Effects of population size on fitness traits in four common and four rare congeneric alpine plant species

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While for lowland species it is known that small populations have a reduced individual fitness and therefore increased risk of local extinction, alpine species are not sufficiently studied in this regard. Also, it is not clear how species rarity can mediate the direction and strength of the relationships between population size and fitness. We assessed how population size and rarity affect seed mass, seed number, germination, germination initiation time, seedling survival and seedling height in 90 natural populations of four congeneric alpine plant species pairs in the Swiss Alps (*Androsace chamaejasme, A. puberula, Gentiana acaulis, G. alpina, Potentilla crantzii, P. nivea, Viola calcarata* and *V. lutea*). We observed significantly larger seed numbers in larger populations across all species. At the same time, the number of germinated seeds and surviving seedlings was marginally significantly lower in larger populations, indicating a trade-off between seed quantity and quality. While there was no difference in fitness traits and population size between common and rare species, significant positive relationships between fitness and population size were more prevalent in rare than in common species. Our results indicate that population size affects individual plant fitness also in alpine species. Especially rare species might suffer from a reduced fitness in small populations, which could make them even more susceptible to environmental changes. Future studies should therefore address also long-term fitness traits such as adaptive trait plasticity when studying the relationships between fitness and population size.

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