Evidence of local adaptation in temperature tolerance traits of the gametophytic and sporophytic stages in *Solanum carolinense* (horsenettle)

Abstract

Climate change is rapidly altering local temperature regimes across the landscape. In response to these rapid changes, plant species must tolerate or avoid heat stress or risk extinction. We compared temperature tolerance traits in *Solanum carolinense* populations from Texas and Minnesota to understand how a single species adapts or acclimates to different types of temperature stress. We included traits in both the gametophytic and sporophytic stages to differentiate between these distinct phases of selection and examine potential correlations between the two. We found that temperature sensitivity differed between populations of the south that face extreme heat regularly and northern populations that do not. However, the results were not always consistent with our expectations, including counter-gradient results in both the sporophyte and gametophyte. Based on the ideas from previous work, our results are consistent with the hypothesis that an avoidance mechanism mitigates extreme heat in the gametophyte through producing a higher proportion of pollen grains that remain dormant during high temperature conditions. There were no correlations in temperature tolerance between the sporophyte and gametophyte, suggesting that there are different temperature tolerance strategies between the stages. These findings indicate that wild populations have the potential to adapt to rising temperatures due to climate change in the future.