UT Invasive Species Research Program

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Fire ants – problematic invasive species

Tawny crazy ants – an emerging threat in Texas

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Exotic range grasses that impact fire ecology and displace native species

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Cactoblastis moths – potentially a major problem in S Texas ecosystems

Tawny crazy ants – an emerging threat in Texas

Fire ants – problematic invasive species

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Mission

To study the basic biology of exotic invasive pests in their native lands and seek novel and sustainable approaches to countering problem organisms that threaten biodiversity in the central and southern parts of Texas.

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- Undertake basic research into invasive species complexes.

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- Contribute to understanding
  - causes
  - impacts & interactions
  - biological control

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- Integrative approaches across disciplines
  - Community ecology & food webs
  - Behavior and chemical ecology
  - Molecular & microbial ecology
  - Landscape and habitat management

UT Invasive Species Research Program

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- Lee & Ramona Bass Foundation

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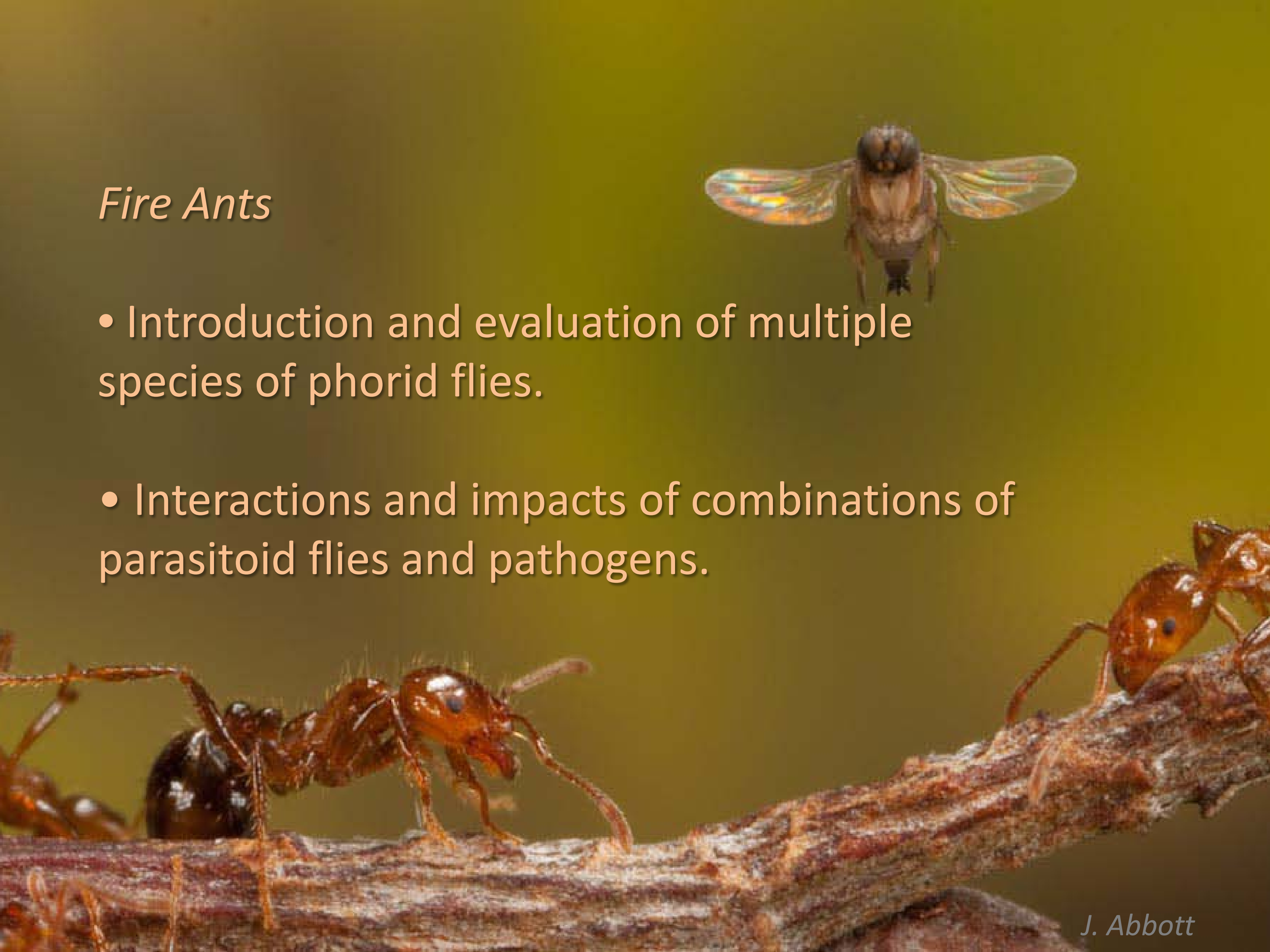
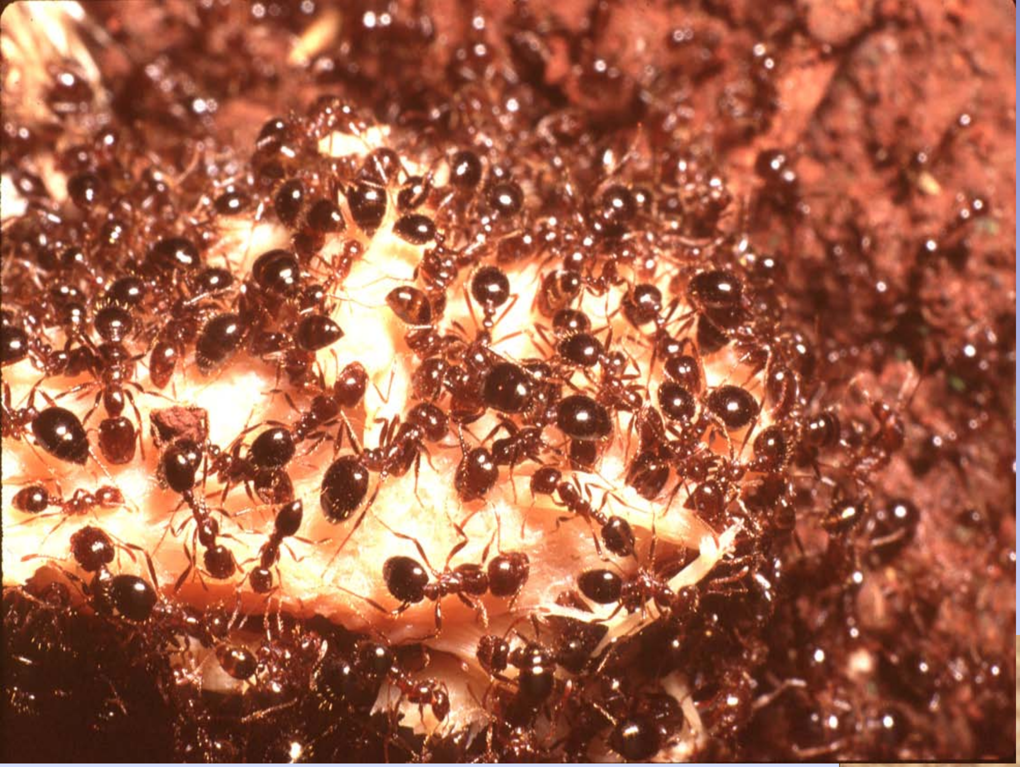
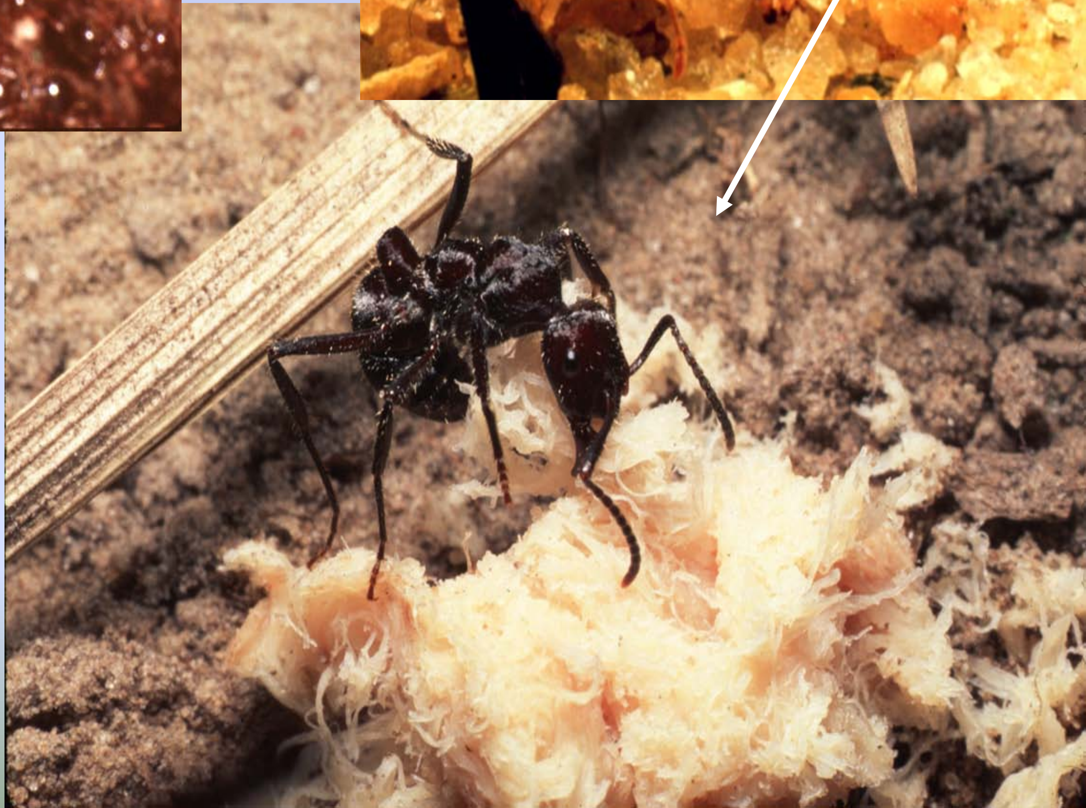
- Recent long-term support from Robert & Helen Kleberg Foundation
- State Fire Ant program


Fire Ants
• Introduction and evaluation of multiple species of phorid flies.
• Interactions and impacts of combinations of parasitoid flies and pathogens.
J. Abbott



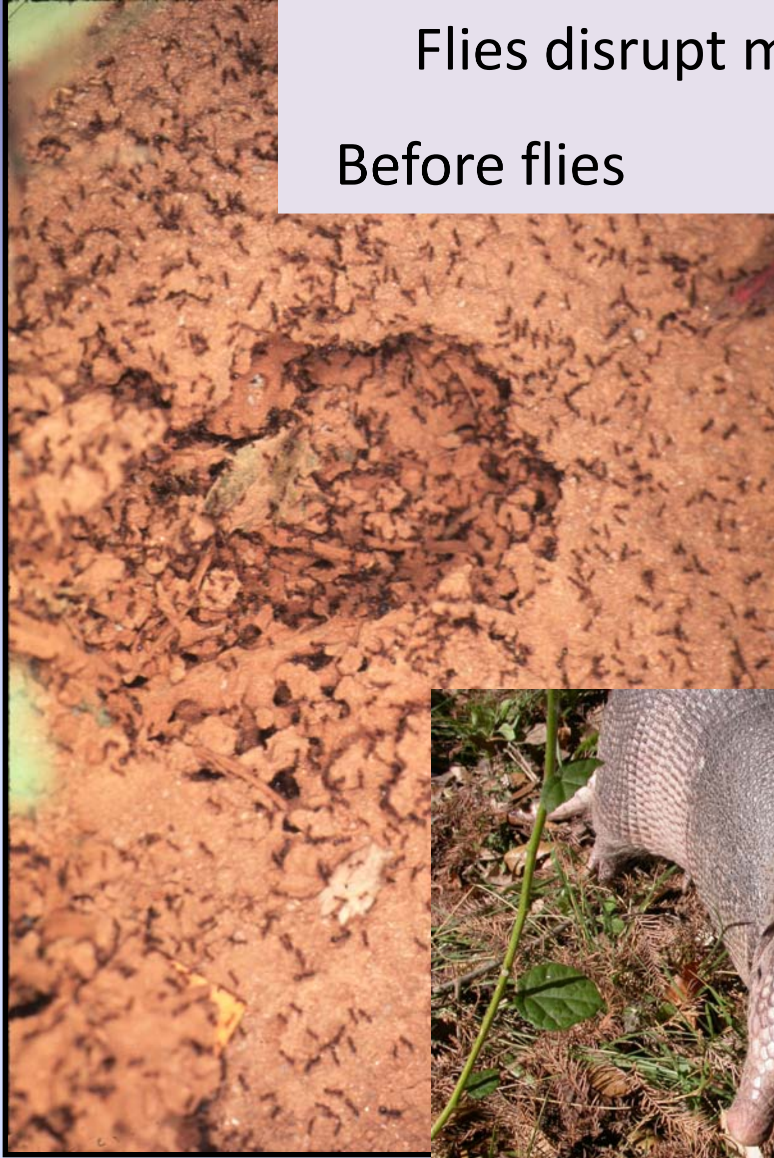


Pseudacteon flies disrupt foraging by fire ants

Reduces colony growth rate

Flies disrupt mound defenses

Before flies



After flies

Impacts: loss of brood, impedes mound reconstruction.

Reduces colony growth rate

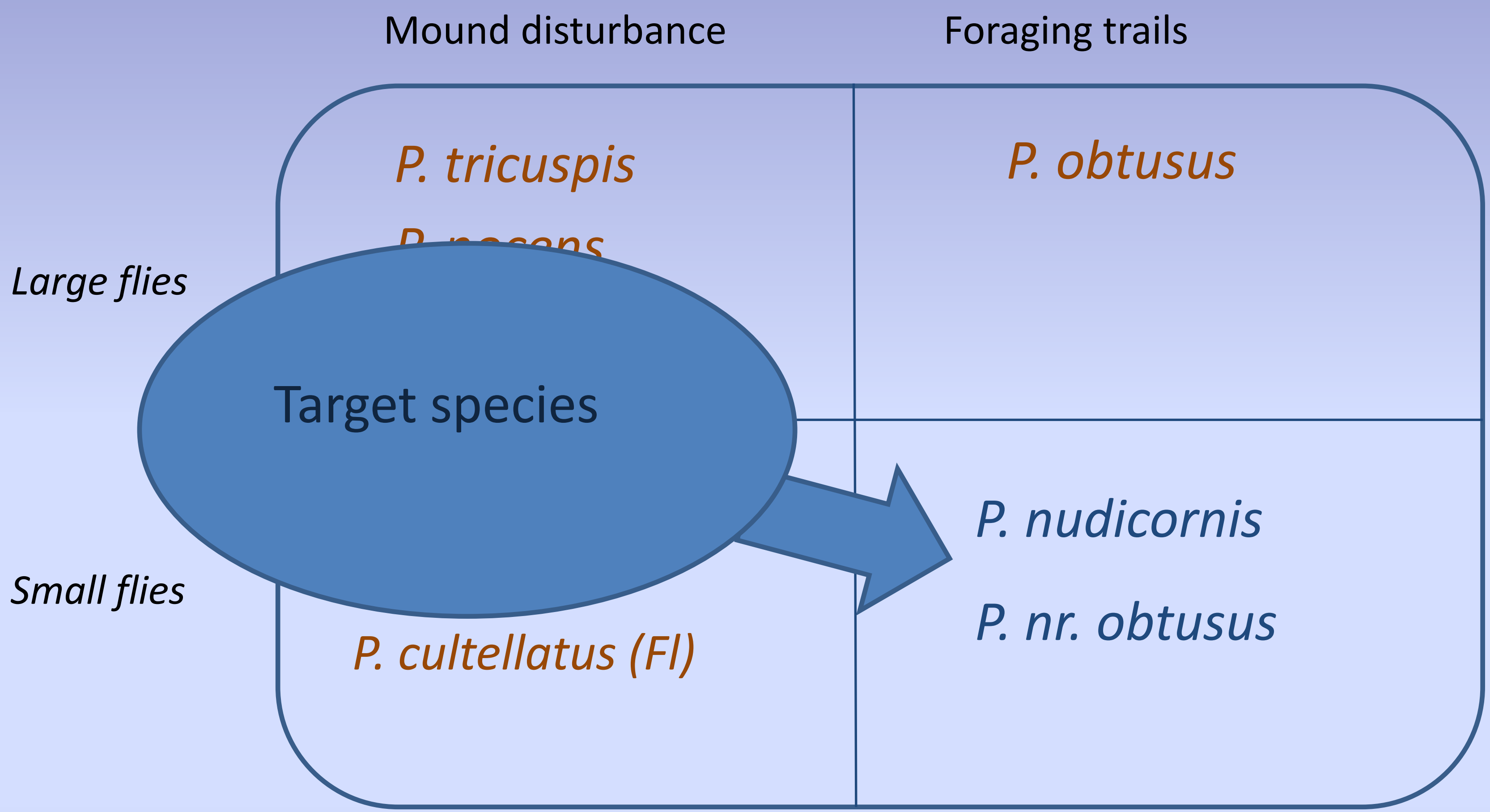
23+ species in native range

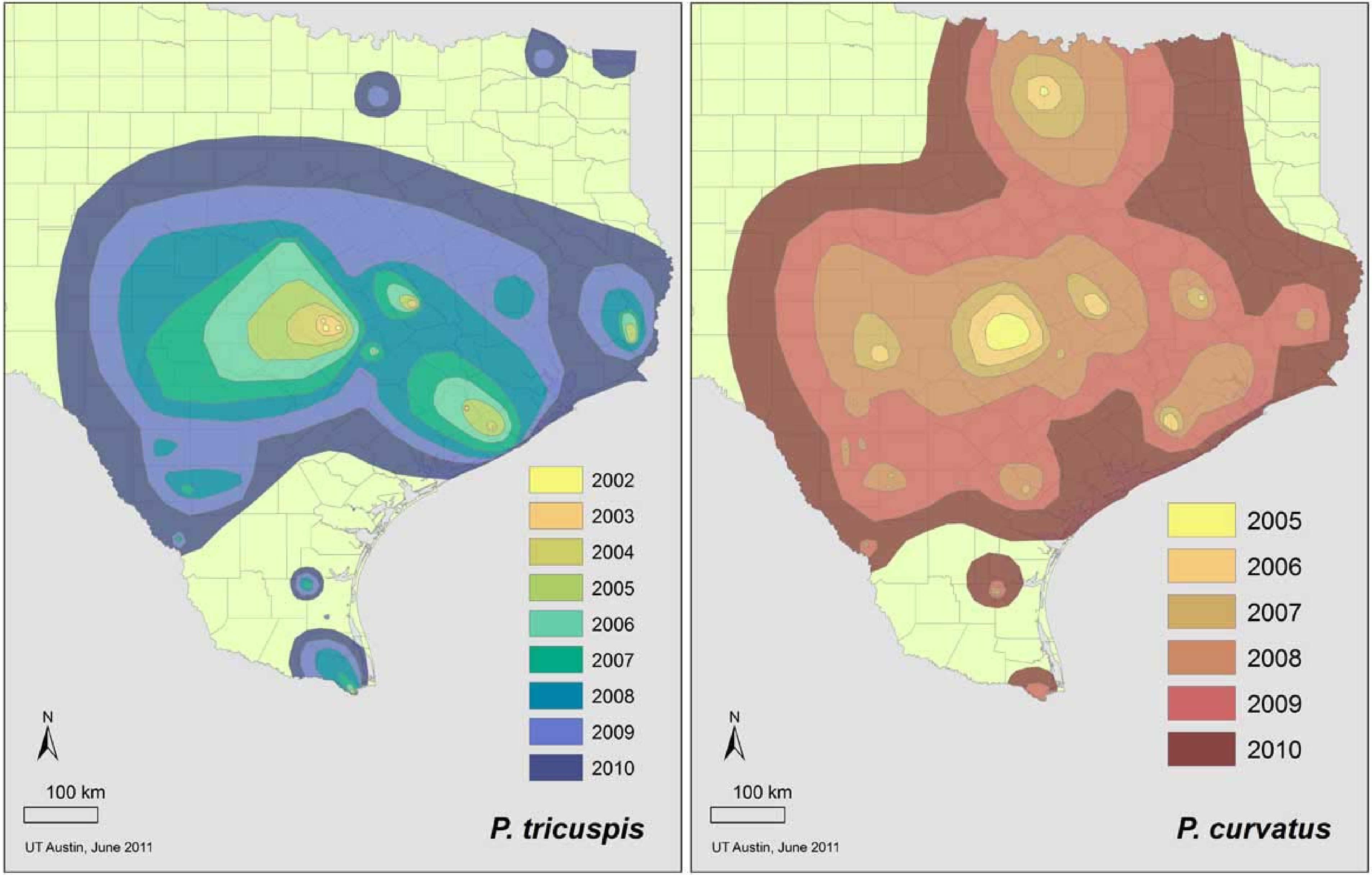
- 15 spp may co-occur locally
- ovipositor shapes
- sizes linked to ant hosts
- activity period
- mating behaviors
- host location cues

Species established in North America

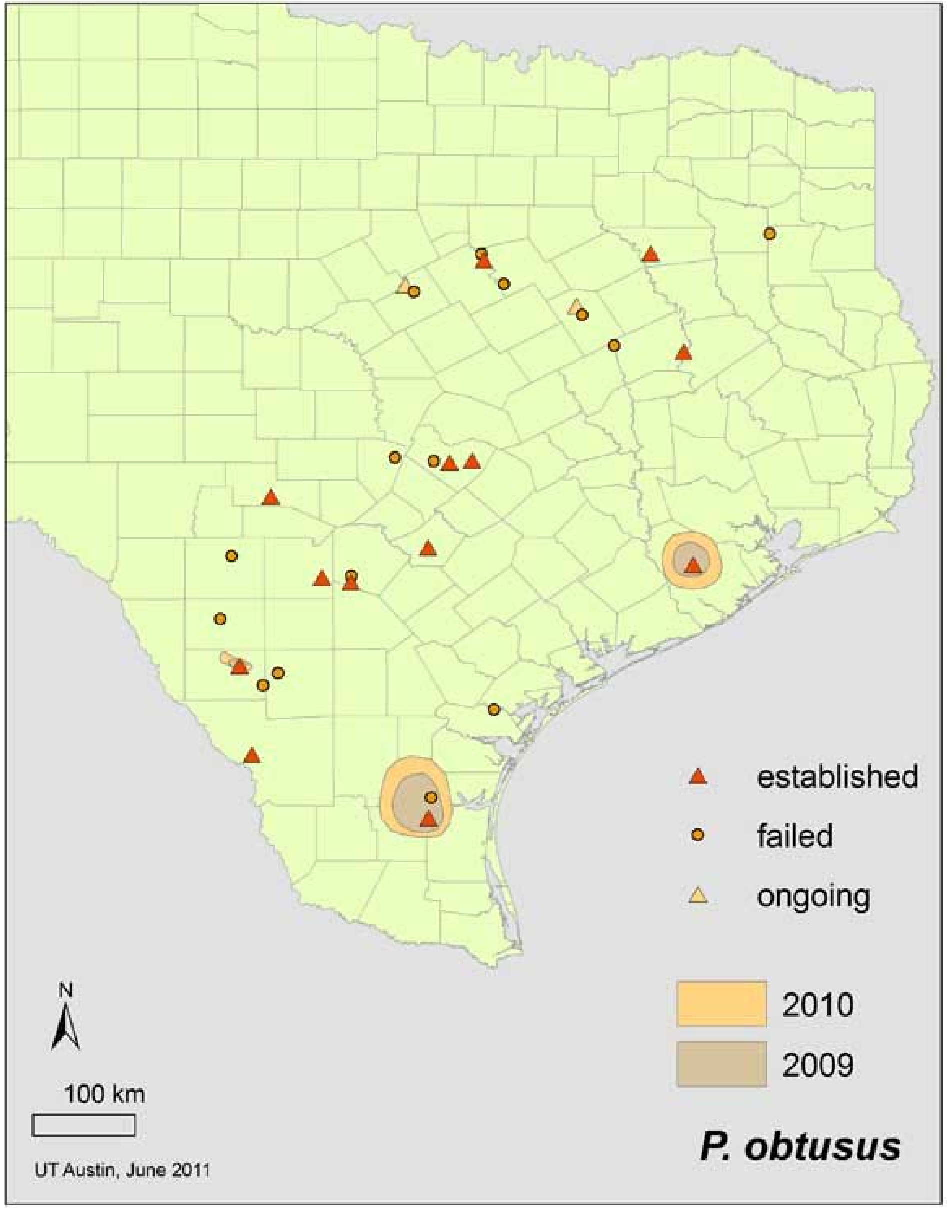
	Mound disturbance	Foraging trails
Large flies	*P. tricuspis* *P. nocens* *P. litoralis (Al)*	*P. obtusus*
Small flies	*P. curvatus* *P. cultellatus (Fl)*	

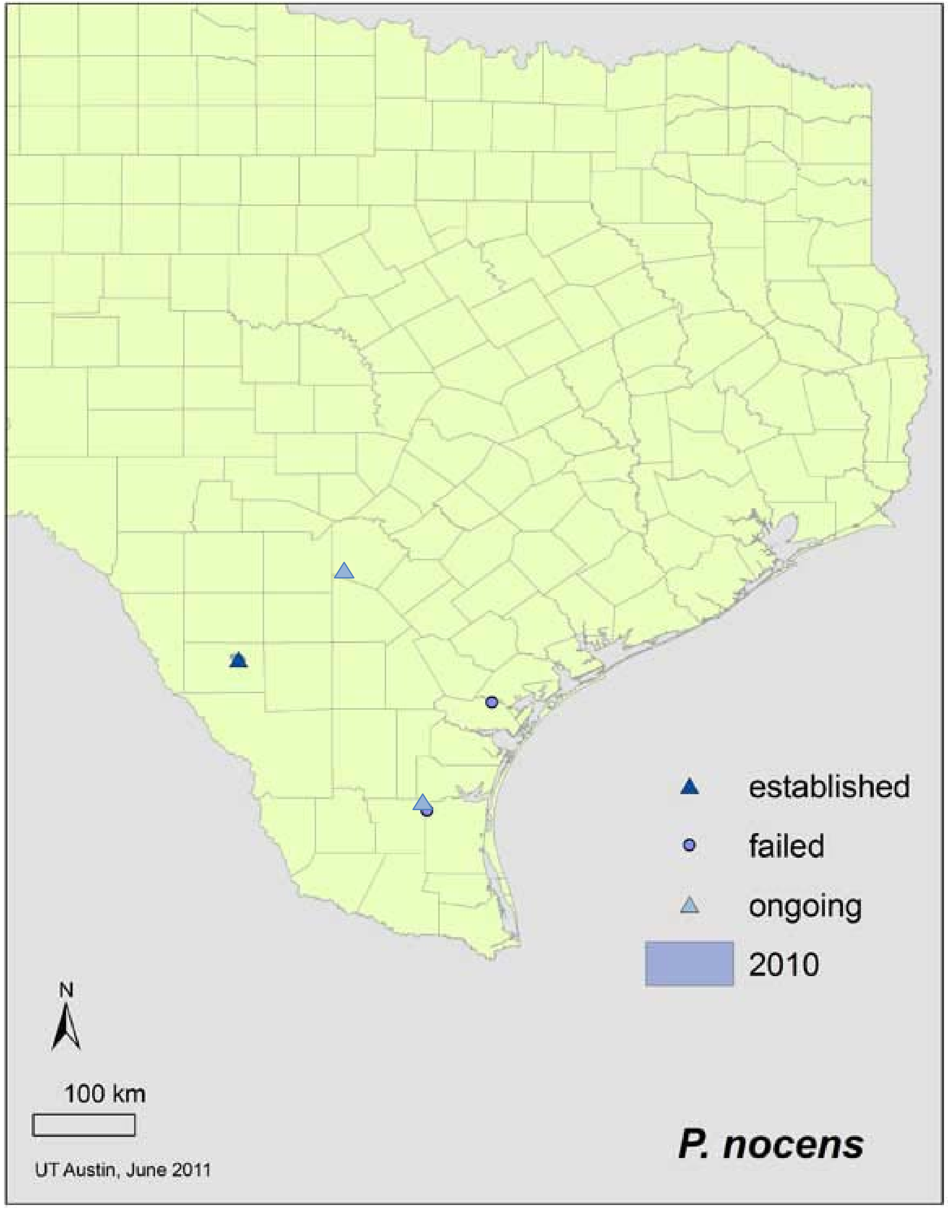
Species established in North America





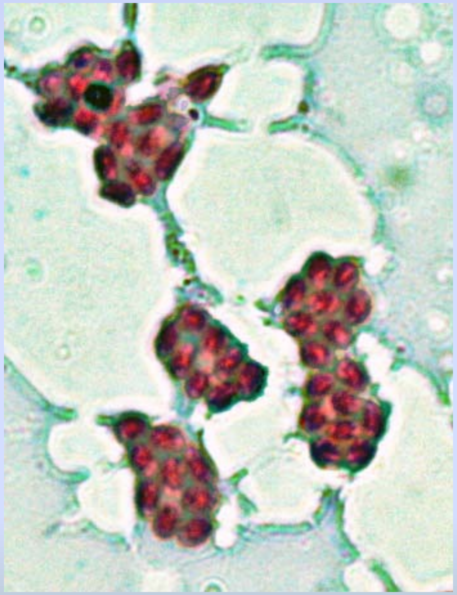
Dynamic expansion in recently introduced populations of fire ant parasitoids (Diptera: Phoridae). LeBrun, Plowes, Gilbert 2007

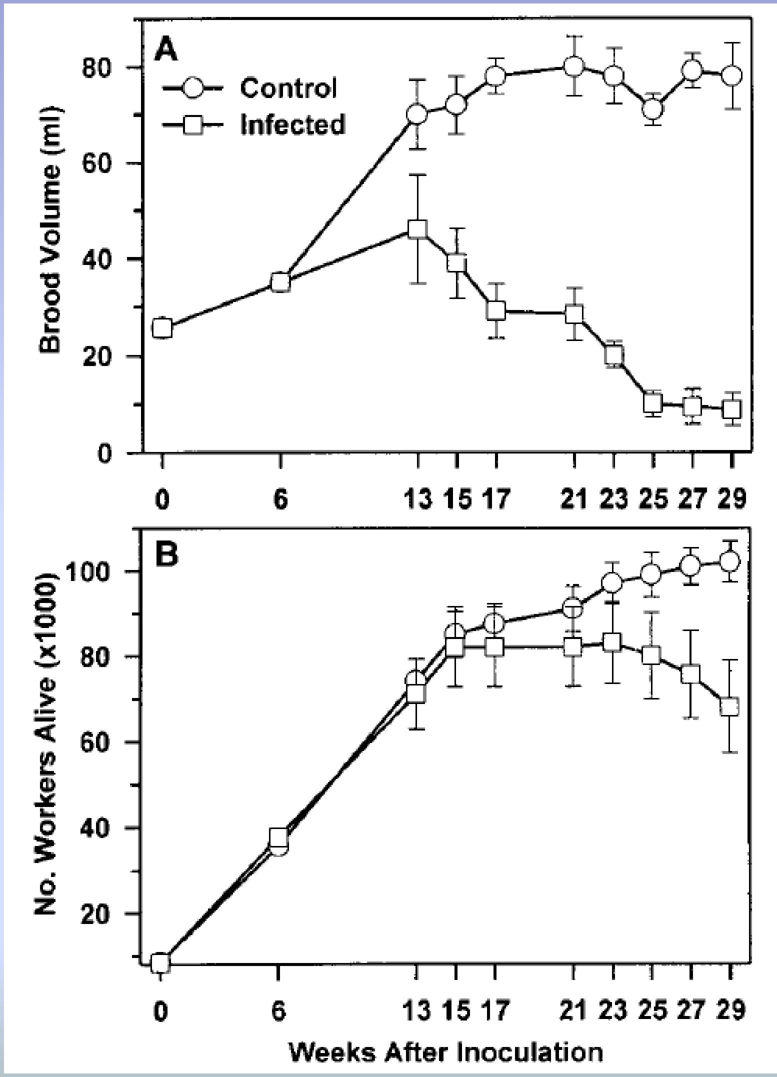

established
failed
ongoing
2010
2009
N
100 km
P. obtusus
UT Austin, June 2011


established
failed
ongoing
2010
N
100 km
P. nocens
UT Austin, June 2011


Microsporidian pathogens

- Specialized parasitic fungi
- Highly reduced organisms
  - 2Mbp genomes, no mitochondria
- Possible vectoring by phorid flies





Williams et al 1999

Pre-emptive *Cactoblastis* study

USDA

USDA

H Robertson

Problem statement

- *Cactoblastis* arrived in FL in 1989.
- Is likely to spread into Texas & Mexico
- Projected major impacts to ecosystems

- USDA approaches:
  - sterile male releases
  - eradication at local scales

C. cactorum larva (right) and Melitara prodenialis from Texas (left).

Project structure and goals

Goal: to identify potential approaches for biological control of *Cactoblastis*

The immediate objectives are:

- Build on prior studies that identified egg & larval parasitoids in the native range in S America.
- Study the parallel system of Texan cacti that host closely related moths and their parasitoids.
- Explore microsporidian and other host specific pathogens
- Produce demographic life-table studies to identify key mortality factors

Assessing the South Texas parasitoid fauna

Given the diversity and abundance of Opuntia in South Texas, it is likely that several Lepidopteran species utilize this as a host plant, and in turn they may support a range of parasitoids.

Genus	**species**	**Comment**
Melitara	*prodenialis*	North-Central & South East Texas native
	dentata	South Texas native
	texana	South Texas native
	doddalis	SW Texas
	apicigrammella	Texas
	subumbrella	Central Texas
	junctolineella	S. Texas, florivorous, 6 recorded parasitoids
Ozamia	*fuscomaculella*	Florivorous, California
	clarefacta	Florivorous, Texas
	lucidalis	Fruit feeding, Texas
Rumatha	*4 species*	Host plant: *Cylindropuntia*

C. cactorum larva (right) and Melitara prodenialis (left).

USDA

Table 1. Known parasitoids of *Cactoblastis* in their native South America.

Parasitoid species	*Cactoblastis* species	Other hosts	Stage attacked	Degree of attack of *Cactoblastis*	Reference	Presumed specificity
Hymenoptera						
Braconidae						
Apanteles alexanderi Brethes	*C. cactorum* Berg		Larvae		Parker et al. 1953	broad
	C. cactorum Berg *C. doddi* Heinrich	*Tucumania tapiacola* Dyar *Salambona analamprella* (Dyar)		Not mentioned	Mann 1969	
	Cactoblastis spp.			>30%	Zimmermann et al. 1979	
	C. cactorum?				Bennett & Habeck 1992	
		Salambona analamprella *Tucumania tapiacola* *Plutella maculipennis* Curt. *Eulia loxonephes* Meyr. *Eulia* sp. *Argyrotaenia sphaleropa* (Meyr.) Lepidoptera sp.			DeSantis 1967	
Chalcididae						
Brachymeria (Pseudobrachymeria) cactoblastidis Blanchard	*C. doddi* Heinrich		Pupae		Mann 1969	
	Cactoblastis spp.		Pupae prob. hyperparasitoid		Zimmermann et al. 1979	
	C. cactorum?				Bennett & Habeck 1992	
Brachymeria sp.	*C. cactorum*		Pupae?		Thompson 1943	
Ichneumonidae						
Chromocryptus doddi (Cushman)	*Cactoblastis* spp.		?	Rare	Zimmermann et al. 1979	?
Cryptus sp.	*C. cactorum*		?		Mann 1969	?
Phyticiplex doddi (Cushman) (Probably a synonym of *Chromocryptus doddi*)	*C. cactorum*		?		Bennett & Habeck 1992	?
Phyticiplex eremnus (Porter)	*C. cactorum*		?		Bennett & Habeck 1992	?
Podogaster cactorum (Cushman)	*C. cactorum*		?		DeSantis 1967	?
	Cactoblastis spp.			Rare	Zimmermann et al. 1979	
Podogaster sp.	C. cactorum				Mann 1969	?
Temelucha sp. (*Temelucha* = *Cremastus*)	*Cactoblastis* spp.	*Salambona analamprella* *Tucumania* spp.		5-30% Rare 5-30%	Zimmermann et al. 1979	?
Diptera						
Tachinidae						
Epicoronimyia mundelli (Blanchard)	*C. doddi*	*Tucumania tapiacola* Dyar			Mann 1969	?
					Blanchard 1975	
	C. cactorum?				Zimmermann et al. 1979	

Microsporidian survey

Many insects have host specific microsporidia pathogens. They are often host specific and virulent.

- Survey microbes in larvae from Argentina and Texas cactus moths
- Using molecular phylogenetics, assess patterns of likely host specificity
- Future lab trials to test virulence and confirm host specificity

Nosema cactoblastis, sp. n., and *Nosema cactorum*, sp. n., Microsporidian Parasites of Species of *Cactoblastis* (Lepidoptera) destructive to Prickly Pear. By H. B. FANTHAM, M.A. Cantab., D.Sc. Lond., F.R.S.S.Af., F.Z.S., Strathcona Professor of Zoology, McGill University, Montreal, Canada.

[Received April

NOSEMA (MICROSPORIDA: NOSEMATIDAE) SPECIES AS POTENTIAL BIOLOGICAL CONTROL AGENTS OF *CACTOBLASTIS CACTORUM* (LEPIDOPTERA: PYRALIDAE): SURVEYS FOR THE MICROSPORIDIA IN ARGENTINA AND SOUTH AFRICA

ROBERT W. PEMBERTON[1] AND HUGO A. CORDO[1]

Evaluating detritivores and fungi for Buffel grass management

Problem statement

Buffel grass can achieve dense growth, outcompete native plants and alter the fire ecology, thereby reducing rangeland value for wildlife.

- Some ranchers value buffel grass for pastures, and may object to approaches that diminish its forage value.
- No previous efforts have been made to manage grasses in this situation using biological control.

Project structure and goals

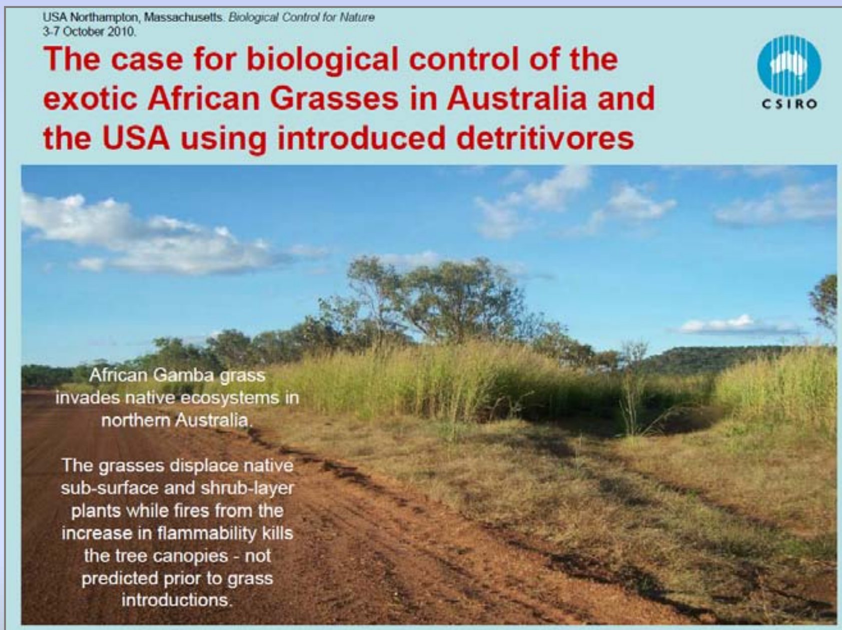
Goal: is to discover and evaluate detritivores and endosymbiotic fungi that facilitate decomposition.

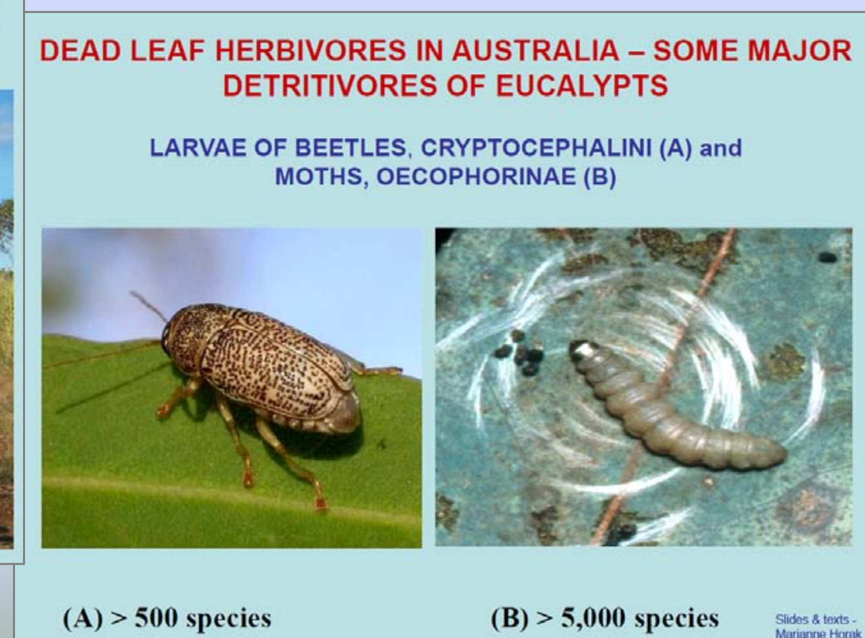
This pilot study would :

- Conduct feasibility studies of prospective detritivores in Kenya
- Investigate decomposition microbiota, especially fungi
- Compare fungi and detritivores in Kenya and Texas

Detritivores as biocontrol agents

Don Sands in Australia suggested that insect detritivores are good biocontrol candidates, being host specific and capable of reducing standing crops of old leaf material and promoting nutrient cycling.





Decomposition microbiota

Endophytic fungi can directly increase the decomposition rate, or facilitate herbivory and litter breakdown.

Plant traits, including litter decomposition, arise not just from the plant genotype, but from the interactions of plant and fungal genotypes.

Ecology. 2010 May;91(5):1329-43.

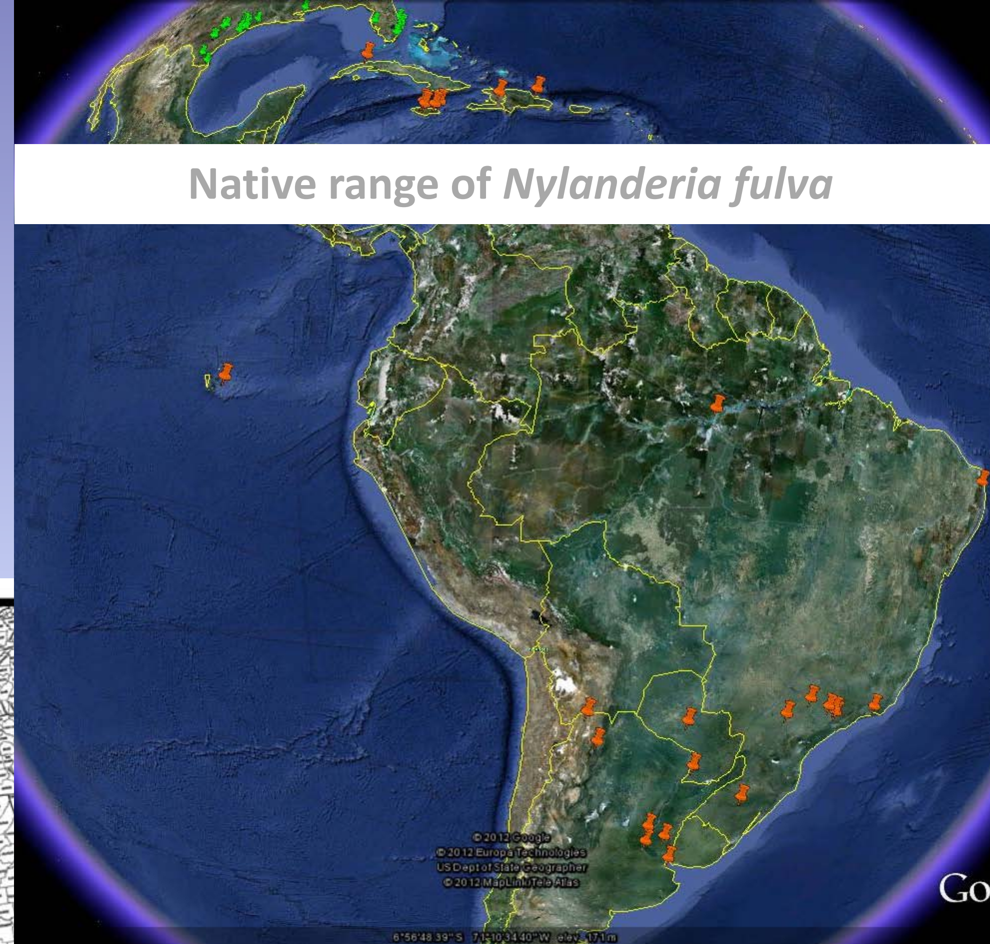
Inherited microbial symbionts increase herbivore abundances and alter arthropod diversity on a native grass.

Faeth SH, Shochat E.

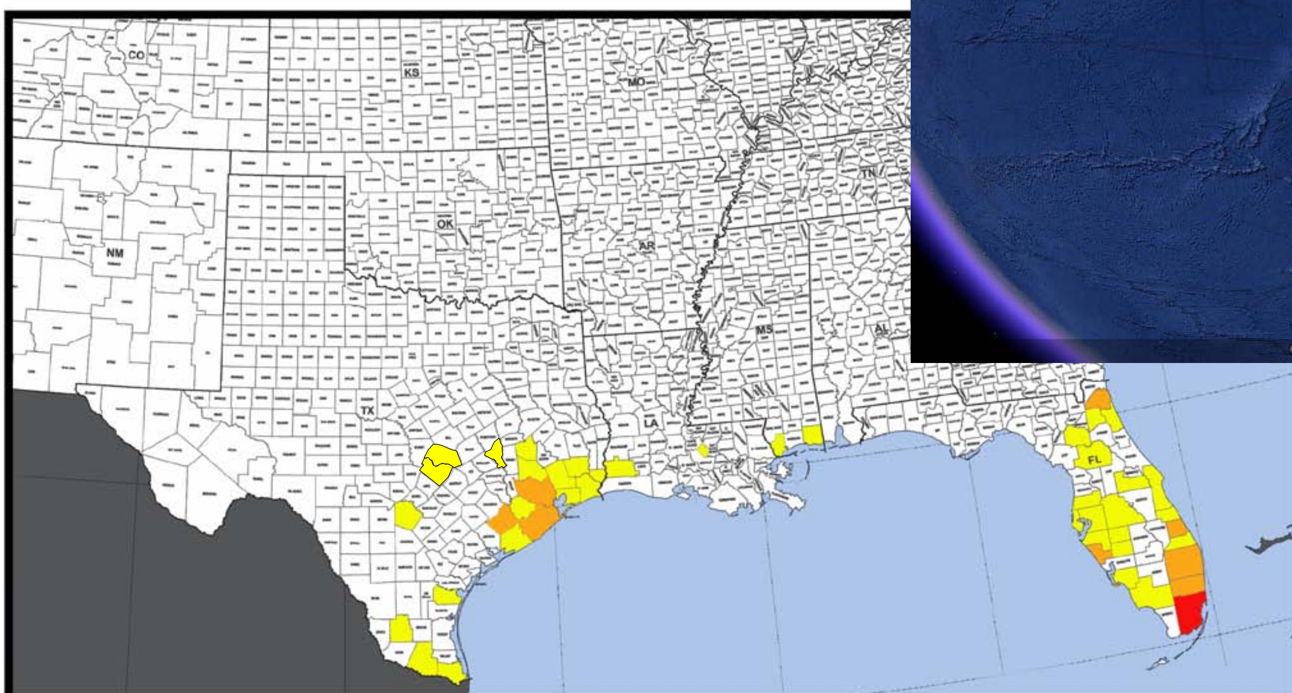
The goal is to identify host specific endophytic fungi on buffel grass.

- Use new molecular tools to identify the endophytic fungi of grasses in Texas and Kenya.
- Evaluate the candidate organisms for host specificity.

Tawny Crazy Ants *Nylanderia fulva*



Native range of *Nylanderia fulva*



Distribution of *Nylanderia fulva* in US

First record from US, 1953
US county records by 2004
US county records, 2004-2011

Adapted from J.A. MacGown

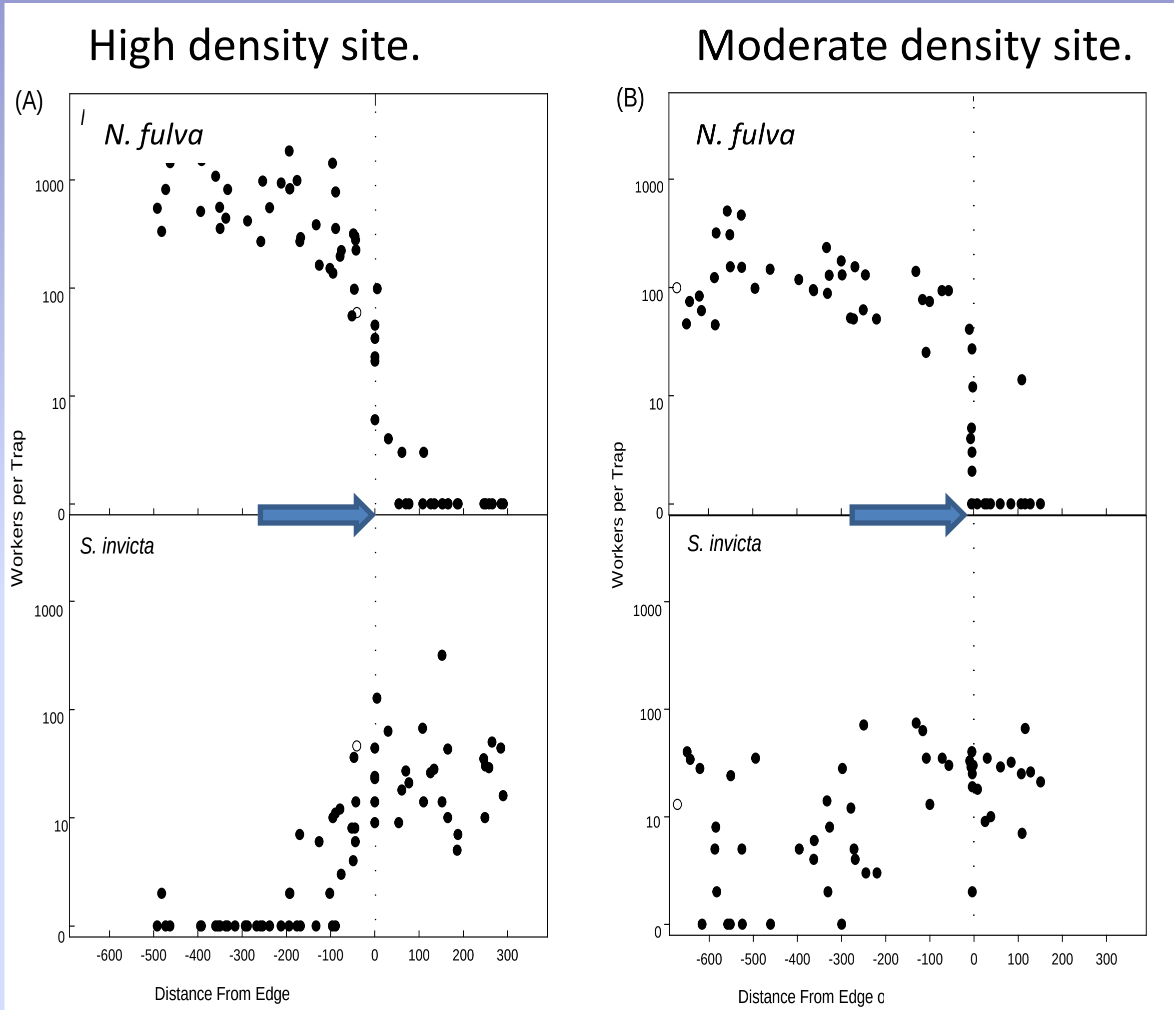
Problem statement

Tawny Crazy Ants are an emerging threat in Texas.

- They form extensive, dense colonies with billions of workers
- Extremely disruptive to humans and native biota
- Not susceptible to available pesticides

N. fulva tending membracids.

Impacts of Tawny Crazy Ants on Imported Fire Ants



Project structure and goals

Goal: to understand the ecological impacts and identify potential biological control agents.

This pilot study would :

- Conduct ecological studies in Texas and Argentina (native range), focused on competitors, food resources and colony dynamics.
- Identify and natural enemies, both parasitoids and pathogens.

Summary

- causes and consequences
- biological control

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