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NC Native Plant Society Tom and Bruce Shinn Grant Update

Background

The purpose of this study is to quantify how sequential heat driven extinctions of native bee species will affect the rewiring of plant pollinator networks and plant fitness. Theoretical network studies predict plants are robust to the loss of several bee species before experiencing reproductive losses,[1] yet there is limited empirical research on what happens to network structure and the remaining members of the community. I aim to fill this gap by establishing controlled plant-pollinator communities that reflect sequential bee extinctions and analyzing the resultant network dynamics and plant fitness outcomes.

Progress Report

In 2022 I acquired all supplies needed to build five pollinator flight cages and successfully established experimental plots at NCSU's Agroecology Farm. I also collected the necessary data on bee abundance, field physiology and thermal limits to determine which bees to use in the experiment (Fig 1). The full bee community that I used, in order of most vulnerable to least vulnerable to climate change as predicted by CTmax, includes *Bombus impatiens, Bombus griseocollis, Xylocopa virginica, Apis mellifera,* and *Halictus ligatus/poeyi*. I also figured out how to get bees to forage semi-naturally in the flight cages and conducted a pilot study.

This summer I used *Bidens frondosa, Chamaecrista fasciculata, Gaillardia pulchella,* white clover and vlaspik cucumber as the five plant study species (Fig 2). On prep days I collected the appropriate number of bees of each species and stocked the cages with bees and plants. On observation days I recorded the number of visits of each bee species on each plant species. I then collected the bees and cucumber stigmas. I will analyze pollen deposition on my samples in fall 2023. My goal is to have all field data collected by the end of July 2023 (total of 3 observation days), and lab work completed by December 2023. I may need to conduct another round of this experiment in 2024. With these data I hope to elucidate how climate change might shape future plant-pollinator networks and the consequences of the loss of bee species on pollination.

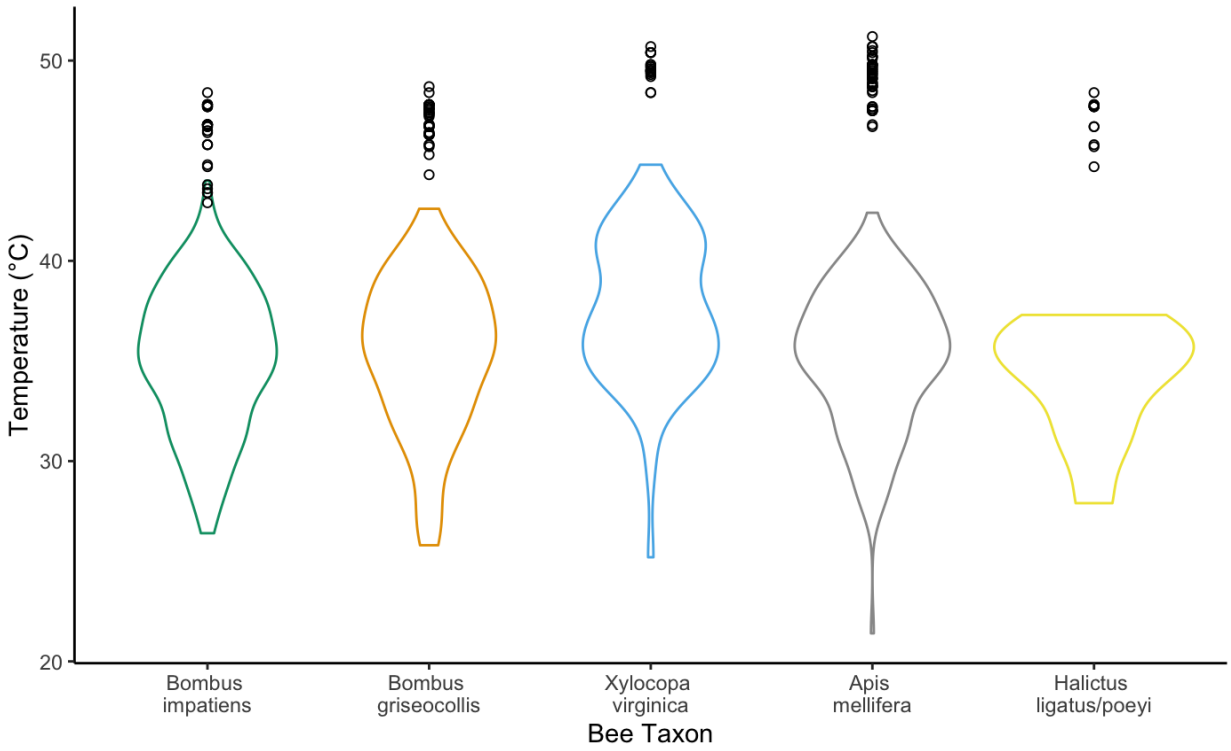

Fig. 1 Bee species' foraging body temperatures (violin plots) and CTmax (points). Numbers reflect the difference between mean CTmax value and the maximum foraging bee body temperature. Some bees forage at temperatures near their thermal limit. These species with the smallest thermal safety margin could be most at risk due to climate change.

Fig 2. Plant species in experimental pollinator flight cage.

Fig. 3 *Halictus ligatus/poeyi* foraging on *Gaillardia pulchella* in an experimental plot.

Literature Cited

[1] Kaiser-Bunbury, C. N., Muff, S., Memmott, J., Müller, C. B., & Caflisch, A. (2010). The robustness of pollination networks to the loss of species and interactions: a quantitative approach incorporating pollinator behaviour. *Ecology letters*, *13*(4), 442-452.