

Pollen limitation and the evolution of selfing in *Clarkia unguiculata*



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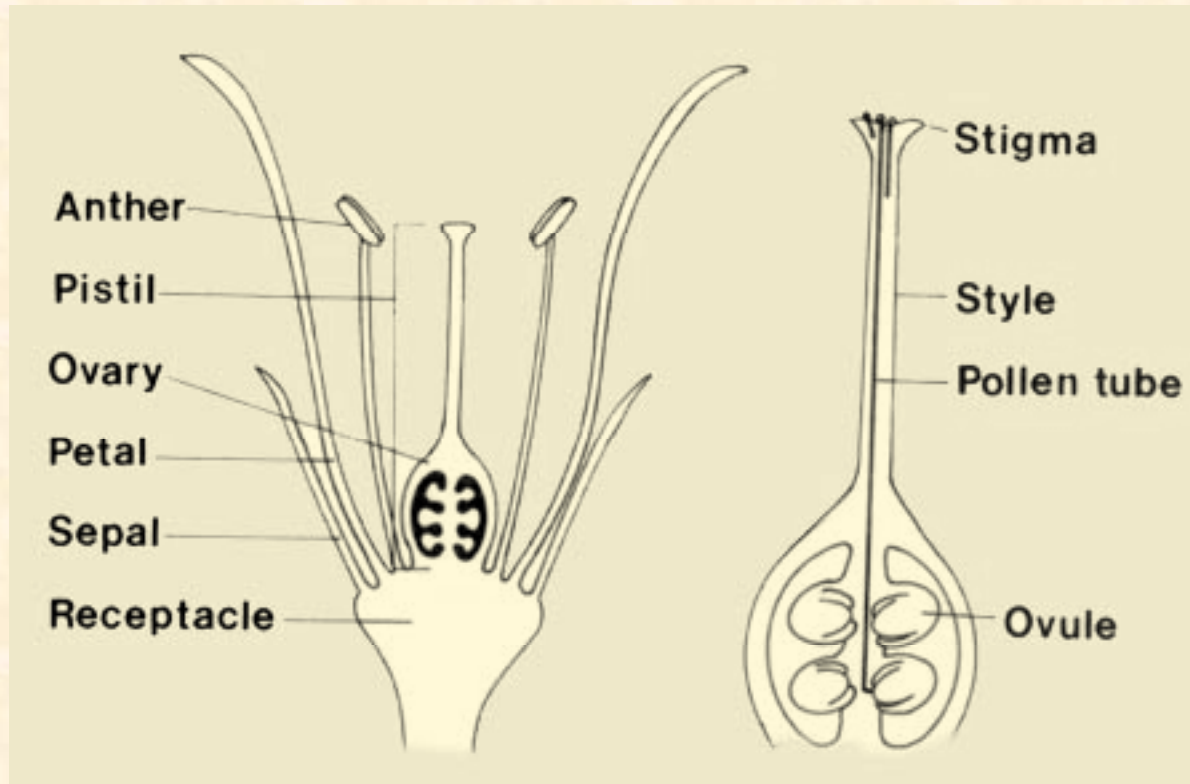
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National Science Foundation

Farewell to Spring

Reproductive structures



Wildflowers from the genus *Clarkia* are good models for studying the evolution of alternative mating strategies

Outcrossers vs. Selfers



Clarkia unguiculata

- Outcrosser
- Flowers later
- Larger petals
- Longer lifespan



Clarkia exilis

- Selfer
- Flowers early
- Small petals
- Shorter lifespan



Costs and benefits

- Possible costs include poor fitness and vitality in inbred offspring and reduced genetic variability
- Selfing allows plants to reproduce in the absence of pollinators



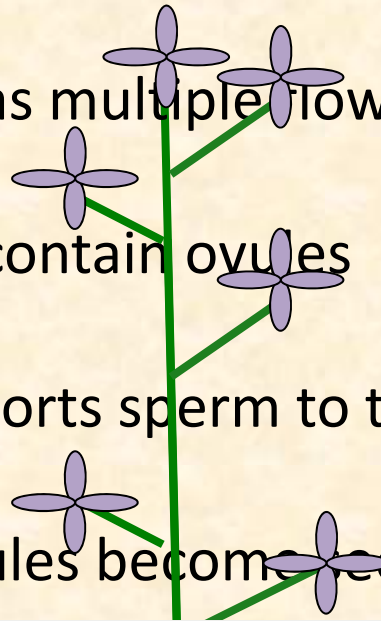
Objectives

- Compare seed production among the fruits of individuals to determine if pollen limitation occurs
- Examine pollen limitation with regard to time of flowering (early in the season vs. late)
- Make inferences about the evolution of selfing



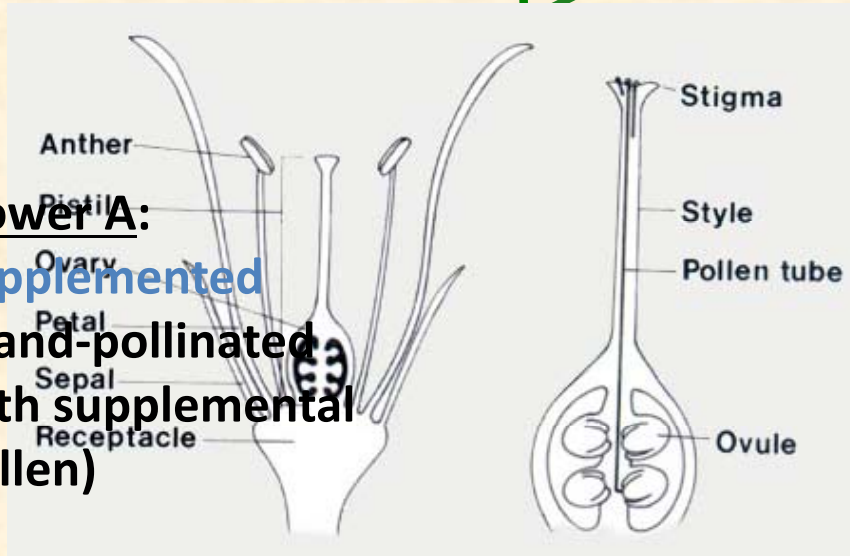
Field Methods

- 200 plants has multiple flowers
- 100 early
- 100 late



- The flowers contain ovules
- Pollen transports sperm to the ovules
- Fertilized ovules become seeds

Flower A:
Supplemented
 (Hand-pollinated with supplemental pollen)



Flower B:
Natural
 (Pollinated by naturally occurring sources)



Live Oak

Stark Creek

Mill Creek

3498 ft
35°28'08.76" N 118°44'15.16" W

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image U.S. Geological Survey

Apr 2008

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Eye alt 12780 ft

Laboratory Methods



Compare seed production between the hand pollinated and naturally pollinated flowers

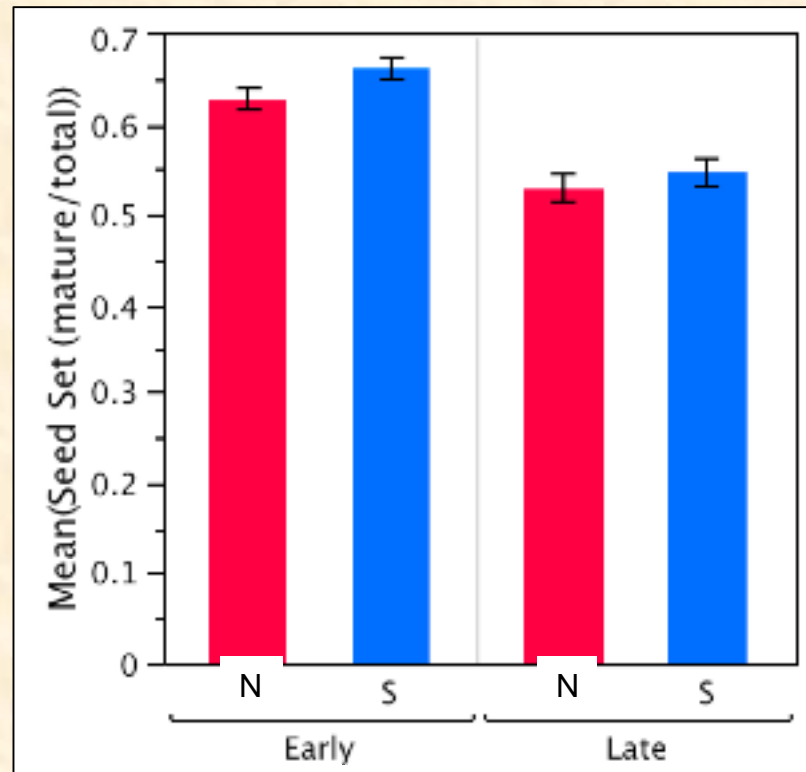
$\text{seed set} = \text{developed seeds} / \text{original number of ovules}$

Detect significant differences among groups using ANOVA

Results

Seed set yielded by supplemented fruits significantly higher than naturally pollinated fruits in the early season.

$p=0.0479$

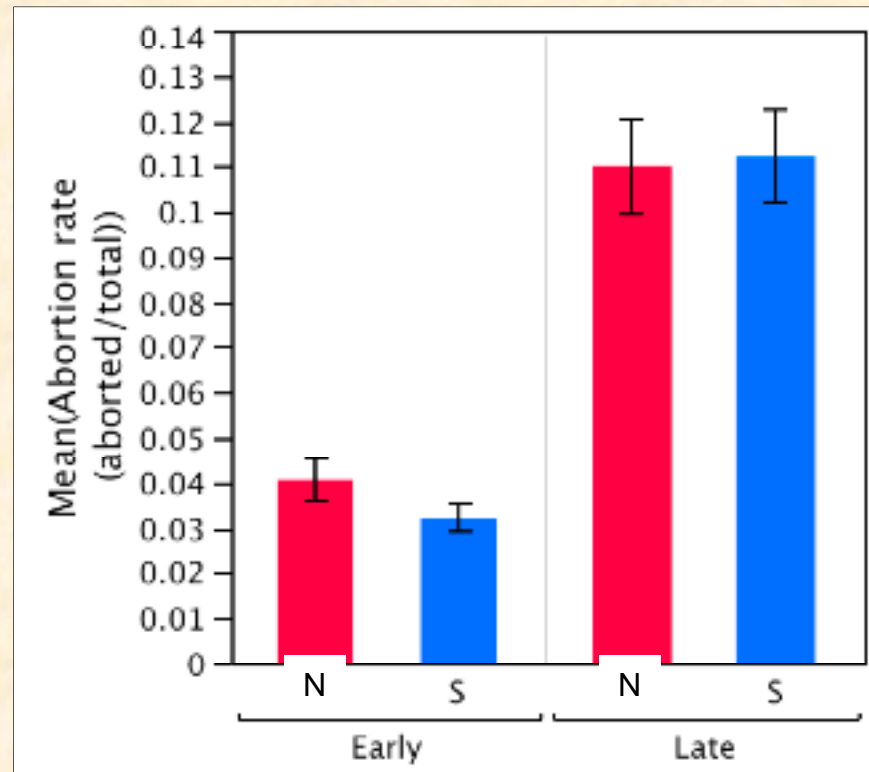


Pollen limitation does occur

Results

Abortion rates are significantly higher in the late season than the early season

$p < 0.0001$



A higher ratio of seeds are aborted in the late season

Conclusion

- Selfing is likely to have been a major influence on the evolution of plant reproductive pathways
- High abortion rates in the late season are likely to have nullified the advantages of self-fertilization in the early season
- We detected pollen limitation in *Clarkia unguiculata*

Acknowledgements

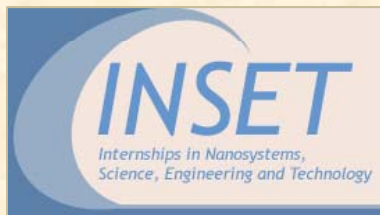


Alisa Hove, Mentor

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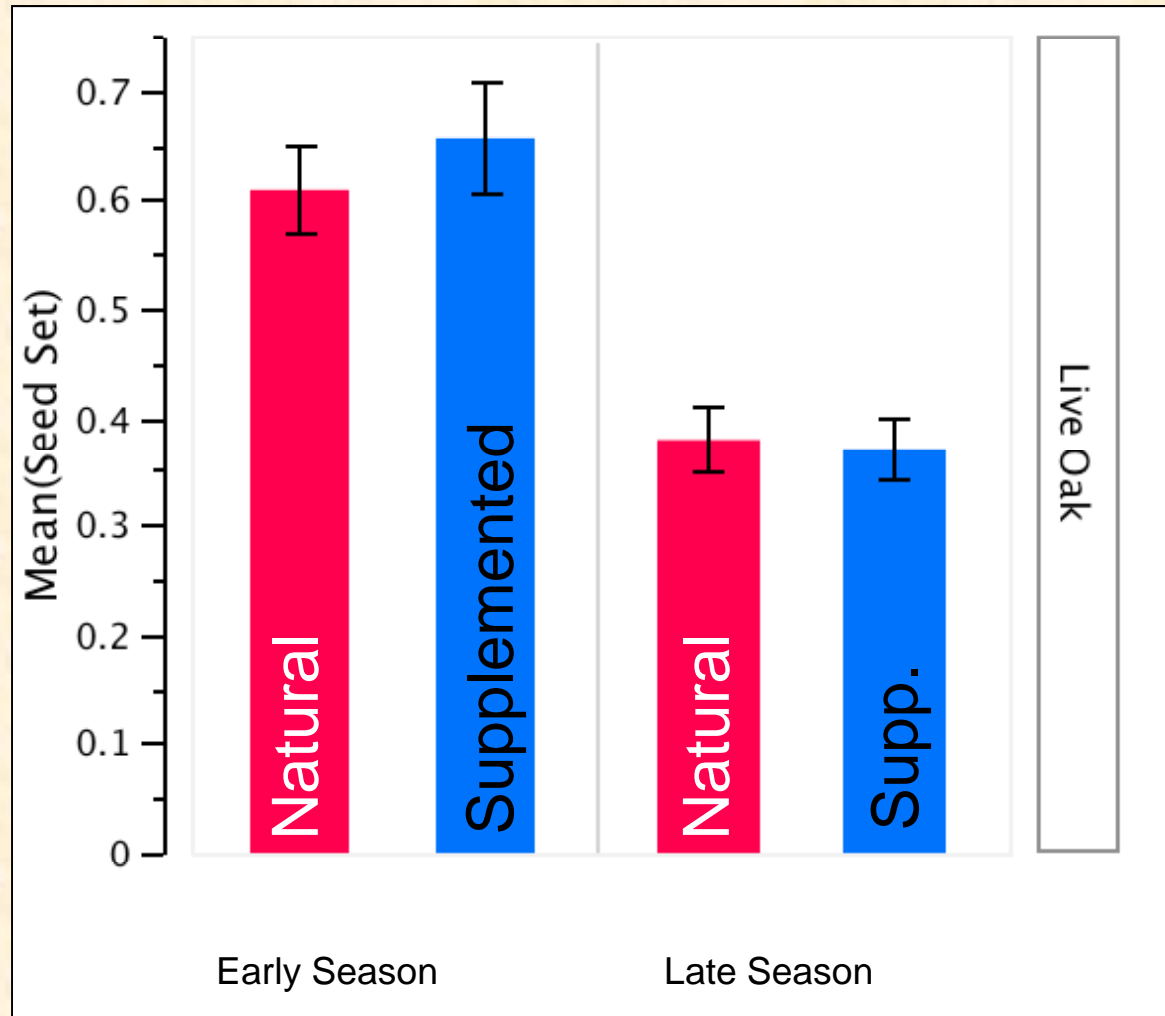
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ANOVA

- Analysis of variance, detects the significant differences between two or more groups
- Analysis performed on JMP for this data set
- p-value is the probability that the difference between groups is due to random chance

Additional notes



Findings consistent throughout the three sites, the data was shown to have not been affected by geographic distribution

The effect of abortion rates

- An advantage exists when a plant can produce a higher ratio of seeds than ovules
- Resource limitations cause a plant to allocate its resources into producing a fixed number of seeds, different than the original number of fertilized ovules
- Therefore the amount of pollen deposited would not increase seed production
- No advantage would be gained by selfing

The effect of rates rates cont.

- The first attempts to detect pollen limitation were unsuccessful
- Previous data was collected during dryer seasons
- Abortion rates are likely to have masked the occurrence of pollen limitation
- This further supports the argument that selfing does not provide a benefit in the late season when it is hotter