

Nicole Martinek

Germination studies on snow-bed plant species of the north-eastern calcareous Alps of Austria

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Alpine plants, and especially those adapted to naturally fragmented habitats like snowbeds, are often considered as particularly vulnerable to the impacts of climate change. Adaptive migration will crucially depend on the processes of seed dispersal, germination and seedling establishment.

Using a representative set of ten snowbed specialists of the north-eastern Calcareous Alps of Austria this study focuses on one of these processes, namely germination. Based on a factorial experimental design we analysed the effects of

- (a) duration of dormancy,
- (b) frost stratification and
- (c) pre-treatment with gibberellic acid on the germination rates and on the duration of the first developmental phases of the live history of the study species.

In doing so we also evaluated if the comparatively high germination rates previously observed for some snowbed species are a general feature of snowbed plants of the northern Calcareous Alps, too, and if an eventually observed variability is correlated to attributes of the seeds, in particular to seed size.

The results demonstrate high to very high germination rates for the majority, but not for all of the study species. Gibberellic acid enhanced germination rates of three and accelerated germination of all species. Frost stratification had no measurable effect on rates nor on pace of germination in any of the study species. The time of dormancy as such seems to play a crucial role for breaking dormancy as germination generally was enhanced for seeds stored 6 as opposed to 4 months under cool and dry conditions. We could not find any significant correlation among seed size and germination success.

From our results we conclude that most snowbed plants of the North-eastern Calcareous Alps may achieve fairly high germination rates after several months of dormancy and under favourable conditions. Hence, for these species germinability is unlikely to represent a crucial bottleneck for adaptive migration driven by an upward shift of snowbed habitats under a warmer climate. *S. sedoides* makes an exception to this general trend. This is the more alarming as this species is a narrowly distributed regional endemic.