The Delineation of Outbreeding Depression's Effects on the Viability of *Penstemon Pachyphyllus* Seeds

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Introduction:

Penstemon pachyphyllus also known as "Thickleaf Beardtongue" is a flowering plant that is native to Western United States. This plant is usually found in the Great Basin, and it is generally used for habitat restoration and the preservation of natural habitats in that area. It is known to be quite effective in terms of soil protection and supporting biodiversity for such environments. However, in the act to conserve and protect these areas, through mixing various populations of different geographic areas, this has potentially caused outbreeding depression. Outbreeding depression generally causes unfit offspring, unviable seeds, and a decline in future populations.

I hypothesize that the farther away the populations are geographically, the less likely the seeds of their crossing will be viable, especially for those with different genome sizes. When the populations are farther apart geographically, the populations will be farther apart genetically causing hybridization to occur between these crosses. This in turn gives rise to issues with the fertility of the succeeding generations.

Methods:

* 4 populations of *Penstemon pachyphyllus*, two from the Great Basin (PLVA, PACR) and two from the Colorado Plateau (PICR, CORO) were represented by 6-7 maternal lines.
* Each maternal line was hand-pollinated and received pollen from itself, within its population, within its geographic region, a different region with the same genome size, a different region with a different (smaller) genome size, and different taxonomic varieties.
* Each resulting fruit was scored as developed or not, and resulting seeds were counted, x-rayed to assess viability, and weighed.

Results:

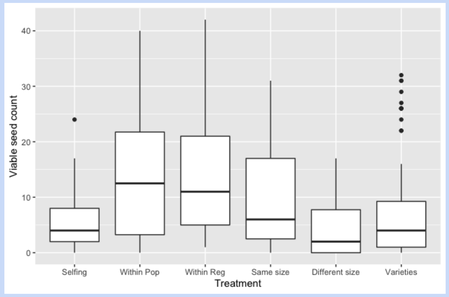

Fig. 1. Boxplot graph of the type of treatment received and its affect on the amount of viable seeds that were produced.

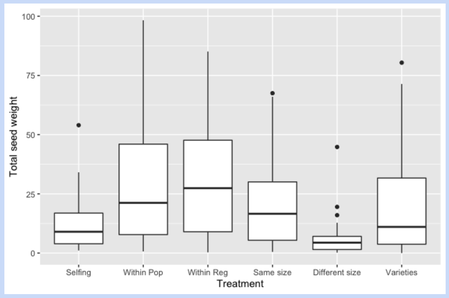

Fig. 2. Boxplot graph of the type of treatment received and its affect on the total seed weight.

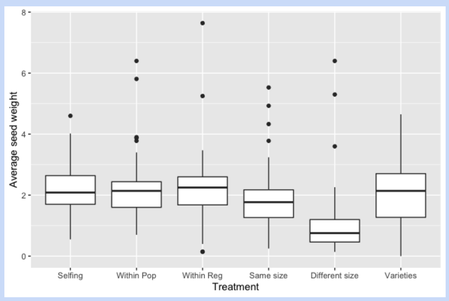

Fig. 3. Boxplot graph of the type of treatment received and its affect on the average seed weight.

Conclusion:

As seen in Figure 1-3, there is a noticeable trend in the relationships between geographical distances and viability as well as the weight of the seeds produced. Selfing being as close as possible from the area and varieties being as far as possible. Based on the skewing of the whiskers in the data, I can conclude that the crosses with different chromosome sizes do in fact have an inversely proportional relationship when it comes to the viability of seeds. Not only is its mean significantly smaller for the viability but it is smaller for the total/average weights as well. This is quite reasonable seeing that the heavier the seeds are, the more likely they are to be filled with an embryo (therefore making them viable). While varieties had a typically low average for viability and weight, its range was larger for weight most likely due to hybridization.

References:

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2. Casanova, R. U., (2021). Disentangling a Penstemon complex: Phylogenomic analysis of Penstemon pachyphyllus sensu lato and its allies. Microsoft Word - APS_ResearchGrant_2022_RUrbina_v3.docx (googleusercontent.com)

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