Abstract

Gender-specific response to rising temperature and drought raises the question of whether global change could lead to drastic change in sex ratio and whether that change in sex ratio could drive population extinction. Answering that question requires an understanding of the mechanism by which change life history traits could be translated into significant change in population dynamics.

Introduction

Rising temperature and extreme drought events have already caused broad-scale diebacks of native species, leading to increased concern on how species will redistribute across the globe under future climate conditions. In more than 50% of the diecious herb species studied, a sex ratio bias toward female has been reported. For dioecious species with a range-limited distribution, climate change could therefore magnify skewed sex ratios and this could affect population demography and thereby favor higher risk of extinction. However, accurate forecasts of colonization-extinction dynamics under future climate scenarios are hampered by limited mechanistic research on the demographic response of dioecious species to climate change across their range.

The effect of climate conditions on species distributions is currently derived by correlative relationships between occurrence record or abundance patterns and current climate conditions (Source). These established relationships serve as the basis for predicting how species will redistribute across the globe in a changing world. However, the responsiveness of species abundance patterns often lags behind environmental change, which can lead to pronounced mismatches in current climate conditions and colonization-extinction dynamics. This mismatch can be particularly pronounced for dioecious species. The ability to track environmental change is dependent on the sex, lifespan, and range position of a species. Accounting for these complexities is a long-standing challenge in accurately predicting which sex will successfully track environmental change and which sex will be driven towards extinction.

Studies on the effect of climatic variation on sex- ratio revealed higher sensitivity (e.g., smaller leaf stomatal conductance, smaller net cardon assimilation and smaller productivity) of females to stress-related resource availability conditions. This high sensitivity to extreme aridity conditions results in high female mortality and thereby male bias sex ratio (Hultine et al.2022). Additionally, a more recent study demonstrated that in wind pollinated dioecious species, the proportion of females increased with warmer temperature and lower precipitation (Burli et al.,2022).