The impact of flower size on the fitness decline from inbreeding depression in *Oenothera primiveris*

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Background

Conservation genetics is an applied science to reduce the risk of extinction and preserve heritable genetic variation. However, as populations get smaller, plants are more likely to mate between relatives or self-fertilize, which is a major genetic concern that can lead to inbreeding depression. **Inbreeding depression is the decline in fitness caused by the expression of deleterious alleles.** Deleterious alleles are often recessive and cause a fitness decline when relatives with the same allele mate with each other. After several generations, inbreeding depression should lower since the recessive allele will be purged out.

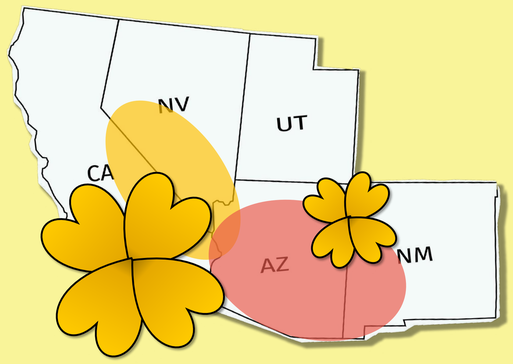

Fig. 1: Geographic map of *Oenothera primiveris* populations indicating large and small flowers.

Oenothera primiveris is a desert evening primrose that has a variation in flower size **(Fig 1). The experiment will calculate inbreeding depression between 6 populations of *O. primiveris* that is categorized into 2 groups: self-compatible with large flowers and self-compatible with small flowers**. The smaller flower has been known to have higher levels of inbreeding, but after several generations, it is expected that the negative effects from inbreeding will be purged out.
We hypothesized that the larger flower will have higher inbreeding depression.

Methods

- Seeds were sterilized and stored in a fridge to mimic dormancy
- Each seed was measured in three different stages
- Cumulative fitness was calculated by multiplying the proportion of each stage to each other

Acknowledgements and References

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Results and Discussion

- **Values above 0 indicate inbreeding depression**, with population 7 showing the most inbreeding depression
- **Values below 0 indicate little to no inbreeding depression**
- Number of crosses mentioned to show proportion values in calculation **(Table 1)**

Table 1: Inbreeding depression values of cumulative fitness and each stage of plant growth

	Cumulative Fitness	Viability	Germination	Survival	# of Self	# of Outcross	Flower Size
Pop 2	-0.48	0.35	-0.23	-0.48	6	5	Large
Pop3	-1.64	-0.07	-1.31	-1.64	3	4	Large
Pop4	0.82	0.09	-0.39	0.83	8	8	Small
Pop5	-2.28	-2.07	-1.05	-2.28	5	2	Small
Pop6	0.73	0.49	0.55	0.74	8	7	Small
Pop7	0.75	0.44	0.71	0.75	9	8	Small

- The **large flowers showed a higher cumulative fitness**, which in return shows a lower inbreeding depression than the small flowers **(Fig. 2)**
- The **small flowers showed a higher inbreeding depression.** It is possible that purging of the deleterious allele did not occur after one generation **(Fig. 3)**
- Different amounts of cumulative fitness show there is a variation of inbreeding depression between populations
- Population 5 is low in fitness with larg negative values because of its small sample size

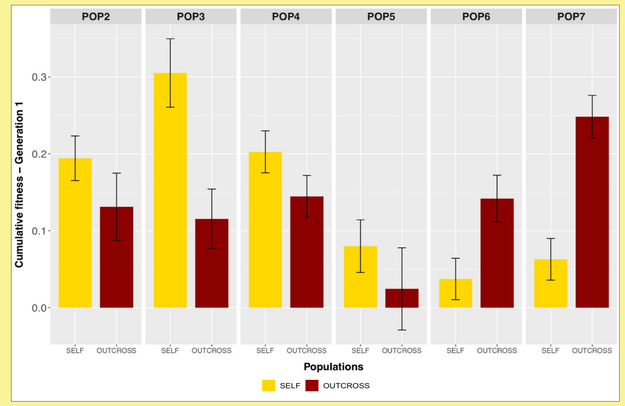

Fig. 2: Comparison of cumulative fitness across six populations between self and outcross. Fitness of each cross was used to calculate inbreeding depression

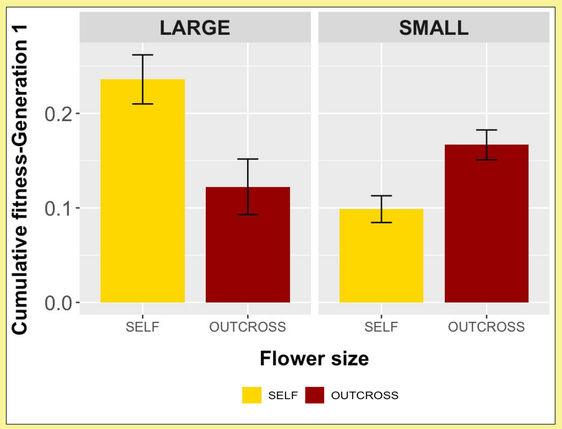

Fig. 3: Comparison of inbreeding depression between small and large flower of *O. primiveris*. The average across all populations was used for the comparison

Conclusion

- To ensure more accurate values, a **different analysis of fitness** could be used to calculate inbreeding depression that fits within the expected range
- If one plant is viable and germinates, but does not survive, it was considered a 0 in overall cumulative fitness
- It is possible that inbreeding depression does not depend on flower size, but the frequency of pollinators might be more important