Life History Traits of Solitary Bees as Mediators of Responses to Climate-Warming: Phenological Shifts, Body Size, and Life Span

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Climate change threatens pollinators and plants due to temperature-sensitive species traits that affect pollinator-plant interactions. For example, climate-warming is causing shifts in seasonal pollinator activity and flowering periods (i.e. phenologies) that are species-specific in magnitude and direction, which has uncoupled pollinator-plant interactions. Additionally, environmental temperature during development may affect pollinator body size and life span, with implications for pollinator-plant interactions and pollinator fecundity. Species-specific responses to climate-warming indicate that certain pollinator and plant species may be more vulnerable to the negative effects of climate-warming than others. The goal of this study was to help pinpoint species of concern by experimentally determining the role of solitary bee overwintering life stage (adult vs. prepupae) as a mediator of responses to climate-warming. Using multiple bee species and temperature-controlled chambers, I subjected bees to eight manipulations, i.e. factorial combinations of two temperatures (warm vs. cool) and two durations of fall and winter (i.e. short and long). Bee emergence date, weight (before and after manipulations), and longevity following emergence were recorded. Results suggest that increased temperature may cause bees that overwinter as prepupae to advance their phenology more than bees that overwinter as adults, while bees that overwinter as adults showed a greater reduction in body size and life span compared to bees that overwinter as prepupae. These results indicate the potential for overwintering life stage to mediate bee responses to climate-warming and suggests that certain species may be more prone to either phenological responses or altered body size and life span.