Endophytes and Mycotoxins in Florida Pastures

Dr. Ann Blount
North Florida Research and Education Center
University of Florida-Marianna Beef Unit

IFTBC
International Forage & Turf Breeding Conference
A Global Vision for Innovation

Oregon State University

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, better manage standing hay).

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

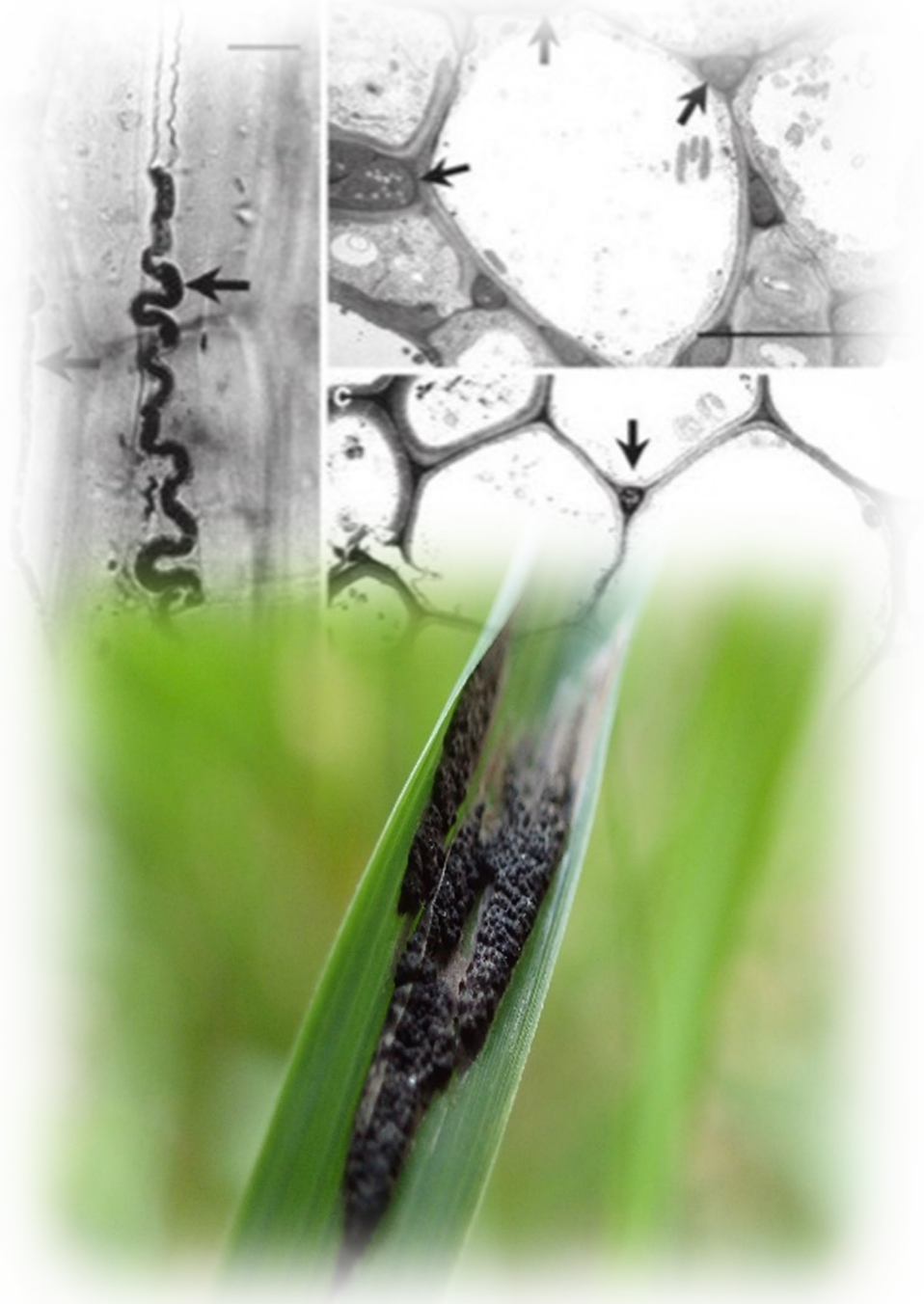
- Funded by the Florida Cattlemen's Association in 2018

- Working with Oregon State University Mycotoxin Service Laboratory:

  Dr. Jennifer Duringer, Toxicologist

  Dr. Morrie Craig, Toxicologist

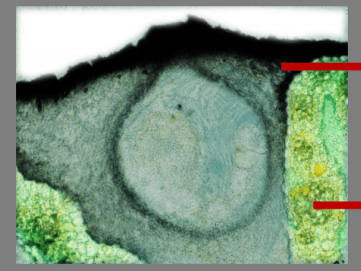
- Evaluated the presence of fungal endophytes in predominant forage and weedy grasses species



Grasses examined

- *Myriogenospora atramentosa*

(on Bahiagrass leaves)



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'
Sporobolus indicus (smutgrass) – common

Collaborators

- **UF-IFAS Faculty PIs:** Marcelo Wallau, Sunny Liao, Glen Aiken, Cheryl Mackowiak, Ian Small, Fanny Iriarte, Carissa Wickens, Samantha Brooks, Lori Warren, Saundra Tenbroeck, Angela Gonella Diaza, Jose Dubeux, and Nicholas Dilorenzo

- **UF-IFAS County Faculty PIs:** Aaron Stam, Brittaney Justesen, Ed Jennings, J.K. Yarbourough, Clay Cooper, Joe Walter, Ray Bodrey, Alicia Halbritter, Doug Mayo, Kayln Waters, Caitlin Bainum, Shep Eubank, and Justina Dacey

- **International Cooperators:** Carlos Acuna and Florencia Marcon (Fulbright Scholar), UNNE-Argentina

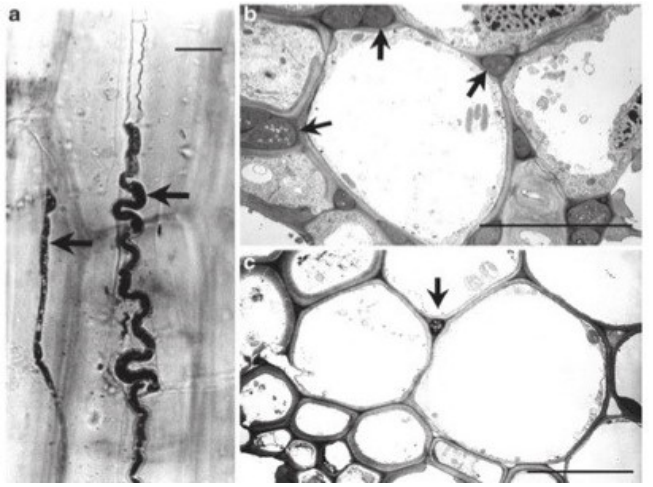
Collaborating ranches

- 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

Sampling protocol

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

Current status



- Nearly completed collecting and processing 300 forage samples from the fourteen locations around the state
- Included hay and silage samples
- Cultured leaf portions of each grass to determine the endophytes
- DNA sequencing to further identify endophytes present

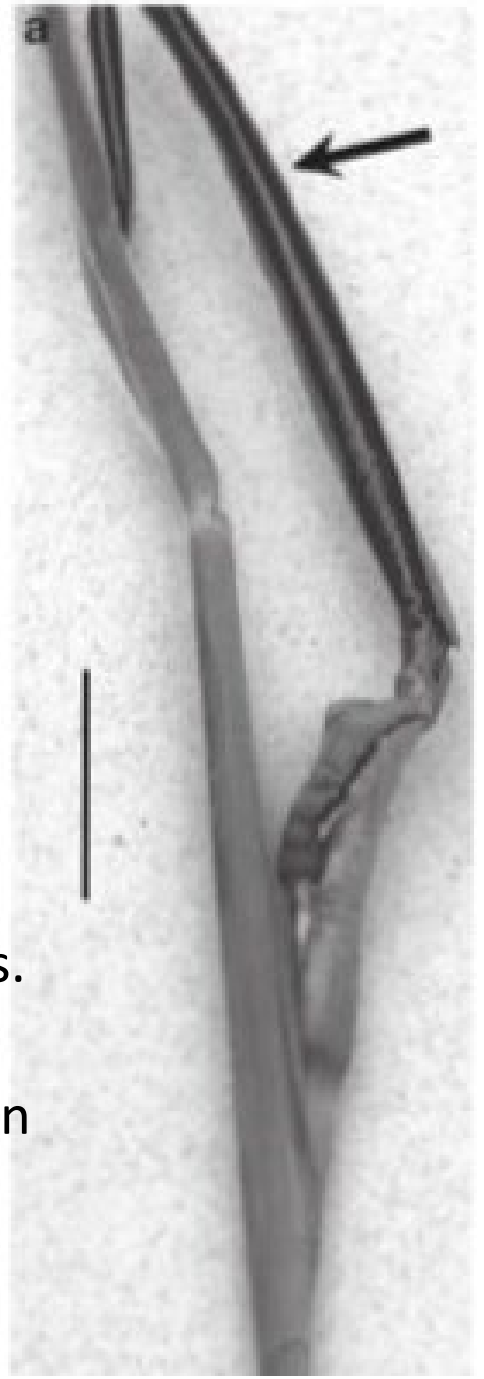
Current endophyte findings

- Leaf sampling and DNA sequencing of fungal endophytes identified:
  - *Balansia epichloe*
  - *Myriogenospora atramentosa*
  - *Fusarium* spp.
  - *Alternaria* spp.

- This is a first report of *Myriogenospora atramentosa* occurring on *Hemarthria altissima.*

- *Myriogenospora atramentosa* occurred on both Argentine and Pensacola bahiagrass.

- What their concentrations are in our plants and what these mycotoxins do in relation to animal health is the next step.



Myriogenospora atromentosa

On limpograss

symptoms include tangled head appearance, leaf bridging and distinct presence of stroma stage on leaves.

On smutgrass

symptoms include distinct presence of the stroma stage on leaves.

Balansia epichloe

Current mycotoxin findings

- Extracted mycotoxins from sampled grasses
- Identified and quantified the presence of:

Zearalenone and zearalenone metabolites

Beauvericin

Alternariol

Ergoline alkaloids

15-AcetylDON

Other mycotoxins were identified that are potentially deleterious to animal health.

- Animal exposure may be chronic and/or cumulative.

Mycotoxin patterns

Grass	ZEAR + metabolites	Alternariol + AME	Beauvericin	Fumonisins	Emodin	Ergoline alkaloids
Bermudagrass	X	X	X	Few	X	
Bahiagrass		X	X	Few	X	
Limpograss	X		X		X	
Smutgrass			X		X	X

*ZEAR=Zearalenone
AME=alternariolmethylether

“Emerging Mycotoxins”

- **Zearalenone**
  - 500-2000 ppb for cattle, depending on age of animal and country
  - Reproductive effects: ↓d conception and effects on repro tissues
- **Alternariol and alternariolmethylether**
  - No guidance limits
  - Reproductive effects; DNA damage (mutagen); ↓d immune response
- **Beauvericin**
  - No guidance limits
  - Creates pores in membranes; anti-carcinogenic; reproductive effects
- **Fumonisins**
  - 50 ppm
  - Liver effects → less protein turn-over; nephrotoxic; cancer
- **Emodin**
  - No guidance limits
  - Gastrointestinal effects: laxative, ↑ gut motility
- **Ergoline alkaloids**
  - Less potent than larger ergot alkaloids, no official limit; suggest 2000 ppb
  - Vasoconstriction on extremities; decreased wt. gain; reproductive effects

Our appreciation to the Florida Cattlemen's Association for funding this project

We hope to provide unbiased information about endophyte and mycotoxin presence in Florida forages and how it relates to animal health and performance.