Effects of Self-Pollination on Germination Rate of *Synthyris bullii*, a Rare Midwestern Endemic Species

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chicago botanic garden
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Synthyris bullii: Kittentails

Synthyris bullii is a midwestern endemic species threatened at the state level across the species range. Many populations have been impacted by habitat loss due to agricultural land use change, causing some to become smaller and more isolated. We have observed lower overall germination in a small and isolated population compared to a small and connected one (Figure 1), and suspect pollen limitation could be leading to higher rates of selfing and increased mating with close relatives. Although we know that *S. bullii* is a self-compatible species, the viability of self-pollinated (more inbred) seeds is unknown. By understanding the viability of seeds when selfing increases, we can better predict population decline.

Image 1: Kittentails at the Chicago Botanic Garden.

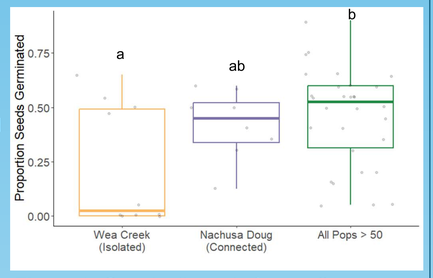
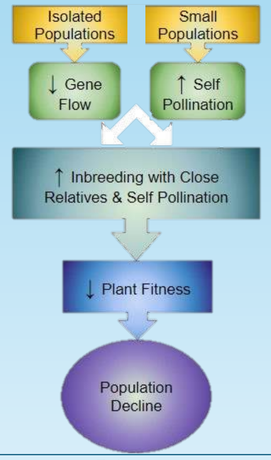


Figure 1: Germination rate for small populations (< 50 individuals) that are isolated and connected, with germination for larger populations for context.

Hypothesis

Seeds from self-pollinated flowers will germinate at a lower rate than seeds from open-pollinated flowers.



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Results & Discussion

❖ Seeds from self-pollinated plants had a significantly reduced germination rate compared to open-pollinated plants.

❖ Seeds from self-pollinated plants did not germinate at a delayed rate compared to open-pollinated plants.

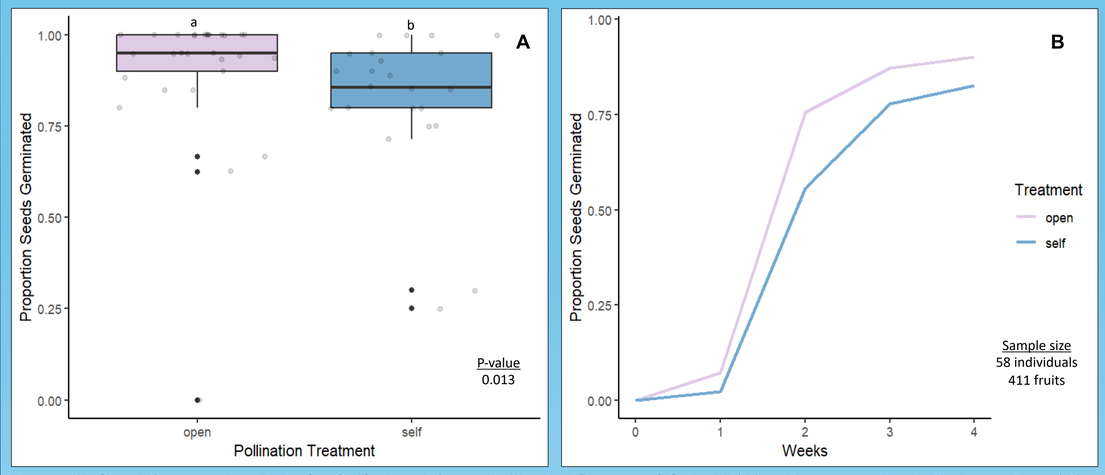


Figure 2: Seed Germination Rate for Selfed and Open Pollinated flowers of *S. bullii* (**A**), with mean rate plotted over time (**B**). A Wilcoxon Rank Sum test was used to test for differences between open and self-pollinated seed germination ($p < 0.05$).

❖ In line with the literature (Brook et al. 2002; Frankham 2005), results demonstrate the negative impacts of self-pollination/inbreeding on plant fitness and represents a challenge to the long-term persistence of *S. bullii* populations experiencing higher rates of inbreeding.

❖ These results indicate a fitness reduction from a single selfing event for *S. bullii* across populations, but selfing/inbreeding over multiple generations is likely to have an enhanced effect (Hedrick et al. 2016).

❖ Though we do not have the sample size to draw conclusions from population level differences in germination rate, when we break our results down by population, certain populations do appear to be driving the trend (Figure 4).

❖ Future research should further explore the impacts of selfing at the population scale to better understand if inbreeding depression is occurring in small and isolated populations like Wea Creek.

❖ To assist in the recovery of inbreeding depression, future research should also assess how germination rate is impacted by cross-pollination between populations at different geographic and genetic distances.

❖ Understanding how this critical life history stage is impacted by mixing populations will help land managers make better conservation and restoration decisions for small and isolated populations in decline.

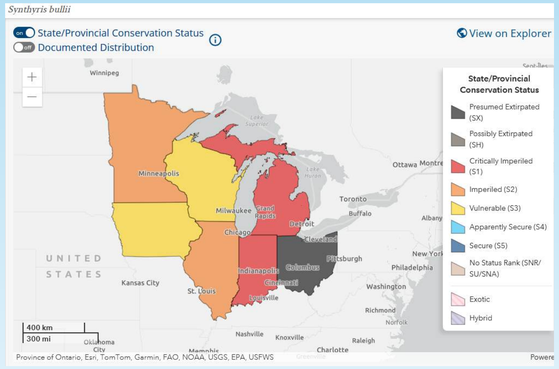


Figure 3. State conservation status for *S. bullii.*

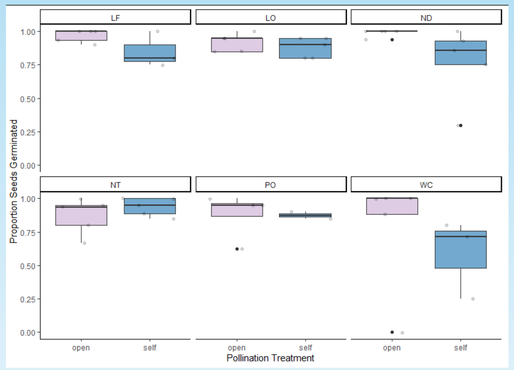


Figure 4. Seed Germination Rate for Selfed and Open Pollinated flowers of *S. bullii* by population.

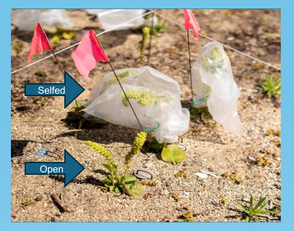
REU Site: *Plant Biology & Conservation Research Experiences for Undergraduates - From Genes to Ecosystems* (Supported by NSF award DBI-2149888).

Northwestern University

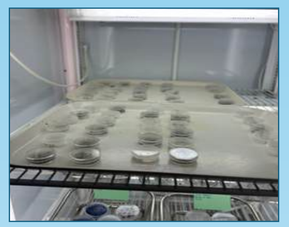
Methods

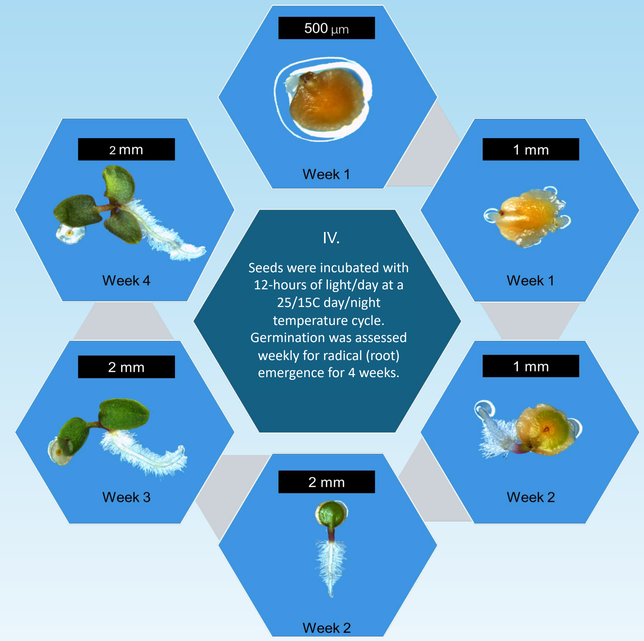
I. In 2022, seeds were collected from six wild populations across Illinois and Indiana, and grown in a sandbox at Chicago Botanic Garden in 2023

II. In Spring of 2024, 29 individual stems (five from each population) were bagged with bridal veil before flowers opened to induce self-pollination, and 29 individuals were left unbagged for open-pollination.



III. Once fruits developed, 5 fruits per individual were collected; seeds were extracted, counted, and placed onto agar plates to germinate.





Acknowledgements

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