Some Native Seeds Require Sun to Germinate

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Some native seeds need long exposure to the sun in order to germinate. This report describes the role sun plays in the germination of seeds from three species. Two are borages: *Phacelia parryi* and *Cryptantha intermedia*. The third is *Cneoridium dumosum*, a citrus. It goes into some detail about the mechanisms that affect germination of these seeds. It then puts all this into the context of Deno's theories of germination inhibition.

The final section shows that pretreatment with Gibberelic acid, a plant hormone, enables the borage seeds to germinate as well as pea seeds we buy from a store.

Phacelia parryi

P. parryi has long frustrated me because, in the wild, it can produce areas of brilliant blue, and because I was unable to reproduce that around my home. More than once, I distributed seeds over a half acre, but only a few plants grew and bloomed, one here, one there.

Kay Stewart [1] gave me my first clue to unlocking the secrets of *P. parryi* by explaining how she had grown *P. parryi.* She sowed them in a flat that she had sprinkled with charred buckwheat. Her flat grew many plants, and she had a great display for the Del Mar Fair! *P. parryi* is a known fire follower, but Kay's result demonstrated specifically that it is stimulated by chemicals produced in fires. I was not able to reproduce Kay's recipe, but I found that Liquid Smoke served the purpose.

It turns out that *P. parryi* is more complicated. Seeds fall out of *P. parryi* in April and May. They sit on the ground exposed to the sun until they germinate the following winter. To collect seeds, you must get them in April. Soon after than, they are gone. I store the seeds I collect indoors, protected from the ravages of the sun. The sun is the great sterilizer, and I assumed it is good for these tiny seeds. Three years ago, I tried an experiment by placing *P. parryi* seeds in a coffee cup on a table outdoors. The seeds were exposed for months to the sun, to mist, and to drizzle. I expected the sun to harm the seeds and to reduce germination rates, but seeds germinated best after being exposed to the sun for at least two months.

The best germination combines the following: a) a minimum of 2 months exposure to sun, b) soaking the seeds in 10% Liquid Smoke for one hour, and 3) stratification at 55°F. About 50% of the seeds treated this way germinate in 2-3 weeks.

Cryptantha intermedia

Popcorn flowers bloom all around where I live, including Poway, Scripps Ranch, and Spring Canyon just north of Mission Trails Park. They are known to be fire followers, but unlike *P. parryi*, smoke chemicals play no role. However, they also need sun. In May 2017, I harvested dried seed pods and separated out the seeds. Later, in August, I saw plants that still held their seed in the air, so I collected some more seeds. The contrast between the May and August seeds caught me by surprise. The May seeds did not germinate. The August seeds germinated in about a week at nearly 100%. All were stratified at 55°F.

Phacelia parryi (left and below) and Cryptantha intermedia (left)

C. intermedia seeds need a summer of sun in order to germinate. If you collect them in the spring, store them, then sow them in November, the results could be disappointing.

Cneoridium dumosum

Cneoridium dumosum

Bush rue produces beautiful red/green berries in the spring. These bake in the sun all summer, turning chocolate brown by the end of summer. Nearly 100% of these dark brown seeds germinate in a couple of weeks when stratified at 55°F. Seeds picked before they turn brown do not germinate. I tried an experiment with seeds I collected from a single plant in June, 2018. About half were chocolate brown and half were still largely green. 90% of the brown seeds germinated, but none of the green seeds germinated.

Several years ago, a friend asked me to start some seeds he purchased from a prominent seed supplier. They were a beautiful tan color, but they did not germinate. I put some in a cup outdoors for a month or so, but they still did not germinate. My conclusion is that they must stay both in the sun and on the plant all summer.

Germination inhibition

“Every species has some mechanism for delaying germination until after the seed is dispersed.” Deno 1993 [2]. For those of us interested in finding ways to get seeds to germinate, Deno is essential reading.

Deno posits that seeds employ mechanisms to inhibit germination until the time is right. Some seeds have multiple inhibition mechanisms. A seed will not germinate until all of its inhibition mechanisms are overcome.

P. parryi employs three inhibition mechanisms. Smoke chemicals overcome one. Sun exposure overcomes a second. Stratification at 55°F overcomes the third. Stratification at room temperature produces no germination. The 55ºF temperature makes sense because 55ºF is a common temperature in the rainy season and uncommon in the summer and early fall.

The results with *P. parryi* suggest that its inhibition mechanisms are not black and white. *P. parryi* grows profusely after a fire, but it grows without fire too, just not as well. There seems to be an element of randomness in *P. parryi* seeds as to whether the inhibition mechanisms are at work. Seeds that are missing the smoke chemical inhibition germinate without a fire, but seeds that need smoke chemicals could lie in the soil for years waiting for a fire.

Gibberelic acid

Giberrelic acid (GA3, [3]) is a naturally-occurring plant hormone, commonly used in the nursery trade to stimulate seed germination. Soaking the borage seeds in GA3 overcomes all of the inhibition mechanisms. *P. parryi* seeds soaked in 1500 ppm GA3 for 10 hours begin to germinate in two days, without exposure to sun, exposure to smoke chemicals, and at room temperature. The germination rate rises to almost 100%. The same is true for the *C. intermedia*.

Phacelia parryi seedling 13 days old, about 3/4" in diameter

The good news is that this allows us to collect seeds early in the season, store them at room temperature, then sow them just in advance of the fall rains with the expectation of a profuse bloom. Pretreated seeds stay viable for at least 8 months. I have tested seeds 8 months after treatment, and they germinate as well as seeds immediately after pretreatment.

In my tests, *P. parryi* has exhibited one very puzzling behavior. *P. parryi* seeds soaked in 750 ppm GA3, germinate well on top of coir (a bland potting soil). However, they would not germinate on top of soil, either in my temperature chamber or outdoors. Increasing the GA3 concentration to 1500 ppm is the trick; now they germinate at a high rate on soil. I find this result befuddling. After sowing pretreated seeds in October 2017, there were many small seedlings within a few weeks. Unfortunately, the young plants disappeared almost immediately due to predation. More seedlings appeared in January and February, and these survived better and produced a great bloom.

[1] Kay Stewart is a member of the CNPS San Diego Chapter, and prominent for her leadership and her contributions.

[2] Norman Deno, ***Seed Germination Theory and Practice***, 1993; https://naldc.nal.usda.gov/download/41278/PDF

[3] I get GA3 from powergrown.com. You can get 90% purity, or 25% purity that is water soluble. The water soluble GA3 is considerably easier to use.