



# Biotic Resistance in Weed Biological Control

**MELISSA C. SMITH**, ELLEN C. LAKE, CAREY R. MINTEER, MIN  
RAYAMAHJI, GREG WHEELER, PHILIP TIPPING, F. ALLEN DRAY

GEER 2017, APRIL 18

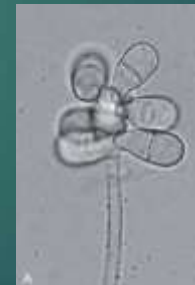
# Biotic Resistance



Competition



Predation



Pathogens &  
Parasites

Elton (1958)

# Biological Control

- ▶ >50% of arthropods released for weed biological control are suppressed by native species
- ▶ Why do some biological control introductions fail??
  - ▶ Agent fails to establish at all
  - ▶ Populations establish, but target weed does not decline
  - ▶ Local failure
  - ▶ Global failure

# Biotic Resistance

- ▶ For Biological Control?
  - ▶ Enemy release
  - ▶ Competitor release
  - ▶ Allee effects



# Biotic Resistance

- ▶ For Biological Control?
  - ▶ Enemy release
  - ▶ Competitor release
  - ▶ Allee effects
  - ▶ Relation to a pest spp.



# Biological Control Failures: Examples

## ▶ *Austromusotima camptozonale*



- Pyralid moth introduced to control *Lygodium microphyllum*
- Larvae and pupae attacked by native parasitoids and predators (Boughton & Pemberton 2008)
- < 2 generations in the field

# Biological Control Failures: Examples

## ▶ *Spodoptera pectinicornis*



- Noctuid moth introduced to control *Pistia stratiotes* (Water lettuce)
- Larvae and pupae attacked by native birds and fire ants (Dray et al. 2001)



# Biological control conflicts

- ▶ Insect Biological control vs. Weed Biological control



*Trichogramma exiguum*



European corn borer



# Biological control conflicts

- ▶ Insect Biological control vs. Weed Biological control



*Trichogramma exiguum*



European corn borer

# Biological control conflicts

- ▶ Insect Biological control vs. Weed Biological control



*Trichogramma exiguum*



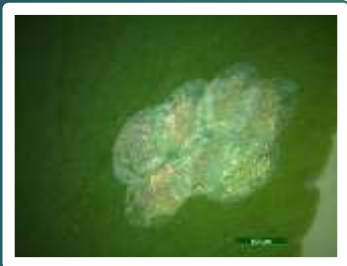
*Neomusotima conspurcatalis*

# What can be done?

- ▶ Susceptible biocontrol agents rapidly accumulate native parasitoids (Paynter et al. 2010)
- ▶ Biological control agents in proximity to analogs
- ▶ Example: *Neomusotima conspurcatalis*



Boughton et al.  
2012  
*Cotesia*  
sp.



*Megamelus scutellaris*



*Megamelus davisii*



*Kalopolynema ema*





# What can be done?

- ▶ Actively search out insects without native analogs in close proximity
- ▶ Example: *Oxyops vitiosa* (*Melaleuca quinquenervia*)



# What can be done?

- ▶ Sometimes you don't have any other options:
  - ▶ *Lygodium microphyllum*
  - ▶ *Rhodomyrtus tomentosa*
- ▶ Parasitoid accumulation in the native range doesn't predict parasitoid susceptibility in the adventive range
- ▶ Parasitoid species assemblages are often poorly studied – difficult to predict
- ▶ **Study the native insect communities in the invaded communities**
- ▶ **Coordinate between insect biological control and weed biological control**



# Discussion and Questions?

- ▶ References:
- ▶ Goeden, R.D. and S.M. Louda. 1976. Biotic interference with insects imported for weed control. *Ann. Rev. Entomology*.
- ▶ Paynter, Q. et al. 2010. Predicting parasitoid accumulation on biological control agents of weeds. *J. Appl. Ecol.*
- ▶ Boughton, A.J. and R.W. Pemberton. 2008. Efforts to establish a foliage-feeding moth, *Austromusotima camptozonale*, against *Lygodium microphyllum* in Florida.... *Biological Control*
- ▶ THANK YOU:
  - ▶ Dr. Ellen Lake
  - ▶ Dr. F. Allen Dray
  - ▶ Dr. Carey Minter