Phenology dictates the import of climate change on geographic distributions of six co-occurring North American grasshoppers

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Abstract

Throughout the last century, climate change has altered the geographic distributions of many species. Insects, in particular, vary in their ability to track changing climates, and it is likely that phenology is an important determinant of how well expands can either expand or shift their geographic distributions in response to climate change. Grasshoppers are an ideal group to test this hypothesis, given that co-occurring confamilial, and even congeneric, species can differ in phenology. Here, I tested the hypothesis that early- and late-season species should possess different range expansion potentials, as estimated by habitat suitability from ecological niche models. I used nine different modeling techniques to estimate habitat suitability of six grasshopper species of varying phenology under two climate scenarios for the year 2050. My results support the hypothesis that phenology is an important determinant of range expansion potential. Early-season species might shift northward during the spring, while the modeled geographic distributions of late-season species were generally constant under climate change, likely because they were pre-adapted to hot and dry conditions. Phenology might therefore be a good predictor of how insect distributions might change in the future, and conservation efforts might focus most heavily on early-season species that are most impacted by climate change.

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