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Floral nutritional value and plant-pollinator interactions in Providence, RI

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Background

With proper research of nutritional ecology, urban environments can support diverse insect pollinators (Baldock et al., 2019). This requires a long-term study as well as knowledge of the nutrients provided by floral resources. My research builds upon prior Bonoan Lab research on pollinator abundance and diversity on campus by investigating floral abundance and nutritional quality of on-campus rainwater retention gardens (bioswales). I collected data on plant-pollinator interactions, pollen nutrition, and nectar nutrition. I predict flower species with higher nutritional value will have relatively more visits from insect pollinators.

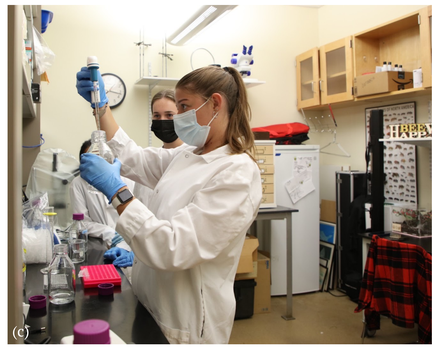


Figure 2. (a) Survey being performed with blazing star and anise hyssop in bloom. (b) Pollen dissection from blue wild indigo. (c) Nectar amino acid preparation. (d) Bagged purple coneflower in a bioswale.

Figure 1. Brown-belted bumble bee (*Bombus griseocollis*) on blazing star (*Liatris spicata*, LIASPI). All photos: Rachael E. Bonoan and Gracey Sorensen.

Methods

Plant-pollinator interactions:
- 53 quadrats (1m x 1m) were placed in 3 bioswales on Providence College campus.
- The quadrats were surveyed for 10 minutes weekly from the last week of May to the last week of July (Figure 2a).
- Data collected in the quadrat included plant species, number of flowering units, and identity of flower-visiting insects, with a focus on bees.

Nectar:
- Flowers from each species were bagged 24 hours prior to nectar collection (Figure 2d).
- Nectar was collected using the washing method and stored in the lab for later use (Morrant et al., 2009; Pavlik et al., 2018).
- Both sugar and amino acid concentrations were found using a colorimetric assay (Mckenna and Thomson, 1988).

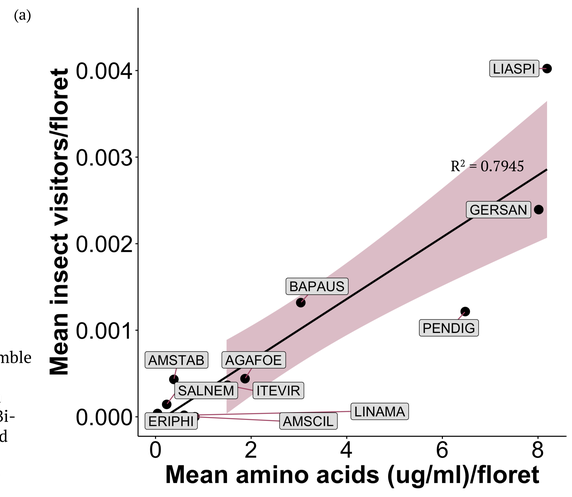
Pollen:
- Pollen samples were collected from the closed buds of flowers by dissection (Figure 2b).
- Percent carbon and nitrogen were found using elemental analysis.

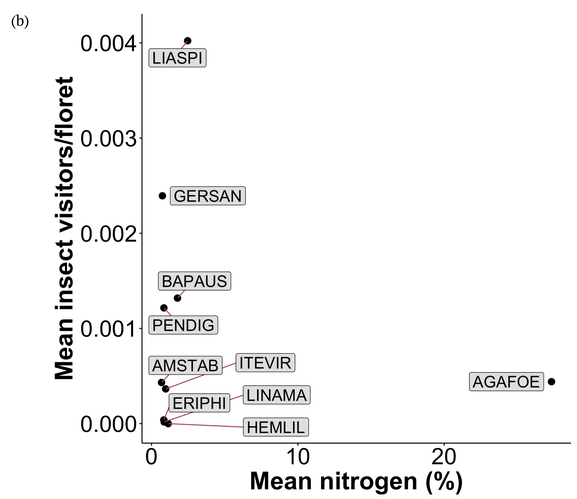
Results

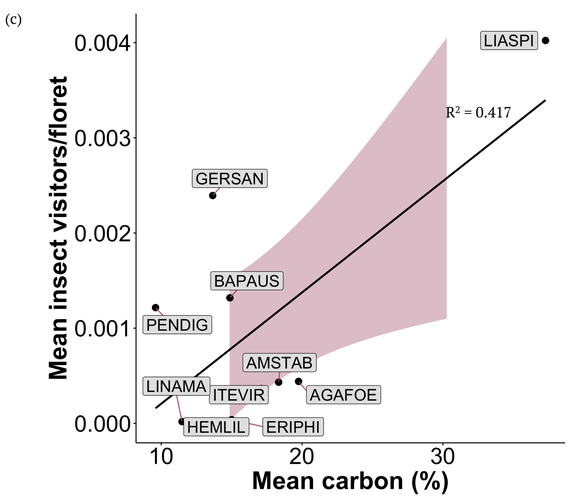
Nectar:
- Significantly more insects visited flowers with higher concentration of amino acids ($F = 39.67$, $df = 1/9$, $p < 0.001$) (Figure 4a).

Pollen:
- There was not a significant correlation between number of insect visits and nitrogen content ($F = 0.8792$, $df = 1/7$, $p = 0.380$) (Figure 4b).
- Significantly more insects visited flowers with higher carbon content ($F = 8.2462$, $df = 1/7$, $p = 0.024$) (Figure 4c).

Figure 5. (a) Confusing bumble bee (*Bombus pexrplexus*) on AGAFOE. (b) Bi-colored striped sweat bee (*Agapostemon virescens)* on ECHPUR.







Figures 4. (a) Correlation of mean insect visits and mean amino acid concentration per floret. (b) Correlation of mean insect visits and mean percent nitrogen per mg. (c) Correlation of mean insect visits and mean percent carbon per mg.

Conclusions

These data suggest insect pollinators, mainly bees, are more likely to forage on plants that have higher nectar amino acid concentration and higher pollen carbon content. However, LIASPI is likely skewing the pollen data and therefore more samples are required. Future research will continue to test more plant species for pollen nutrients and plant-pollinator interactions. Analysis of nectar sugar concentration is ongoing.

In the future, I will quantify nutritional value of the Providence College bioswales throughout the year. These data can inform floral recommendations that augment pollinator nutrient availability in urban environments.

Acknowledgements

This research was supported by the Providence College Biology Department. Thanks to Providence College Walsh Student Research Fellowship for providing funding for the project and the Southeastern New England Educational and Charitable Foundation for providing funds for the elemental analyzer.

Literature Cited

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Figure 3. (a-o) Floral species studied with 6-letter plant code. Note, some plants are depicted with flower-visiting insects.