

Interaction of native and invasive grasses with a generalist herbivore insect

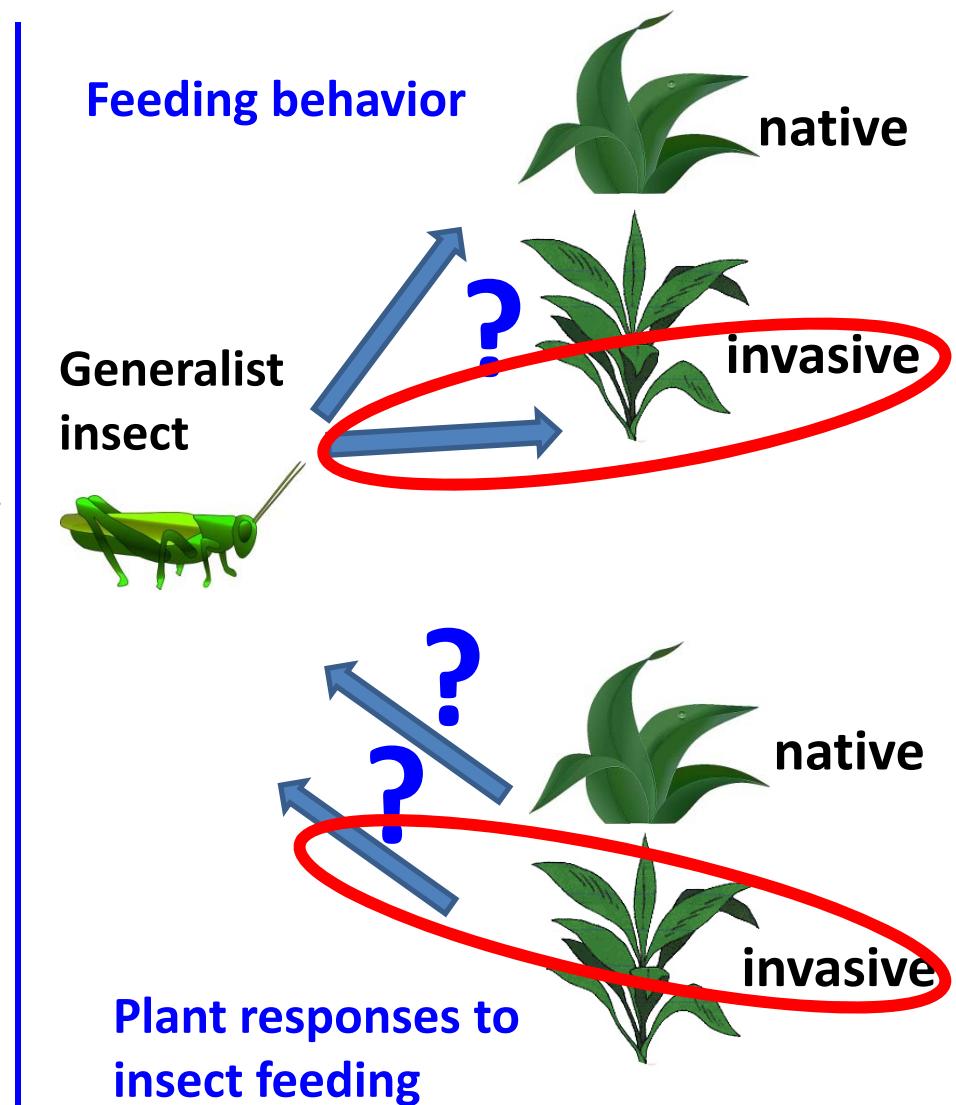
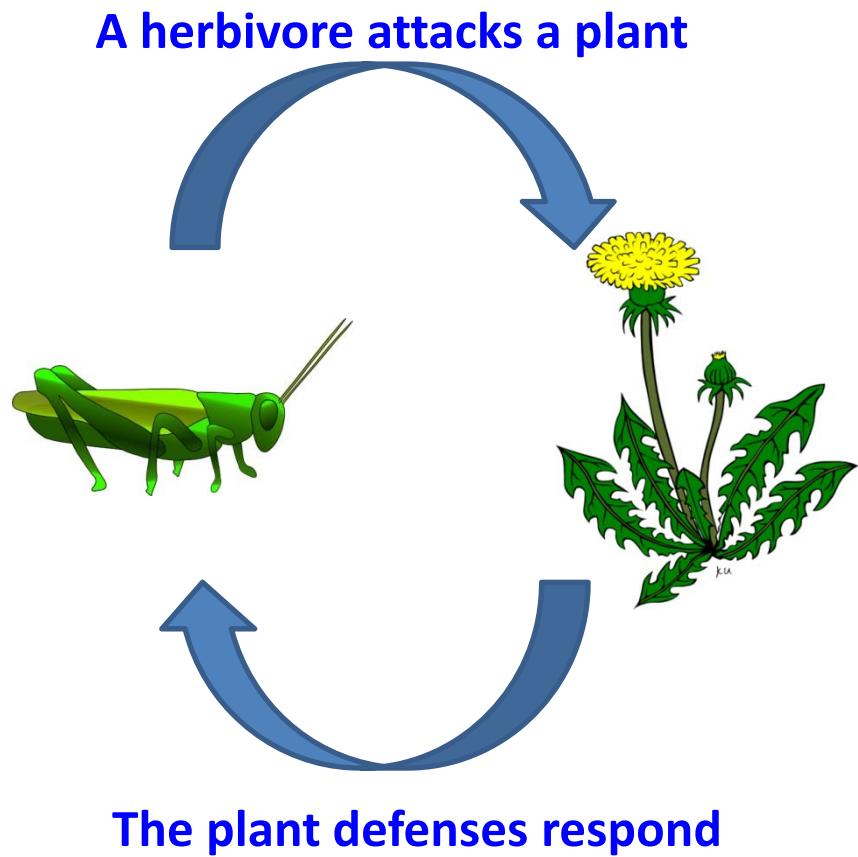
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<http://ptygmatics.wordpress.com/category/insects/>

The interaction between plants and insect herbivores



Ecological explanations for successful invasion of exotic plants

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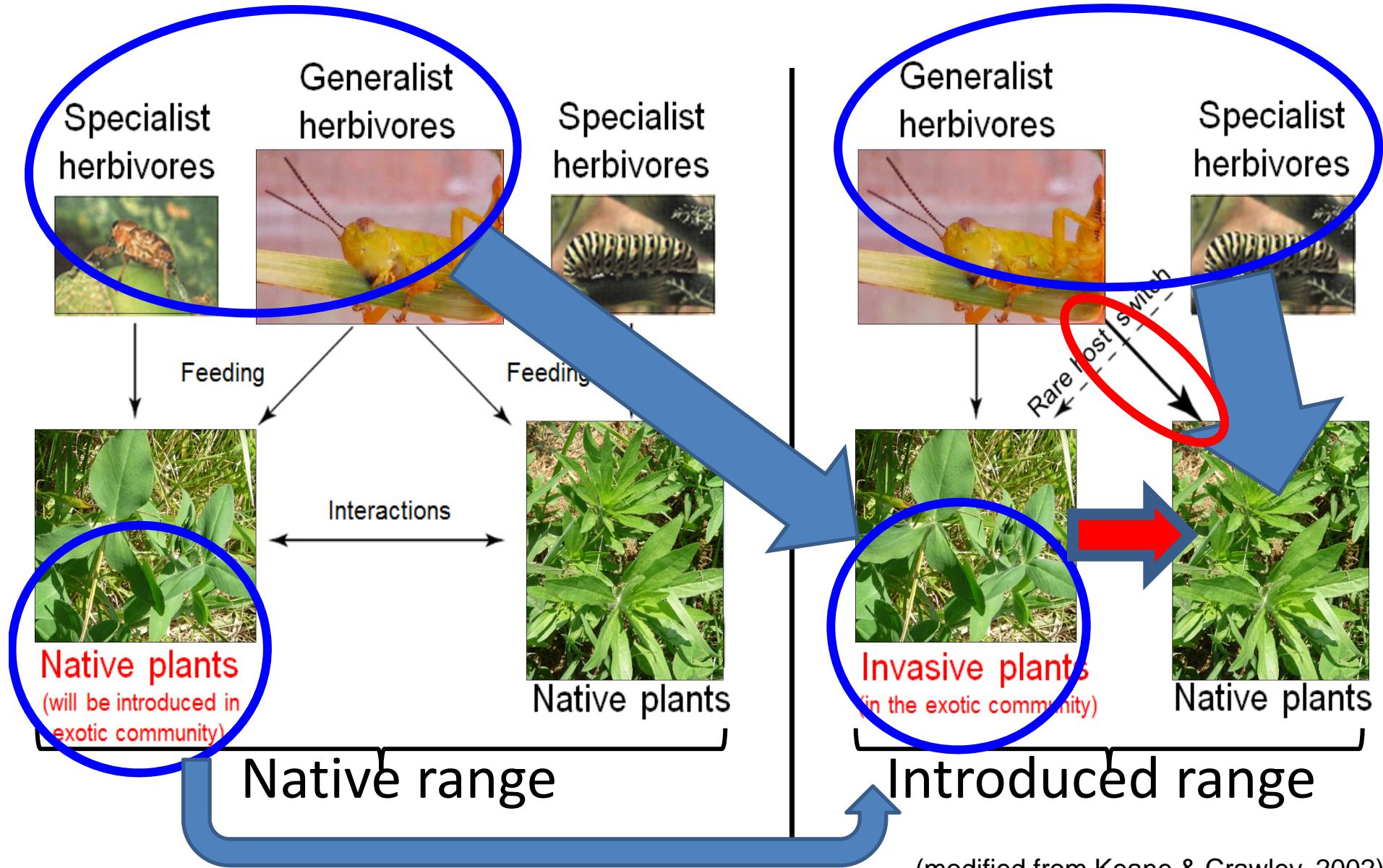
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Table 1 Major hypotheses for the success of exotic plants

hypothesis name	definition	references
biodiversity resistance hypothesis (BRH)	More diverse communities should be less susceptible to invasion by exotic species.	Elton (1958)
enemies release hypothesis (ERH)	Exotics are released from natural enemies that control their population growth.	Darwin (1859); Williams (1954)
evolution of increased competitive ability hypothesis (EICA)	Exotics experience rapid genetic changes linked to new selection pressure in the novel environment.	Hermes (1992); Blossey and Notzold (1995)
novel weapon hypothesis (NWH)	Exotics bring novel ways of biochemical interaction to recipient communities.	Rabotnov (1982); Willis (1994)
niche opportunity hypothesis (NOH)	Exotics are promoted among of resources, natural enemies, and the physical environment.	Shea & Cheeson (2002)

Enemy Release Hypothesis

(Darwin 1859, Williams 1954, Elton 1958, Gillett 1962)



Main question

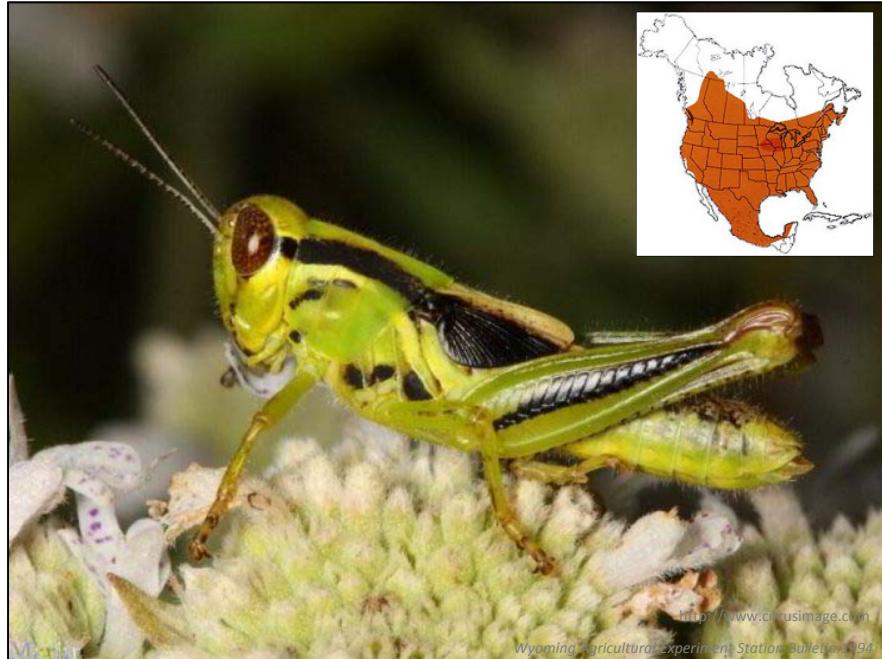
Do invasive grasses receive less leaf damage from generalist herbivores than native grasses?

- Generalist grasshoppers feed on a wide variety of plants
- They often switch between plants
- They prefer new food

Main hypothesis

Invasive grasses will receive more leaf damage from native *Melanoplus* grasshoppers than native grasses

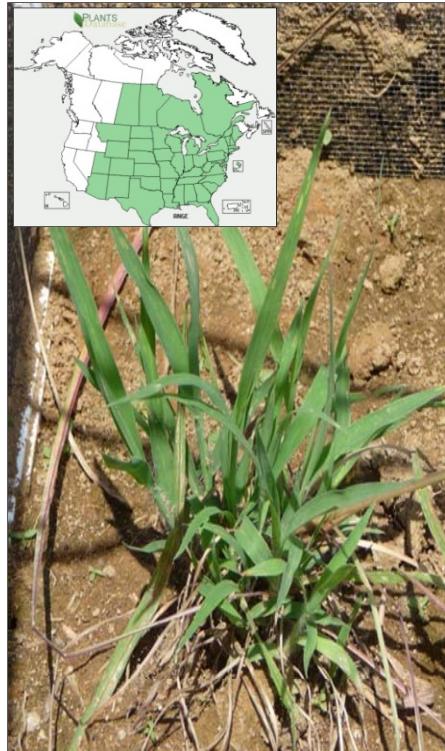
Study Organisms



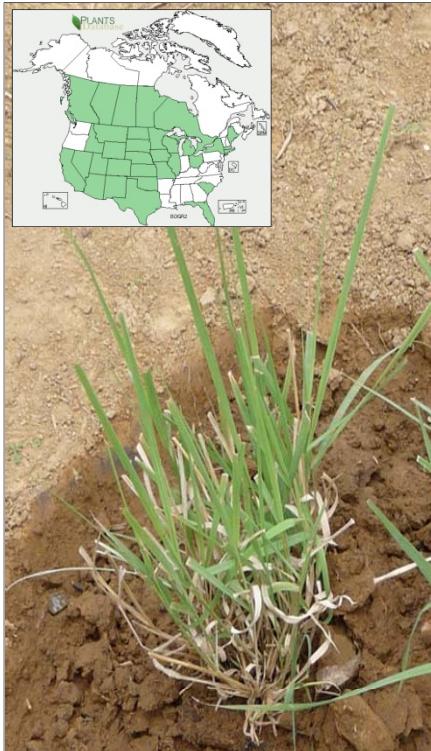
Melanoplus spp.
(Orthoptera: Acrididae)
grasshopper nymph



Study Organisms (cont.)



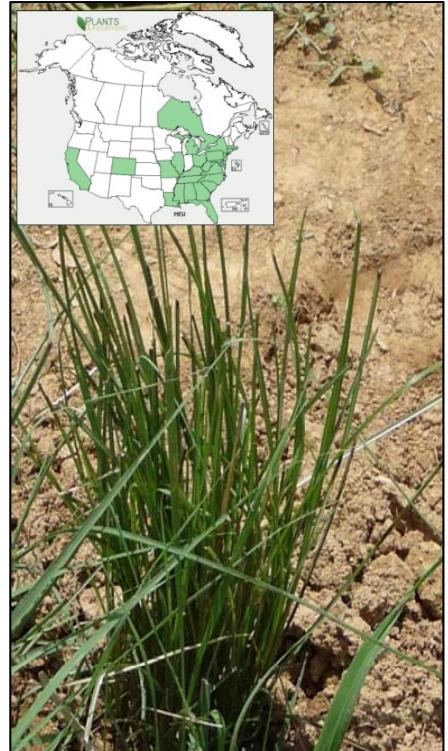
*Andropogon
Gerardii*
Big Bluestem



*Bouteloua
Curtipendula*
Sideoats Grama



*Miscanthus
sinensis
'Zebrinus'*
Zebra Grass



*Miscanthus
sinensis
'Gracillimus'*
Maiden Grass

Native grasses

Family: Poaceae

Invasive grasses

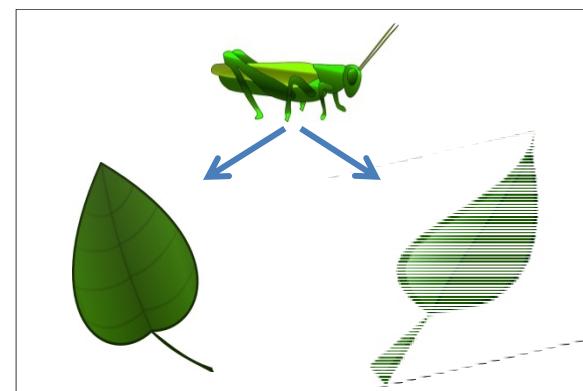
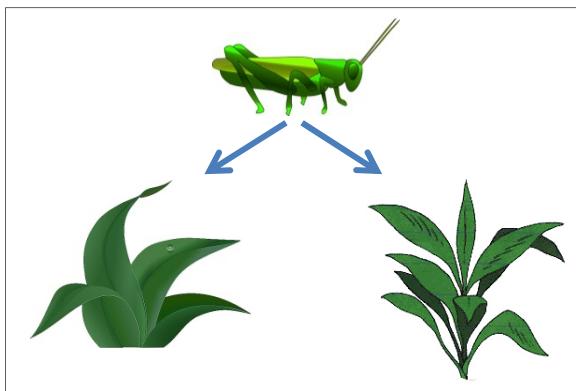
Choice feeding experiments



Plants



Leaves



Study Sites

**Western Maryland
Research and Education
Center (MD)**
Experiments with nymphs



**Cincinnati Center
for Field Studies (OH)**
**Experiments with adult
grasshoppers**



**University of Cincinnati
Greenhouse (OH)**
**Experiments with adult
grasshoppers**



Main hypothesis

Invasive grasses will receive more leaf damage from native *Melanoplus* grasshoppers than native grasses

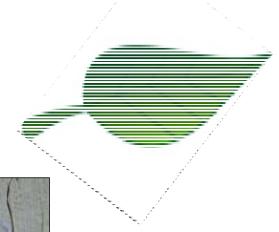


Research questions

1. Does total leaf damage from grasshoppers differ in native and invasive plants?
2. Does frequency of grazing by grasshoppers differ on native and invasive plants?
3. Does leaf consumption of grasshoppers differ on native and invasive plants?
4. Does proportion of leaves consumed by grasshoppers differ on native and invasive plants?



Measurements



Leaf damage: Volume of the grazed portion [$\text{length} \times \text{width} \times \text{depth of "scars"}$, cm³]

Frequency of grazing:

[number of scars per plant]

[number of scars/number of leaves]



Leaf consumption: [leaf tissue offered – leaf tissue not eaten, g]

Proportion of leaves consumed:
[leaf consumption/leaf tissue offered]
[(length of leaf offered-length of leaf remained)/length of leaf offered]

Field experiments with plants



*Andropogon
gerardii*



*Miscanthus sinensis
'Zebrinus'*

Native/invasive
plant pairs



*Bouteloua
curtipendula*



*Miscanthus sinensis
'Gracillimus'*

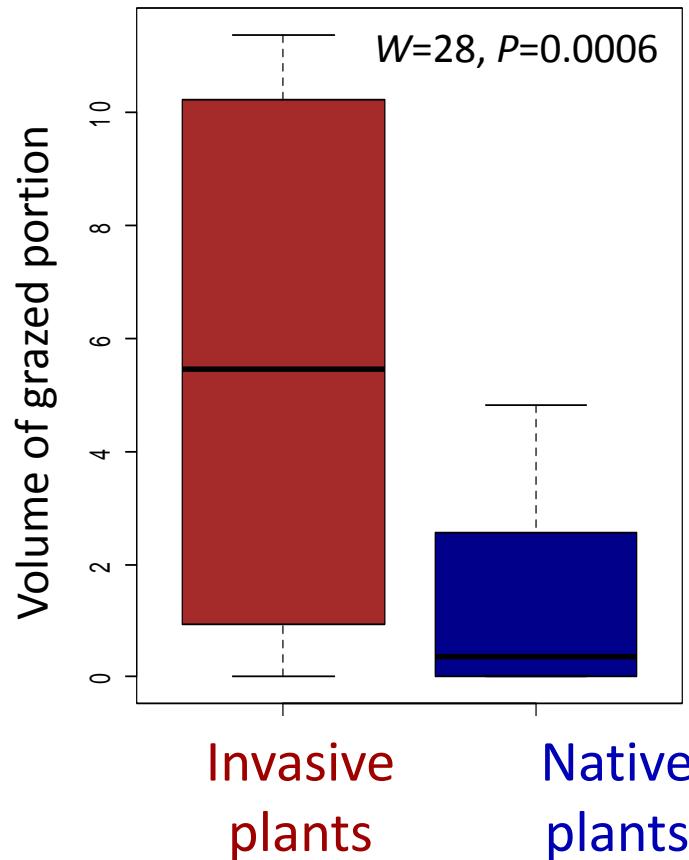


5 days

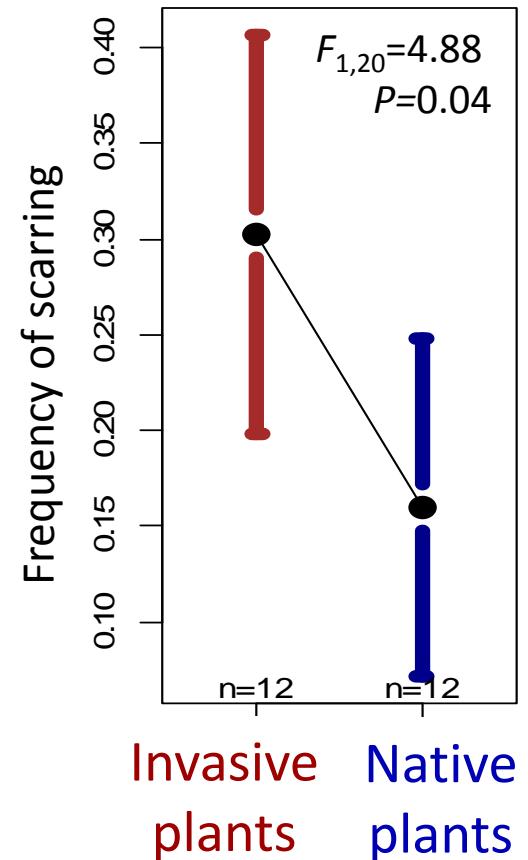
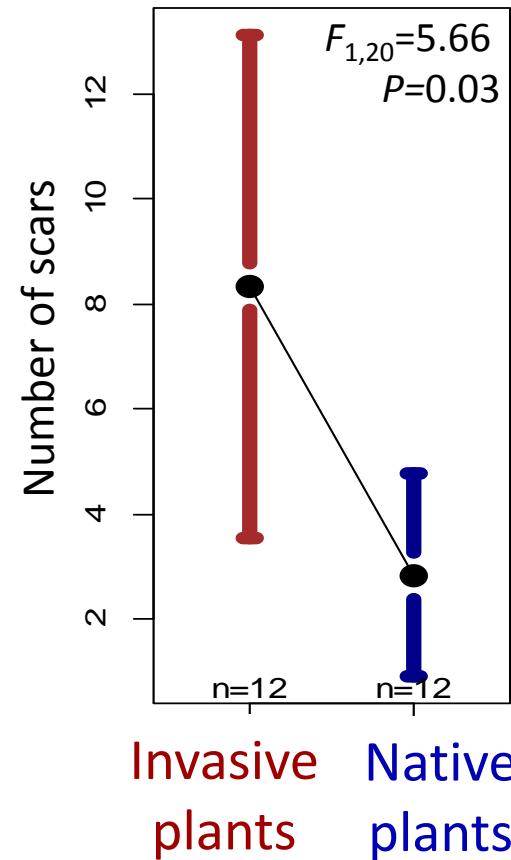


Results: Field experiments

Leaf damage



Frequency of grazing



Both leaf damage and frequency of grazing of grasshoppers were greater on invasive plants

Experiments with leaves



*Andropogon
gerardii*



*Miscanthus sinensis
'Zebrinus'*

Native/invasive
plant pairs



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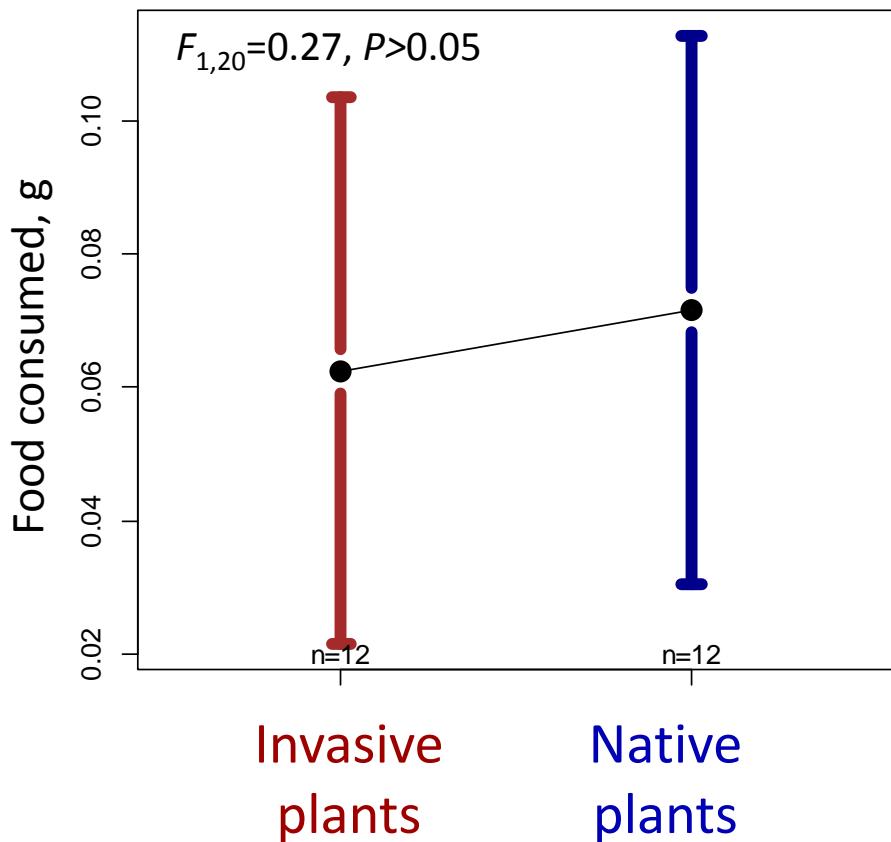


5 hours

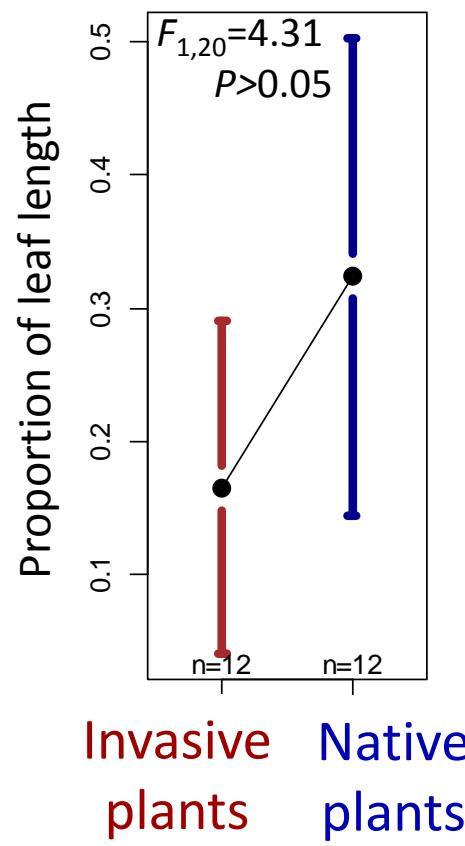
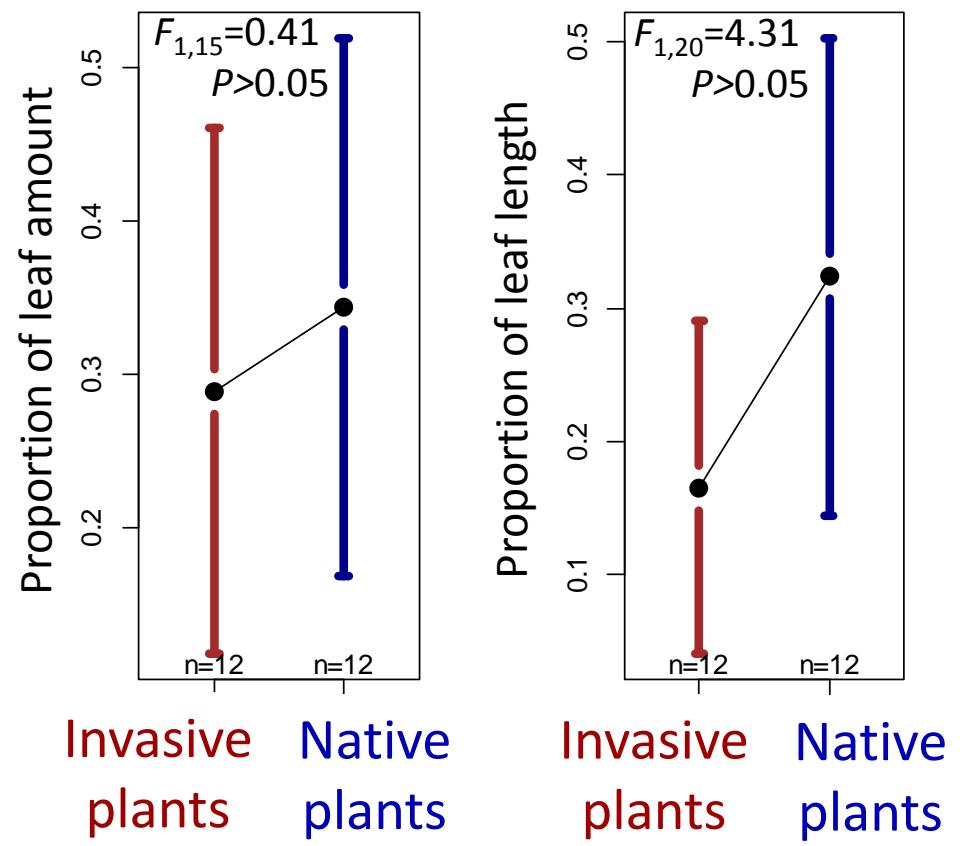


Results: Experiments with leaves

Leaf consumption



Proportion of leaves consumed



Both leaf consumption and proportion of leaves consumed by grasshoppers did not differ significantly between plants.

Conclusions

Main hypothesis: Invasive grasses will receive more leaf damage from native *Melanoplus* grasshoppers than native grasses. The hypothesis was supported in the experiments with intact plants but was not supported in the experiments with leaves.

- differences in grasshopper feeding under natural (intact plants) and artificial (leaves) conditions: needs to be further examined
- decreasing in resistance of plant leaves after they have been clipped

Main question: Do invasive grasses receive less leaf damage from generalist herbivores than native grasses?

No. Nymph grasshoppers of the *Melanoplus* genus did not show any feeding preferences towards native plants.

Significance to the field of study



Impact of generalist insects on invasive and native plants are still uncertain

Effective pest control strategies in order to preserve biodiversity in native communities.

The choice of grasshoppers: agricultural importance
(Hewitt & Onsager, 1983)

Convenient plant-insect model (may be used and extended in future studies)



Thank you!

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