Effects of climate change and pollen supplementation on the reproductive success of two grassland plant species

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Abstract

Climate change has the potential to alter plant reproductive success directly and indirectly through disruptions in animal pollination. Climate models project altered seasonal precipitation patterns and thus the effects of climate change on available resources and pollination services will depend on the season. Plants have evolved reproductive strategies to minimize pollen and resource limitations, and therefore we expect that the disruption of climate change might cause plants to be more pollen limited in seasons that become wetter than they were historically. In this study, we conducted a pollen supplementation experiment within the Global Change Experiment Facility (GCEF) in Central Germany. The GCEF experimentally manipulates future climate based on a realistic scenario of climate change for the region (drier summers and wetter springs and falls) in a native grassland ecosystem. We quantified seed production of two perennial species Dianthus carthusianorum and Scabiosa ochroleuca in response to pollination treatments (control, supplement), climate treatments (ambient and future) and season (summer and fall). Dianthus carthusianorum produced more seeds in future climate conditions independent of the season, but only when given supplemental pollen. Both species showed an increased reproduction in summer compared to the fall. We did not find any evidence for our expectation of higher pollen limitation in the future climate and fall season (i.e. no three-way interaction pollination x season x climate), which might be explained by the high drought tolerance and generalized pollination of our focal plant species. We conclude that plant reproductive success might be limited by the services of animal pollinators in future climates, and have many suggestions for future studies that are necessary to understand the context-dependence and underlying mechanisms of plant reproductive responses to climate.

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