

Bet-hedging strategies of native and exotic annuals promote coexistence in semiarid Chile

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Abstract

Scientists are increasingly interested in the evolutionary responses of organisms to unpredictable, variable, and extreme climate changes. In semiarid environments, inter-annual variability in the frequency and amount of rainfall affects both the growth and recruitment of plant species, especially annuals. In these inherently variable environments, individual selection should favor demographic responses that spread the risk of mortality over time and enhance long-term reproductive success (i.e., bet-hedging strategies). However, the same processes that allow the persistence and recruitment of native species could facilitate the introduction and establishment of exotics. We assessed whether native and exotic annuals in semiarid Chile displayed similar or contrasting bet-hedging traits, and discuss mechanisms of coexistence of both types of species and their demographic variation under interannual rainfall variability driven by El Niño Southern Oscillation (ENSO). We analyzed a proxy of long-term fitness, i.e., the variability of seed density over 17 years, for the two most common native and two exotic annual plant species present in the study area. We experimentally tested whether the quality of the maternal environment (soil water supply in a given year) had an extended effect (e.g. the next year) on the proportion of seed germination or on the mean and/or variability of seed size and seed dormancy. Results showed that native and exotic species in this annual plant assemblage displayed contrasting bet-hedging strategies as evolutionary responses to variable rainfall. Although rainfall variability promotes the evolution of bet-hedging strategies, the nature of these strategies varies across species, presumably to minimize competitive exclusion. In semiarid Chile, the success of two exotic ephemerals that are components of a diverse community of native annual species seems to reflect bet-hedging germination strategies that complement rather than compete with those expressed in dominant natives..