Evaluating key pest and beneficial arthropods in urban community garden sites in the Twin Cities metro area

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INTRODUCTION

Urban vacant lots provide an opportunity to revitalize urban spaces into enriching areas like urban community gardens, which can provide nutritional, health, social, and ecological benefits, especially in low-income neighborhoods. While directly managing the flora in community based gardens has a large influence on their growth, other organisms play a key role in their development. Arthropods are an important part of the interactions that take place. Though some are pests, many contribute to the vitality of our productive green areas. These arthropods are considered beneficial, and provide ecosystem services such as pollination, pest management, recycling of nutrients, decomposition of plants and animal waste, and soil aeration. Arthropods also serve as food for fish, birds and other living organisms. Though it is known that aboveground plant diversity contributes to the diversity and abundance of arthropods, this has not been extensively studied in urban, highly-managed areas.

Pilgrim Church Community Garden

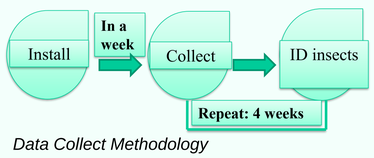
Mashkiikii Gitigan

Growing Lots

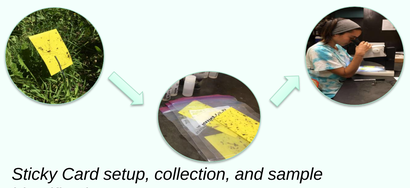
Frogtown Farm

METHODS

In this study, we investigated arthropod diversity across four urban community garden sites named, Mashkiikii Gitigan, Pilgrim Church Community Garden, Frog Town Farm, and Growing Lots, in the Twin Cities metro area using pitfall traps, and sticky cards over a four week period during summer, 2018. Through the use of these materials, arthropods were measured and identified.



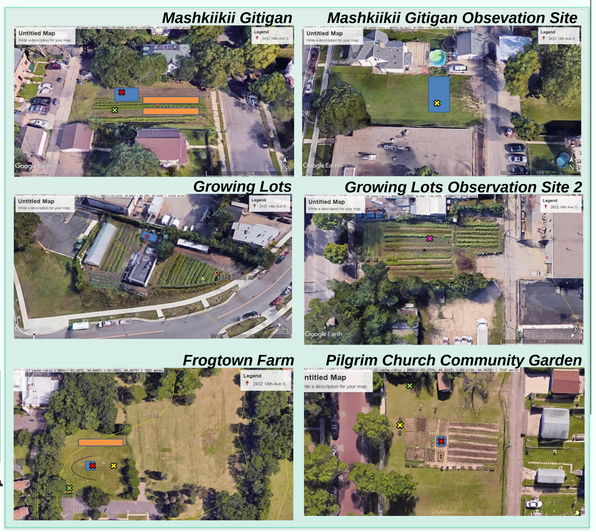
Data Collect Methodology



Sticky Card setup, collection, and sample identification

Pitfall Trap setup, collection, and sample identification

To install the traps, three random collection sites were selected within the farms in order to give a broader view of the diverse composition in each site. These were categorized Research Site (RS), Natural Site (NS), Observational Site (OS).



Legend: Plot Setup

Experiment Plot
Pitfall trap and sticky card: Natural Site
Pitfall trap and sticky card: Observational Site 2
Pitfall trap and sticky card: Research Site
Pitfall trap and sticky card: Observational Site
High tunnel

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RESULTS & DISCUSSION

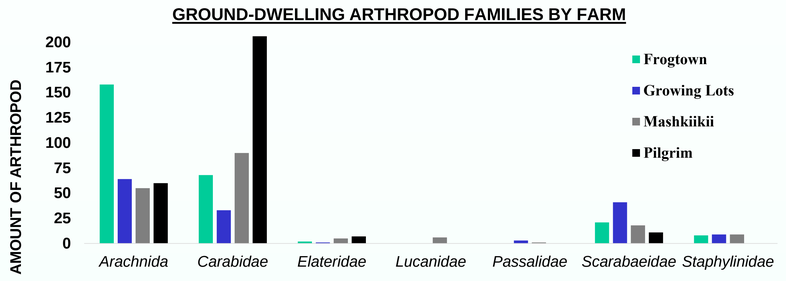


Fig. 1 Pitfall Traps were a tool used for capturing ground-dwelling arthropods. Pilgrim Garden showed highest abundance percentage (32%) of total arthropods collected among all farms, this can have some relationship with the low management and disturbance of the ecosystem. Growing Lots, lowest showed abundance (17%), thought it's high in crop diversity, their farm is developed on top of pavement and located in the middle on the city, which could have a direct effect in the arthropod presence. *Carabidae* (45% total collected at all farms combined), *Arachnida* (38%), and *Scarabaeidae* (10%), were the families with biggest overall presence. These are beneficial arthropods as they provide ecosystem services such as depredation (*Carabidae, Arachnida*) and decomposition (*Scarabaeidae*).

Arachnida (Predatory)

Carabidae (Predatory)

Elateridae (Pest)

Scarabaeidae (Decomposers)

Staphylinidae (Predatory)

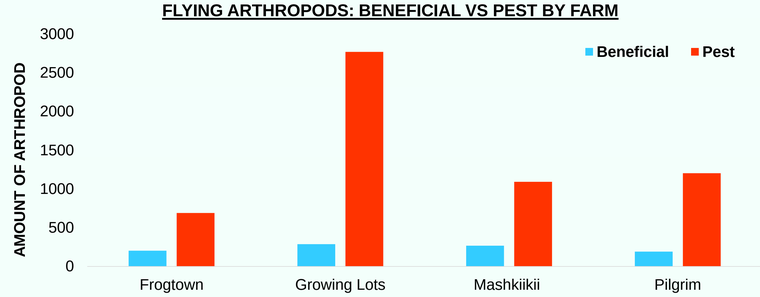


Fig. 2 Sticky cards were a tool use to capture flying arthropods. Growing Lots showed highest percent of beneficial arthropods (30%) collected among all farms, this can be related to the high abundance and diversity of crops that can attract many beneficial arthropods, also, weedy areas can provide a habitat for these beneficials. Pilgrim had lowest percent of beneficials (20%), this can be related to their low abundance and diversity of crops, and low surrounding plant diversity. Parasitoids Wasps (79%) and Minute Pirate Bugs (18%) make up the bulk of the beneficials found. Thrips (38%) and Aphids (39%) are the most prevalent pests identified.

Parasitoid Wasp (Beneficial)

Minute Pirate Bug (Beneficial)

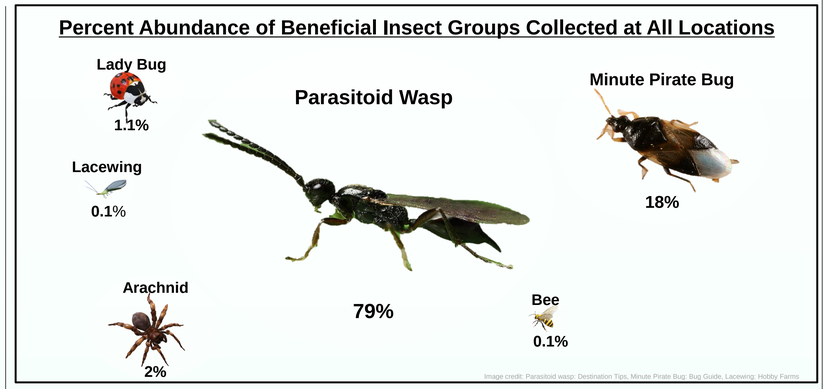
Lady Beetle (Beneficial)

Thrip (Pest)

Aphid (Pest)

Beneficial:Pest Ratio			
Frogtown	**Growing Lots**	**Mashkiikii**	**Pilgrim**
29:100	29:100	25:100	16:100

A total of beneficial to pest ratio was calculated to demonstrate the relationship between arthropods and balance of the ecosystem at each site.



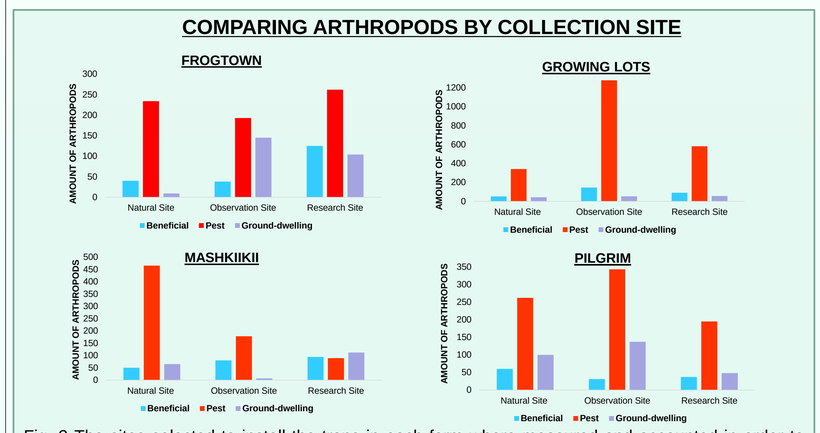


Fig. 3 The sites selected to install the traps in each farm where measured and accounted in order to observe the differences in abundance and diversity throughout the farms. In the ground-dwelling (pitfall trap) data, Observational sites were the most abundant, with Observational and Research Sites containing 75% of total collected arthropods among all sites. Since these sites are managed by the farmers and receive constant nutritional substitution by agriculture best management practices, these soils can be viewed as a sign of healthiness. The Observational Sites had 1.5 times more ground-dwelling arthropods than the Natural Sites. Research Sites were also most diverse with 8 out of 9 families collected. In the sticky card data, Research sites were the most abundant in beneficial arthropods with 41% of total collection among all sites, Observational Sites had the most pest abundance with 45%, and 25% for Research Sites.

CONCLUSIONS

- There was a diversity of both pest and beneficial arthropods at all sites.16% beneficial arthropods, and 84% pest overall.
- Farm sites differ from each other in arthropod abundance and diversity. Our results highlight key pests and beneficial insects common to urban community garden sites, reveal trends based on surrounding plant diversity, and can be used for follow up studies with the goal of improving urban ecosystem functioning by conserving beneficial arthropods.
- Future research could quantify plant diversity between sites, compare more urban gardens, and expand arthropod and insect sampling methods (i.e. aerial nets, visual counts, etc.).

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