Detection of biotic resistance to *Mikania micrantha* in Florida

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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

Inflorescence present from late October to February

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

Native sp. 1  Native sp. 2

Exotic sp.

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 least one native plant
Mikania micrantha is an alternative host for several crop pests

Mite: *Tetranychus* sp.

Aphid: *Aphis spiraeola*

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

<table>
<thead>
<tr>
<th>M. cordifolia</th>
<th>M. scandens</th>
<th>M. micrantha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colletotrichum-1</td>
<td>Glomerella/Colletotrichum spp.-1</td>
<td>Glomeralla, Collectotrichum-31</td>
</tr>
<tr>
<td>Phomopsis-3</td>
<td>Diaporthe/Phomopsis-5</td>
<td>Diaporthe/Phomopsis-13</td>
</tr>
<tr>
<td>Fusarium-4</td>
<td>Fusarium-8</td>
<td>Didymella-3</td>
</tr>
<tr>
<td>Cladosporium-7</td>
<td>Alternaria-5</td>
<td>Fusarium-3</td>
</tr>
<tr>
<td>Alternaria-1</td>
<td>Non-pathogens-8</td>
<td>Alternaria-4</td>
</tr>
<tr>
<td>Non-pathogens-5</td>
<td>Unknown-1</td>
<td>Non-pathogens-5</td>
</tr>
</tbody>
</table>
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

![Bar chart showing biomass of different species with and without treatments (Control, Fungicide, Insecticide, and Fungicide + Insecticide).]
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.

**Damage by insects I**

- **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.

Strong evidence for biotic resistance.
Plant biomass per species was similar between control (water) and exclusion treatments.

Biomass of *M. micrantha* is 3.9-times that of *M. scandens* and 2.7-times that of *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.
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?

Century Pioneer

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?