



The University of Texas at Austin
Environmental Science Institute

Hot Science - Cool Talk # 115

***Fire Ants, Crazy Ants
& Zombie Ants***

**Dr. Rob Plowes
October 26, 2018**

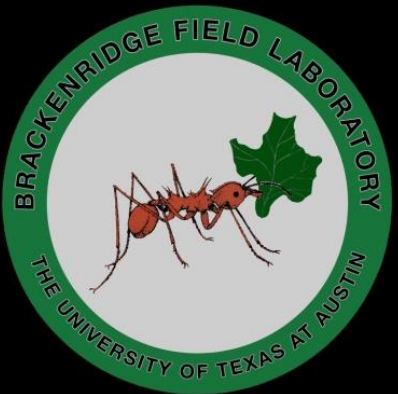
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Fire Ants, Crazy Ants and Zombie Ants

Rob Plowes

Photo Credit: A Wild



HOW TO SURVIVE

A ZOMBIE ATTACK

STEP 1. REMAIN CALM | STEP 2. TERMINATION

ALL ZOMBIE OUTBREAKS RENDER HEAVY POPULATED AREAS HAZARDOUS. YOUR FIRST ACTION SHOULD BE TO REMAIN CALM. IN DOING SO YOU PREVENT YOURSELF FROM GETTING HURT FROM THOSE WHO ARE PANICKING AROUND YOU THROUGHOUT YOUR CITY OR TOWN.



EVACUATE

GATHER FAMILY AND ESSENTIAL SMALL VALUABLES ONLY. DO NOT ATTEMPT TO SECURE OR DEFEND PROPERTY OR VALUABLE POSSESSIONS.

REGROUP

ONCE YOU HAVE FLED THE IMMEDIATE INFECTED AREA REJOIN OTHERS THAT HAVE NOT BEEN INFECTED.



RELOCATE

PROCEED IMMEDIATELY TO RESCUE STATIONS ASSIGNED TO YOUR AREA. IN THE ABSENCE OF A RESCUE STATION, FIND A FORTIFIED LOCATION AND MONITOR LOCAL RADIO BROADCAST FOR HELP AND DIRECTIONS.

1 THE ONLY KNOWN METHOD FOR DISPATCHING A ZOMBIE IS A HEADSHOT. THIS MAY BE DONE WITH ANY BLUNT OR SHARP OBJECT OR A FIRE ARM.

2 SHOOTING A ZOMBIE IN THE ARMS AND CHEST WILL RESULT IN LESS ODDS OF THAT ZOMBIE FROM GRABBING YOU.

3 SHOOTING OR CUTTING A ZOMBIE'S LEGS MAY SLOW IT DOWN BUT IT IS STILL DANGEROUS TO YOU SINCE IT'S ON THE FLOOR CRAWLING TOWARDS YOU OUT OF YOUR LINE OF SIGHT. MANY PEOPLE HAVE BEEN BIT BY CRIPPLED ZOMBIES DUE TO THE CONFUSION OF DISPATCHED BODIES.

**DO NOT ENGAGE
IF YOU CAN AVOID
A ZOMBIE!**



*Fire Ants, Crazy Ants
and Zombie Ants*

Rob Plowes

Zombie invasions from Old to New World

**Zombie
invasion
zone**

**Zombie
staging
grounds**

**Zombie
home range**

You are here

**Zimbabwe
– my home**

MAP OF
THE WORLD,
On Mercator's Projection.



N. Webinger

Ants are Superorganisms

- Advanced social organization
- Colonies have Queens and sterile workers
- Communicate – by pheromones, sounds, touch, odors
- Fire ant larvae serve as the centralized digestive system.



Photo Credit: L Gilbert

Fire ant larvae are the centralized digestive system



Source: Lekhnath Kafle

Queen with larvae attended by workers

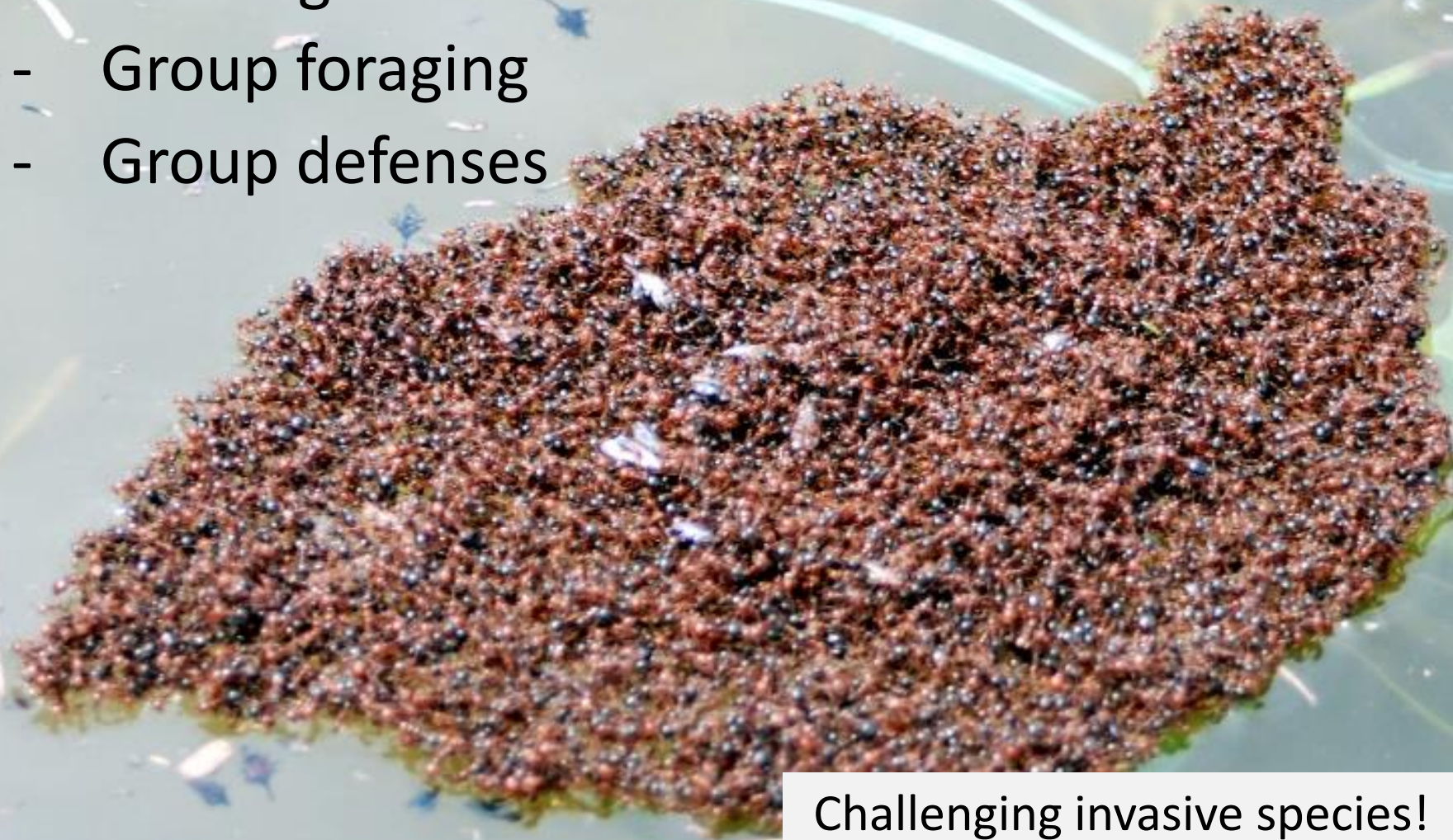


Emergent properties of ant colonies

- Cooperation
- Building nests
- Group foraging
- Group defenses

Raft of fire ants survives flooding

Challenging invasive species!





The University of Texas at Austin

Brackenridge Field Laboratory

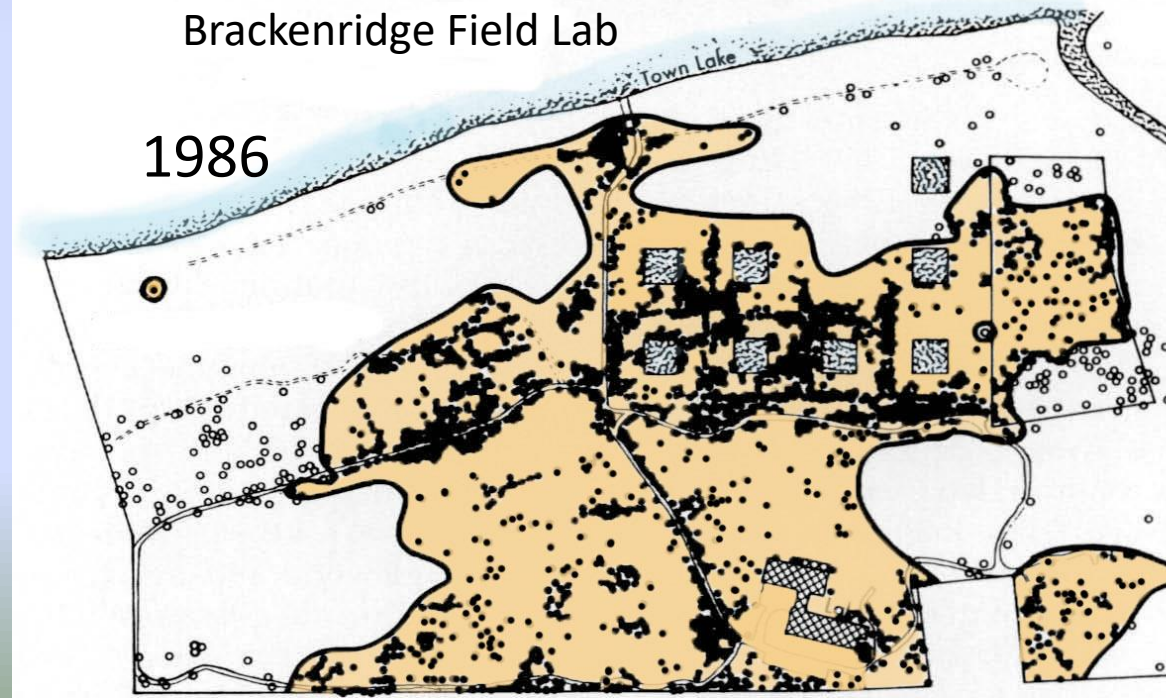
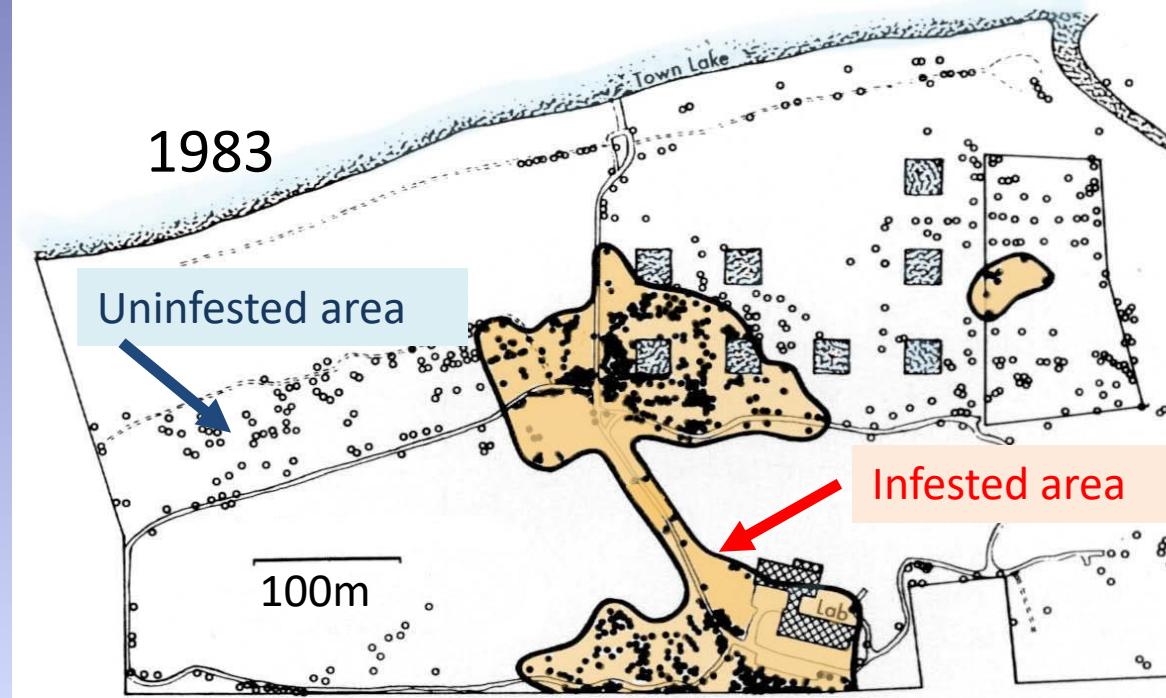
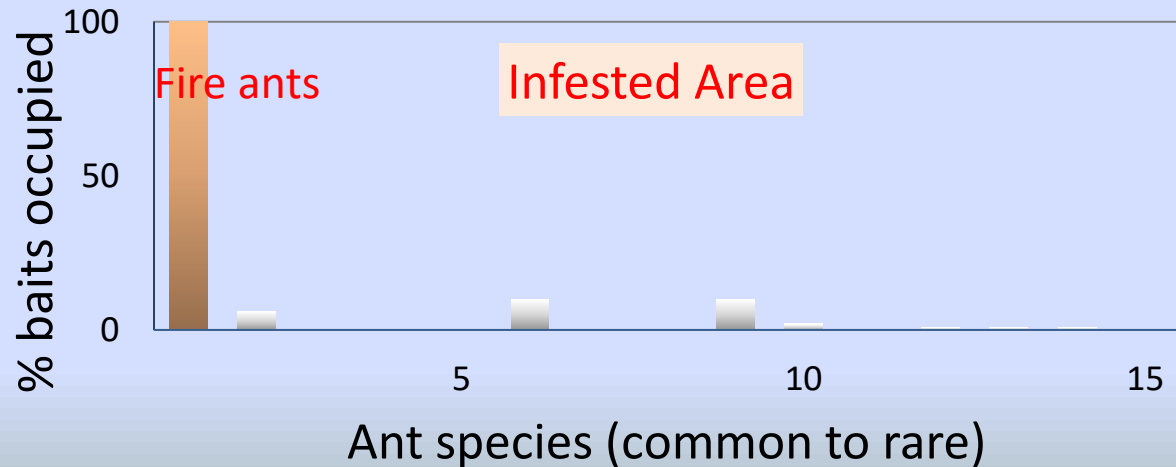
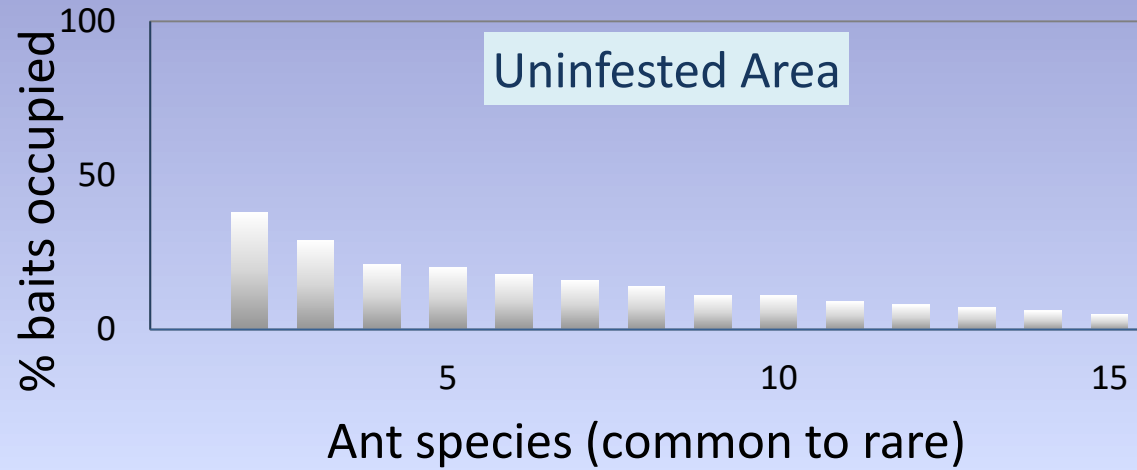
College of Natural Sciences

Data



Long-term studies in 82 acres of grassland, woodland and lakeshore

1980's - Fire ants invade the field station



Fire ants invasions

Invasion zone

You are here

Fire ant home range

THE WORLD, On Mercator's Projection.

Fire ants invasions

Invasion zone

You are here

Fire ant home range

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Fire ants invasions

Invasion zone

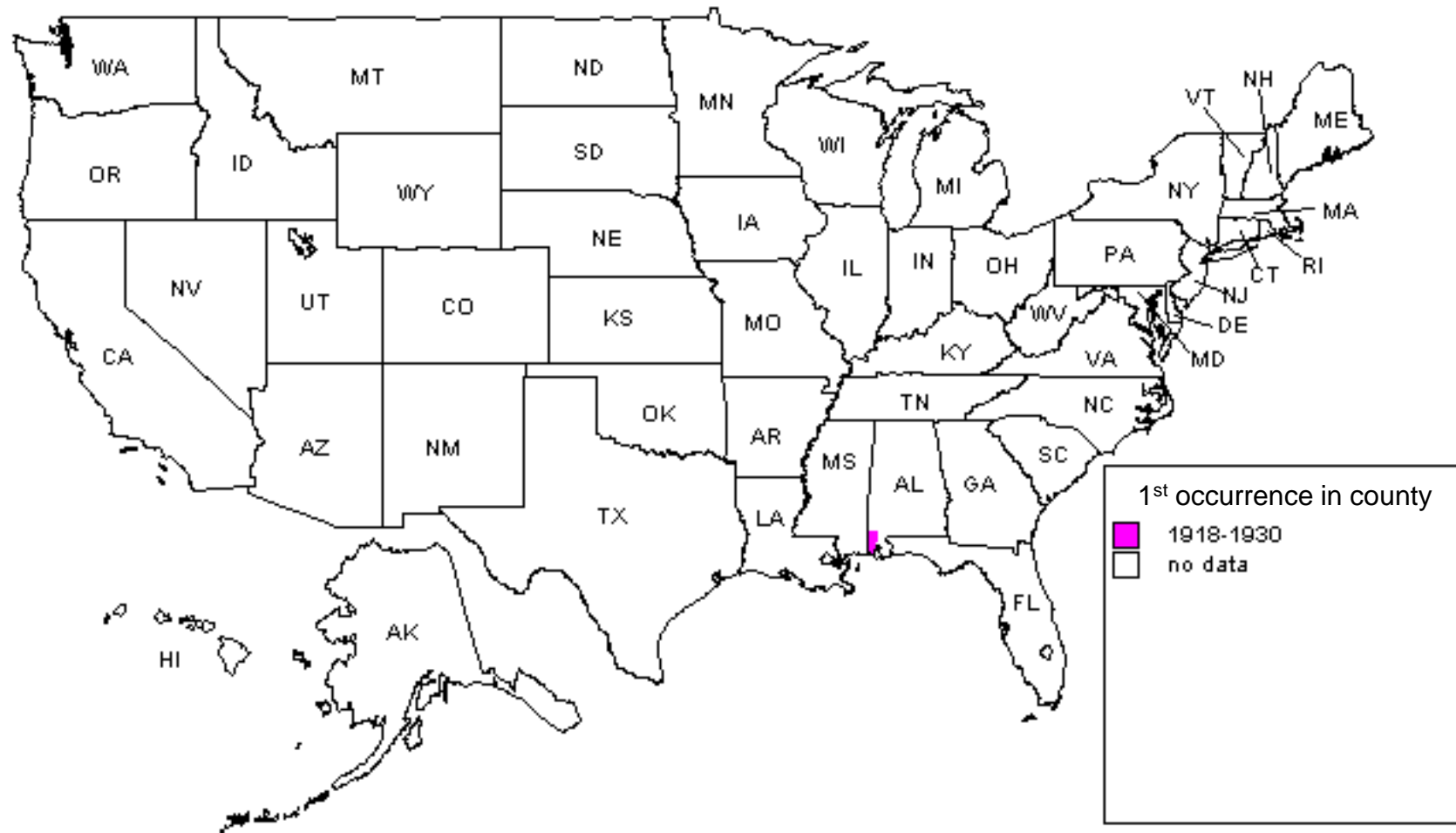
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Fire ant home range

THE WORLD, On Mercator's Projection.

First Reported Occurrence of Red Imported Fire Ant; *Solenopsis invicta*

2000-04-21 Data retrieved from National Agriculture Pest Information System



Center for Environmental Regulatory Information Systems does not certify to the accuracy or completeness of this map.

Schmidt Pain Index of Insect Stings

Bullet ant (4+)

Like fire-walking over flaming charcoal with a 3-inch rusty nail grinding into your heel.



Photo Credit: Hillewaert

Schmidt Pain Index of Insect Stings

Tarantula hawk wasp (4)

Blinding, shockingly electric. A running hair drier has been dropped into your bubble bath.



Photo Credit: NPS/Robb Hannawacker

Schmidt Pain Index of Insect Stings

Harvester Ant (3)

Bold and unrelenting.
Somebody is using a
drill to excavate your
ingrown toenail.



Schmidt Pain Index of Insect Stings

Acacia ant (1.8)

A rare, piercing,
elevated sort of pain.
Someone has fired a
staple into your cheek.



Schmidt Pain Index of Insect Stings




Fire ant (1.2)

Sharp, mildly alarming.
Like walking across a shag
carpet and reaching for
the light switch.



Photo Credit: L Gilbert

Problem ants in Texas

Argentine Ant <i>Linepithema humile</i>	Red Imported Fire Ant <i>Solenopsis invicta</i>	Tawny Crazy Ant <i>Nylanderia fulva</i>
1890	1950	2002
No stinger	Stinger	No stinger
 <p>Photo Credit: AntWeb</p> <p>0.5 mm</p>	 <p>1.0 mm</p>	 <p>0.2 mm</p>

Red imported fire ants – *Solenopsis invicta*

- \$ 1.2 billion/year economic damage in Texas
- 80 million acres of rangeland infested



Red imported fire ants – *Solenopsis invicta*

- Impact on ground nesting birds and animals
- Disruption of food web: loss of species, pollinators



Tawny Crazy Ants – *Nylanderia fulva*



Source: Joe McGowan

Tawny Crazy Ants – *Nylanderia fulva*

- Major invader of urban areas along Gulf Coast
- Spread by human transport
- Extremely high densities
- Knock out native fauna
- Displace fire ants

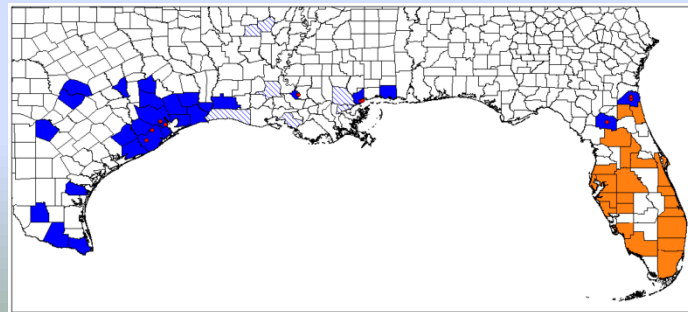
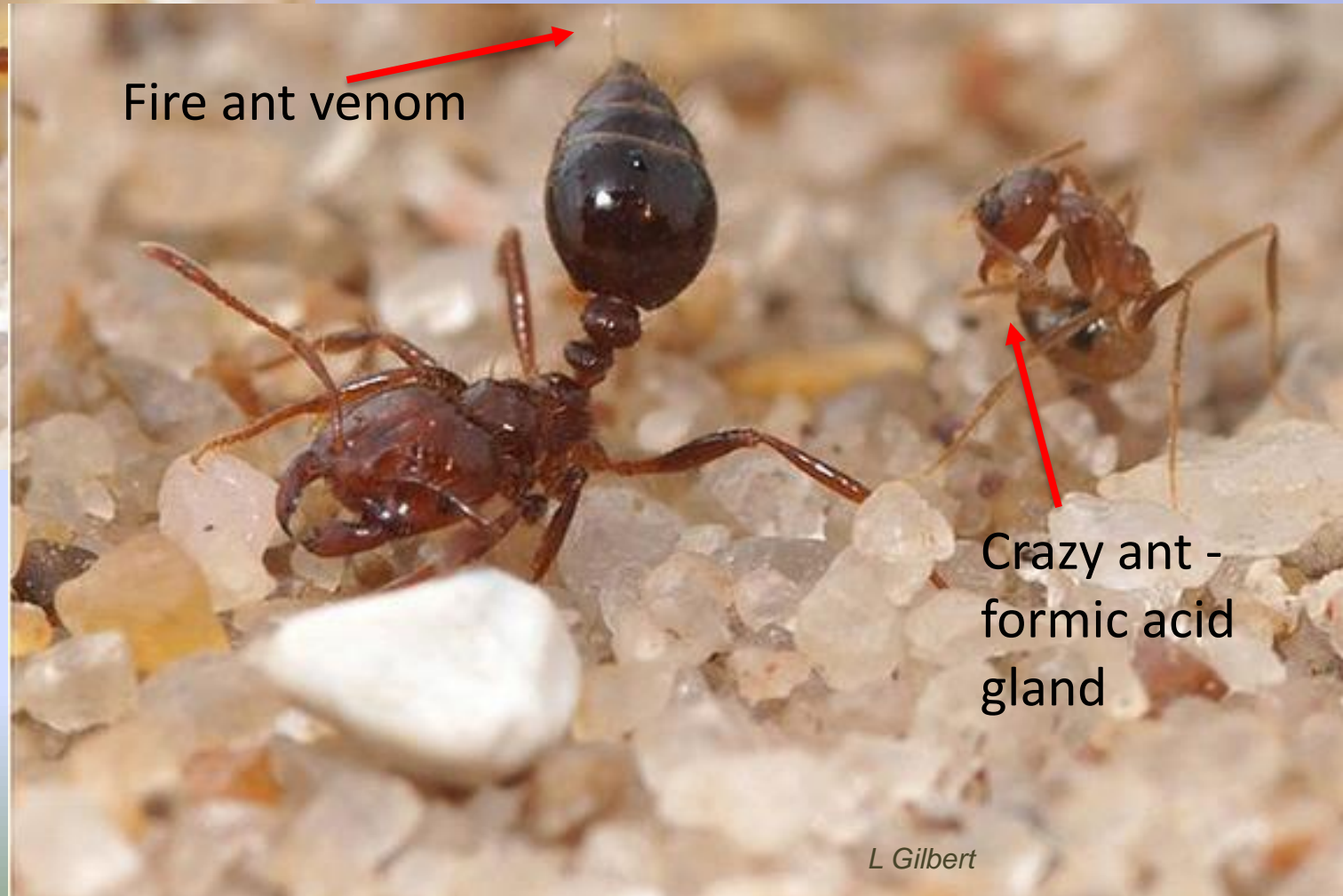


Photo Credit: L Gilbert

Chemical Warfare - Crazy Ants vs Fire Ants



Scienceexpress

**Chemical Warfare Among Invaders: A
Detoxification Interaction Facilitates an
Ant Invasion**

Edward G. LeBrun,* Nathan T. Jones, Lawrence E. Gilbert

L. Gilbert

Why do some species become invasive?

- Enemy escape hypothesis (competitors, parasites, pathogens)
- Fast growth & reproduction
- Good at dispersal
- Associated with disturbance



Photo Credit: AntWeb

Red imported fire ant



Brown tree snake



Zebra mussels

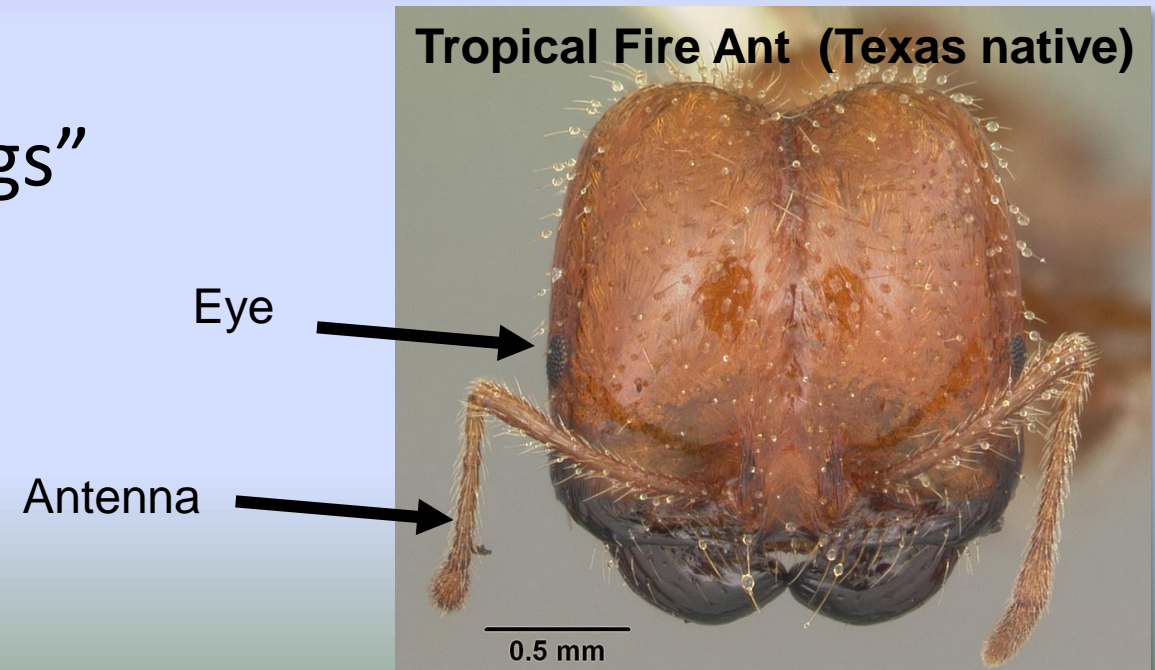
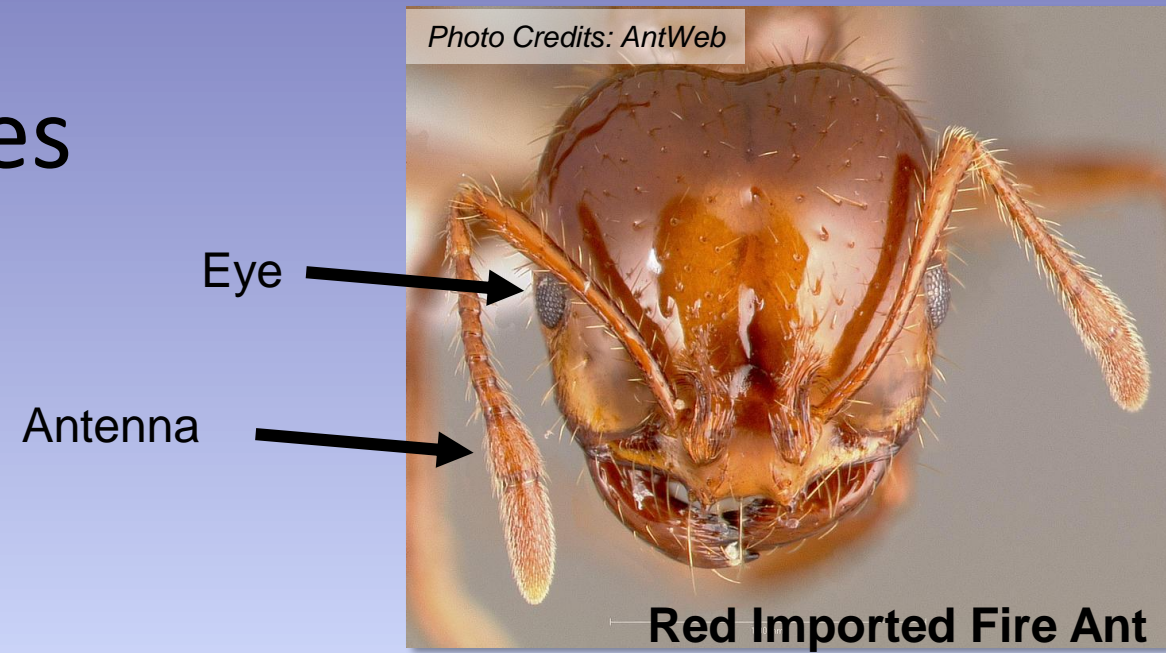


Photo Credit: Kerry Britton

Kudzu vines

Traits of invasive ant species

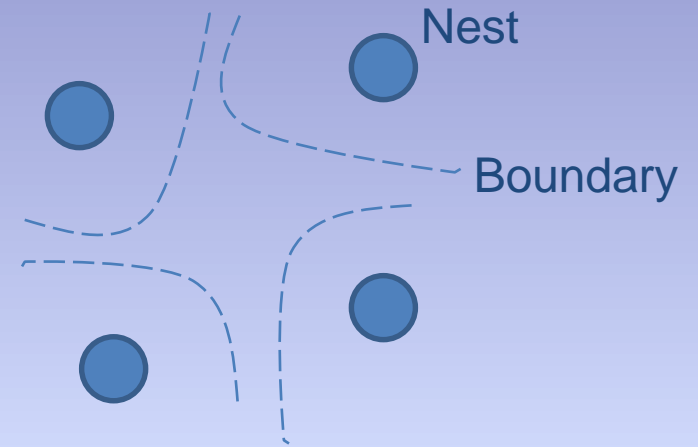
- Multiple queens -“polygyne”
- Clonal spread
- Low aggression between nests
- High densities of colonies
- Dominant competitors – “top dogs”



Social forms of fire ants

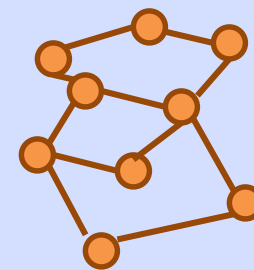
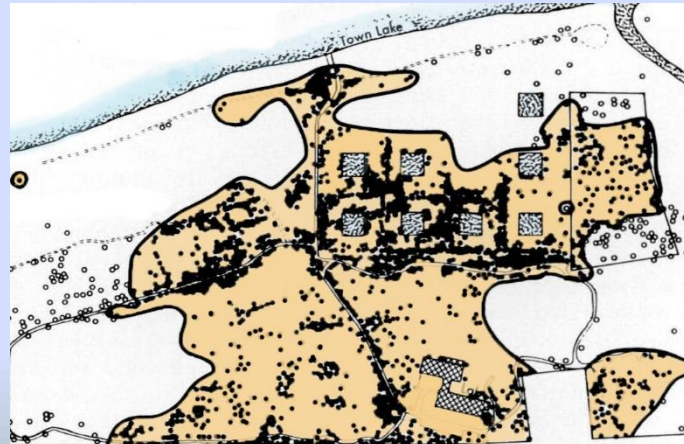
Monogyne

- Single queen colony
- Large, isolated nests
- Territorial
- 120 mounds/acre
- Isolation creates a “social immune” defense against diseases



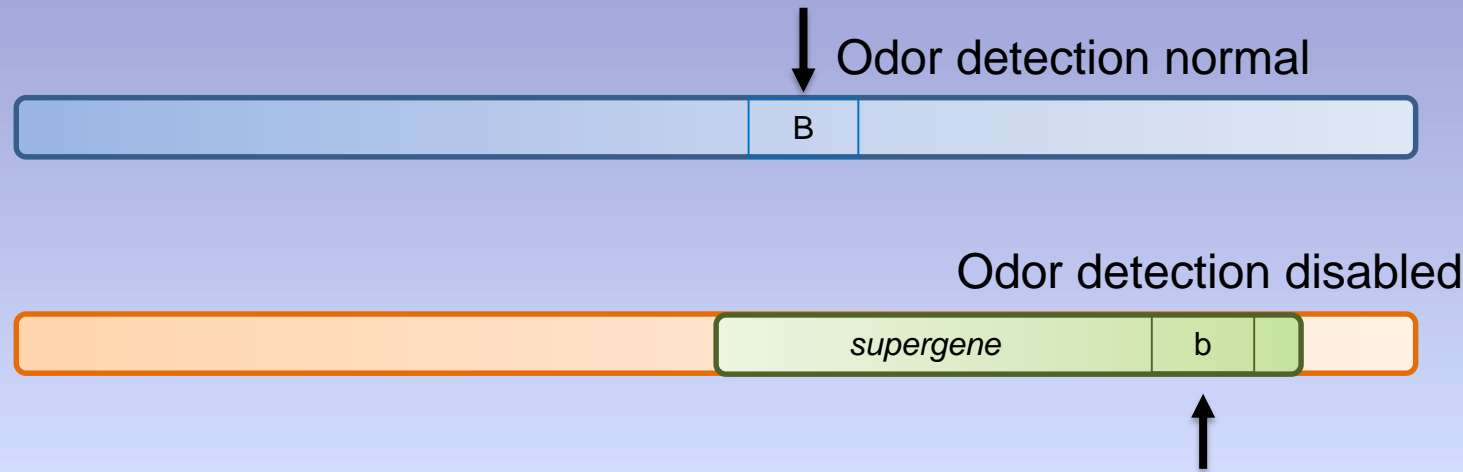
Polygyne

- Multiple queens per colony
- Small nests
- Interconnected network
- Up to 800 mounds/acre
- Disease risk from foreign workers



Supercolonies
of connected
nests

It's a Supergene!



Monogyne BB

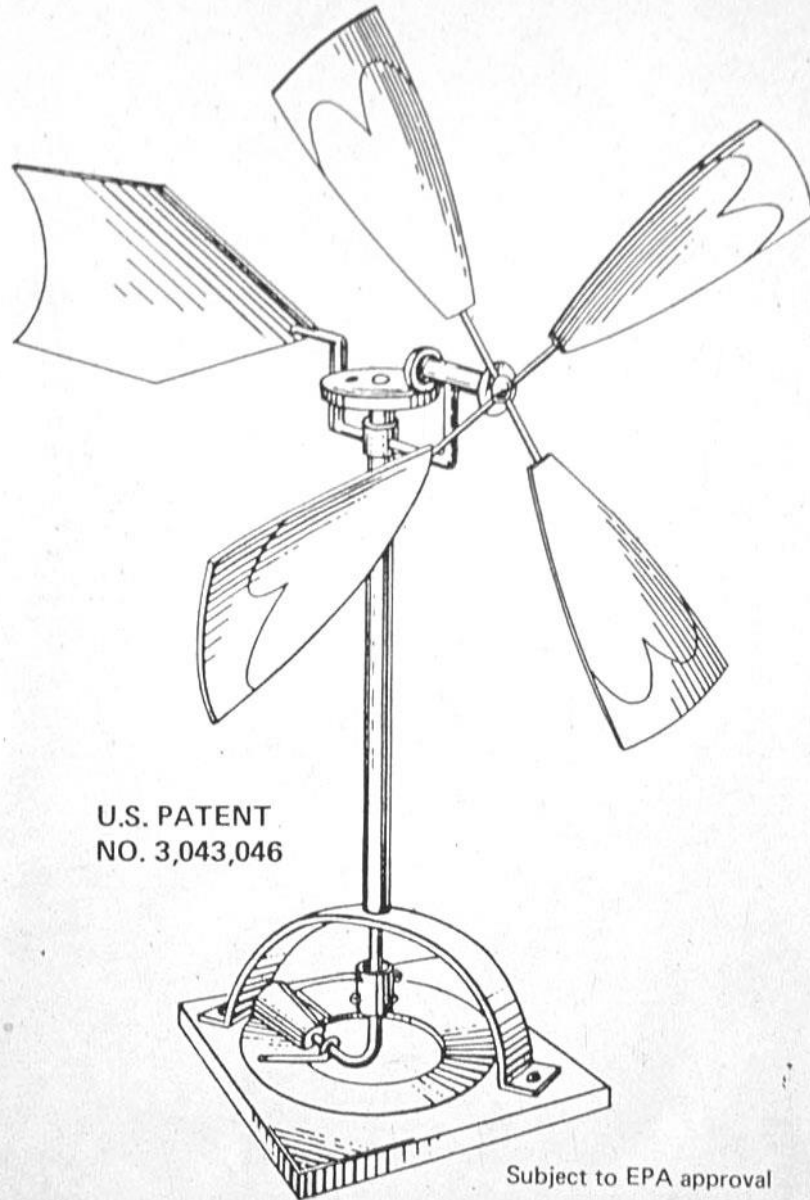
- workers recognize nest mates
- single queen

Polygyne Bb

- workers can't distinguish nest mates
- multiple queens

GET RID OF THESE PESTS WITH THE

McCOY ANT STOMPER



U.S. PATENT
NO. 3,043,046

Subject to EPA approval

The McCoy Ant Stomper kills emerging fire ants quickly, safely and economically!

- *Durable, heavy metal construction
- *Easily portable
- *No chemicals
- *Environmentally safe for people, pets, cattle, land—everything except fire ants!

The McCoy Ant Stomper can be used again and again. It's a practical investment in fire ant control!

only **\$98⁵⁰**

- *Wind-driven
- *Price includes freight and handling
- *Six to eight weeks delivery

NOW BEING DEVELOPED...

- *Total electric battery-driven model
- *Price slightly higher than wind-driven model
- *12 to 14 weeks delivery



Post WWII – The Power of Science

Nuclear energy, penicillin and DDT

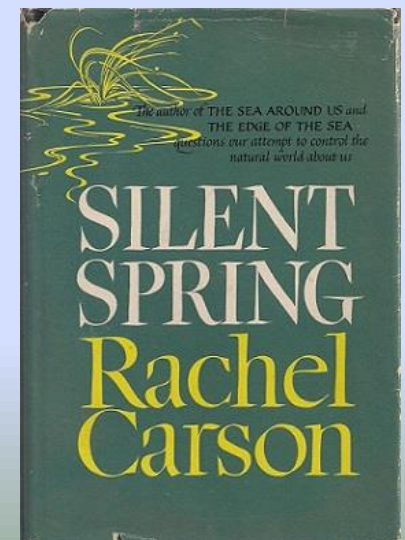


Comments about the 1957 Federal campaign to eradicate fire ants from 20 million acres using dieldrin and heptachlor

“It is an outstanding example of an ill-conceived, badly executed and thoroughly detrimental experiment in the mass control of insects, an experiment so expensive in dollars, in destruction of animal life, and in loss of public confidence in the Agriculture Department that it is incomprehensible that any funds should still be devoted to it.”

Silent Spring

Rachel Carson, 1962



Biological control

Opportunities to use natural enemies

- should be host specific
- self-sustaining after release
- low future costs

Concerns

- unforeseen collateral damage
- host-shifting after introduction
- may only have low impacts

Natural enemies of ants

Carpenter ants

- Live in trees, forage on the ground
- Become infected with fungal spores
- Develops seizures and begins a zombie walk
- Descends to ground, climbs a plant
- Bites down and dies



Ophiocordyceps fungus turns
carpenter ants into zombies



D. Newman

Pseudacteon phorid flies: Parasites of fire ants



J. Abbott





Source: National Geographic

Ant neck

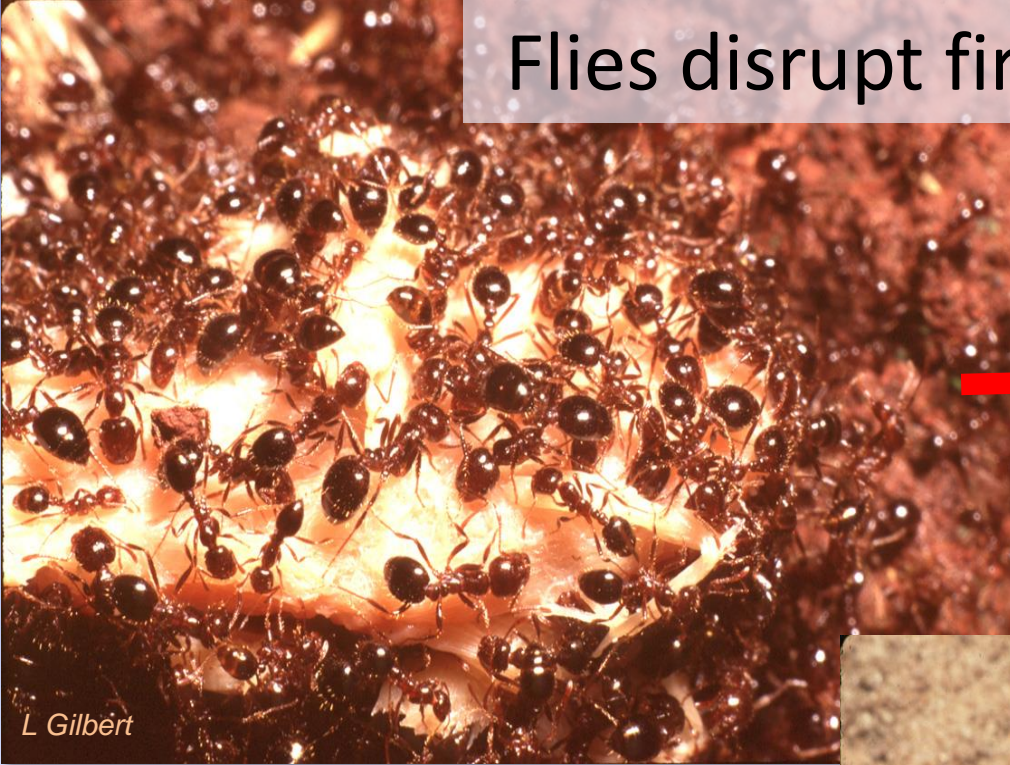
Phorid fly
larva

Ant jaws

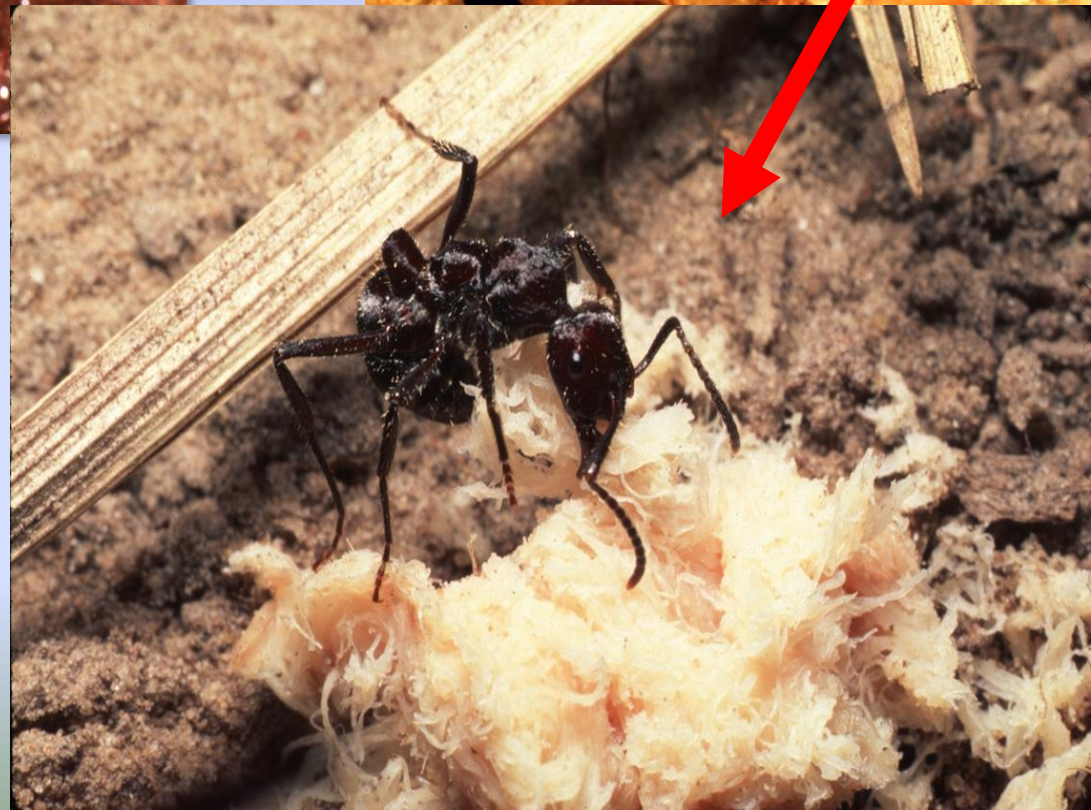


Image Credit: E. Economo

Flies disrupt fireant feeding



- Ants feed in high numbers, emit a foraging pheromone.
- Phorid flies detect and attack.
- Ants go into alarm mode, go home
- Native ants gain food,
fire ants lose out!



Zombie defenses



Flies disrupt mound defenses



Loss of young reduces colony growth rate

Potential for biocontrol with phorid flies

- Direct effects - may kill up to 3% of workers
- Indirect effects – up to 50% reduction in gathering food
- Decreased nest defenses – loss of workers and brood
- Possible vectoring of pathogens by flies

➡ Slower colony growth, stronger native ant community

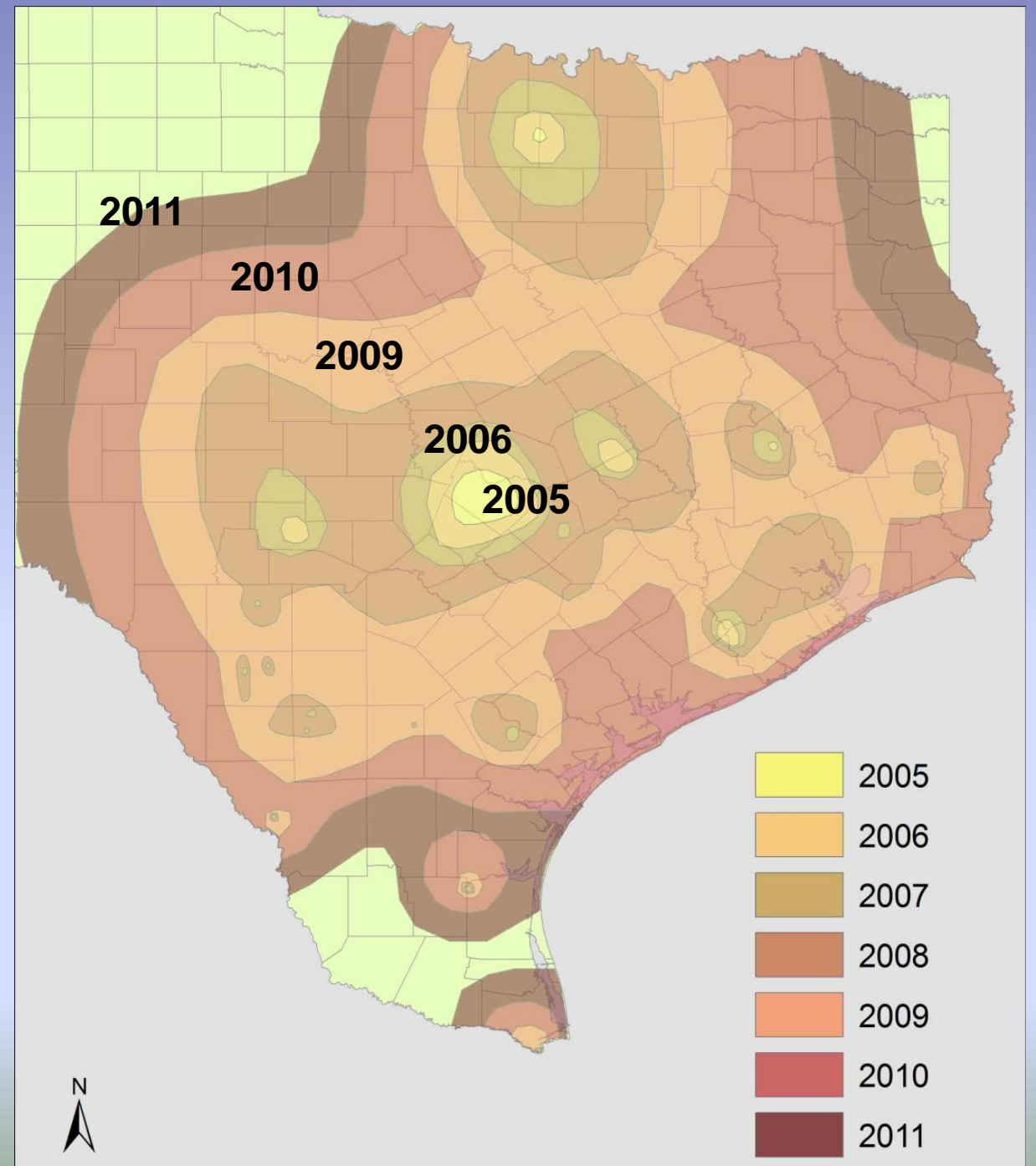




Release and dispersal of phorid flies

Pseudacteon obtusus

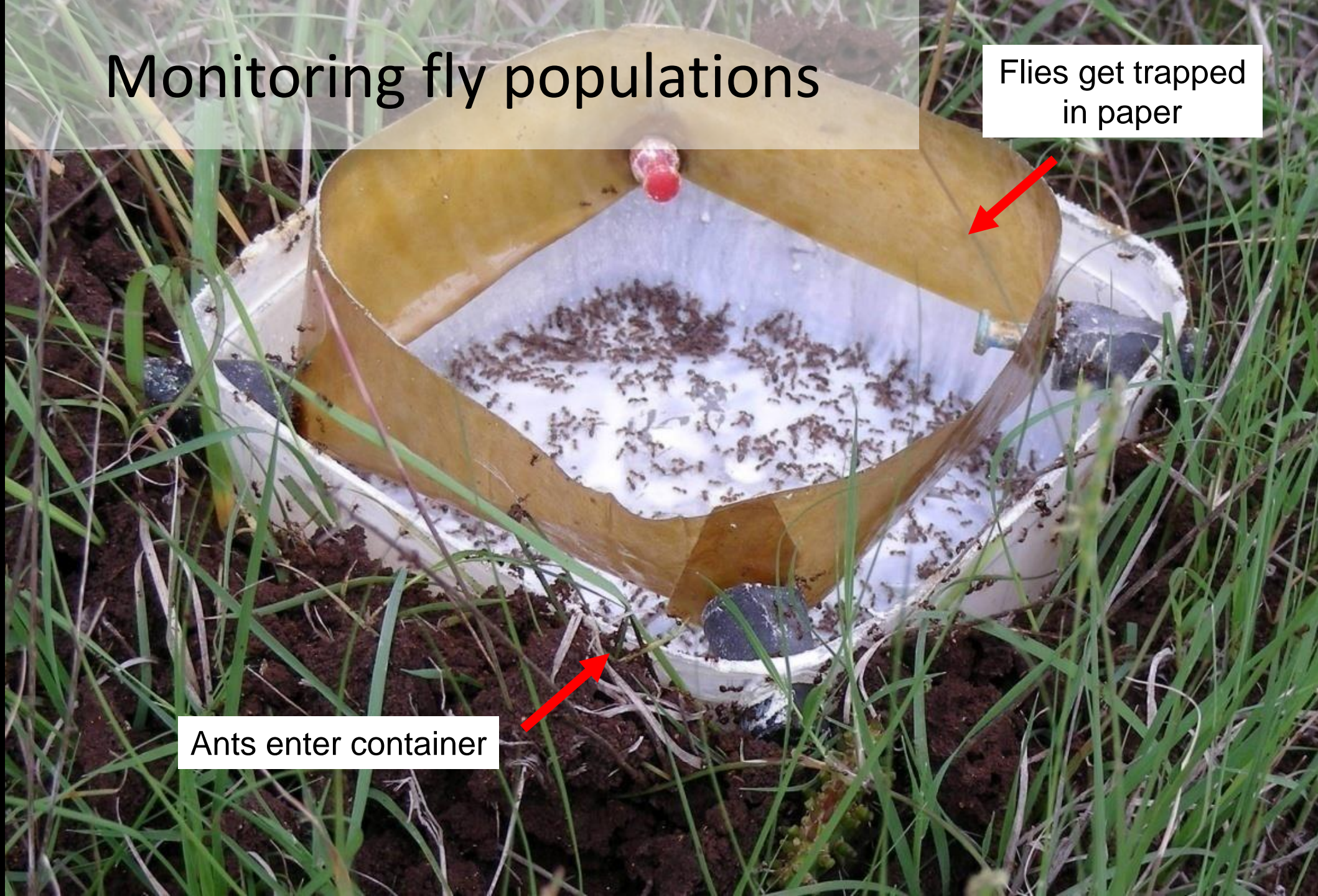
- Many release sites
- Rapid spread
- Self-sustaining populations



Monitoring fly populations

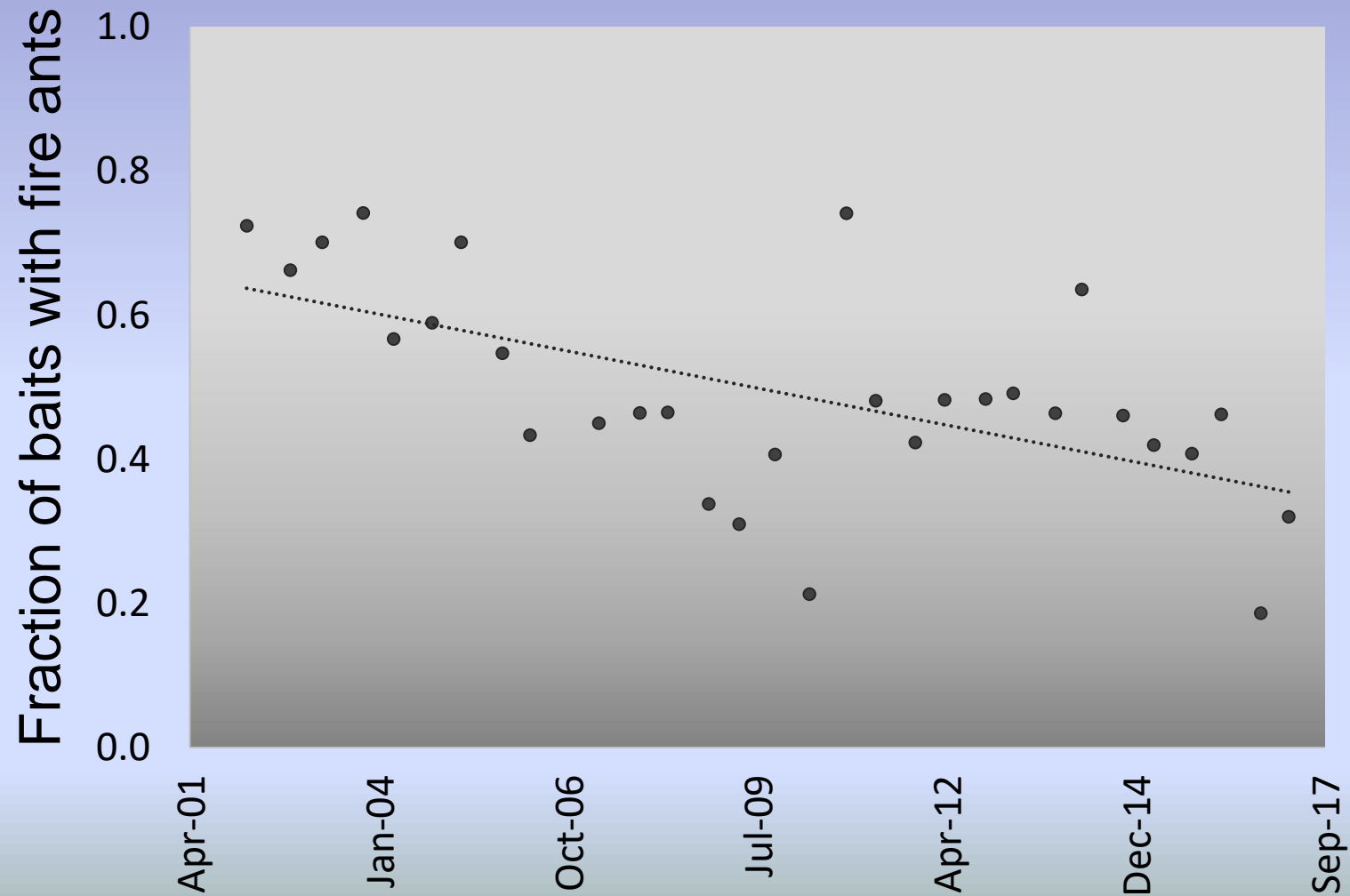
Flies get trapped
in paper

Ants enter container





Potential biocontrol success? Brackenridge Field Station



IN THE EVENT OF ZOMBIE ATTACK

3 STEPS TO SURVIVING INFESTATION

1. Avoidance
2. Termination
3. Disposal

Summary

- Zombie ants are real
- Invasive ants pose a complex challenge for biocontrol

Acknowledgements: Larry Gilbert, Ed LeBrun, Pat Folgarait, Nathan Jones, Sanford Porter, UT Fire Ant Lab team, USDA, Landowners



Funding: Lee & Ramona Bass Fdn, Robert & Helen Kleberg Fdn, Ecolabs, TPWD, USFWS