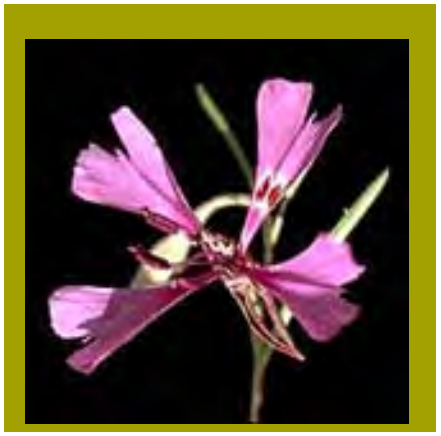
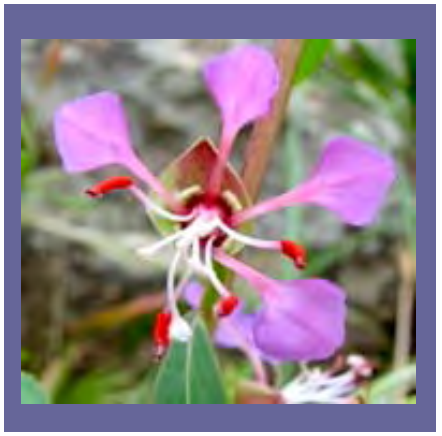
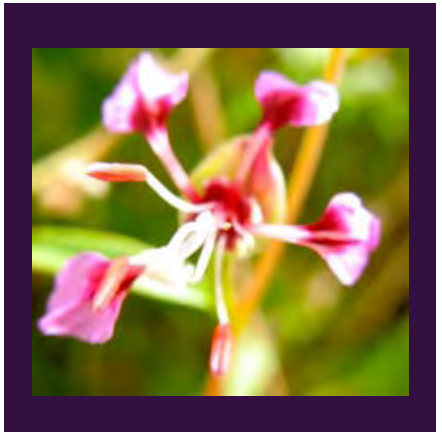
Mating System Evolution of *Clarkia:*

physiological traits correlated with plant biomass







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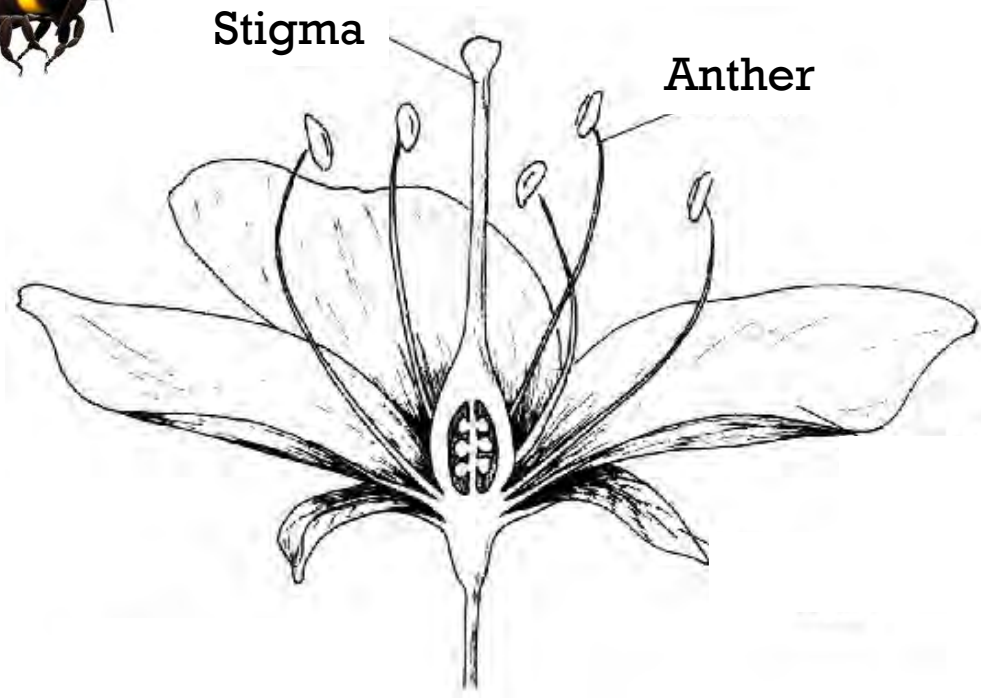
Floral Mating Systems

- Out-cross pollination (outcrossers)
  - Vector driven
  - Genetic variation
  - More chances to be able to adapt

- Self-fertilization (selfers)
  - Synchronicity
  - Smaller distance between anther & stigma
  - Ensures reproductivity
  - Reduced genetic diversity
  - Inbreeding depression



Hypothesis

- Reproductive Assurance Hypothesis
  - As pollinator population decreases or is absent, selection for high autogamy occurs

- Drought Avoidance Hypothesis
  - When there is low amounts of water available, selection for traits to avoid drought occurs

Behind the Research

- Evolution of Selfing
  - Driven by climate change
  - Occurrence of drought
  - Outcross phenotype resembling selfers will have higher fitness
- Future Predictions
  - Outcrosser population will evolve into selfer
  - Accumulate deleterious alleles
  - Lower genetic diversity
  - Extinction

Clarkia xantiana ssp *parviflora* (selfer)

Evolution of Selfing Through Drought Avoidance

- Drought Avoiders: plants that avoid drying-out
- Possible Strategy to avoid drying out:
  - Complete lifecycle when water is plentiful
    - Early flowering
    - Grow faster
    - Start reproducing at a smaller size (smaller above-ground biomass)
    - Greater carbon gain in shorter amount of time
    - Lower water use efficiency
  - Prevent water from escaping
    - Smaller leaves, overall above ground biomass, petals
    - Decrease water loss
    - Increase water use efficiency

Research Goals

- *Clarkia xantiana*
  - ssp *xantiana* (outcrosser)
- Main questions
  - Do outcrossers at dryer climates show drought avoidant phenotypes?
  - Are carbon gain and water loss negatively correlated with above-ground plant biomass?
- Plant physiology project
  - Physiological process
  - Estimate plant biomass

Methodology

- Study site
  - Lake Isabella
  - 42 miles from Bakersfield
  - Seasonal temperatures
  - 3000 ft above sea level
- Study population
  - Sawmill (in sympatry with selfing taxon)
  - plants from *Clarkia xantiana*

Physiological Traits

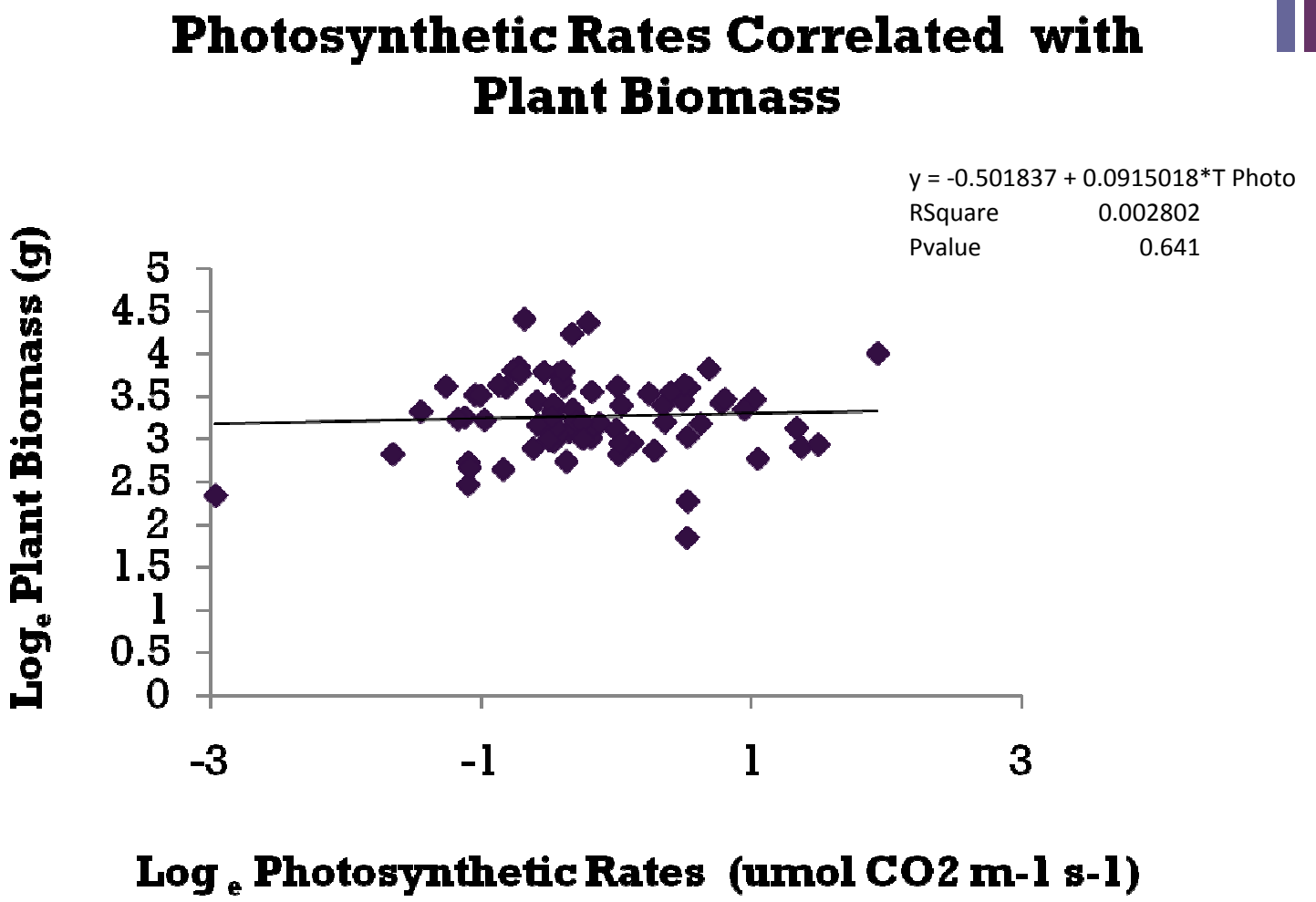
Photosynthesis (umol CO_2 m^{-2} s^{-1})	**Transpiration (mol H_2O $m^{-2}s^{-1}$)**	**Water Use Efficiency (umol CO_2/mol H_2O)**
Carbon gain	Water loss	Photosynthesis /transpiration
Selfing traits: Increased rates, decreased biomass	Selfing traits: Increased rates, decreased biomass	Selfing traits: decrease WUE, decrease plant biomass

Infrared gas analyzer

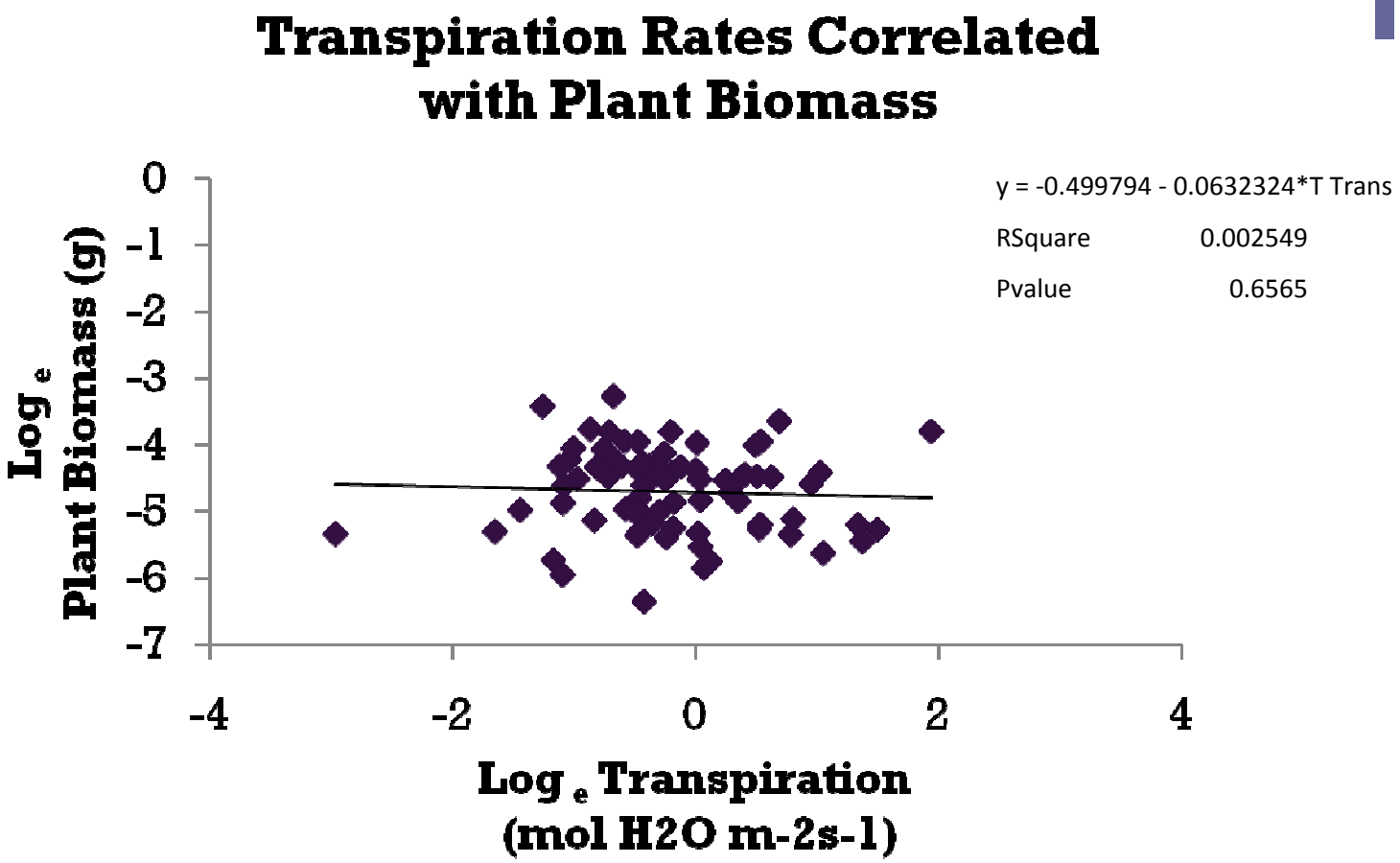
Methodology

- Leaf areas
  - Outline leaves and scan image to computer
  - Measure leaf area
  - Accounts for surface area available for gas exchange
- Plant Biomass
  - Separate above/below ground plant structures
  - Weigh above stem

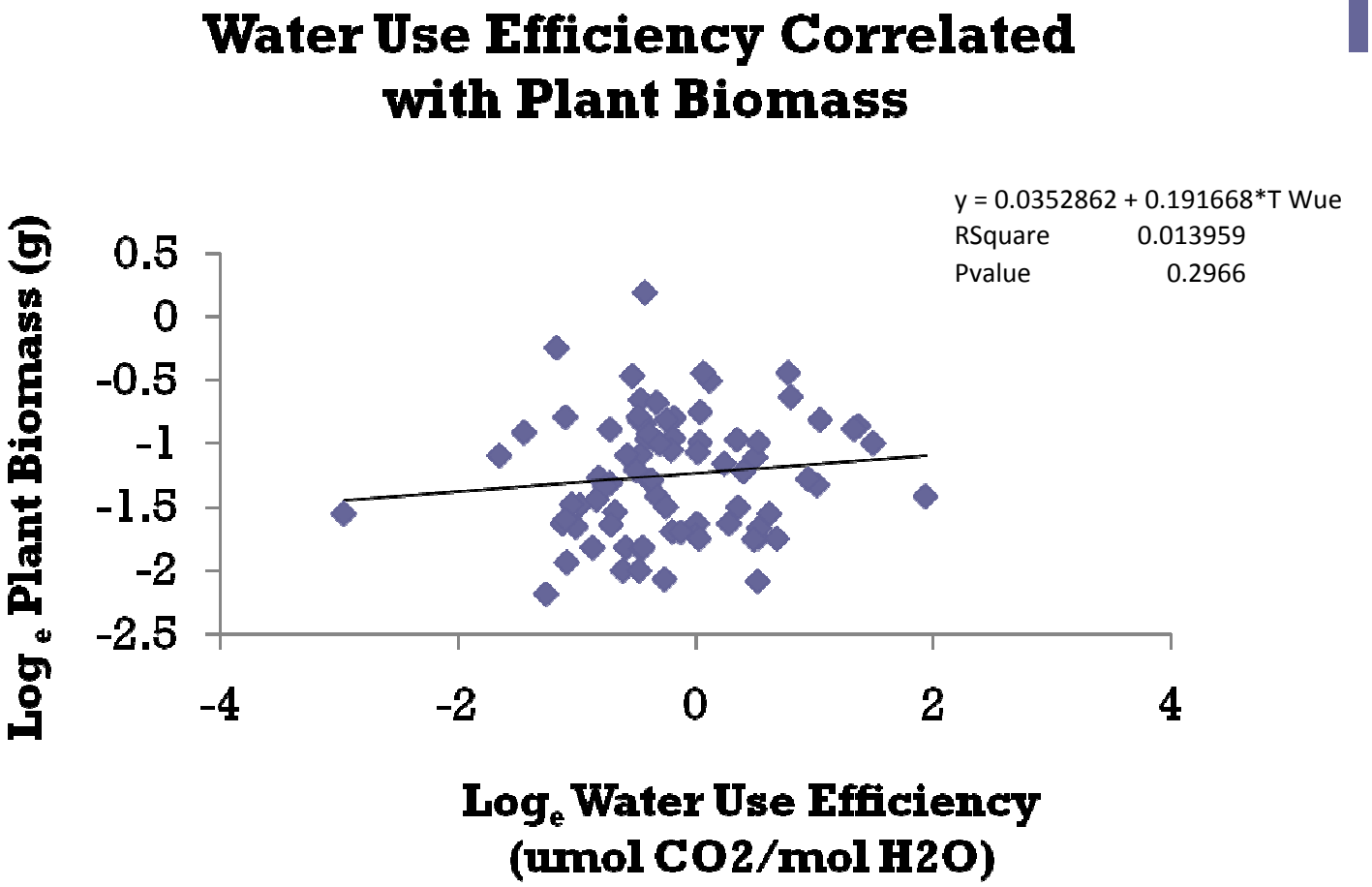
Results


Photosynthetic Rates Correlated with Plant Biomass
y = -0.501837 + 0.0915018*T Photo
RSquare 0.002802
Pvalue 0.641
Log e Plant Biomass (g)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-3
-1
1
3
Log e Photosynthetic Rates (umol CO2 m-1 s-1)

Results


Transpiration Rates Correlated with Plant Biomass
y = -0.499794 - 0.0632324*T Trans
RSquare 0.002549
Pvalue 0.6565
Log e Plant Biomass (g)
0
-1
-2
-3
-4
-5
-6
-7
-4
-2
0
2
4
Log e Transpiration (mol H2O m-2s-1)

Results


Water Use Efficiency Correlated with Plant Biomass
y = 0.0352862 + 0.191668*T Wue
RSquare 0.013959
Pvalue 0.2966
Log e Plant Biomass (g)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-4
-2
0
2
4
Log e Water Use Efficiency (umol CO2/mol H2O)

Discussion

- Physiology does not correlate with above-ground plant biomass
  - Current change in the environment is at a slow rate
  - Or does not exist
  - Location is cooler

- Future Research
  - More data from different outcross populations
  - Measures different examples plant fitness

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