Seed Storage Characteristics and Germination of Select South Florida Native Plant Seeds

Anne Frances
Fairchild Tropical Botanic Garden

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Species	**Seed storage requirements**	**Seed viability and longevity**	**Germination requirements**
Aletris bracteata	Unknown	Germination is relatively easy under mist, but seedlings are very slow growing (Wilsdon pers. obs. in Wendelberger 2004).	Unknown
Amorpha herbacea var. *crenulata*	Orthodox. Seeds stored for 2.5 years germinated at between 21% and 24% after cryogenic storage (Carrara 2001).	Fresh wild-collected seed with fruit coat intact germinated at about 50% in 12 days. Fresh wild-collected seed with fruit coat removed (by hand) germinated at about 85% in 12 days (Fidelibus and Fellows 2002). In another study, fresh seeds (with fruit coat intact) from the *ex-situ* collection germinated readily within one week of sowing on soil-less media, with germination values ranging from 60% to 84% after 7 weeks (Carrara 2001).	Removal of fruit coat increased both rate and percent of germination (but length of experiment was only 14 days). Fruit coat appears to be a physical rather than chemical or other type of barrier. Percent germination of fruit that had dehisced naturally versus fruit retained on infructescence was similar (Fidelibus and Fellows 2002). Wild collected fruit had 29% unhealthy appearing seed versus *ex-situ* collected fruit had 11% unhealthy appearing seed based on visual inspection (Fellows 2002a).
Crossopetalum ilicifolium	Unknown	Fresh seed germinated at 24%. Seed stored 1 and 3 months did not germinate (Fairchild unpublished)	Unknown
Harrisia aboriginum	Not recalcitrant. Seeds that had been desiccated for three days and frozen for 16 hours germinated (Frances unpublished). Experiment should be repeated with prolonged time in freezer to confirm that seeds are orthodox.	Fresh seeds germinate readily (Frances unpublished).	Unknown
Harrisia fragrans	Not recalcitrant. Seeds that had been desiccated for three days and frozen for 16 hours germinated (Frances unpublished). Experiment should be repeated with prolonged time in freezer to confirm that seeds are orthodox.	Seeds kept in the refrigerator for five years germinated at 16-50% (Frances unpublished.) Germination of fresh seeds varied by accession, ranging from 0-78% (Carrara 2001). Seeds stored in the refrigerator were slower to germinate than those stored at room temperature (Frances unpublished).	A sulfuric acid treatment increased the rate and percentage of germination (Fisher 2002). Perez (2001) found that acid scarification followed by soaking in gibberellic acid sigificantly increased germination rate and percentage.

Harrisia simpsonii	Not recalcitrant. Seeds that had been desiccated for three days and frozen for 16 hours germinated (Frances unpublished). Experiment should be repeated with prolonged time in freezer to confirm that seeds are orthodox.	Fresh seeds germinate readily (Frances unpublished). Seeds that had been stored 4 years at room temperature germinated at 93% (Frances unpublished.)	Unknown
Ipomoea microdactyla	Unknown	Fresh seed germinates readily; over 90% germination rate (Geiger 2004).	For fresh seed (i.e. removed from undehisced fruit as the capsules turn from green to brown), no scarification of seed coat or water soaking necessary for high seed germination rates (Geiger 2004).
Jacquemontia reclinata	Preliminary results from a current experiment indicate that seeds are orthodox. Seeds in storage at -20°C for 3.5 years are germinating at about 10-50%, higher than seeds stored at 12°C or 23°C. Percent seed moisture content (SMC) did not seem to affect germination. Seeds dried to 5% SMC before storing germinated (Frances unpublished data in Wright 2004a).	Percent germination of fresh seed was variable at 20-82% (Carrara 2001), but germination of >50% was common (Carrara and Garvue 2003). Seeds stored for five years under ambient conditions remained viable with 19-42% germination in four trials (Carrara and Garvue 2003).	Soaking of seeds prior to sowing did not affect rate or percent of germination, even though a yellow pigment was leached from the seeds (Fidelibus and Fisher 2003). Seeds did not need light to germinate (Fisher 2003). Soaking in seawater did not affect germination (Griffin and Fisher 2003). Seedlings required arbuscular mycorrhizal fungi under natural soil conditions or where phosphorus is limiting (Fisher and Jayachandran 2002).
Okenia hypogaea	Unknown	In-field studies have shown a 32% germination rate (Wright 2004b). Seedlings germinated in an area that has not had *O. hypogaea* plants in over 5 years (Fernandez pers. comm.). Seeds of fruit harvested in February germinated at a higher percentage (22%) than those of fruit harvested in December (1.6%) (Fisher unpublished).	Germination or seedling emergence are not affected by depth of planting between 1 and 12m (Fisher unpublished). However, fruits may require at least 4-5cm of burial by sand for growth (Iverson 2004). Seeds do not need light to germinate (Fisher unpublished).

Polygala smallii	Unknown	Koptur et al. (1998) found that fresh seeds would not germinate; however, 80-100% of older, buried seeds germinated (without regard to seasonal photoperiod). In another study, seeds that had been soaked in water germinated at about 71%. Seeds had been stored at room temperature for 2 weeks and were sown on wet filter paper in a petri dish (Fellows 2002b). Seeds up to 2 years old did not germinate (Koptur et al 1998).	Seeds are difficult to germinate under standard horticultural conditions: ample soil moisture and aeration is crucial, mold is problematic, and fungicide kills plants (Koptur et al. 1998). Seeds germinated best on moist silica under indirect sunlight and ambient photoperiod (Koptur et al. 1998). Fresh, wild collected seeds showed 50% greater germination following soaking in a smoke extract (Koptur et al 1998). Fellows (2002b) found that smoke treatment of seeds increased the rate of germination (peak germination at 12 days with smoke versus at 26 days without smoke) but not percent germination which ranged from 71 to 86%. Kernan et al. (1999) found that seeds buried > 2cm will develop dormancy.
Pseudophoenix sargentii	Potential to be stored using orthodox methods, but more research is needed to determine if drying and freezing actually increase the length of time seeds remain viable. Seeds that had been dried to 5% SMC germinated (Carrara 2001). Seeds normally withstand much drying prior to germination (Read 1961). Seeds that had been stored for 12 months total, 6 months at 23°C and 6 months in -20°C, germinated at 8 percent. These seeds were not desiccated before storage, but may have dried to a low SMC during the 6 months of ambient temperature storage. Endocarps were removed prior to sowing (Carrara 2001; Fairchild unpublished).	Fresh seeds frequently do not germinate (Carrara 2001; Read 1961). In trials testing temperature, SMC, and time in storage, percent germination ranged from 0-70 and was highly variable among treatments and seed source (Carrara 2001). In some cases percent germination was higher after 3-6 months of storage (Carrara 2001). In their natural habitat, fruits fall during the dry season and a 3-6 month period of dormancy would enable seeds to germinate during the rainy season. Additionally, the mechanical action to remove the fruit flesh and endocarp (thought to be necessary for germination) may occur during this period of dormancy (Garvue and Carrara 2001). Viable seeds float, so a flotation test to determine viability would not work (Read 1961). Seeds may take up to two years to germinate (Fairchild unpublished). Seeds stored for 12 months at 23° C and 12°C germinated at 44% and 49%, respectively with the endcocarps removed before sowing (Carrara 2001). Seeds stored at 23°C for 2 and 4 years germinated at 1% and 0%, respectively (Carrara 2001).	In many cases removal of the endocarp improved germination (Carrara 2001). Soaking did not improve germination after storage (Carrara 2001.) Read (1961) found temperature to be an important factor in germination. Seeds held at a constant 85° F germinated consistently at 90% whereas those seeds in the greenhouse, where temperatures ranged from 60-90°F, germinated at 0-10%. Fungal disease affected seedling development in germination trials in soil and agar media (Fairchild unpublished). Pure perlite produced the healthiest seedlings, preventing damping-off which occurred with other media (Read 1961).

Tephrosia angustissima var. *corallicola*	Orthodox. Percent germination of seeds stored for 3 and 6 months at -20°C ranged from 95-100 and 73-90, respectively. Seeds dried to 5% SMC before storing germinated (Fairchild unpublished).	Germination of fresh seed is generally high. Out of nine trials of fresh seed, germination ranged from 0 to 100%, with a median of 90%. In four of these trials, percent germination was 100, and in only one trial percent germination was less than 50. Percent germination of seeds stored for one or three months at either 12° or 23° C averaged 65%, with no clear differences in germination among storage treatments (Carrara 2001).	Fresh seeds germinated in light under mist within one week (Fisher unpublished). Carrara (2001) found that maximum germination of fresh seed was attained after two weeks. Stored seeds sometimes took longer to germinate than fresh seeds. Four weeks should be sufficient to achieve maximize germination for this species (Carrara 2001). Because germination is generally high, little research has been conducted to improve germination.
Zanthoxylum coriaceum	Presumed orthodox based on results of *Zanthoxylum flavum* (Carrara 2001) but not yet tested.	Germination of untreated fresh seed ranged from 2 to 32%. Seeds in storage for 3 and 6 months showed little decline in viability (Fairchild unpublished).	Percent germination of fresh seed increased (17-65%) with a pretreatment of scarification with sandpaper combined with soaking, although percent germination was not significantly different than untreated seeds (2-32%) (Fairchild unpublished).
Zanthoxylum flavum	Orthodox. Seeds in cryogenic storage had 4% germination. (Carrara 2001)	Generally low (0-11% germination). An x-ray of 50 seeds showed that 44% of seeds were filled, but this percentage of empty seeds does not fully account for the low germination percentage (Carrara 2001). Seeds in storage at ambient temperatures are usually predated by insects, which may contribute to the high numbers of empty seeds.	Scarified seeds (both fully and partially scarified) absorbed water more rapidly than non-scarified seeds, although rate of water absorption was slow compared to other species (Fidelibus unpublished). Warm-stratification treatments did not promote seed germination (Perez 2001).

SMC= Seed Moisture Content

All germination trials were conducted in the greenhouse or laboratory, unless otherwise stated. In most germination trials, seeds were sown on soil or a soil-less medium, and germination was defined as the emergence of the shoot. A few germination trials used filter paper in petri dishes (see Fellows 2002b, Fidelibus and Fellows 2002, and Fidelibus and Fisher 2003) and germination was defined as the emergence of the radicle. For more detailed information about the germination trials, please consult the original document. For more information concerning unpublished Fairchild data, please contact the conservation team at Fairchild.

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