

Evidence for Competition Between Honeybees and Bumble Bees in Southeastern Massachusetts

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Introduction

- Native bumble bees (*Bombus spp.*), similar to European honeybees (*Apis mellifera*), are effective social generalist pollinators (Hury *et al.* 1997).
- Domesticated honeybees have the potential to compete with native bees for floral resources which could negatively impact native bee fitness (Goulson *et al.* 2007, Elbgami *et al.* 2014).
- The popularity of backyard beekeeping in addition to commercial honeybee use, may exacerbate competition for resources already diminished by urbanization (Sudgen *et al.* 1996, Elbgami *et al.* 2014).
- This study examined the relationship between honeybee abundance and bumble bee fitness using intertegular distance as a proxy for fitness to determine if there is competition.

Study Sites

Table 1: Assessment of land-use practices for six study sites located in Southeastern Massachusetts. Native Meadow and Beaver Brook are located on the Brockton campus of Massasoit Community College.

SITES→	Christos	Beaver Brook	Native Meadow	Sachem Rock	Dunrovin Farm	Leland Farm
% Impervious (within 900 m)	44.0%	39.1%	25.9%	11.3%	3.8%	9.9%
Land use	Urban parking lot	Urban college campus	Urban college campus	Suburban park	Semi-forested lot	Commercial farm
Sustainable practice	None	Riparian buffer, Reduced Pesticides	Native plantings, Reduced Pesticides	Community garden	Reduced Pesticides	None

Methods

- Bees were sampled from April to October of 2017 and 2018 at six sites along an urban gradient in Southeastern Massachusetts.
- Bees were caught via sweep nets and pan traps to reduce collection bias (Roulston *et al.* 2007).
- Blue, white, and yellow pan traps (10 per color) were deployed at each study site and retrieved after 24 hours (Droege 2015).
- Sweep netting was performed by two researchers along a 100-m transect for 30 minutes following pan trap collection (Popic 2013).
- Collection methods were normalized to sampling effort to account for damaged pan traps.
- Bumble bees were separated by sex and their intertegular distances were measured using a digital microscope camera with cellSens imaging software.
- Pearson correlation analyses tested for relationships of honeybee abundance and urbanization to intertegular distance.

Results

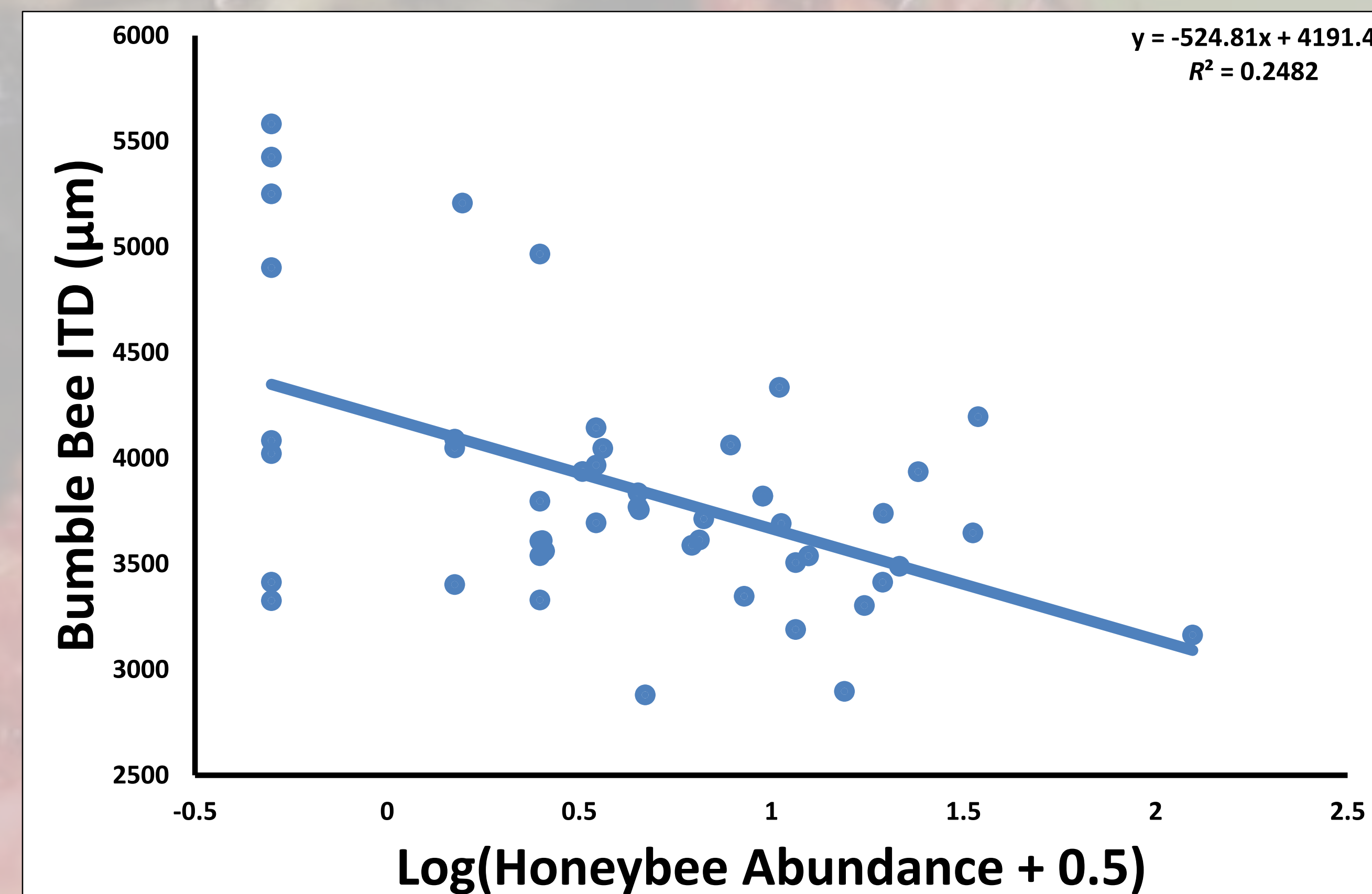


Figure 1: Correlation of bumble bee intertegular distance (ITD) and honeybee abundance. Pearson correlation revealed a significant, but weak, negative correlation between average bumble bee ITD per month and average honeybee abundance per month at each site ($R^2=0.2482$, $p=0.0003$).

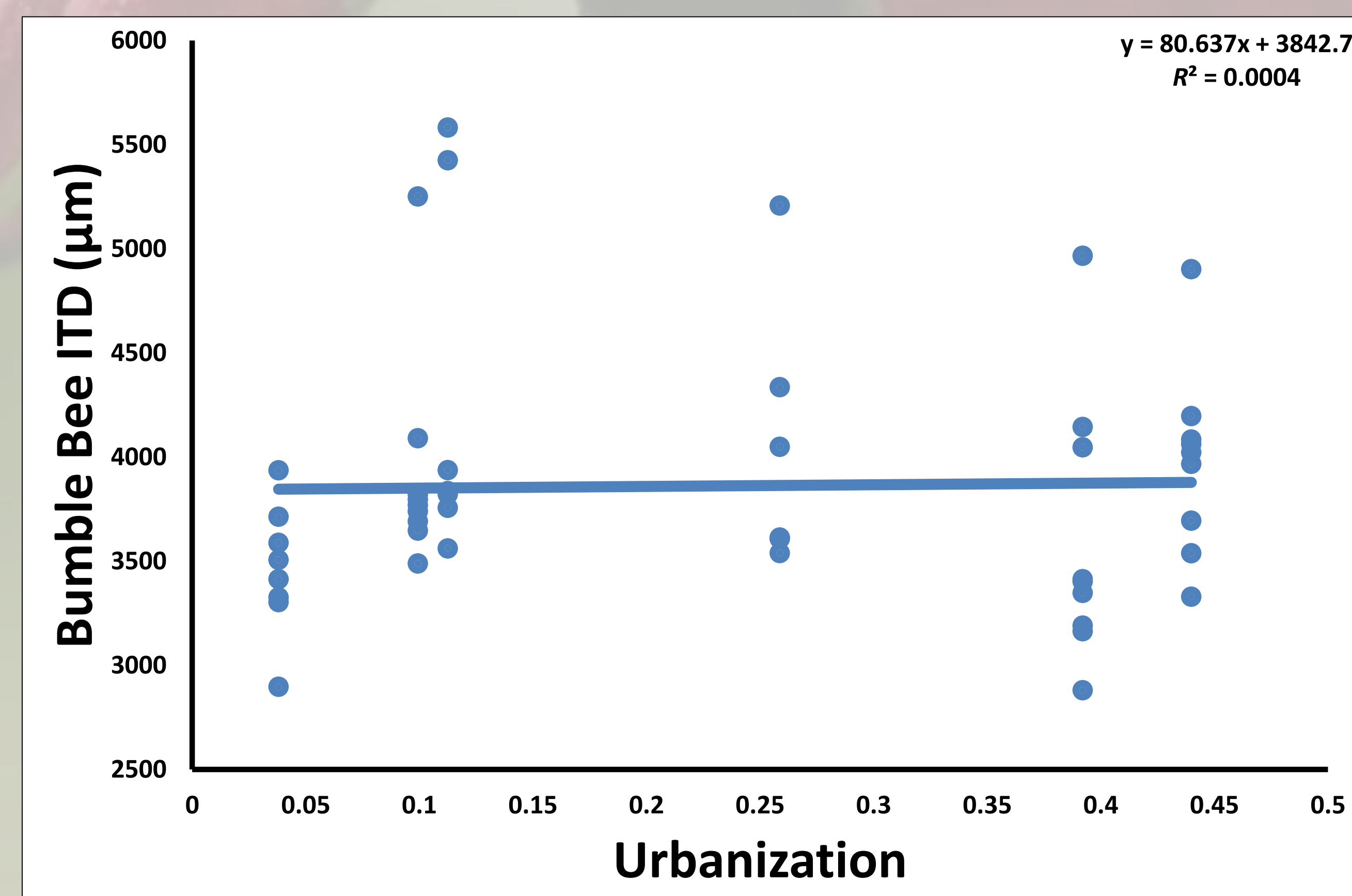


Figure 2: Correlation of bumble bee intertegular distance (ITD) and urbanization. Percent impervious land cover within a 900-m radius was used as a proxy for urbanization. Pearson correlation analysis did not support a relationship between average bumble bee ITD per month and urbanization ($R^2 = 0.0004$, $p=0.8870$).

Discussion & Conclusion

- In general, when there was higher honeybee abundance there appeared to be smaller, less fit bumble bees. This is consistent with previous studies (Goulson *et al.* 2007, Elbgami *et al.* 2014).
- Bumble bee ITD had no correlation with urbanization, suggesting that urbanization does not positively or negatively affect bumble bee fitness. This is contrary to previous studies (Samuelson *et al.* 2018, Milano *et al.* 2019).
- There may be competition between honeybees and bumble bees that impacts bumble bee fitness, however more data are needed.

Future Work

- An evaluation of local plant diversity may determine if the possible competition that is observed is due to lack of floral resources.
- Analysis of additional years of data may determine if the findings are due to seasonal fluctuations.



Figure 3: Measurement of bumble bee intertegular distance (ITD) using a digital microscope camera with cellSens imaging software.

Acknowledgements

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