Universität Basel

Research Project

How local adaption and phenotypic plasticity allow plants to survive in a changing Alpine landscape: Effects of fine-grained vs. croase-grained environmental variability

Third-party funded project

Project title How local adaption and phenotypic plasticity allow plants to survive in a changing Alpine landscape: Effects of fine-grained vs. croase-grained environmental variability
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Alpine biodiversity is particularly rich.ă The flora of the European Alps includes more than five hundred endemic species, i.e. plants unique to a particular mountain region. Plants had to adapt to the particular environmental conditions at high altitude. The richness of endemics is highlighting the strength of selective forces and evolutionary processes in the alpine landscape. While patterns of Alpine species diversity are fairly well known, this is less so for intra-specific variability. It is usually assumed that alpine plants are locally adapted, but this has rarely been tested. Intra-specific differentiation of alpine plants has also been affected by the climatic oscillations during glaciations. Thus, to some extent, phenotypic differentiation in alpine plants may be ecologically relevant and adaptive, but to some degree it may result from random evolutionary processes. Plants can be locally adapted either by fixed genotypic differences or by phenotypic plasticity. Plasticity is the capacity of a genotype to change in response to environmental variation. Genotypic variability and phenotypic plasticity are complementary mechanisms adjusting plants to environmental heterogeneity. To what extent phenotypic plasticity is adaptive and favored by natural selection is an open question. Phenotypic plasticity received increased attention because of its possible role for the colonization of new habitats or to mitigate climate change. But there is a shortage of studies testing the role of phenotypic plasticity in the field. We will reciprocally transplant individuals of alpine plant species among field sites that differ in their type of environmental heterogeneity. The hypothesis to be tested is, that natural selection by fine-grained environmental variability (exposition, slope, snow cover, resource availability) should have favored high phenotypic plasticity, while coarse-grained environmental variability (climatic, elevation, soil type) should have favored increased genotypic variability. This project will contribute to knowledge about still poorly understood questions of evolutionary biology. How much is local adaptation of alpine plants shaped by phenotypic plasticity and how much is it a result of fixed genotypic differences? How important are random evolutionary processes for phenotypic differentiation in alpine plants? Phenotypic plasticity can serve as a pre-adaptation to future environmental change. Therefore, understanding the role of phenotypic plasticity is necessary for predicting how alpine plants will respond to global warming or other environmental changes in the future.

Keywords Alpine landscape, environmental heterogeneity, local adaptation, phenotypic plasticity, reciprocal transplantation

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Follow-up project of 5961 How glacial history, selection and current gene flow affect alpine plants: Population differentiation, local adaptation and demography in a fragmented landscape

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