CHICAGO BOTANIC GARDEN

2021 Research Experiences for Undergraduates Program

Effect of co-flowering species abundance, richness, and diversity on pollinator visitation to tomato and squash flowers

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Many studies have shown that competition over pollination with co-flowering species can lower a species' reproductive success. This is caused by

- competition over limited pollination services[1] and
- interspecific pollen transfer[2]

However, presence of co-flowering species can also enhance a species' reproductive success by

- alleviating pollen shortage (plants not getting enough pollination to be at their full reproductive potential) by attracting pollinators to the area
- reducing geitonogamy (within-plant pollen transfer)[3]

The effect can depend on pollinator density, with

- co-flowering species at high pollinator density facilitating pollination while
- reducing pollinator visitation rate at low pollinator density[4]

Aims

- Examine the effect of floral species richness, abundance, and diversity on pollinator visitation to tomato flowers at urban farms
- Observe the correlation between floral resources and the diversity of the broader pollinator community

Hypotheses

- Increased floral resource richness and abundance could increase visitation to the study plants by boosting pollinator populations and helping attract pollinators to the general area
- Increased abundance and richness of surrounding plants could also negatively affect visitation to the study plants by providing more and better resource options for pollinators, making visitation to the focal plants less desirable

Figure 1.
Peponapis pruinosa (pruinose squash bee), which only pollinates squash and other cucurbits; the most common pollinator observed visiting our squash flowers

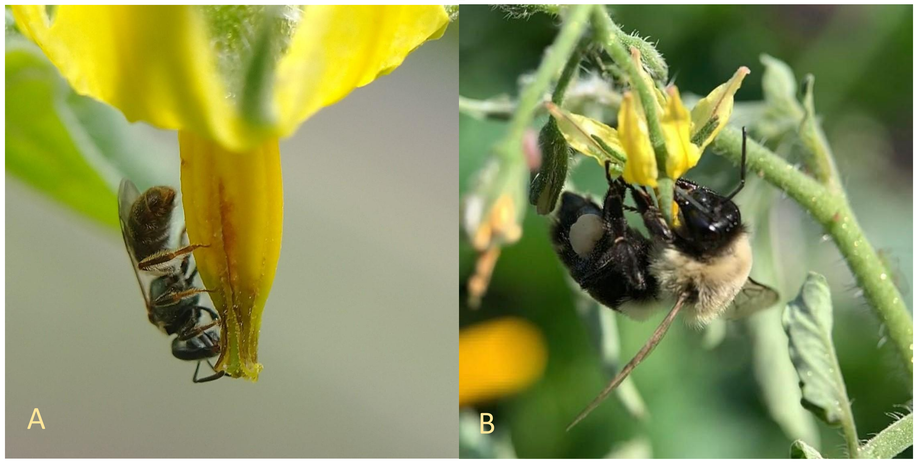

Figure 2.
(A) Lasioglossum sp. (sweat bee) and **(B)** Bombus impatiens (common eastern bumble bee), the only two genera of bees that we observed pollinating tomatoes. They, unlike most other bees, are capable of sonication using their flight muscles, which is required to release pollen from tomatoes.

Methods

- Study conducted at 5 urban farms in Chicago and the Chicago Botanic Garden
- Focal plants consisted of 20 tomato and 20 squash plants at each site
- All animal-pollinated flowers within a 15m radius of the focal plants were identified and counted at each site 2-3 times
- Pollinator visitation to study plants was recorded
- We sampled the broader pollinator communities at each site by monitoring chunks in and around the site in 10 minute intervals
- Many pollinators were only identified to genus or higher taxonomic level
- We did not collect any insects

We calculated site averages for:

- floral resource abundance, species richness, and Shannon diversity
- pollinator visitation rates to focal plants
- pollinator community abundance
- richness and Shannon diversity of pollinator community based on genus

The relationships between these variables were quantified through linear regression

Conclusion/Discussion

- No statistically significant relationships were found besides:
- An unexpected, weak but statistically significant decrease in broader community Shannon index with increasing floral Shannon index
- More data needs to be collected
- The effect of floral resources within 15 meters of the focal plants may be different than that of floral resources in the broader vicinity
- Studying functional diversity and usefulness of floral resources to pollinators could be more insightful than simply looking at floral abundance, richness, and diversity

Results

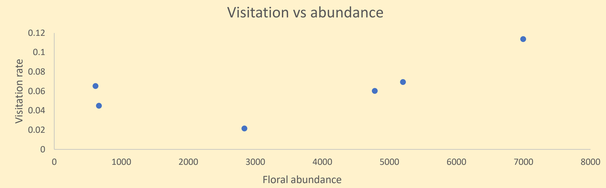

Figure 3. Average visitation rate (pollinators/ number of plants observed) per 10 minute observation period plotted against average floral abundance at each site. P = .164, R^2 = .421

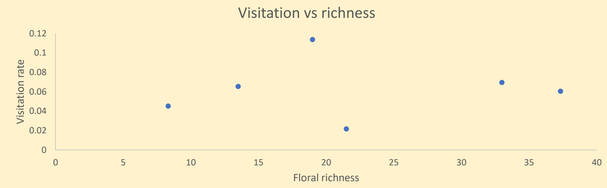

Figure 4. Average visitation rate per 10 minute observation period plotted against average floral species richness at each site. P = .891, R^2 = .005

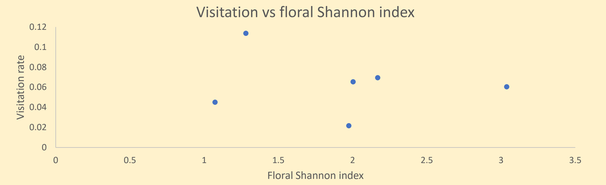

Figure 5. Average visitation rate per 10 min observation period plotted against average floral Shannon diversity at each site. P = .714, R^2 = .037

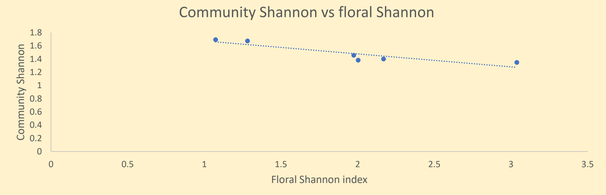

Figure 6. Pollinator community Shannon diversity index (by genus) plotted against average floral Shannon diversity at each site.
Slope = -.196, Y-int = 1.869, P = .013, R^2 = .817

Literature Cited

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