Genetic correlation between flowering time and pollen to ovule ratio in *Clarkia*

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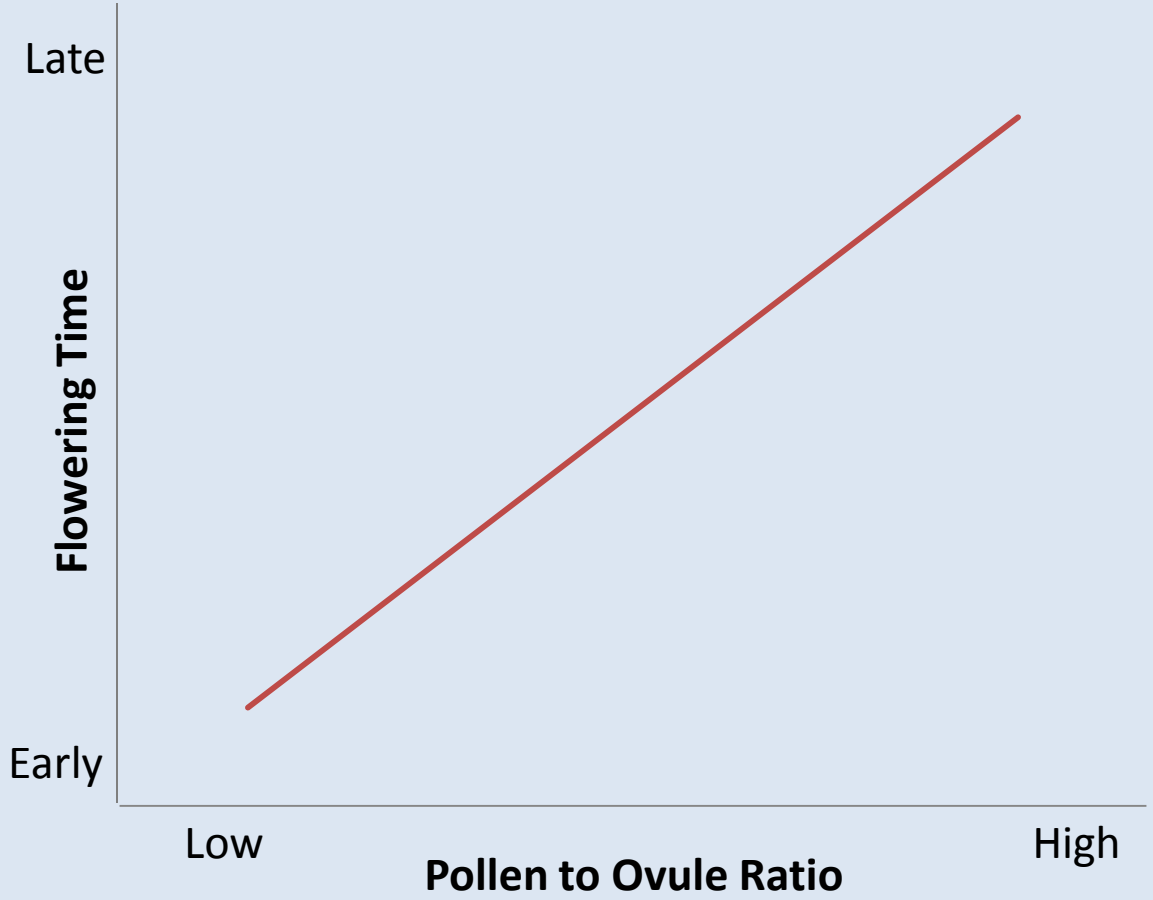
www.yosemitehikes.com/wildflowers/elegant-clarkia/elegant-clarkia.htm

Relationship between flowering time & pollen to ovule ratio



Studies have shown a positive correlation between flowering time and pollen to ovule ratio

Sexual Allocation

- Pollen to ovule ratio (**P:O**) is a measure of sexual allocation

- Sexual allocation is the amount of resources a plant puts into its male vs. female reproductive organs

- Sexual allocation has a direct effect on a plant's reproductive success

Flowering Time

Why does flowering time matter to us?

- Harvest time
- Tourism

Why does flowering time matter to plants?

- Pollinators
- Seasonal changes

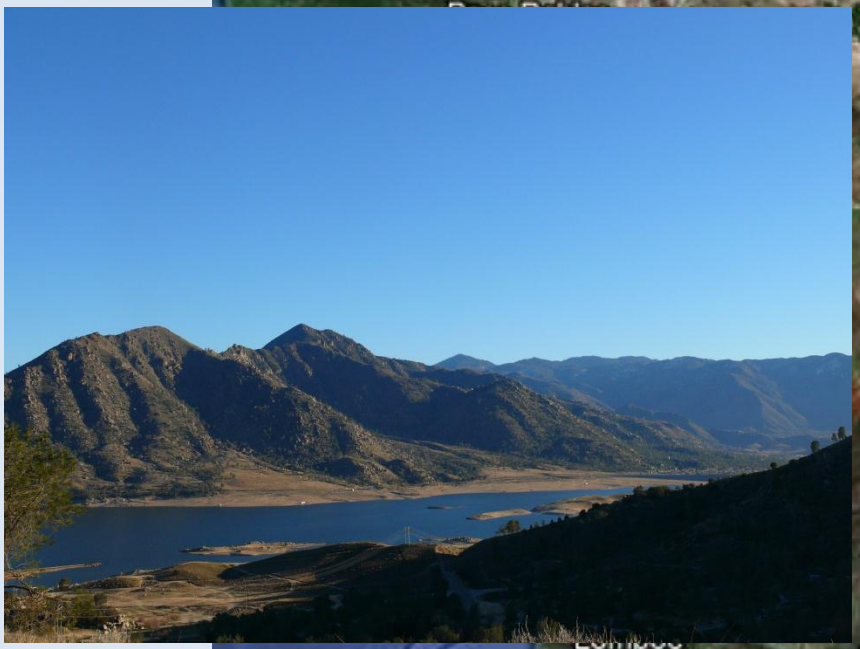
Genetic Correlation

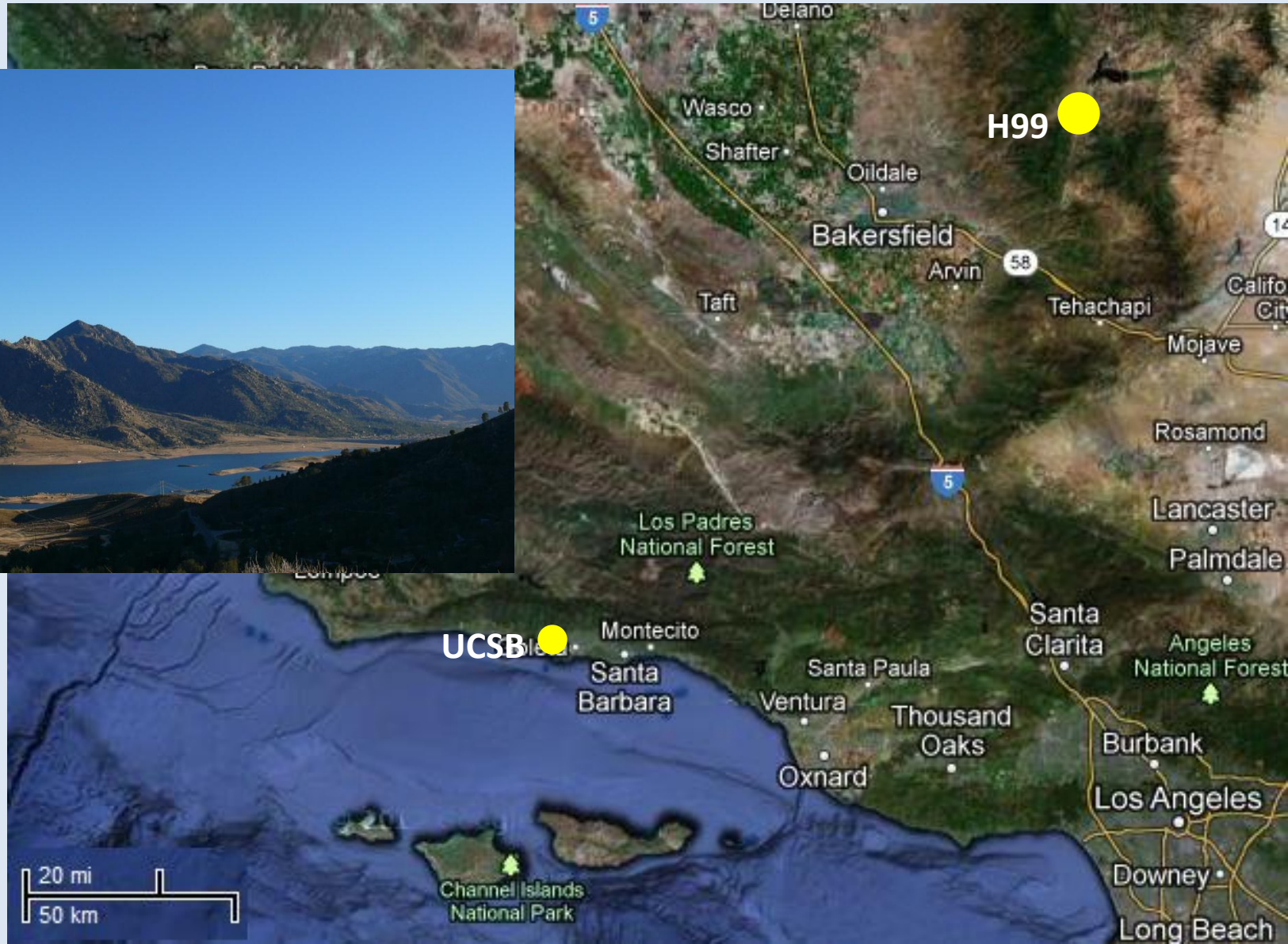
- What causes it?
  - Pleiotropic effect
  - Linkage
- What does it cause?
  - Traits will evolve together, not independently

We are testing to see if the observed positive correlation of flowering time and sexual allocation is a positive genetic correlation.

Clarkia xantiana ssp *xantiana*

Kern County & Lake Isabella Area

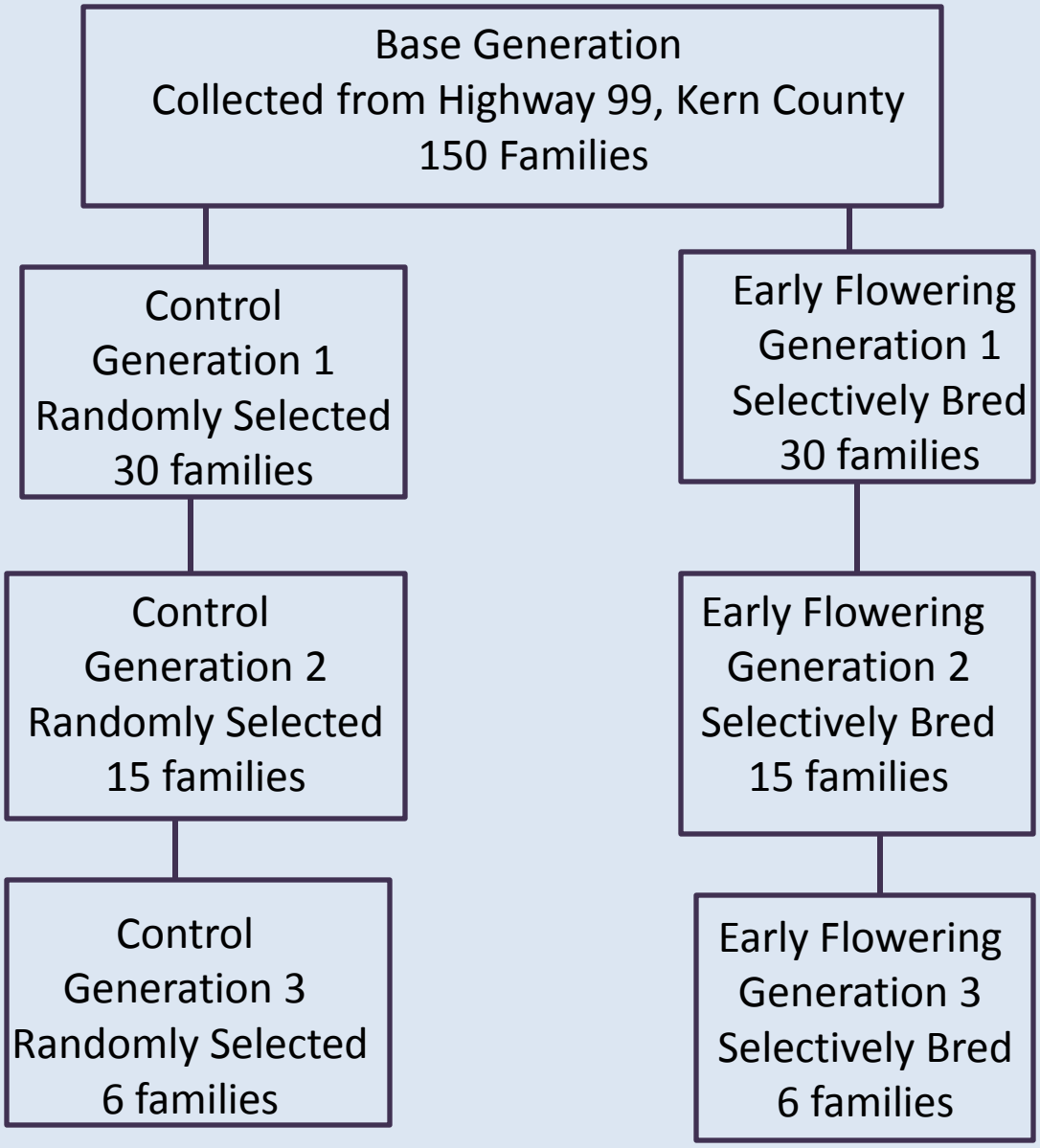




Greenhouse selection experiment

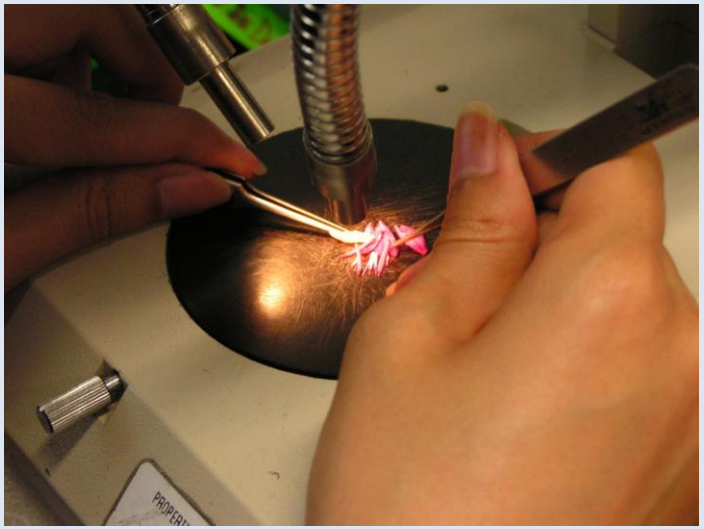
The focus is to compare the pollen to ovule ratio between early flowering plants and a control group

Clarkia Lines



Methods

Bud with ovary attached



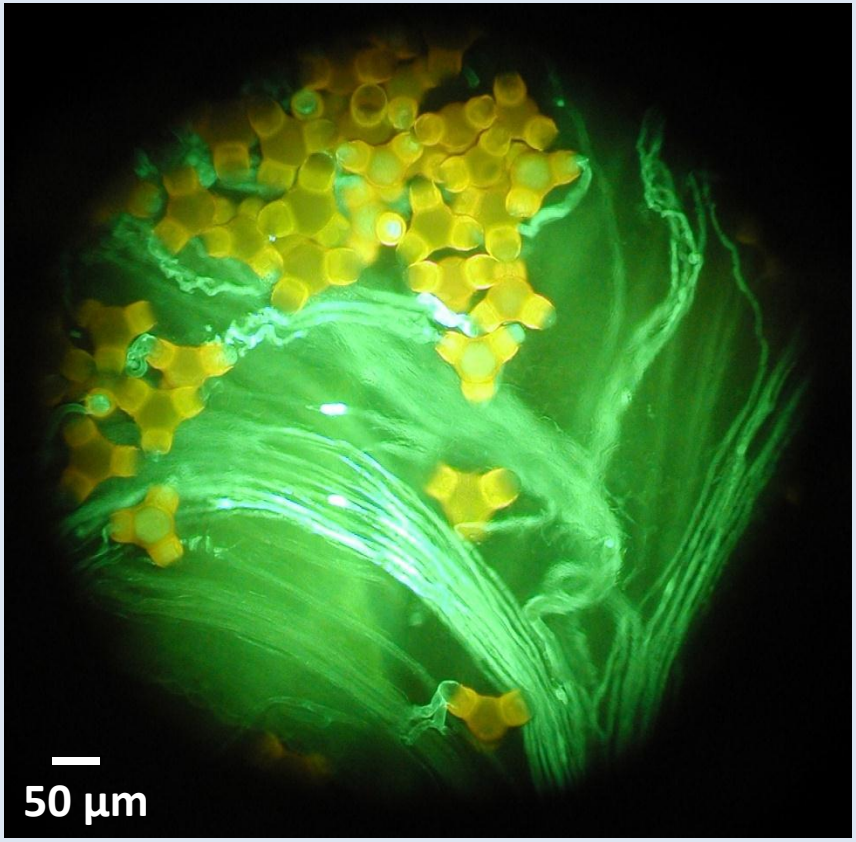
Clarkia with anthers

Ovule Counts

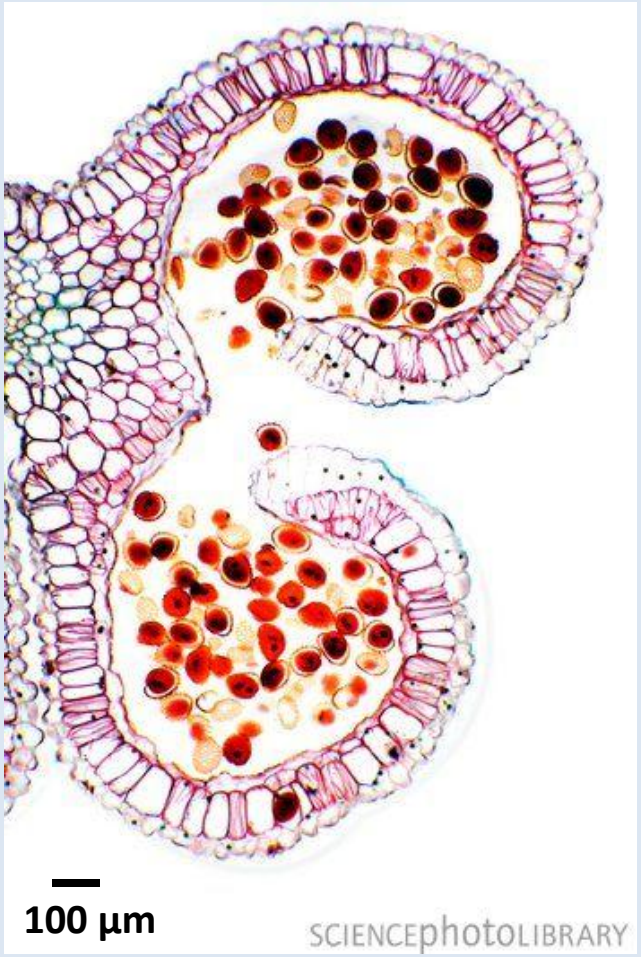
A dissected *Clarkia* ovary with ovules

Cross section of an ovary with locules

Pollen Counts



Clarkia pollen grains

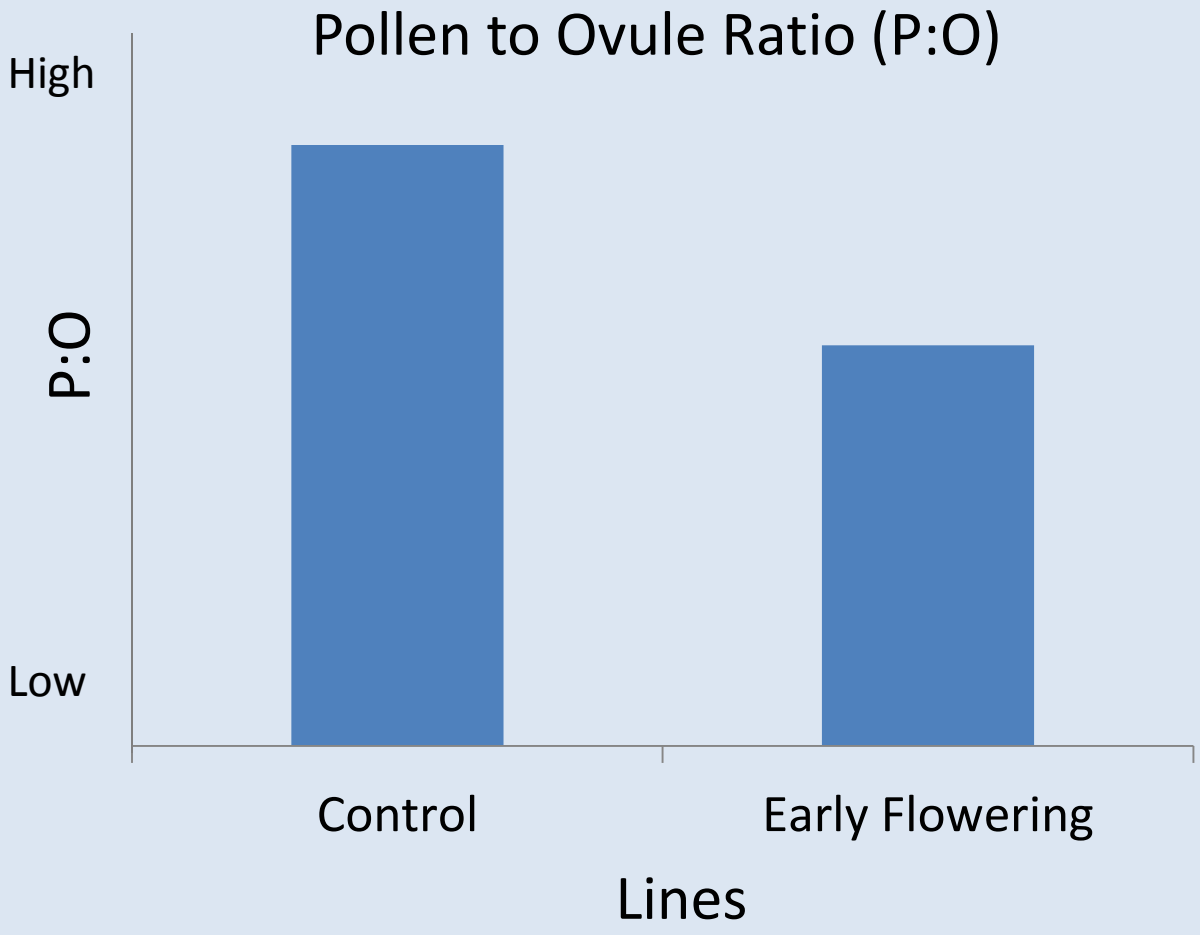


Cross section of an anther

Predictions

Prediction 1
Since early flowering plants flower notably sooner then the control group they will have a lower P:O

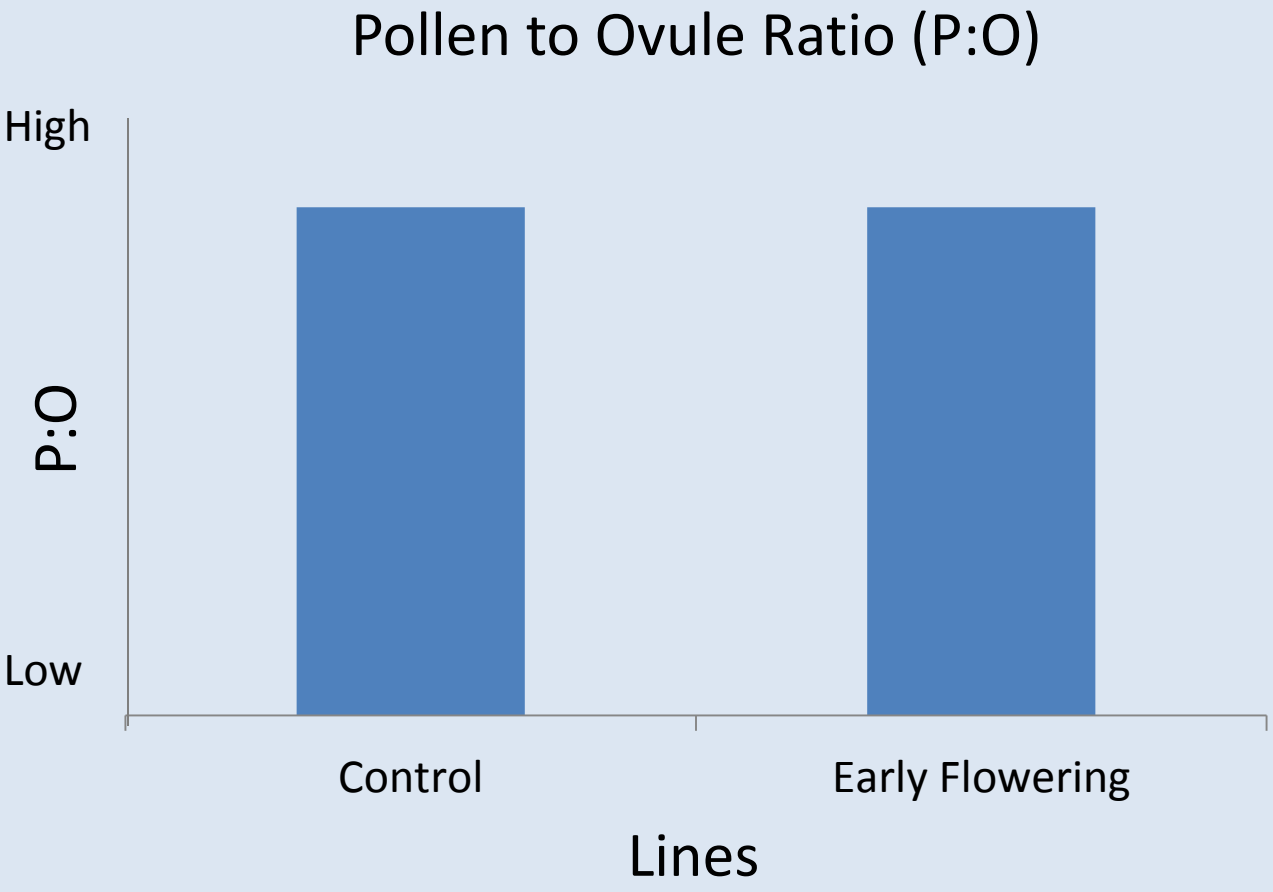
Implication
Traits are genetically correlated and evolve together.



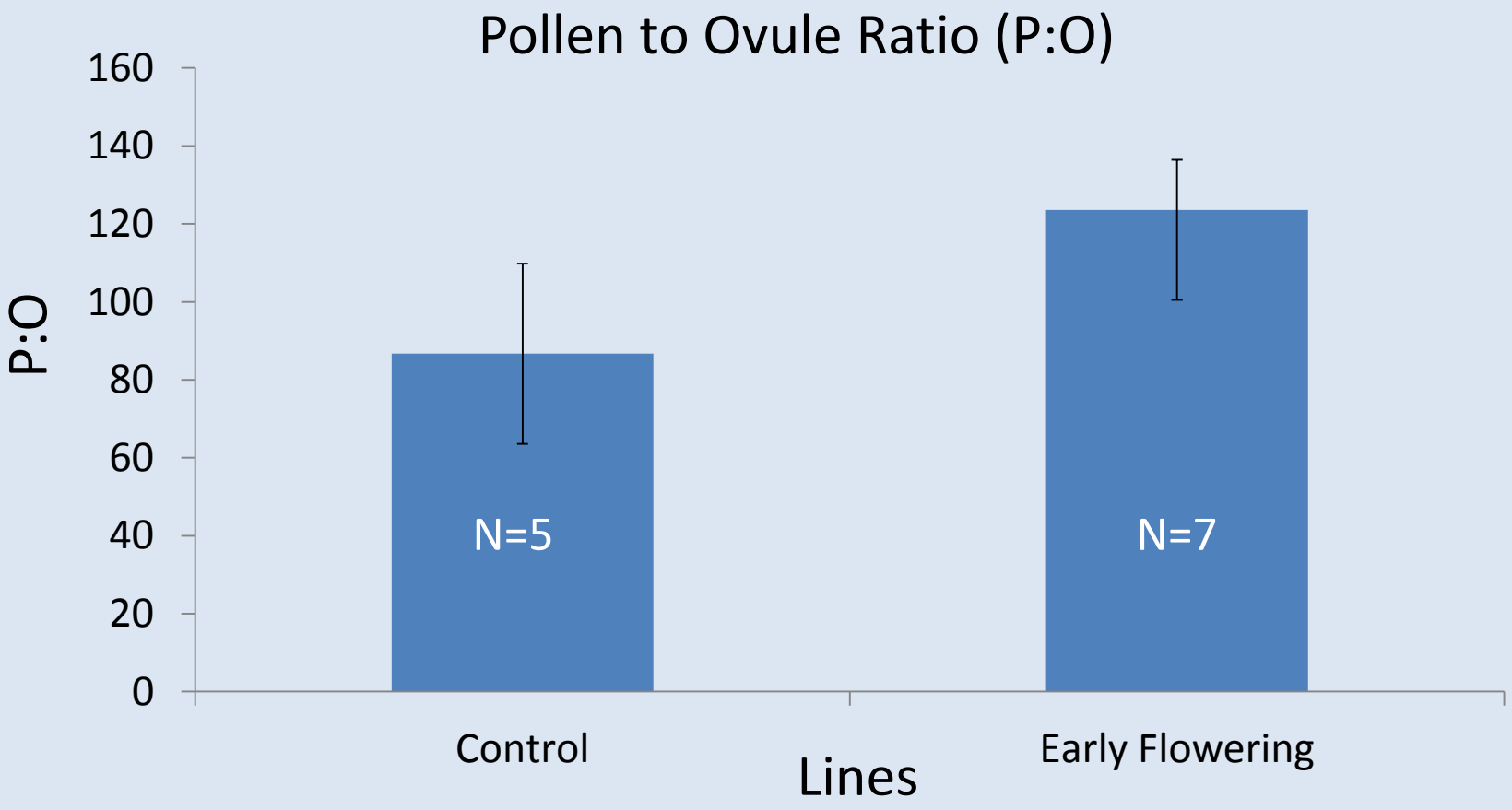
Predictions

Prediction 2
Early flowering plants would have about the same P:O as the control.

Implication
traits are not genetically correlated and evolve independently



Progress to date



The average P:O ratio is higher in early flowering plants.
Preliminary analysis indicates there is no statistical difference between the two.
Data supports prediction 2

In conclusion

If sex allocation and flower time are selected for independently there must be a selective advantage in order for both of these traits to evolve

Acknowledgements

Thank you

- Dr. Mazer and Dr. Dudley for sharing your knowledge and giving me this amazing opportunity
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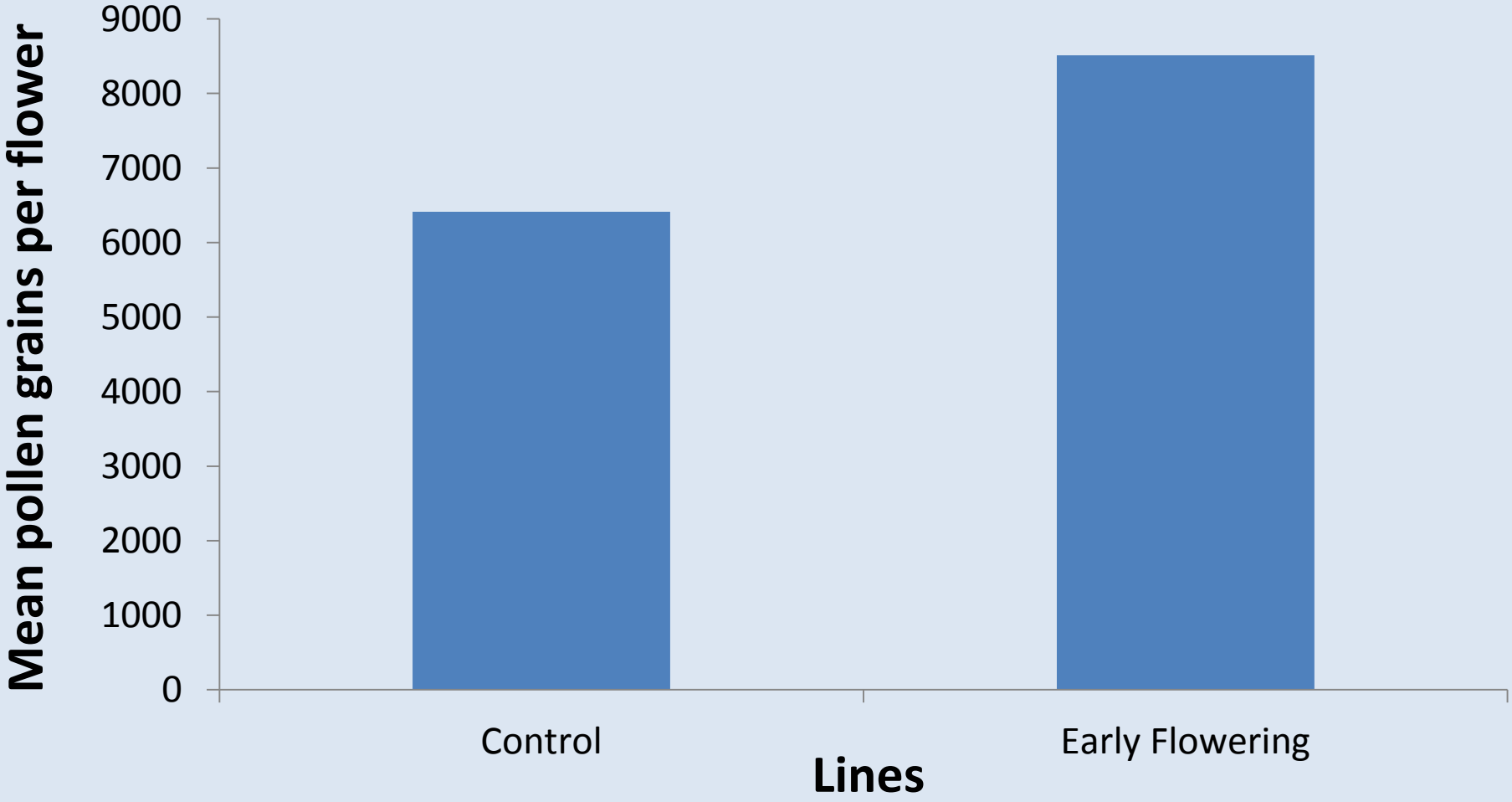
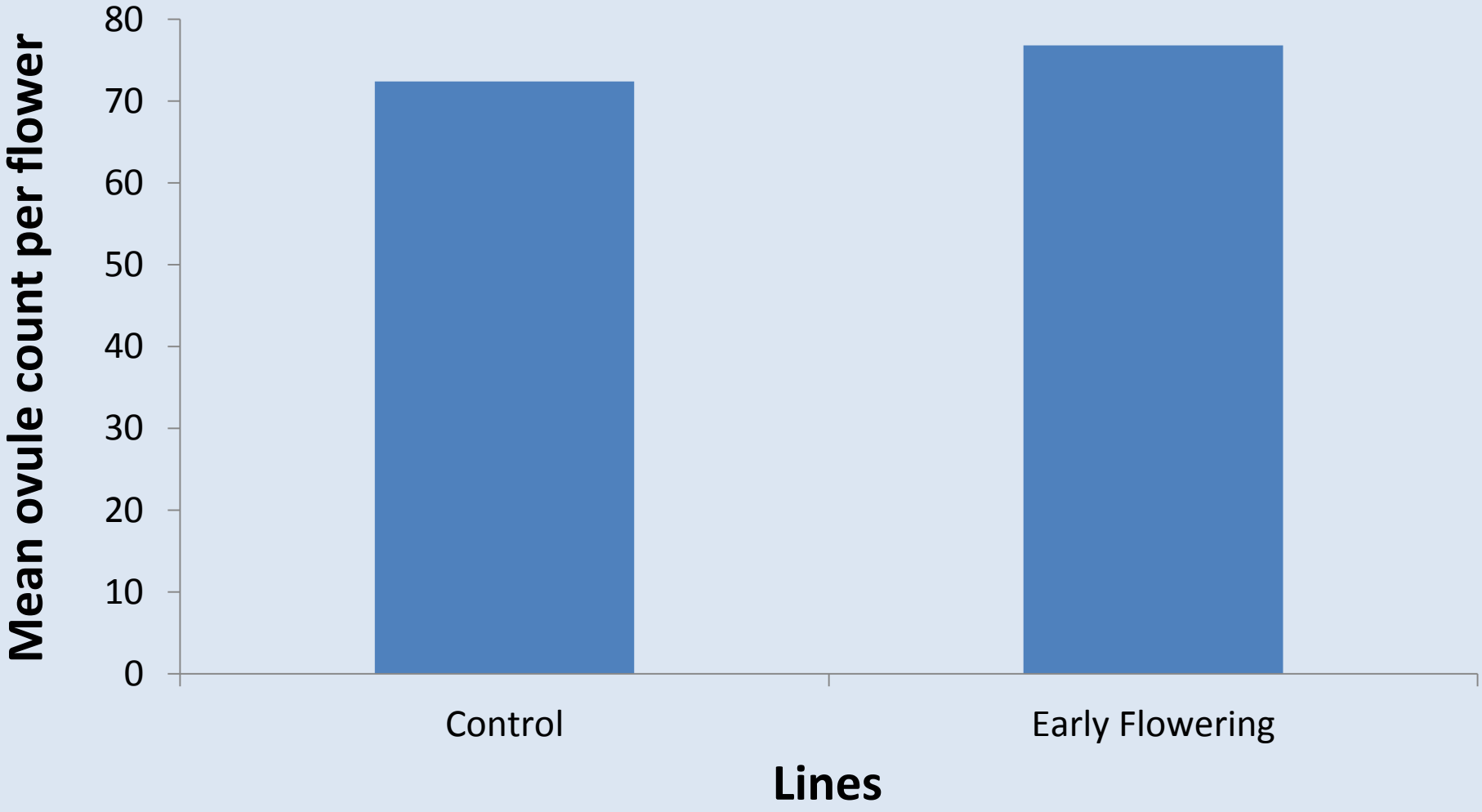
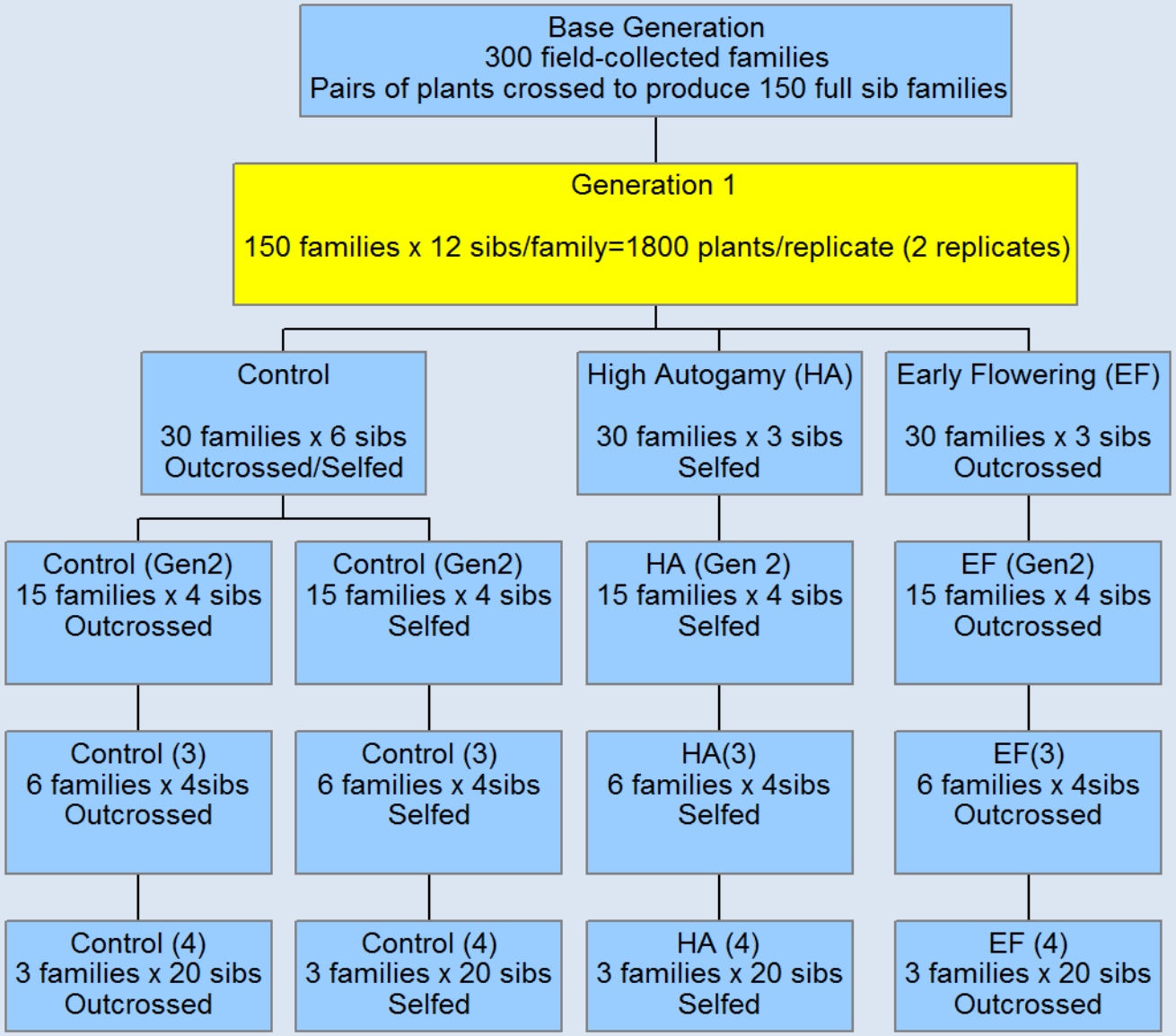
- Jens-Uwe Kuhn and Nick Arnold for your support and help through this process
- NSF for funding undergraduate research

Pollen Count

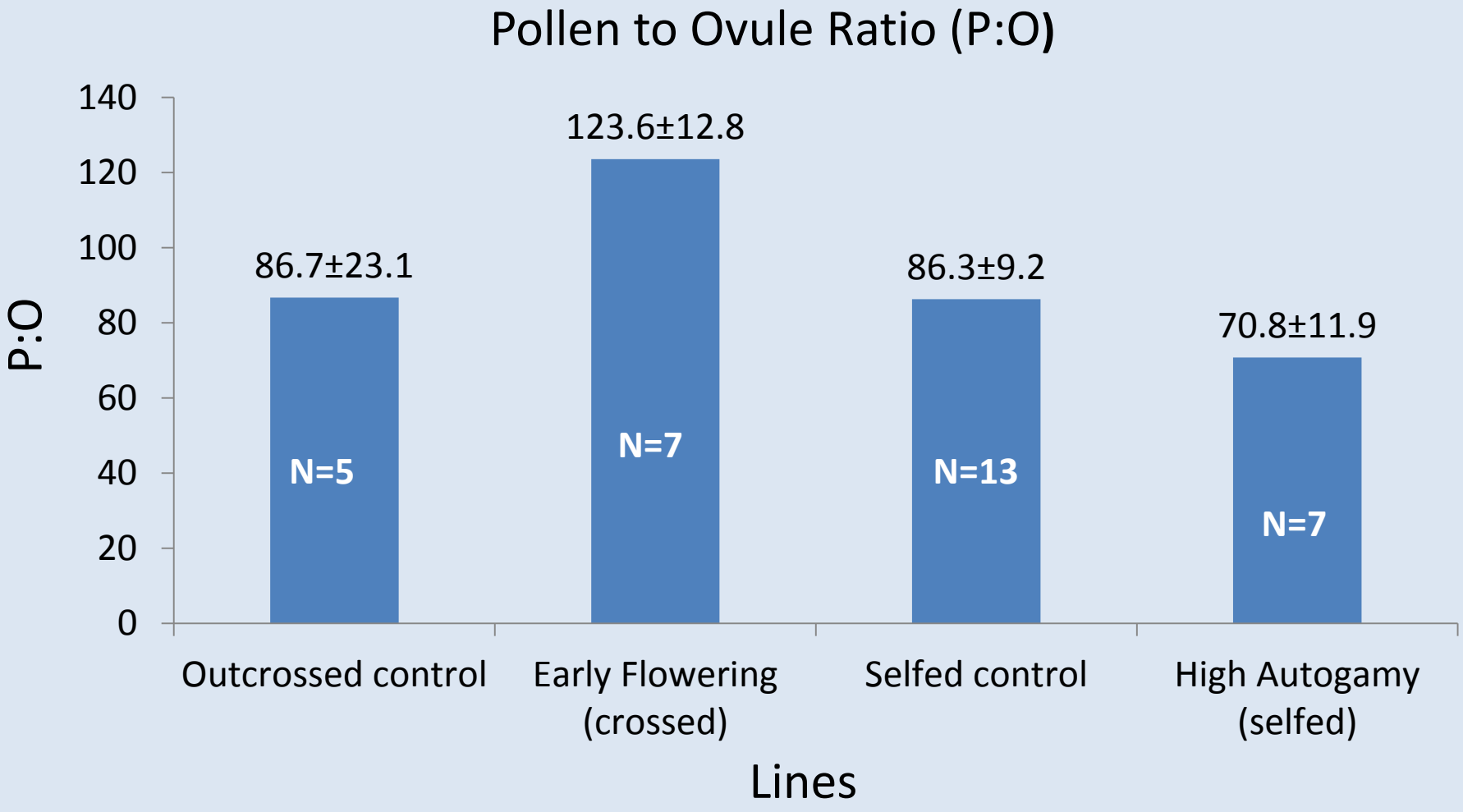


Ovule Count


Mean ovule count per flower
80
70
60
50
40
30
20
10
0
Control
Early Flowering
Lines


Base Generation
300 field-collected families
Pairs of plants crossed to produce 150 full sib families
Generation 1
150 families x 12 sibs/family=1800 plants/replicate (2 replicates)
Control
30 families x 6 sibs
Outcrossed/Selfed
High Autogamy (HA)
30 families x 3 sibs
Selfed
Early Flowering (EF)
30 families x 3 sibs
Outcrossed
Control (Gen2)
15 families x 4 sibs
Outcrossed
Control (Gen2)
15 families x 4 sibs
Selfed
HA (Gen 2)
15 families x 4 sibs
Selfed
EF (Gen2)
15 families x 4 sibs
Outcrossed
Control (3)
6 families x 4sibs
Outcrossed
Control (3)
6 families x 4sibs
Selfed
HA(3)
6 families x 4sibs
Selfed
EF(3)
6 families x 4sibs
Outcrossed
Control (4)
3 families x 20 sibs
Outcrossed
Control (4)
3 families x 20 sibs
Selfed
HA (4)
3 families x 20 sibs
Selfed
EF (4)
3 families x 20 sibs
Outcrossed

Results including HA and HA control

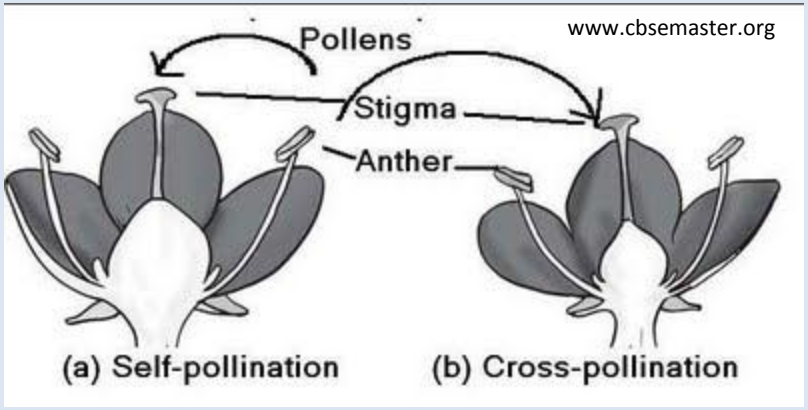


Future Work

- Complete the data set (N=30 for each line)
- replicate the experiment for another taxon
- Look into the selective advantages of flowering time and P:O
- Look at another trait and it’s relation to P:O

What is a mating system?

A **mating system** is determined by the pattern of union between egg and sperm within or among individuals.



Two different mating systems
(a) self-pollination and (b) cross-pollination

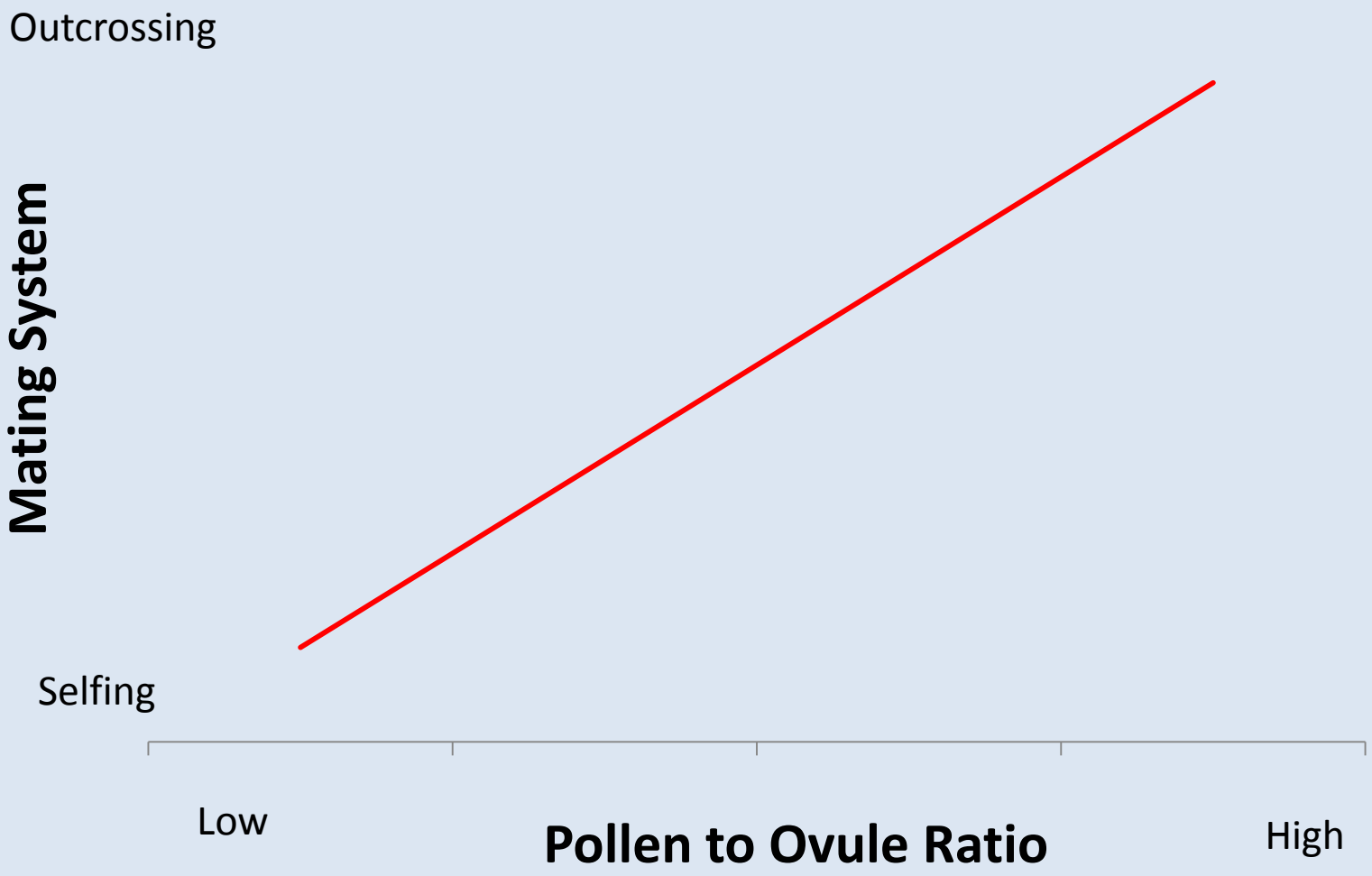
Importance of mating system

Understanding the factors that may lead to the evolution of self-pollination which in time may cause lower fitness

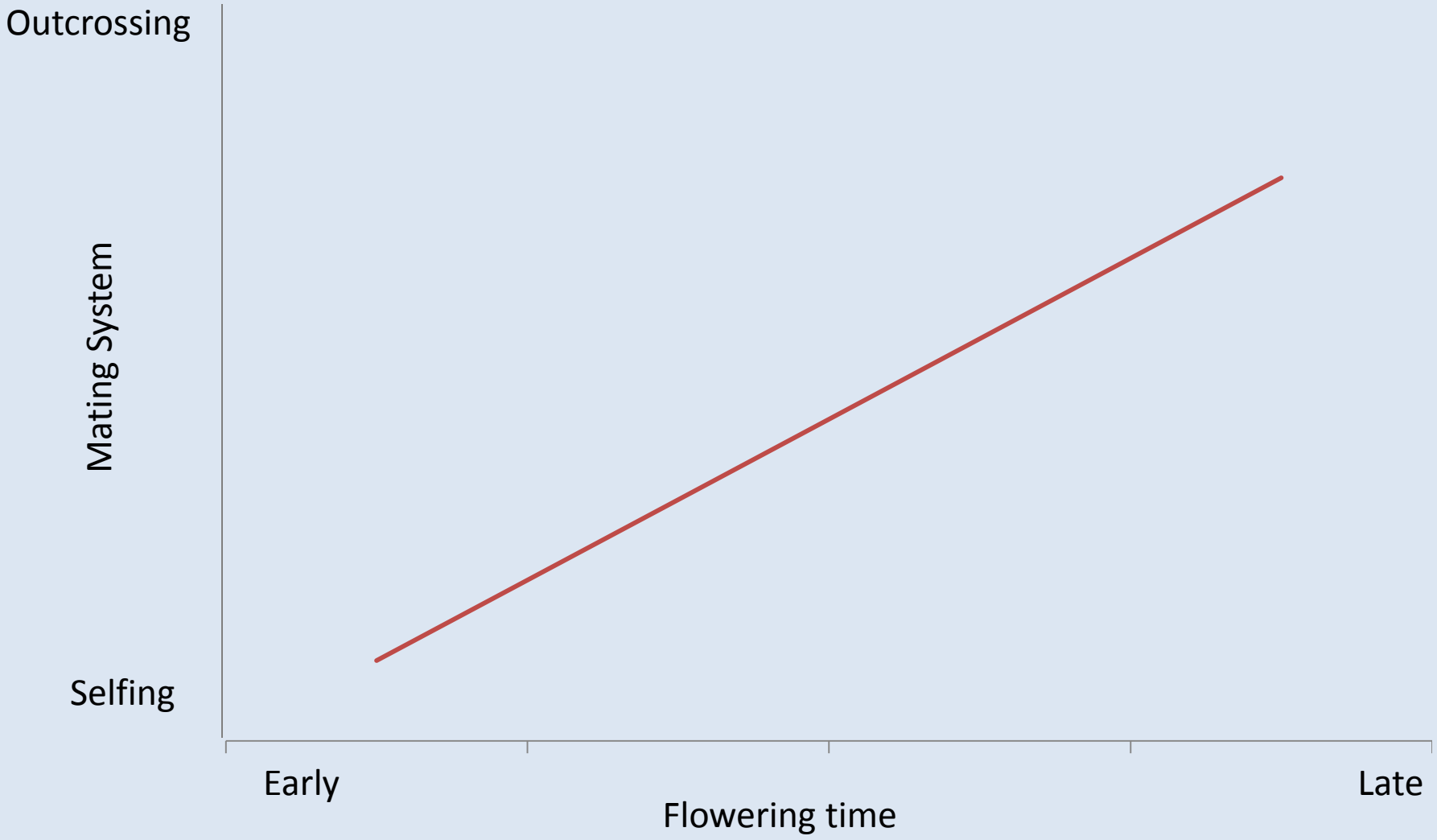
Reasons mating system may evolve:

- Environmental cues
- Correlated traits
- Reproductive assurance

Mating System & pollen to ovule ratio



Mating system and flowering time



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