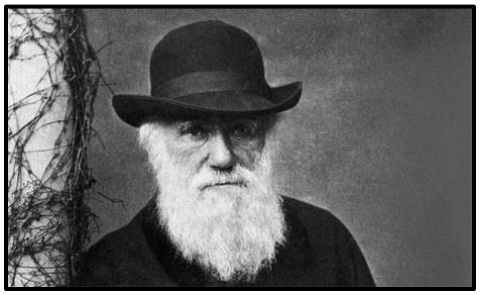
Detection of biotic resistance to *Mikania micrantha* in Florida



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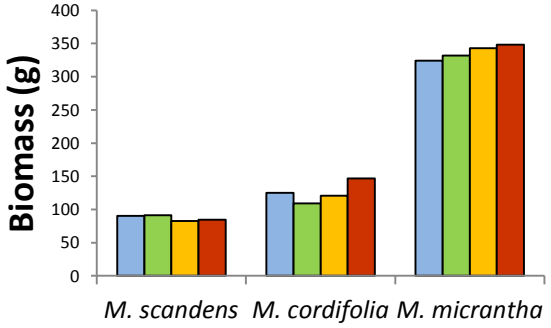
Florida Exotic Pest Plant Council, May 21-23, 2013

Summary of data collected to understand the potential biotic resistance to *M. micrantha*

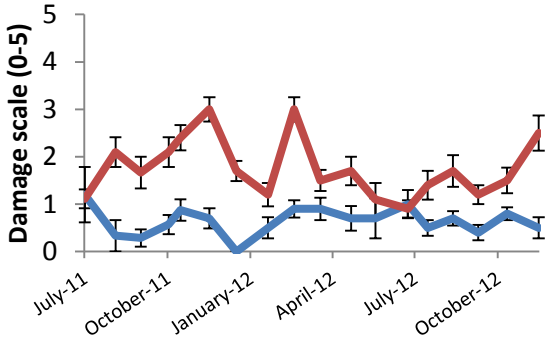
1. Background on *Mikania* spp. and biotic resistance

2. Inventory of insects and diseases

3. Exclusion of experiment in Homestead



4. Field impact of insect herbivory and diseases



1. Background on *Mikania* spp. and biotic resistance

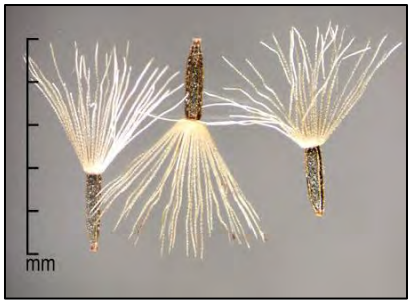
Mikania micrantha Kunth is a vine in the family Asteraceae

Native range: South and Central America

First reported in Florida: 2009, Redlands, Miami Dade Co.

Possible origin of Florida population: Caribbean region

Inflorescense present from late October to February



Achene

M. micrantha is considered among the worst weeds in world (Lowe et al. 2000)


Nepal: One-horned rhino

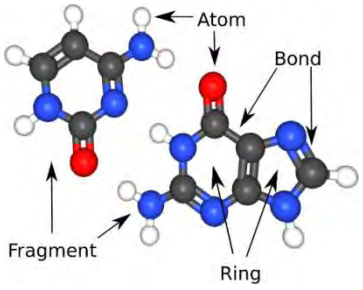

China


Guam

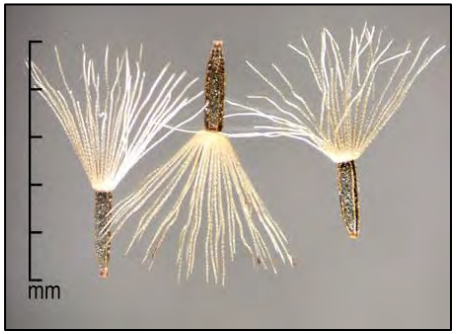
Life history adaptations related to invasiveness

Fast vegetative growth

Massive seed production



Allelophatic properties



Wind dispersal

Efforts to eradicate *M. micrantha* from Homestead

Control efforts in 2010, 2011, 2012

Pictures by Dennis Giardina

Mikania cordifolia and *M. scandens* are native from Florida

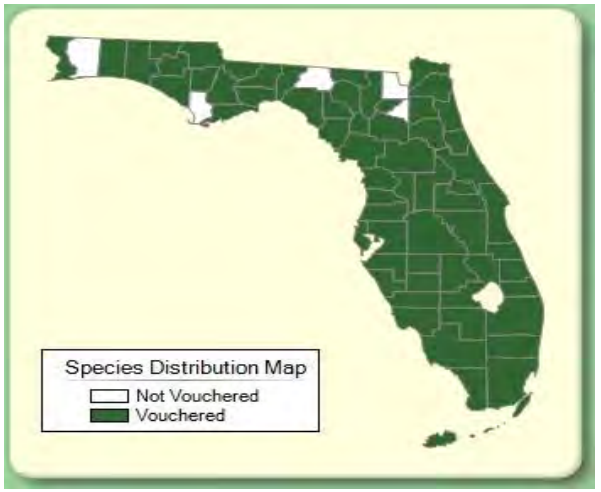
Mikania cordifolia

Grows in dry areas

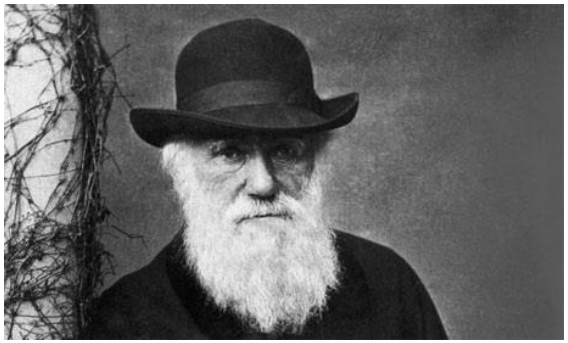
Mikania scandens

Grows in wet areas

Mikania micrantha



Darwin naturalization hypothesis



"Introduced plant species will be less likely to establish a self-sustaining wild population in places with congeneric native species because the introduced plants have to compete with their close native relatives, or ***are more likely to be attacked by native herbivores or pathogens***."

Exotic sp.

Native sp. 1

Biotic Resistance

Native sp. 2

Research questions:

- What are the insect herbivores and diseases of *Mikania* spp.?
- What is their impact on plant growth?
- What level of damage is naturally occurring?

2. Inventory of insects and diseases

Insects and diseases were collected from populations in Fort Pierce and Homestead

- Collection focused on immature insect herbivores
- Adults sent for species identification
- Discovered three new species (2 leafminers, 1 stem galler)

Local herbivores are utilizing *M. micrantha*

- Collected 61 species of herbivores of *Mikania* spp.

-Feeding habits included leaf chewers, sap-sucking, leafminers, stem borers, gall makers

- Herbivores reared from *M. micrantha* were considered polyphagous

- 35% of herbivores on *M. micrantha* were shared with at lest one native plant

Leafminer maggots on *M. micrantha*

Mikania micrantha is an alternative host for several crop pests

Mite: *Tetranychus* sp.

Aphid: *Aphis spiraecola*

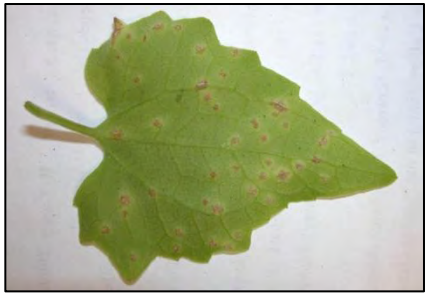
Mealybug: *Phenacoccus parvus*

Leafminer: *Nemorimyza maculosa*

Snail: *Bradybaena similaris*

Symptoms of fungal diseases were easy to find on wild populations

M. cordifolia



M. scandens

M. micrantha

Fungal morphology and DNA used to identify species, so far we have 135 isolates

M. cordifolia	*M. scandens*	*M. micrantha*
Colletotrichum-1	*Glomerella/Colletotrichum* spp.-1	*Glomeralla, Collectotrichum-31*
Phomopsis-3	*Diaporthe/Phomopsis*-5	*Diaporthe/Phomopsis*-13
Fusarium-4	*Fusarium-8*	*Didymella-3*
Cladosporium-7	*Alternaria-5*	*Fusarium-3*
Alternaria-1	*Non-pathogens-8*	*Alternaria-4*
Non-pathogens-5	*Unknown-1*	*Non-pathogens-5*

We tested Koch's postulates using 11 isolates under greenhouse conditions

MMHSM-1-Glomerella cingulata
MMHSM-10-Colletotrichum truncatum
MMHSM-24-C. capsici
MSH-1-Phomopsis sp.
MMHS-216-4-Phomopsis asparagi
MMHSC-12-Didymella sp.
MSH-5-Glomerella cingulata
MMHSTA-1-C. gloeosporioides
MMHSC-11-Phomopsis sp.

Koch's postulates were fulfilled for *Phomopsis* sp., *Colletotrichum*, *Didymella* on *M. micrantha* and *M. scandens*

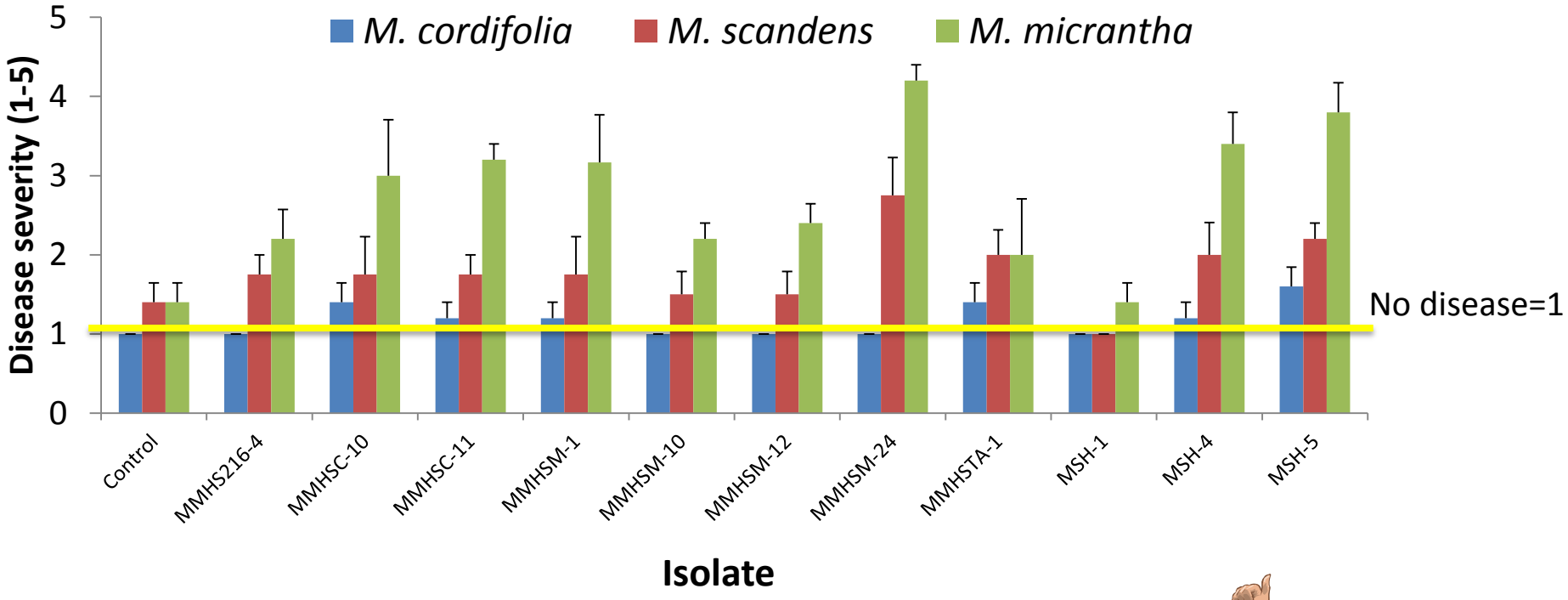
Few symptoms on *M. cordifolia*

Phomopsis on *M. scandens*

Colletotrichum on *M. micrantha*

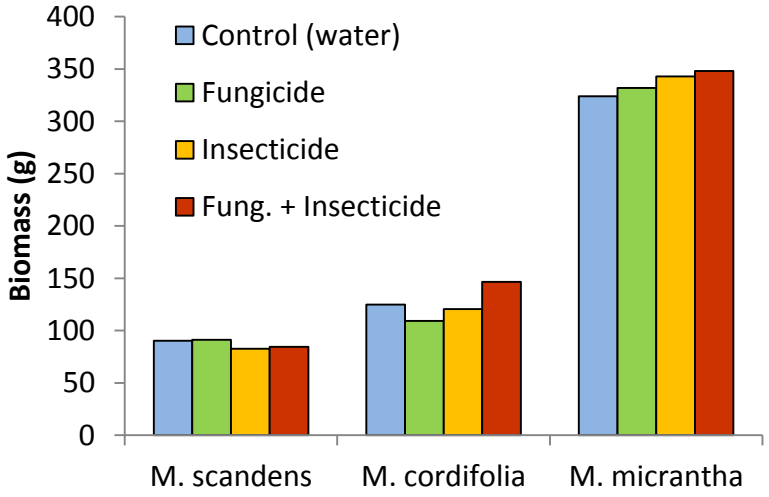
Colletotrichum on *M. scandens*

M. micrantha was highly susceptible to several pathogens-particularly *Colletotrichum*



- Few isolates had any impact on *M. cordifolia*
- ***Puccinia spegazzinii* found in Florida!!!!**
- Excellent potential biological control agents

3. Exclusion experiment in Homestead



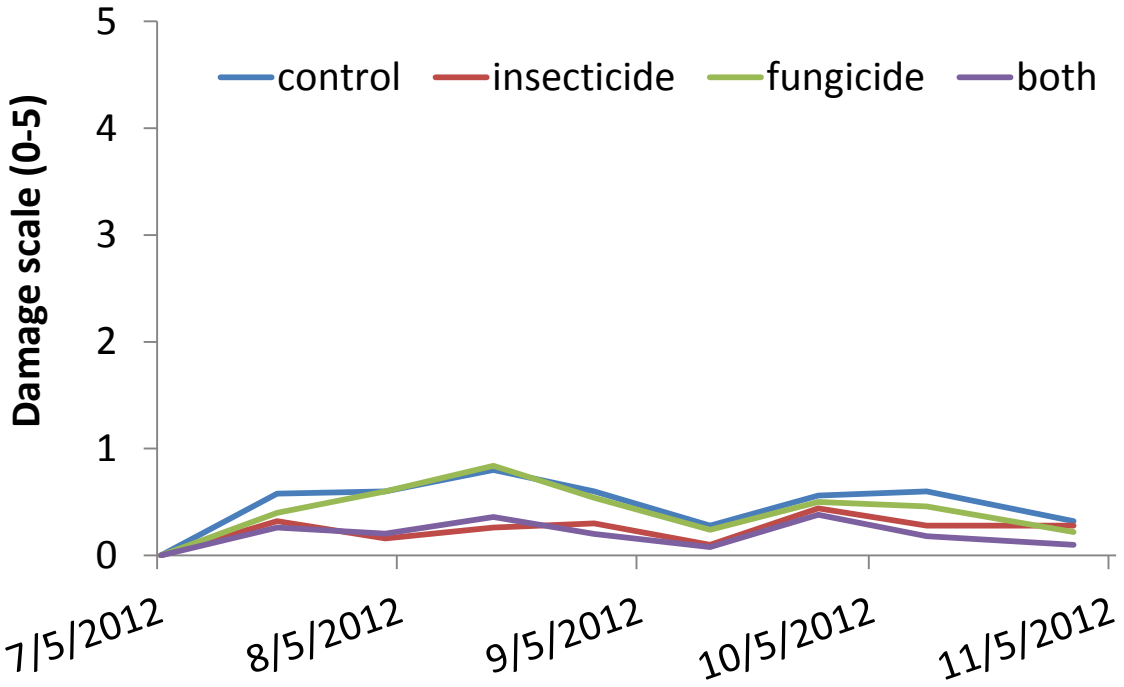
Field plot with three *Mikania* spp. growing in a common garden

Treatments:

1) Insecticide
2) Fungicide
3) Insecticide + Fungicide
4) Control (water)

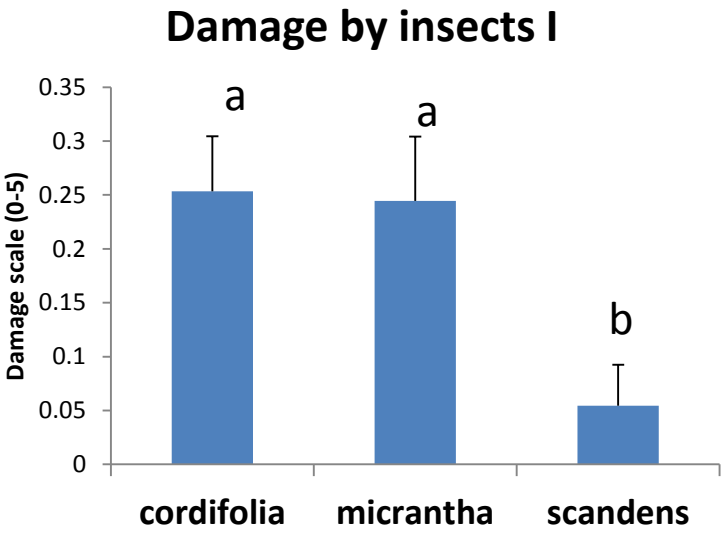
- Collected twice per month the damage severity with scale from 0 to 5
- Biomass collected after 4 months

Very low insect activity in the field plot

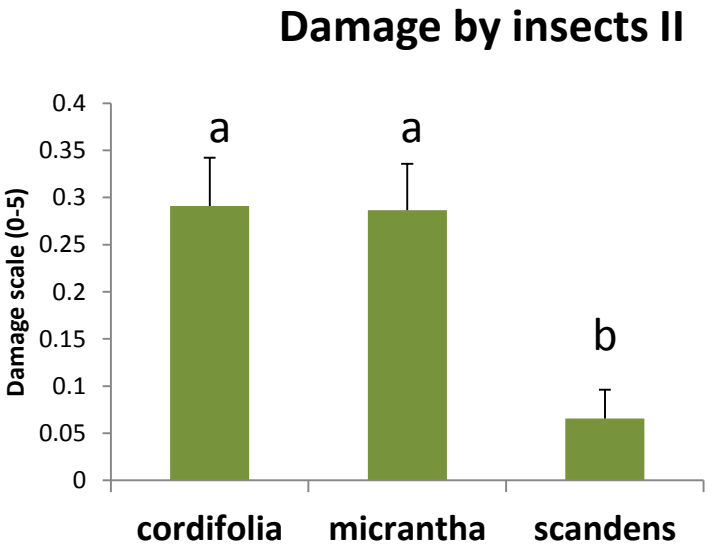


- Similar trend on *M. scandens* and *M. cordifolia*
- Insecticide reduced herbivore pressure
- Insect colonization might be affected by distance to natural infestations

But, *M. micrantha* had similar or more insect damage compared to the native plants

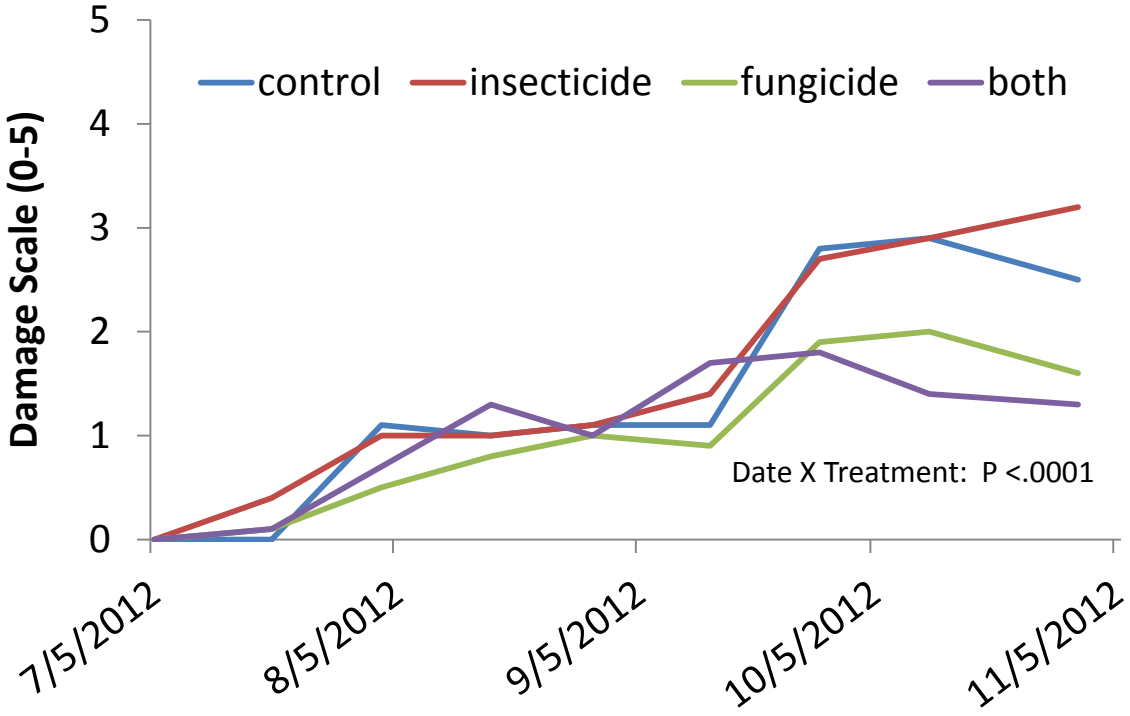


Difference between Control and Insecticide



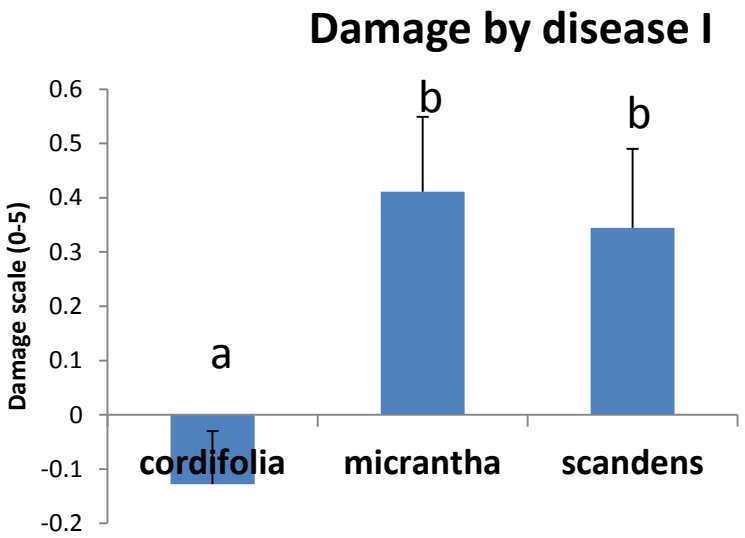
Difference between Control and Insecticide + Fungicide

Damage by leaf pathogens increased over time

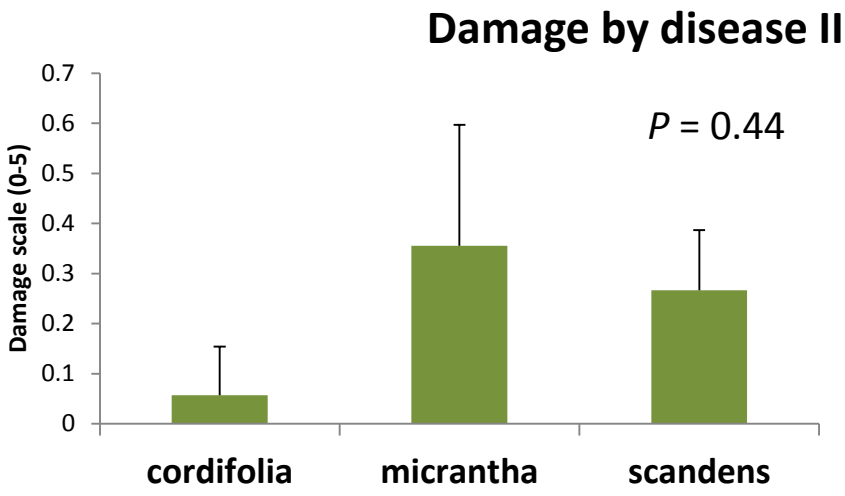


- Similar trend found on *M. scandens* and *M. cordifolia*

Again, *M. micrantha* had similar or more disease damage compared to the native plants



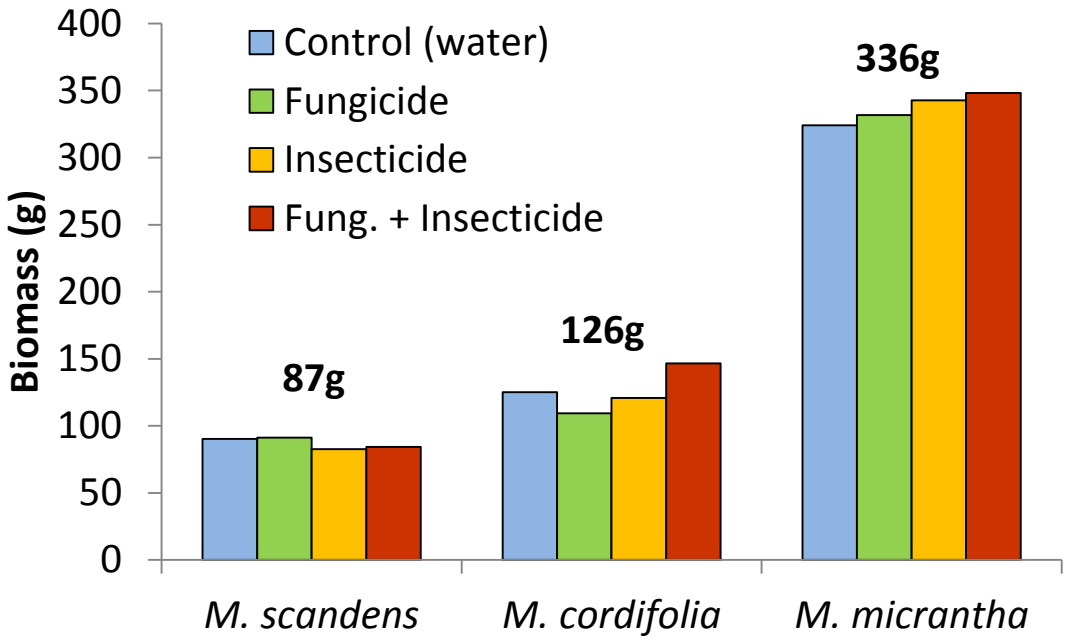
Difference between Control and Fungicide



Difference between Control and Insecticide + Fungicide

Strong evidence for biotic resistance

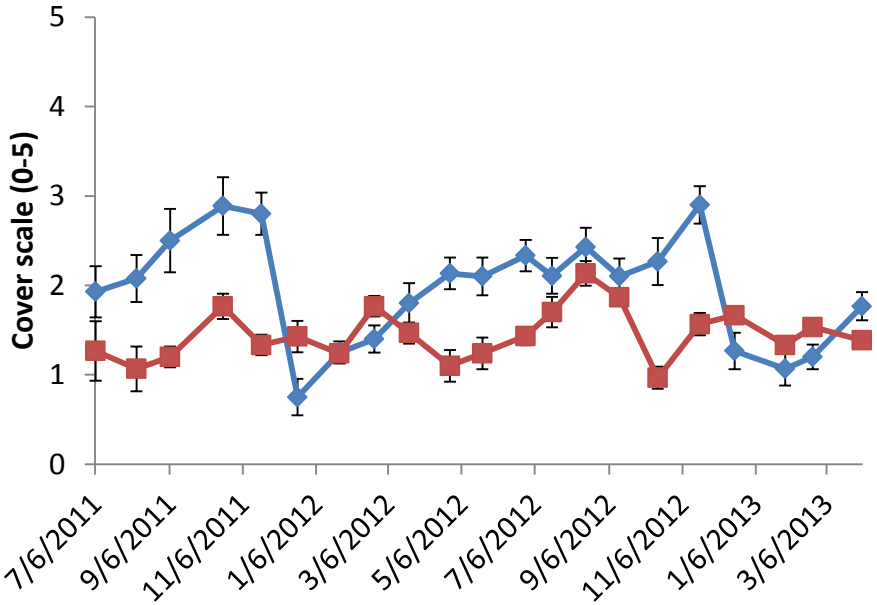
Plant biomass per species was similar between control (water) and exclusion treatments



Biomass of *M. micrantha*

- 3.9-times *M. scandens*
- 2.7-times *M. cordifolia*

4. Field impact of insect herbivory and diseases



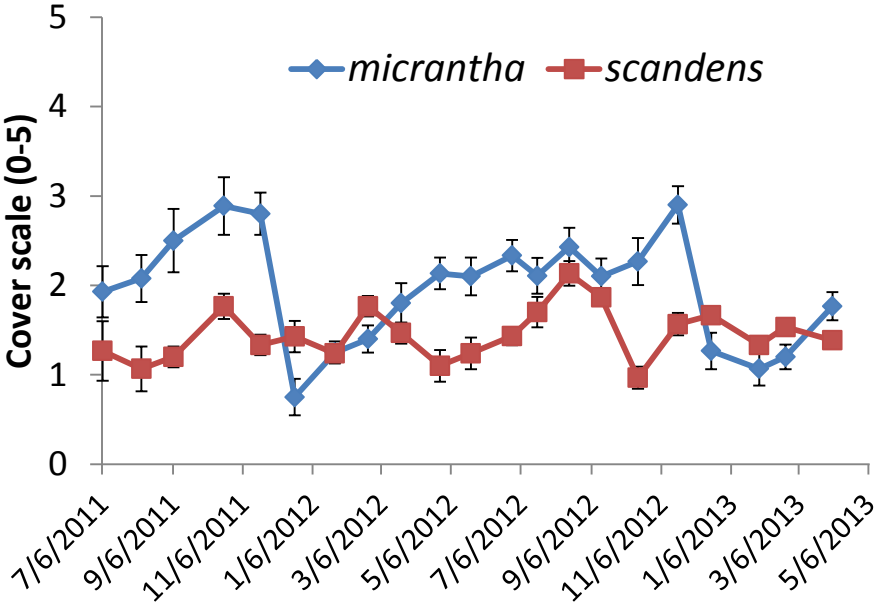
Sampled ‘natural’ infestations of *M. micrantha* and *M. scandens* in Homestead 2011-2013

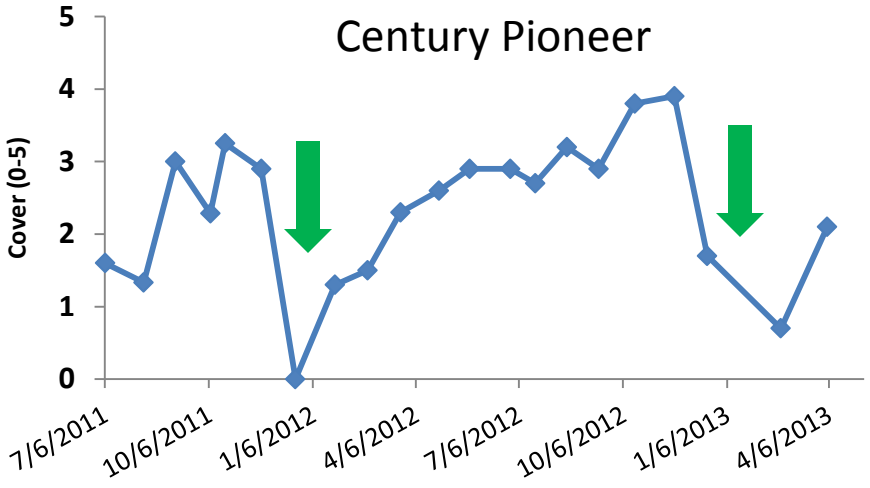
3 sites per species

Linear transects

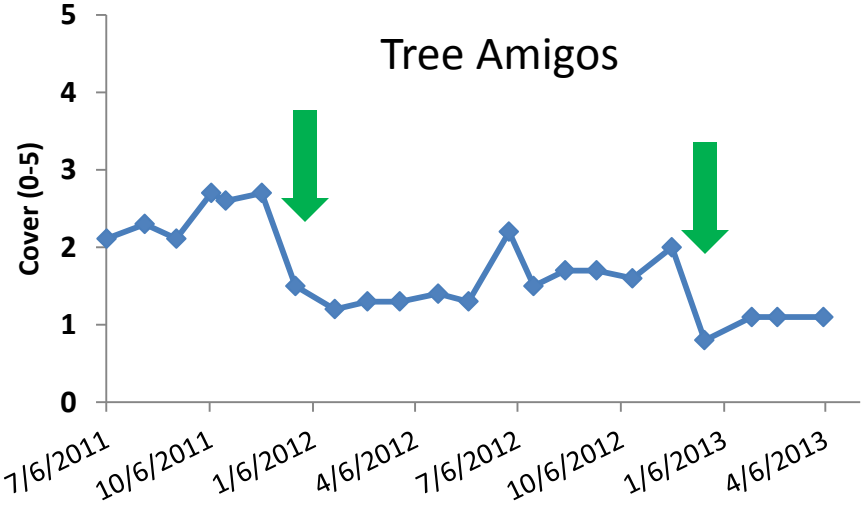
Variables measured:
- Plant cover
- Insect damage
- Disease damage

Cover of *M. micrantha* varied by site and was affected by eradication efforts

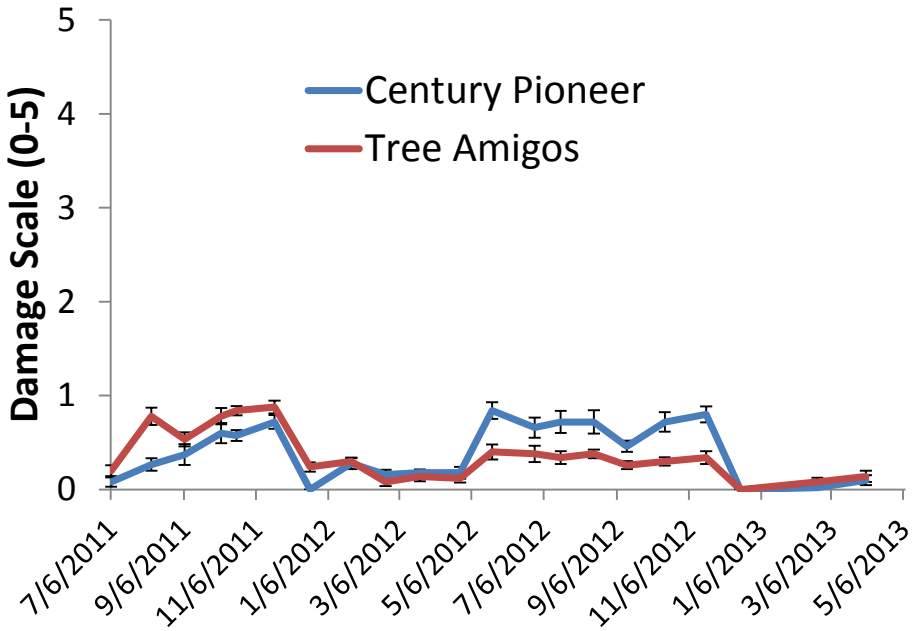


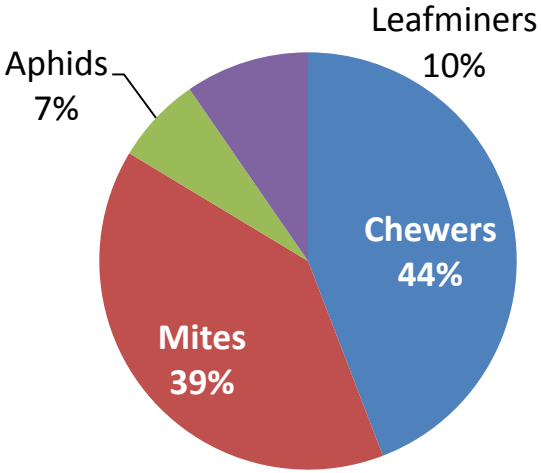


Is eradication working?



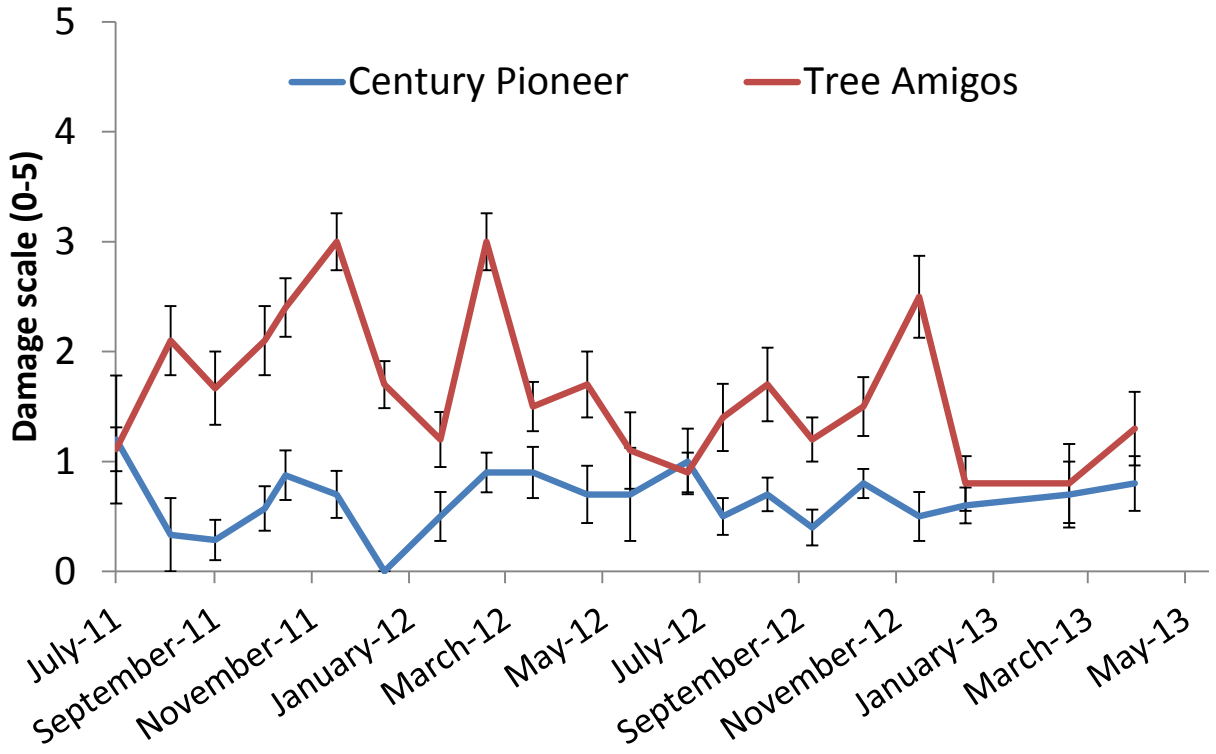
Low herbivory on *M. micrantha* and included generalist species





- Absence of chewers during day sampling suggest, snails could be the major herbivore of *M. micrantha*

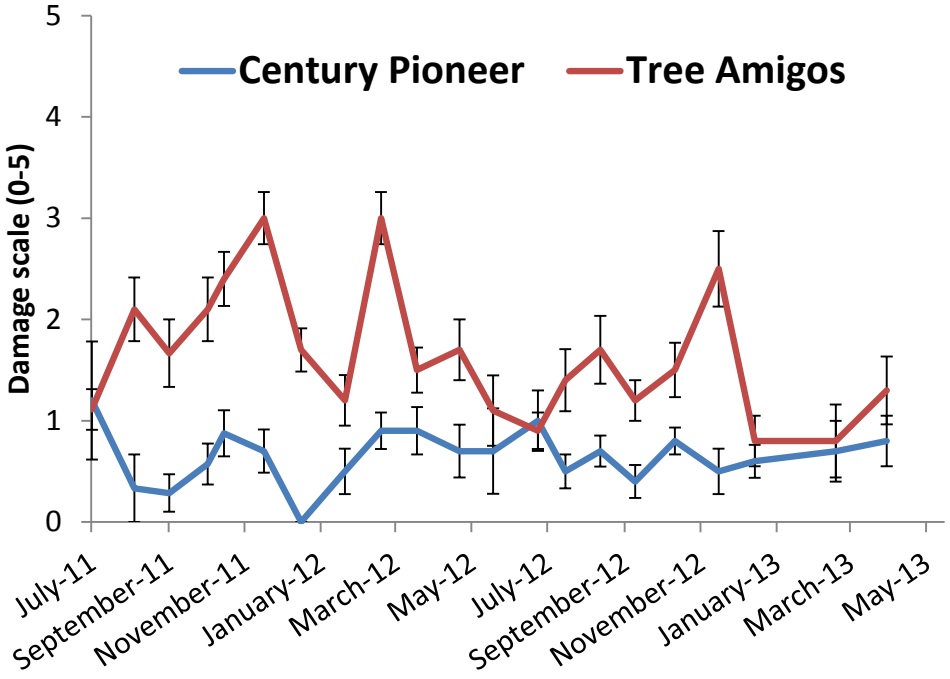
Leaf diseases might have a greater impact but varied by site

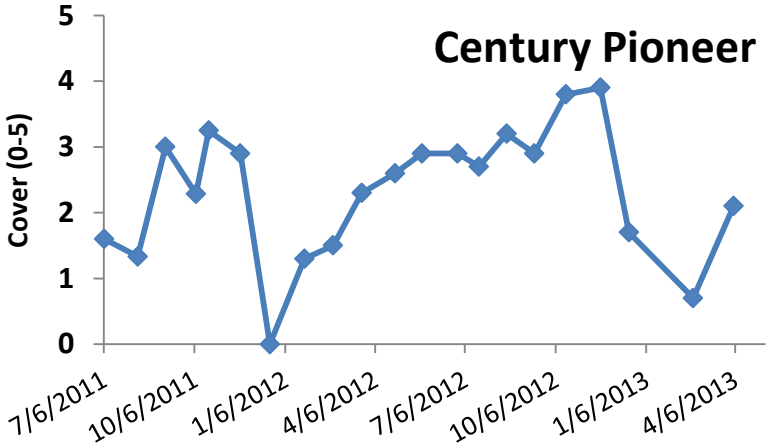


Leaf spot on *M. micrantha*-TREE AMIGOS site

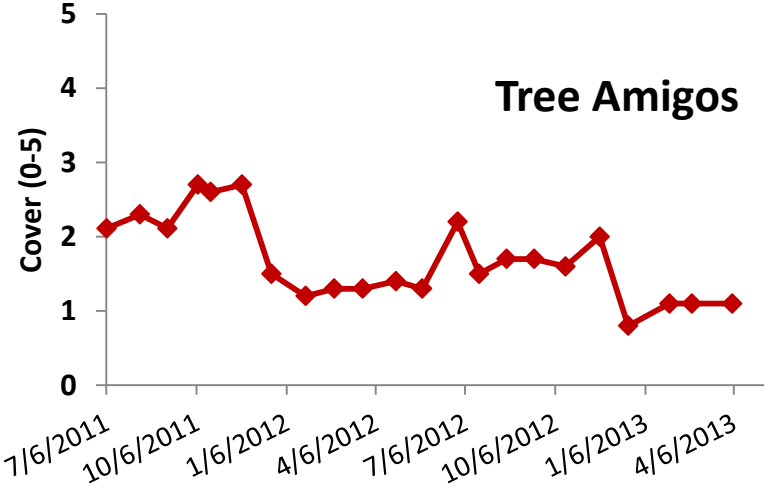
- Isolates maintained at Fort Pierce

Leaf diseases might have a greater impact but varied by site





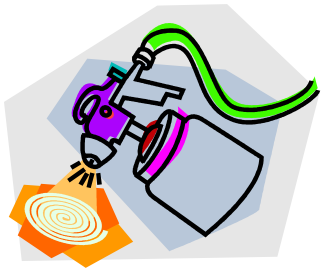
Do diseases help at Tree Amigos?



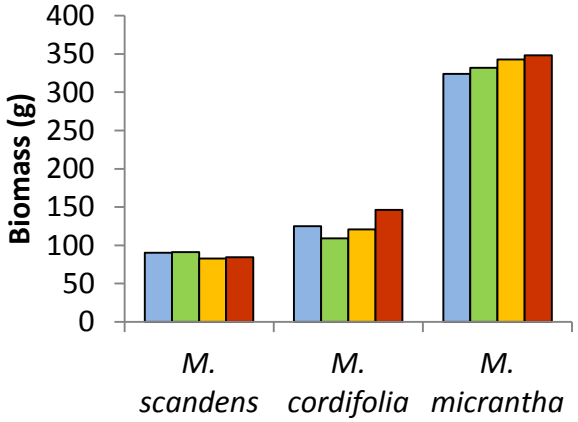
Local natural enemies, specially diseases, are exerting biotic pressure on *Mikania micrantha*

1. Invasiveness of *M. micrantha*

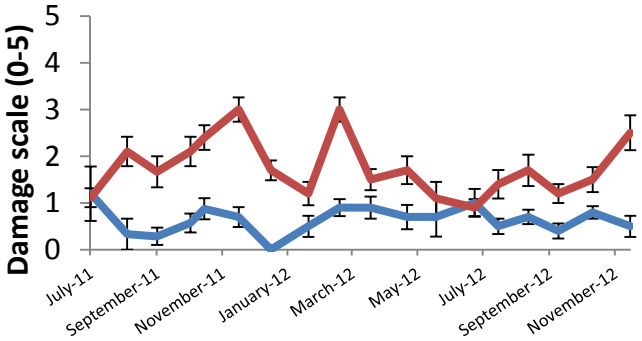
2. Discovered potential natural enemies, specially diseases



3. *M. micrantha* attacked by enemies



4. Impact of enemies varied by site and might be important



Thanks, Questions?