

Maternal and sibling influences on seed germination of *Aegilops triuncialis*

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Dormancy is often a characteristic of seeds produced by annual plants, particularly those from variable environments, and is an evolutionary stable strategy for avoiding catastrophic loss of seedlings through the maintenance of a viable soil seed bank. However, genotypic differences exist within species, and therefore variation in the expression of these evolutionary strategies may exist. As a bet-hedging strategy, dormancy is favored mainly by the parental genotypes. In contrast, delayed germination and reproduction results in reduced fitness for the offspring and dormancy may not be as beneficial. In addition, among closely related siblings, there may be selection for inducing dormancy in siblings as a method for reducing the effects of intra-family competition.

Both maternal and sibling suppression of germination have been observed in barbed goatgrass, *Aegilops triuncialis* L. Like other members of the genus, this species produces both large and small seeds, often in dimorphic pairs, and the seeds show no inherent dormancy. However, a chemical on the tissues of the spikelet strongly suppresses germination of the small seed. In addition, the presence of the large seed or seedling also suppresses germination even when the surficial chemical is removed by repeated washing. We investigated the variation in the strength of these influences by testing the germinability of the small seed from California populations of barbed goatgrass.

Dry inflorescences of *A. triuncialis* were collected in June 2001 from three populations in northern California. The McLaughlin and Snell Valley populations are from the eastern slope of the Coast Range and the Sierra Shubert population is from the Sierra Nevada foothills. Initial tests of the germinability of the small and large seeds (after removal from the spikelets) were made to verify that this species did not possess any inherent dormancy.

To investigate the strength of maternal and sibling influences, small seeds were planted in two treatments (with or without the large seed present), placed into an environmental chamber, and watered daily. Each of the 3 sets of 25 spikelets for each treatment was sown in individual tubes filled with potting soil. The environmental chamber was set for 12 hours light at 20 °C and 12 hours dark at 10 °C. Emergence was monitored and recorded daily for 15 days. After drying completely, the spikelets were re-watered to stimulate germination of the remaining dormant seeds. Emergence data were analyzed with one-way ANOVA to test the strength of the influence of the large seed and for differences between populations.

Within the three populations, germination of the small seeds was 82-97% when removed from the spikelet, but emergence of seedlings decreased to 28-59 % when seeds were in the spikelet and to 5-15% when seeds were in the spikelet with the large sibling seed present. Therefore, both the maternal tissues surrounding the small seeds and the presence of the large sibling seed exerted a significant inhibitory effect on germination of the small seed. More importantly, significant variation was found in the strength of the effect of maternal tissues and siblings on germination of small seeds. These results were consistent with previous studies on a single population in which germination of small

seeds of dimorphic pairs was strongly suppressed by the presence of the large sibling seed and germination increased when it was removed.

While the actions of multiple factors suppressing seed germination are of interest ecologically, this study is the first to demonstrate potential ecotypic variation in the strength of these factors. Also, we assume that some of the variation found here is correlated with environmental variability in California, particularly in terms of the competitive conditions encountered by the populations, but this has yet to be tested. Because barbed goatgrass has only been present in California for 80 years, and its distribution was highly restricted until 10 years ago, the variation in germination patterns seems remarkable. However, some variation may also be related to founder effects and the genetic consequences of multiple invasions.