

Patterns of Pollination and Seed Predation Limit Scotch Broom (*Cytisus scoparius* L.)

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Our Well-Known Nemesis

- *Cytisus scoparius* L.
- Noxious, invasive, toxic, etc.
- Self-incompatible
- Biocontrols introduced



Self-Incompatibility



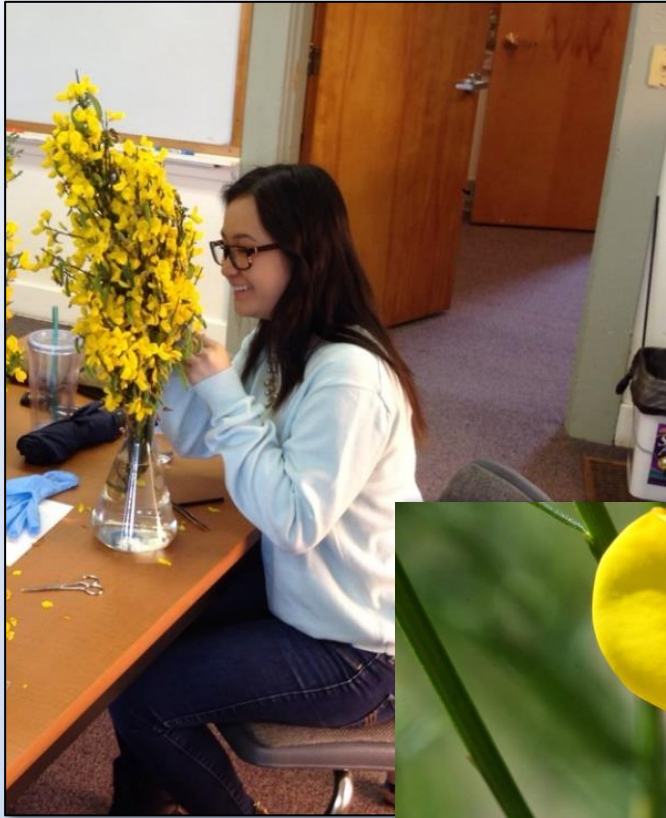
- Unusual in an invasive
- Goldenrod in Britain and Japan
- Kudzu may evolve selfing (Steven et al 2013)
- Invader in need of a pollinator

Pollinator limitation

- Scotch broom is pollinator limited (Parker 1997)
- But it seems to be doing just fine...
- Do urban structures limit pollination in broom?



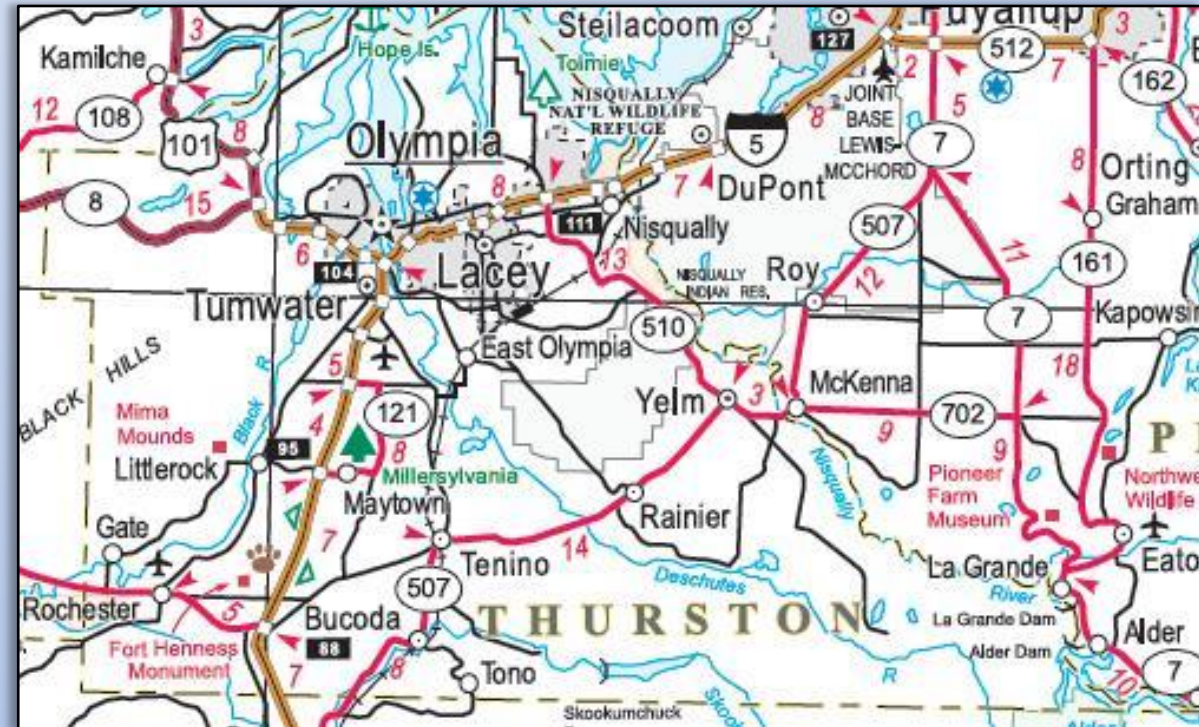
Pollinator selection on Floral Traits in Scotch broom



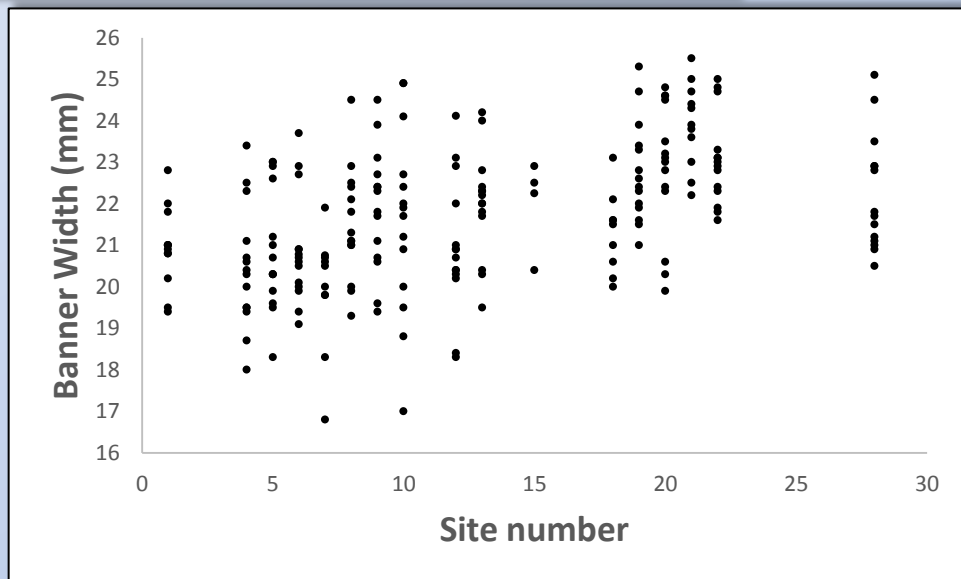
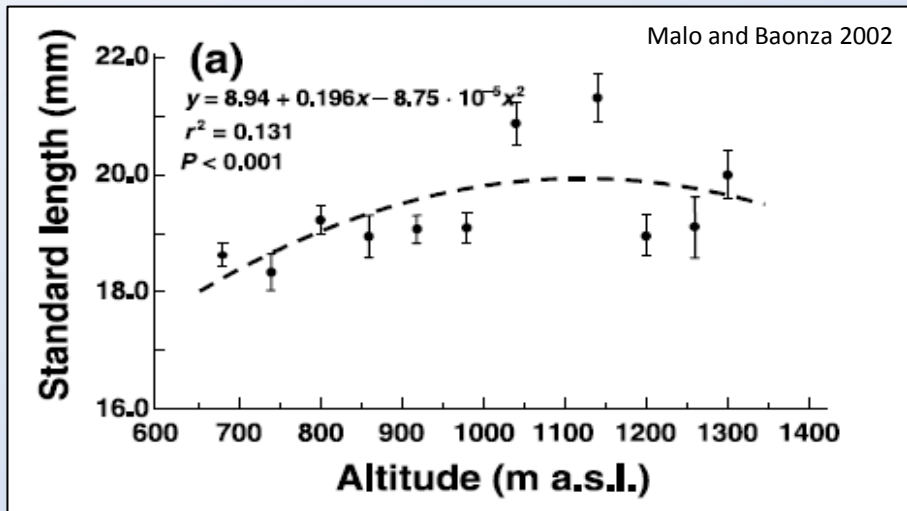
- If pollinators are limiting broom, their choice should exert selective pressure
- We may see pollinator choice
- Footprint of evolution past

Selection along a gradient

- Urban patches may be distinct samples
- Gradient along Martin Way
- Will bees prefer certain plants?
- Will flowers be different sizes?



Flower size varies, but without a pattern

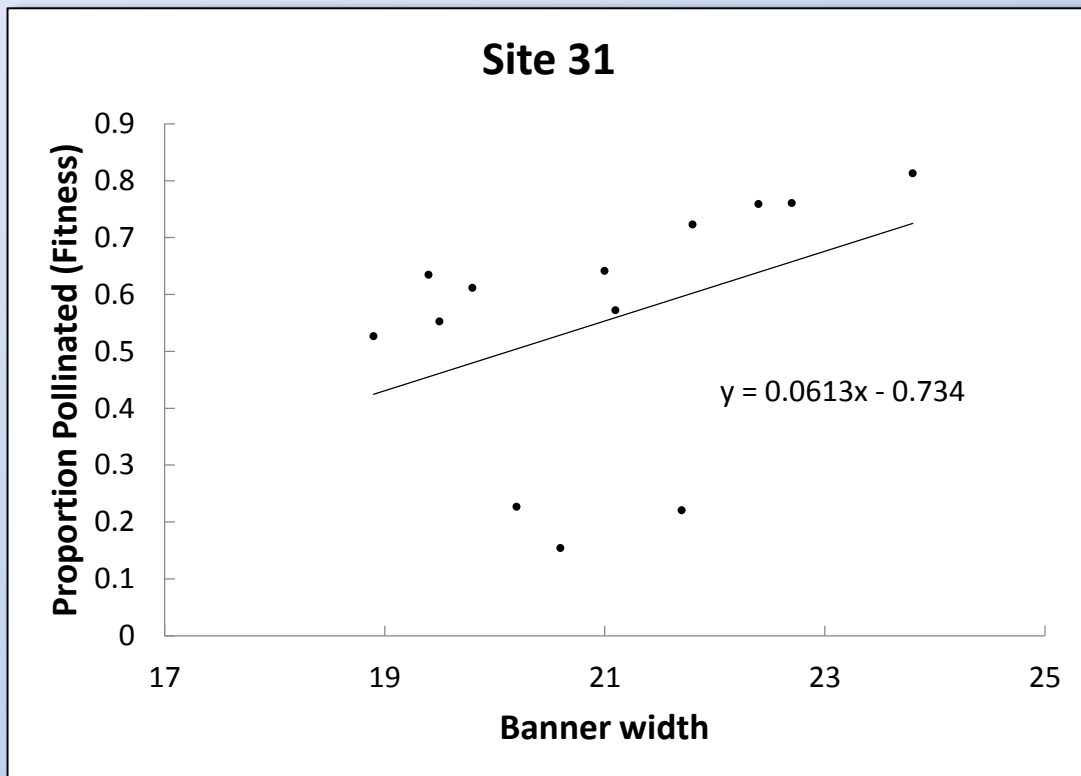


- If selection is present, it has not led to local adaptations
- Gene flow may homogenize the population
- Variation is higher within sites than in Malo and Baonza's entire study!

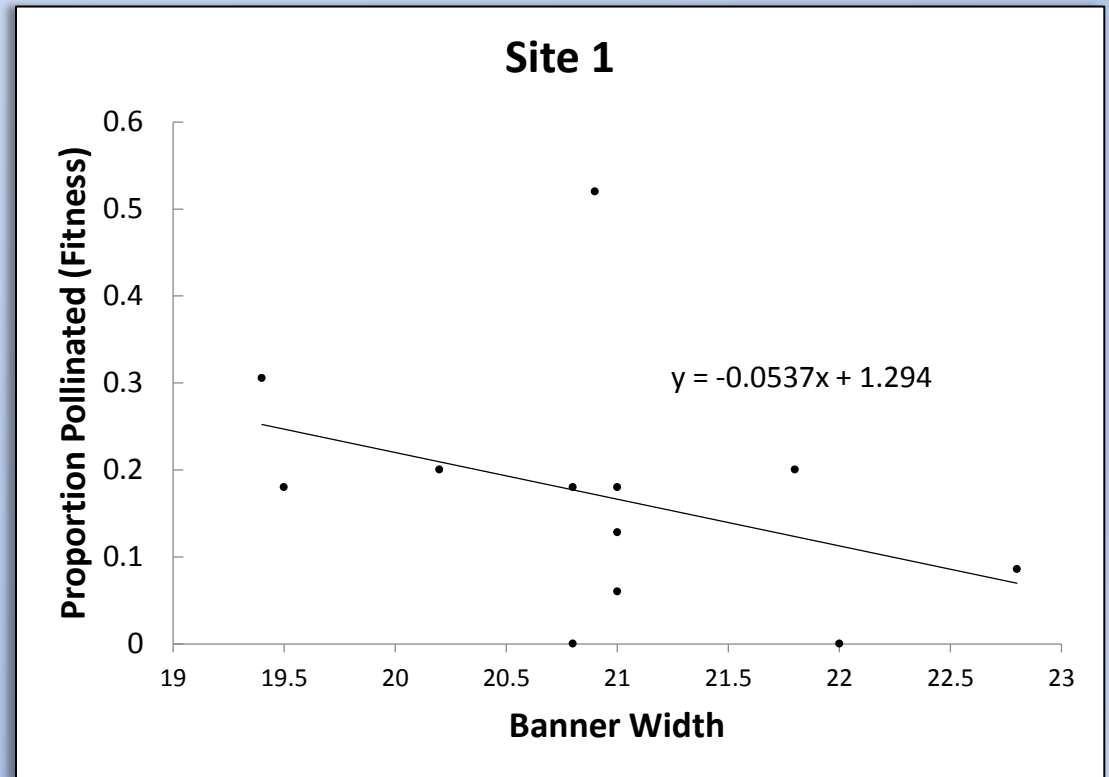
Selection on flowers differs between urban and rural populations

Slope of the line as a selection gradient: pollination as a proxy for fitness

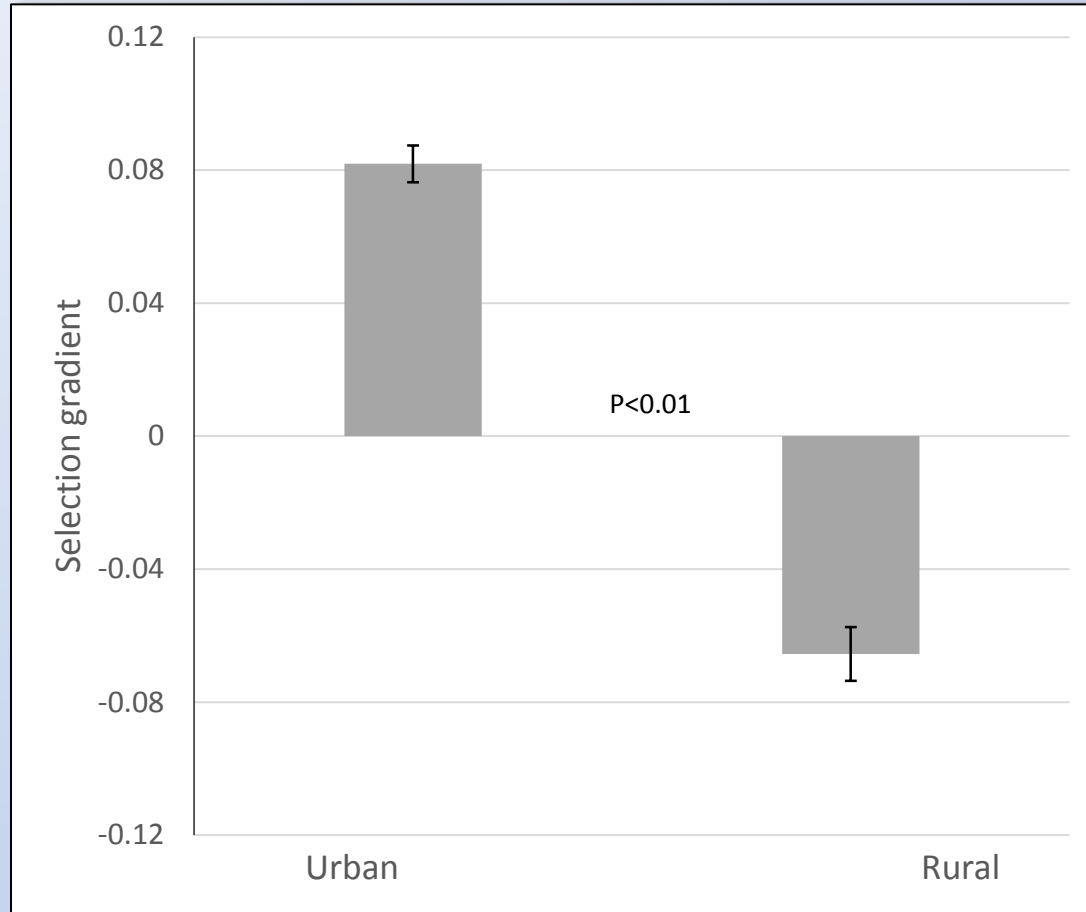
Urban



Rural



Selection differs between Urban and Rural Sites



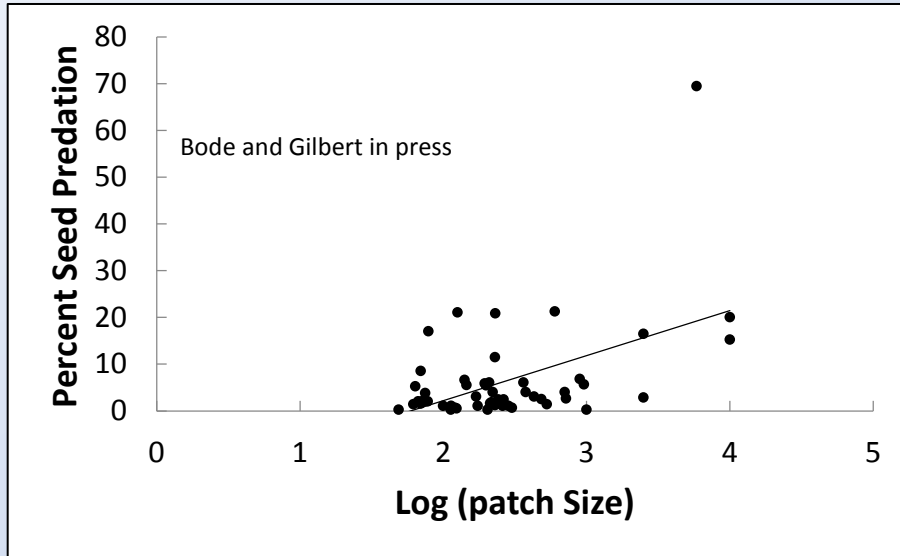
- Plants with large flowers are pollinated more in the city
- Reverse is true in rural areas
- Why?

Biocontrols are ineffective in Scotch broom

- Between 70% and 99.9% of seeds must be eaten to reduce population (Parker 2000)
- In conjunction with bee die-off, seed predators can lead to broom extinctions (Paynter 2010)



Seed Predation in Urban Environments



- Seed predators are our best urban option for weed control
- Arthropods are limited by urban obstacles (Faeth and Kane 1978, Bode and Maciejewski 2014)



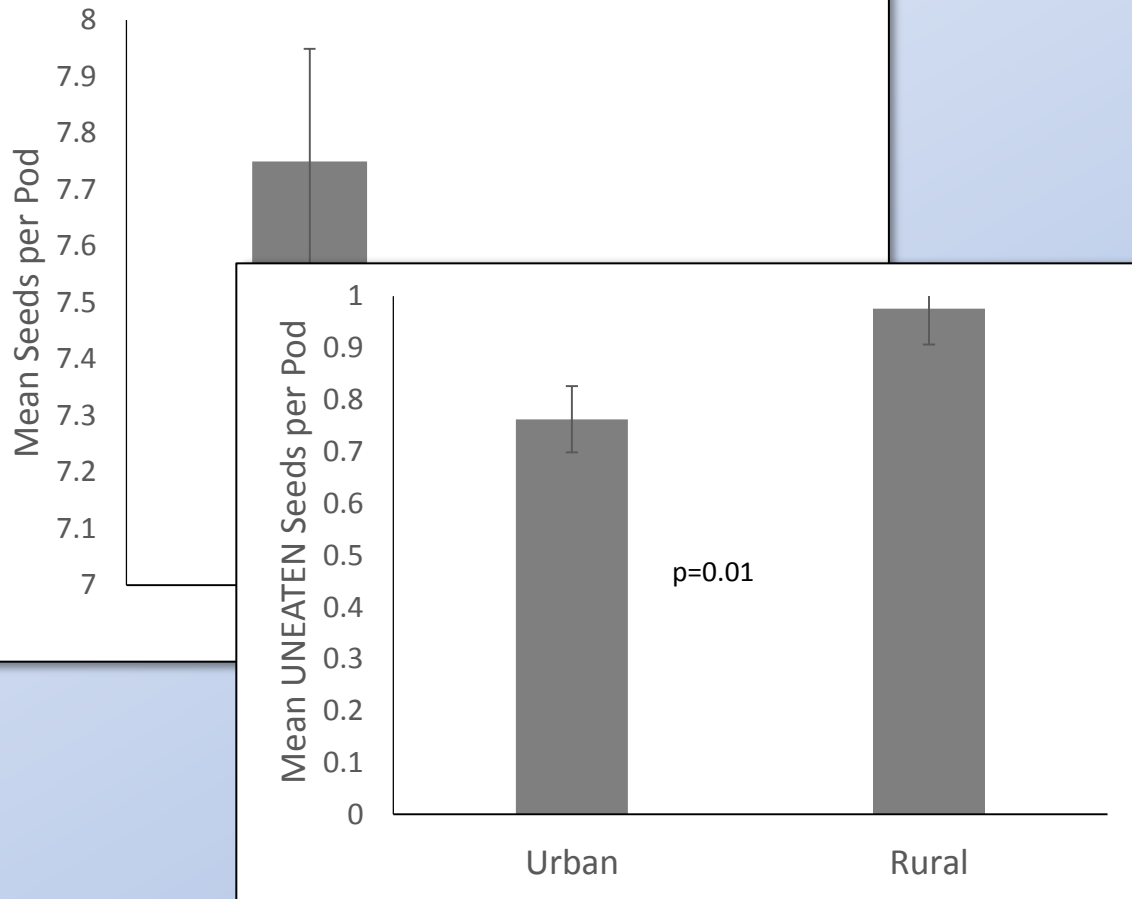
Urban vs. Rural Seed Predation

- How do beetle and weevil impacts on Scotch broom vary between urban and rural environments?
- $(15*2)*15*10$ = large sample!

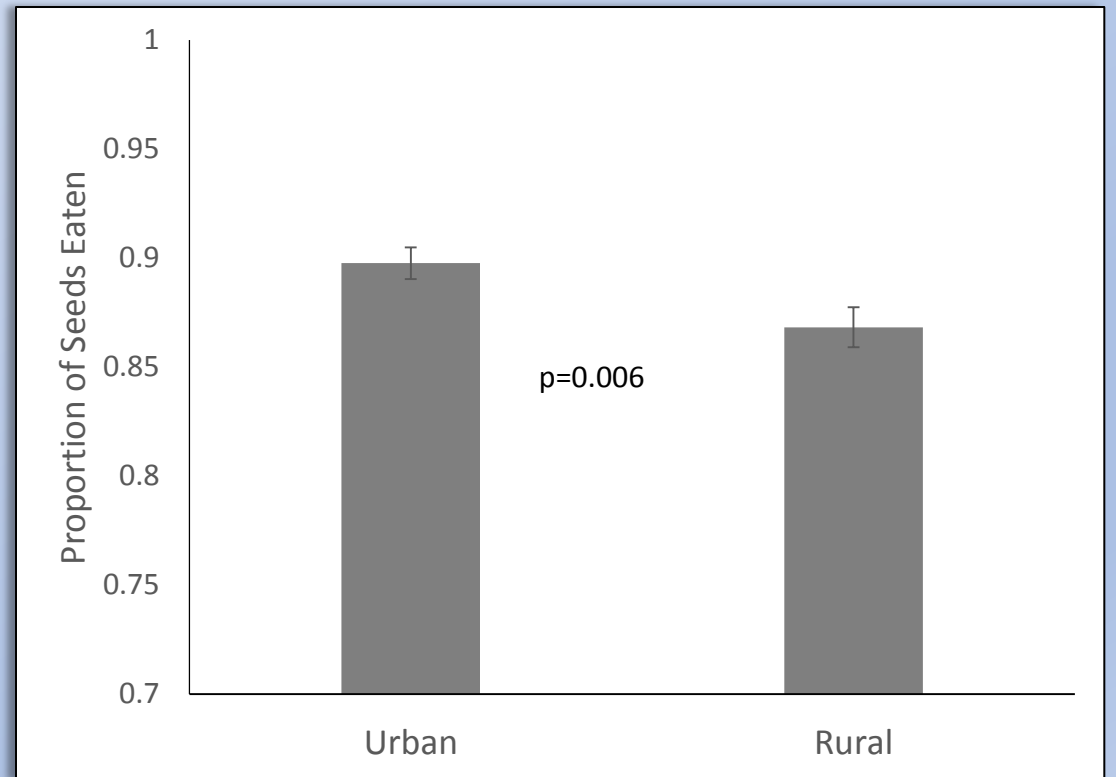


Fitness is Pollination plus Seed Survival

Rural Plants have Higher Fitness

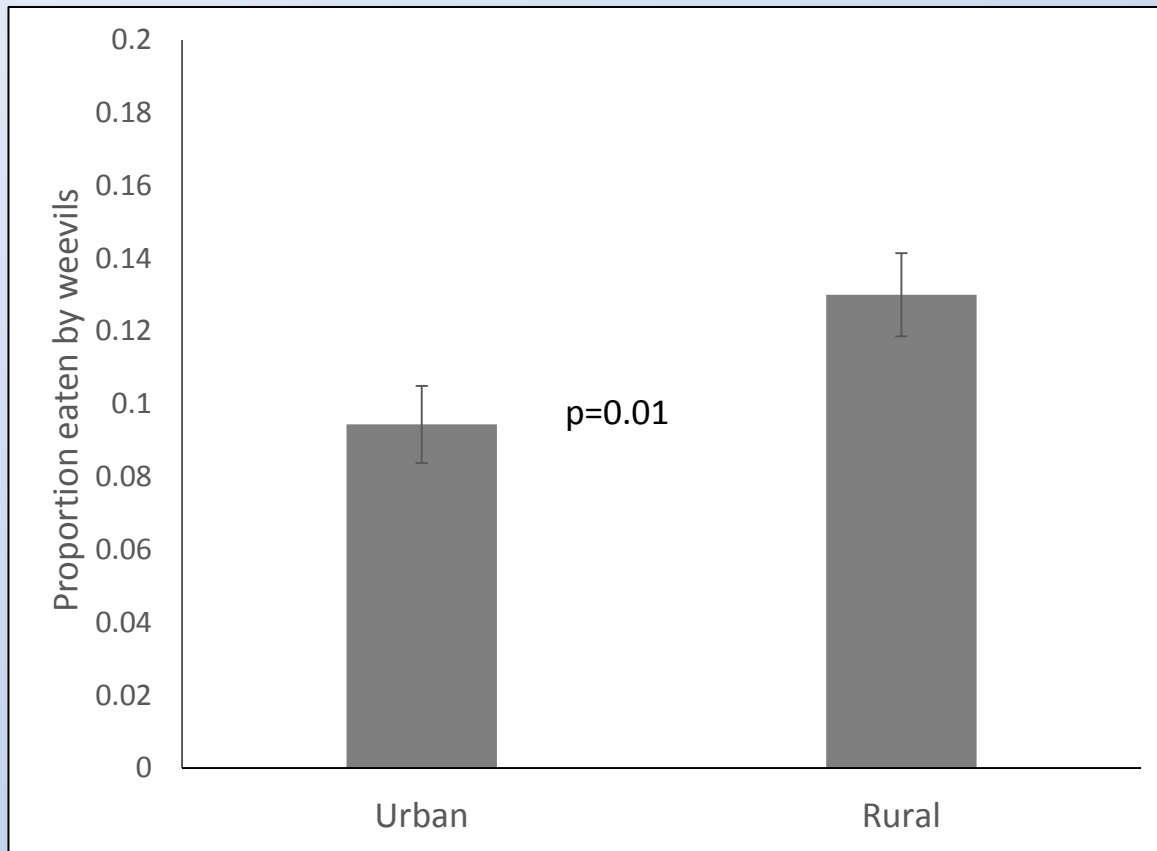


Rural Plants Suffer Less Seed Predation

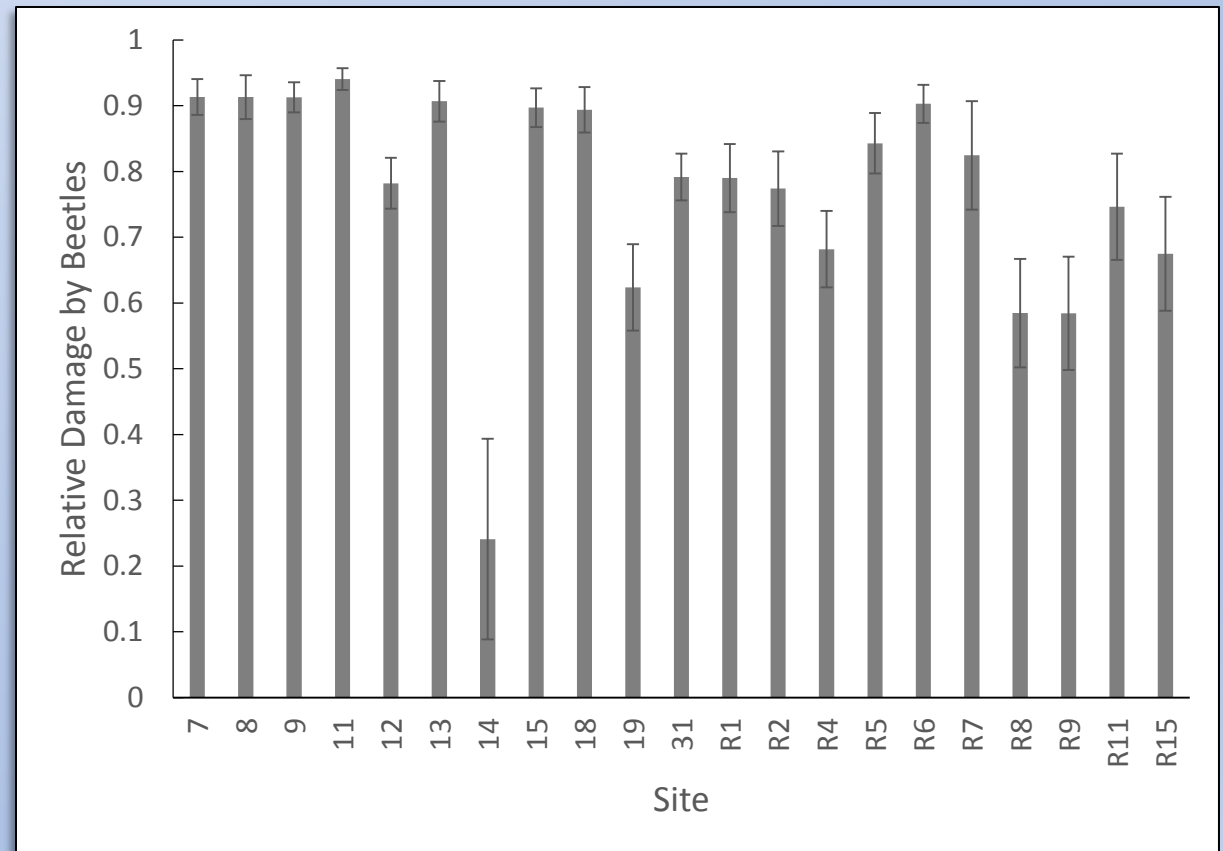


Seed Predators are Not Homogenously Spread

Weevils prefer the Countryside



There is Variability between Sites



What have we found?

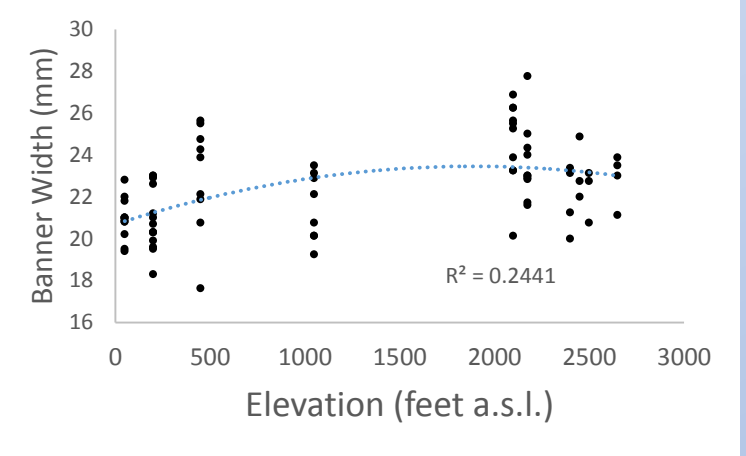
Pollinator selection on Scotch broom

- Big flowers in the city
- Gene flow may homogenize populations
- Balancing selection?

Biocontrol Impact on Scotch broom

- The beetles are doing a good job
- Weevils and beetles differ in distribution
- More control is needed in rural areas (Parker 2000)

Coming soon...

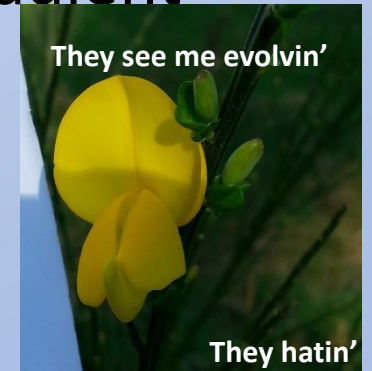


Germination experiments

- Does smoke influence broom germination? (Danner)
- Do local plants release allelochemicals? (Emily)

Elevation experiments

- There is a pattern of flower size along an elevation gradient
- What is causing this?
- Murdock Natural Sciences Grant Proposal



Many thanks

- Saint Martin's University (Funding, lab space, grounds)
- My undergraduate research assistants (Nathan and Rebecca)
- My minions (Danner and Emily)
- Many landowners who could care less what I did to their weeds
- Jenn Andreas, Eric Coombs
- You, the next time you pull out some broom!