Fire Ants, Crazy Ants & Zombie Ants

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October 26, 2018
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Zombie invasions from Old to New World

- Zombie invasion zone
- Zombie staging grounds
- You are here
- Zombie home range
- Zimbabwe – my home

You are here
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.
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!
1980’s - Fire ants invade the field station

- 1983
- 1986

- Uninfested area
- Infested area

Graphs showing percentage of baits occupied by ant species (common to rare) in uninfested and infested areas over the years 1983 and 1986.

Brackenridge Field Lab

Map showing the infestation spread from 1983 to 1986.
Fire ants invasions

Invasion zone

You are here

Fire ant home range
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.
Bullet ant (4+)
Like fire-walking over flaming charcoal with a 3-inch rusty nail grinding into your heel.
Tarantula hawk wasp (4)

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

Photo Credit: NPS/Robb Hannawacker
Harvester Ant (3)
Bold and unrelenting. Somebody is using a drill to excavate your ingrown toenail.
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  
| Linepithema humile | Red Imported Fire Ant  
| Solenopsis invicta | Tawny Crazy Ant  
| Nylanderia fulva |
|-------------------|-------------------|-------------------|
| 1890              | 1950              | 2002              |
| No stinger        | Stinger           | No stinger        |

Photo Credit: AntWeb
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
Chemical Warfare - Crazy Ants vs Fire Ants

Fire ant venom

Crazy ant - formic acid gland
Why do some species become invasive?

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

Red imported fire ant

Brown tree snake
Zebra mussels
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
It’s a Supergene!

Monogyne BB
- workers recognize nest mates
- single queen

Polygyne Bb
- workers can’t distinguish nest mates
- multiple queens

Odor detection normal

Odor detection disabled
GET RID OF THESE PESTS WITH THE

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

Subject to EPA approval
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
Pseudacteon phorid flies: Parasites of fire ants
Source: National Geographic
Ant neck

Phorid fly larva

Ant jaws

Image Credit: E. Economo
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

Ants enter container

Flies get trapped in paper
Potential biocontrol success?
Brackenridge Field Station
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