

Are there Endophytes and Mycotoxins in Florida Pastures?



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- **International Cooperators:** Carlos Acuna and Florencia Marcon, UNNE-Argentina



Yes, there are fungi and mycotoxins in our pastures

- Most of these are naturally occurring endophytic relationships
- More beneficial than harmful to our pasture plants
- They allow these plants to survive under low fertility, sandy soils, plant diseases, insects and other detrimental pests.
- Pasture management may be the key (add legumes, rotationally graze).





Situation

- Livestock ranchers in Florida have reported concerns that their pasture forages are causing reproductive and neurological health issues in cattle, equine and endangered wildlife.

(early embryonic abortion, heat stress, staggers, poor weight gain, respiratory distress, etc.)

Endophytes in warm-season grasses

- Working with Oregon State University Mycotoxin Service Laboratory:

Dr. Jennifer Duringer,
Toxicologist

- Evaluated the presence of fungal endophytes in predominant forage and weedy grasses species



Sampling protocol

- 14 locations
- Pasture-based grab samples or conserved forage
- Seasonal sampling (two month intervals) over 2018-2019



Grasses examined

Evaluated the presence of fungal endophytes in:

Paspalum notatum (bahiagrass) – ‘Argentine’ and ‘Pensacola’

Cynodon dactylon (bermudagrass) – ‘Jiggs’, ‘Tifton 85’ and common

Hemarthria altissima (limpograss) – ‘Floralta’, ‘Gibtuck’ and ‘Kenhy’

Sporobolus indicus (smutgrass) – common

- *Myriogenospora atramentosa*
(on Bahiagrass leaves)



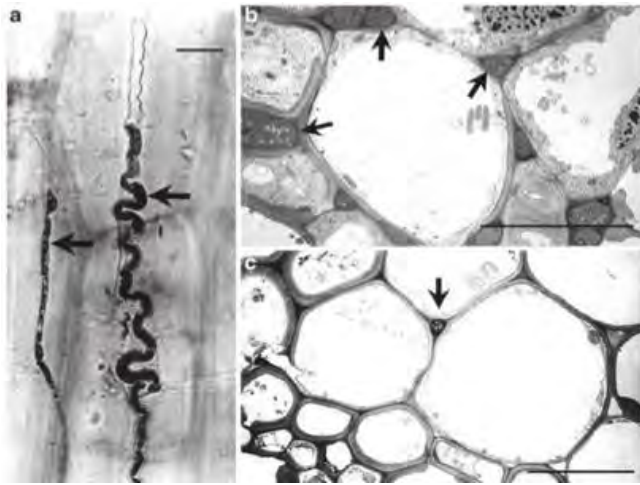
Fungus
(Perithecium)

leaf

Collaborating ranches

- Cherokee Ranch-Jackson County
- Providence Farm-Gadsden County
- Deseret (North)-Gadsden, Gulf, and Liberty Counties
- White Oak Conservatory-Nassau County
- Usher Ranch-Levy County
- UF-Equine Unit-Marion County
- Yarborough Ranch-Seminole County
- Rooks Ranch-Citrus County
- Kempfer Ranch-Brevard and Osceola Counties
- Deseret (South)-Brevard, Orange and Osceola Counties
- Buck Island Ranch-Highlands County
- Seminole Tribe-Big Cypress-Hendry County
- Seminole Tribe-Brighton-Glades County
- Seminole Tribe-St. Thomas Ranch-Glades County





Current status

- Nearly completed collecting and processing 365 forage samples from the fourteen locations around the state
- Included fresh pasture, hay and silage samples
- Cultured leaf portions of each grass to determine the endophytes
- DNA sequencing to identify endophytes present

Current findings

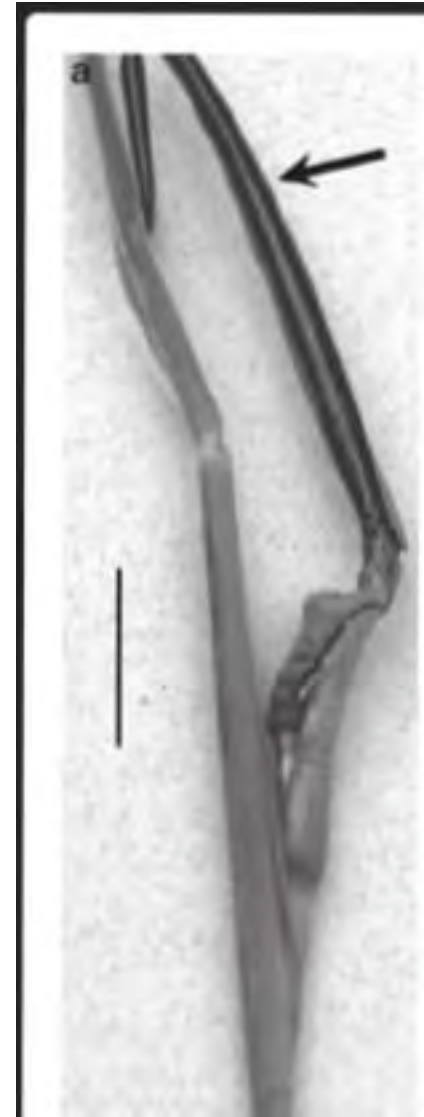
- DNA sequencing of fungal endophytes identified:

Fusarium sp.

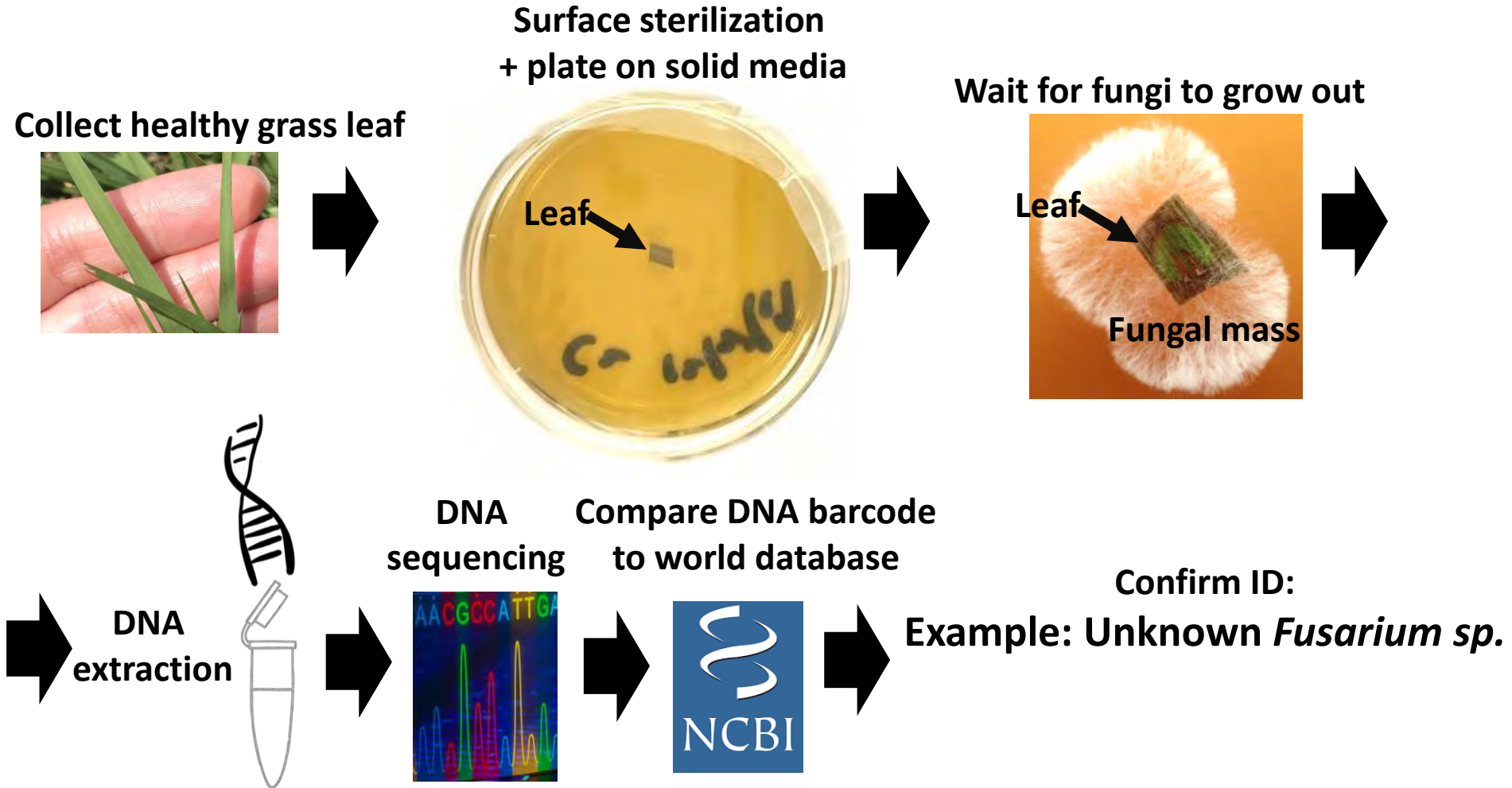
Myriogenospora atramentosa

Balansia epichloe

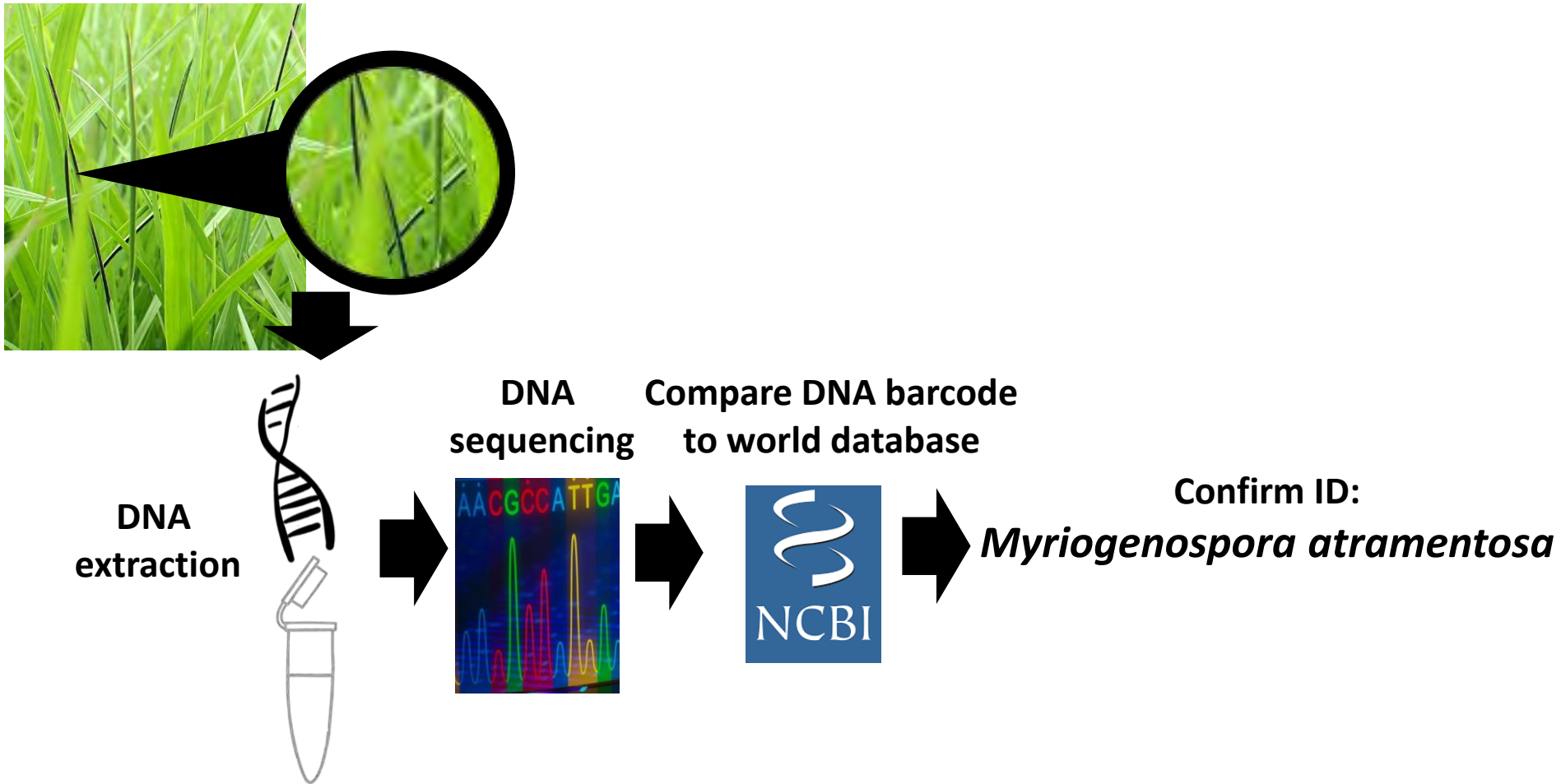
This is a first report of *Myriogenospora atramentosa* occurring on *Hemarthria altissima* (Floralta limpograss).



Bahiagrass: Unknown *Fusarium* sp.



Bahiagrass: *Myriogenospora atramentosa* Fungi



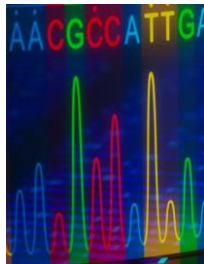
Smutgrass: *Balansia epichloe* Fungi



DNA
extraction



DNA
sequencing



Compare DNA barcode
to world database



Confirm ID:
Balansia epichloe

Current Findings

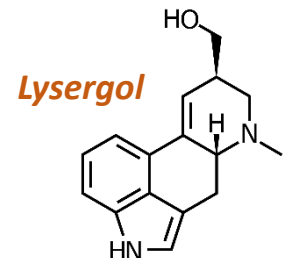
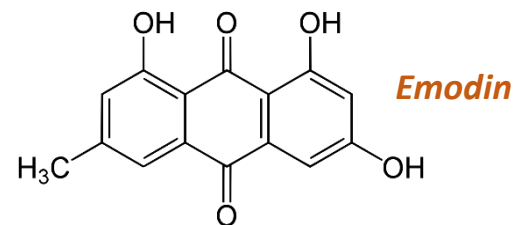
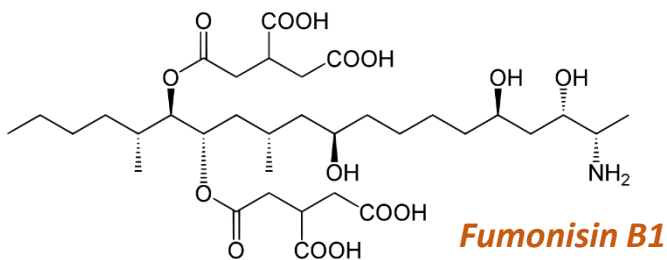
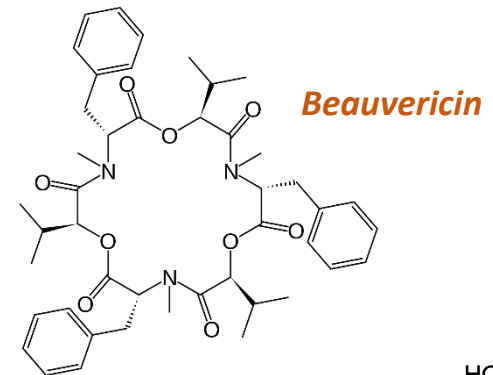
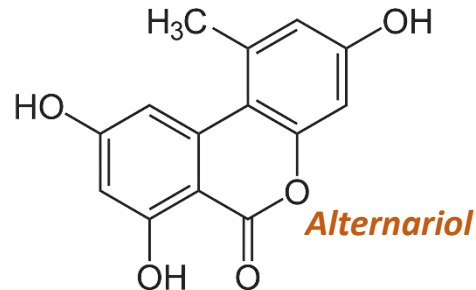
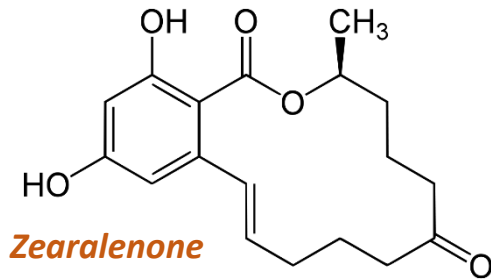
- Extracted mycotoxins from sampled grasses
 - Identified and quantified the presence of:
 - Zearalenone and zearalenone metabolites
 - Alternariol, altenuene + AME
 - Fusarenon-X
 - 15-AcetylDON
 - Beauvericin
 - Ergoline alkaloids
- as well as other mycotoxins that are potentially deleterious to animal health.



Mycotoxin patterns

Grass	ZEAR + metabolites	Fusarenon-X	Alternariol, alternuene + AME	Beauvericin & enniatins	Fumonisin	Emodin	Ochratoxins	Ergoline alkaloids
Bermudgrass	X		X	X	Few	X		
Bahiagrass	X	X	X	X	Few	X	X	Few
Limpograss	X		X	X		X		
Smutgrass			X	X		X	X	X

*ZEAR=Zearalenone, AME=alternariolmethylether



Guidance Limits and Toxic Effects?

- **Zearalenone**
 - 500-2000 ppb for cattle, depending on age of animal and country
 - Reproductive effects: ↓d conception and effects on repro tissues
- **Fusarenon-X**
 - No specific guidance limits, DON is 5-10 ppm
 - Immunosuppression, intestinal malabsorption, developmental toxicity, and genotoxicity
- **Alternariol, altenuene and alternariolmethylether**
 - No guidance limits
 - Reproductive effects; DNA damage (mutagen); ↓d immune response
- **Beauvericin and enniatins**
 - No guidance limits
 - Create pores in membranes; anti-carcinogenic; reproductive effects

Guidance Limits and Toxic Effects?

- **Fumonisin**
 - 50 ppm
 - Liver effects → less protein turn-over; nephrotoxic; cancer
- **Emodin**
 - No guidance limits
 - Gastrointestinal effects: laxative, ↑ gut motility
- **Ochratoxins**
 - No guidance limit in USA; 0.1 ppm in Europe
 - Nephrotoxic; carcinogenic/mutagenic; neurotoxin; immunotoxic
- **Ergoline alkaloids**
 - Less potent than larger ergot alkaloids, no official limit; suggest >300 ppb
 - Vasoconstriction on extremities; decreased wt. gain; reproductive effects



- Remember, animals may be chronically exposed to multiple mycotoxins and their effects may be cumulative.
- The next important question to address is what are the mycotoxin concentrations in our plants and what do they do in relation to animal health.
- We hope we are providing the Florida Cattlemen with unbiased information about endophyte and mycotoxin presence in Florida forages and how it relates to animal health and performance.