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Improving Germination Rates for Select Native Perennial Seeds of The Sonoran Desert

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IMPROVING GERMINATION RATES FOR SELECT NATIVE PERENNIAL SEEDS OF THE SONORAN DESERT

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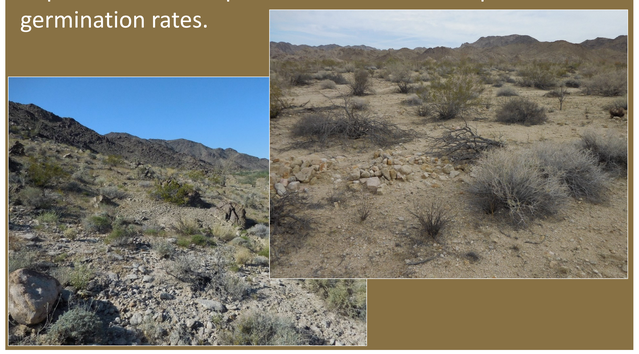
Introduction

Anthropogenic influences, such as the removal of vegetation for road and alternative energy construction, have degraded deserts of the southwestern United States (Abella, 2010). Sensitive and endangered wildlife, such as the desert tortoise, are dependent on desert vegetation for their diet and habitat in the Mojave and Sonoran Deserts (Nussear et al., 2009). Disturbed desert lands contribute to increasing dust storms, which pose as a human health hazard (Pointing and Belnap, 2014).

Revegetation by outplanting nursery-grown plants has been more reliable than seeding for establishing native desert perennials, suggesting a need for further research if seeding is to be successful (Abella et al., 2012). To minimize time and expenses for restoration projects, it is important to develop seed treatment techniques that raise germination rates.



Hypotheses

The goals of this study are to identify treatments that effectively increase the germination rates of native perennial seeds. Specifically, I tested the following hypotheses:

- Rinsing seeds with a bleach solution before germination will reduce the potential for fungal infections.
  - **Seeds subjected to a longer rinse time in bleach solution will have reduced fungal infections**, and therefore an increase in germination rates.
- *Ambrosia dumosa* seeds experience a cool and moist fall and winter season before germination. Therefore, **a 30-day stratification in cold, moist sand will improve *A. dumosa* germination** compared to seeds stored at room temperature after field collection.
- **Mechanical scarification and gibberellic acid (GA) will individually and together increase the germination rate of *Encelia farinosa*** compared to seeds not treated with either treatment. *E. farinosa* seeds treated with both will result in the highest germination rates.
- **Increasing amounts of GA will result in increasing germination rates for *Hilaria rigida*.**

Study Area and Methods

- Colorado Desert subdivision of the northwestern Sonoran Desert
- Site east of Indio, California and west of Blythe, California along the Interstate 10 freeway that connects the two cities.
- Dominant shrubs to the area are *Larrea tridentata* and *A. dumosa,* with infrequent patches of *E. farinosa* and *H. rigida*
- Seeds were collected between May to June 2016

Table 1. Tests and treatment methods used on selected species.

	Imbibement	Bleach cleaning	Mechanical Scarification	GA Scarification	Cold Stratification
Ambrosia dumosa	x	x			x
Encelia farinosa	x	x	x	x	
Hilaria rigida	x	x		x	

Treatment methods used on each species are indicated by an "x."

Results

Ambrosia dumosa

- Bleach cleaning did not reduce fungus or increase germination
  - At 2 weeks, the majority of seeds were overcome with white and dark brown fungi (Fig. 1)
- Neither cold stratification nor different levels of cold stratification resulted in significant differences ($F_{1,22}$=0.010;P=0.9212) in germination

Figure 1. Left: *Ambrosia dumosa* 14 d after a 30 s 1% bleach solution wash. Right: *A. dumosa* 14 d after UV exposure and sowing in sterilized sand.

Encelia farinosa

- Bleach cleaning and control both resulted in low germination rates (≤3%)
- Scarification did not have an effect on germination rates when GA was absent
  - However, at a GA concentration of 500 ppm, scarification did contribute to increasing germination (Fig. 2)

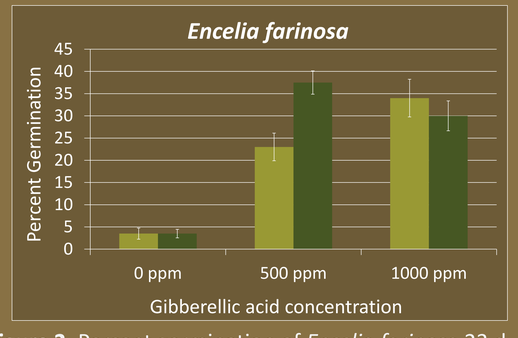


Figure 2. Percent germination of *Encelia farinosa* 23 d after application of gibberellic acid treatments of 0 (control), 500, and 1000 ppm concentrations and either mechanically scarified with a scalpel or not scarified. Error bars ± 1 standard error of the mean.

Hilaria rigida

- Significantly higher germination percentage with a 60 s bleach wash compared to no bleach wash (F1,14=4.601; P<0.001) (Fig. 3)
  - 120 s bleach solution wash was not significantly different from the control, but resulted in a decrease in germination compared to the 60 s wash
- Germination not affected by GA over the 27 d observation period (Fig. 4)

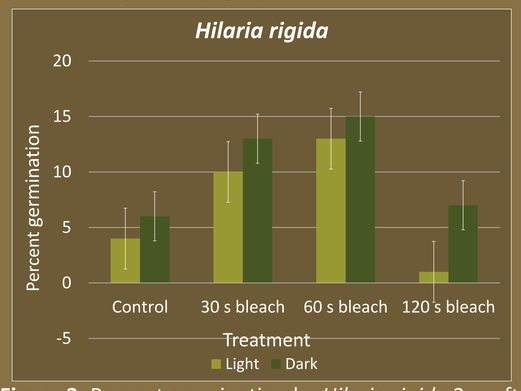


Figure 3. Percent germination by *Hilaria rigida* 2 w after applying a 1% bleach solution rinse and either covered or uncovered to replicate dark and light. The control consisted of rinsing seeds for 120 s with polished water (PW). After bleach rinse, all sample units were washed with PW for 60 s. Error bars ± 1 standard error of the mean.

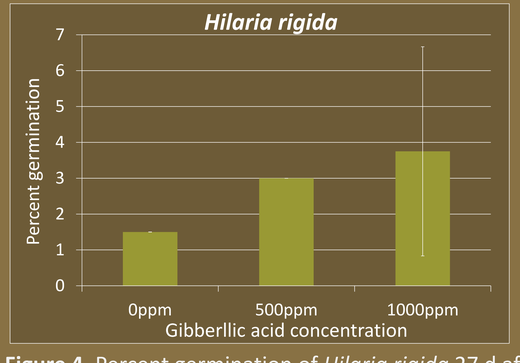


Figure 4. Percent germination of *Hilaria rigida* 27 d after application of gibberellic acid (GA) treatments at concentrations of 0 (control), 50, and 1000 ppm. GA treatment was found to significantly increase percent germination. Error bars ± 1 standard error of the mean.

Discussion

A. dumosa seeds could require a longer bleach wash, as almost all seeds were affected by fungus after 2 weeks. However, when seeds were subjected to UV light for 2 h and then sowed into a sand substrate, they germinated much more successfully after the 2 week period.

Literature suggested that *A. dumosa* emergence improves with 30 d of cold stratification (Graves et al., 1975). Because outplanting studies are time-sensitive, it is valuable to test whether a shorter cold stratification period can accelerate germination. **A cold stratification less than 30 d did not improve germination.**

E. farinosa germination rates were improved with GA treatment at 500 ppm concentrations only when its seeds were scarified. The act of mechanically nicking the seed coat may not have been sufficient enough to break dormancy. **Scarification, along with GA, resulted in a higher percent germination than nicking alone.**

H. rigida **seeds did not show an improved germination rate with any of 3 different GA concentrations.** Overall average germination percentages were still low**.** As the 60 s bleach wash improved germination, a cleaning treatment along with GA may help to break dormancy.

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