Mating System Evolution:
Correlations between Seed Set and Physiological rates

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Mating System

- Outcrossing
  - Vector needed
  - Great genetic diversity
  - Ability to adapt

- Self-fertilization
  - No vector needed
  - Low genetic diversity
  - Inability to adapt
  - Extinction
Hypotheses

Selfing evolved from outcrossing species
  • Reproductive assurance hypothesis
  • Drought avoidance hypothesis

Why does Selfing persist?
  • Counterintuitive
  • Long-term problems

Question:
Is fitness correlated with drought avoidant traits?
When Selfers Evolve

If trends exist then selfers will have evolved from outcrossers on the high fitness spectrum.
## Drought Avoidance

<table>
<thead>
<tr>
<th>Photosynthesis</th>
<th>Transpiration</th>
<th>Water Use Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Gain</td>
<td>Water Loss</td>
<td>Carbon Gain / Water Loss</td>
</tr>
<tr>
<td>Higher rates Positively correlated with fitness</td>
<td>Higher Rates Positively correlated with fitness</td>
<td>?</td>
</tr>
</tbody>
</table>
Seed Set

Definition: A measure of plant fitness. Corresponds to the actual number of mature seeds compared to seed potential.

How you measure:

Percentage: \[	ext{_____Mature seeds} \]

Mature seeds + aborted ovules
Study Site: Sawmill

- *Clarkia xantiana* ssp *xantiana*
- Sympatric with selfing sister taxon: *xantiana* ssp *parviflora*
- Seasonal Temperatures
- Extreme edge of habitat
- Hot and dry region
Project Goals

• Correlating physiological rates with fitness
• Looking for general patterns in outcrossing species

What will be done in lab:
• Measure Seed set in plants collected in field
• Correct physiological data taken in the field using leaf area
• Correlate physiological rates to seed set
Experimental Methods: Physiological rates

- An infrared gas exchange analyzer was used to measure:
  - Photosynthesis
  - Transpiration
  - Measures the CO₂ taken in and H₂O given off

- Collected measured leaves
  - Measure area of leaves analyzed in IRGA

Infrared gas analyzer
Experiment Methods: Seed set

- In the Field:
  - Glued fruits shut with silicon
  - Collected plants after all fruits matured

- In the Lab:
  - Separate fruits from stem
  - Open fruits
  - Separate mature seeds from aborted ovules
  - Count mature seed and aborted ovules

![Images of mature seeds, aborted ovules, and underdeveloped ovules.]
Results: Photosynthesis

Photosynthetic Rate (umol CO₂ m⁻² s⁻¹)

Seed Set

y = 0.82 - 0.0016x

R² = 0.03

P = 0.3
Results: Transpiration

\[ y = 0.67 - 0.02x \]

\[ R^2 = 0.018 \]

\[ P = 0.42 \]
Results: Water Use Efficiency

\[ y = 0.77 + 0.0006x \]

\[ R^2 = 0.000008 \]

\[ P = 0.98 \]
What patterns are present between outcrossing species?
- There is no correlation between seed set and physiology
  - Only one population of a data
  - Preflowering vs. Flowering

The Next Step:
- Analyze more data from different populations and species
- Account for flowering stage
- Take out other effects, such as biomass.
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