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Non-native Coccinellid beetles and land use abundance patterns in the Quad Cities region

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Introduction

Invasive species are a large driver of species extinctions. Invasive species are capable of outcompeting native species in urban environments, leading to declining native populations. Coccinellid beetles, commonly called ladybugs, are a common easily recognizable group of beetle species found in urban landscapes all over the globe. Many native species of coccinellid beetles are in decline in the United States. Some studies point to the intentional introduction of non-native species as biological control agents as partially responsible for native species declines. Studies indicate that the invasive species *Harmonia axyridis* can outcompete native species (Pell et al. 2008). The Quad Cities, located along the Mississippi river between Iowa and Illinois, has had two commonly found non-native species of coccinellid beetles since the 1980s. Records from the Augustana Entomology collection show that the appearance of these two beetles corresponds with the extinction of 6 of the 12 native species found locally. Understanding how these species uniquely impact native beetles will help us understand the complex relationships between native and non-native species.

Research Questions:

- How do both the non-native *Harmonia axyridis* and *Coccinella septempunctata* populations correlate to land use?
- How do these two non-native species of coccinellid beetles potentially contribute to declines of native species?

Methods

During the summer of 2021, surveys were conducted by sweep net, visual search, and yellow sticky traps within 35 different sites comprising seven land use categories: agriculture, industrial/commercial, forest, gardens, mowed grass areas, native prairie, and unmowed grass areas. Every two weeks, 5 yellow sticky traps were deployed 25 m apart at each site. During the collection and redeployment of sticky traps, sweep netting occurred for 10 minutes near and around the surrounding sticky traps. Once the 10 minutes was up, sweep nets content were sorted. Lady Beetles were placed into vials of isopropyl alcohol and brought back to the lab for identification, curation, and uploading to the SCAN-Bugs Database. This survey was conducted a total of five times between the dates of June 23 and August 19, 2021.

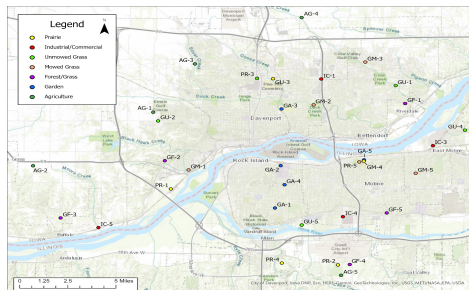


Figure 1. Map of the 35 study site (circles) with 7 land use types (color of circle) in the Quad Cities area of NW IL/SE IA.

Results

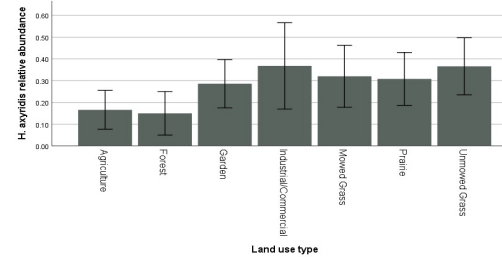


Figure 2. *Harmonia axyridis* relative abundance with land use. There is greater relative abundance of this species in industrial/commercial and unmowed grass sites.

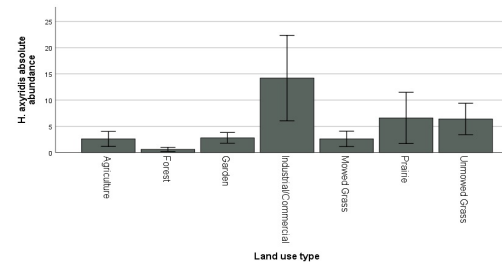


Figure 3. *Harmonia axyridis* absolute abundance with land use. There is greater absolute abundance of this non-native lady beetle in industrial/commercial sites.

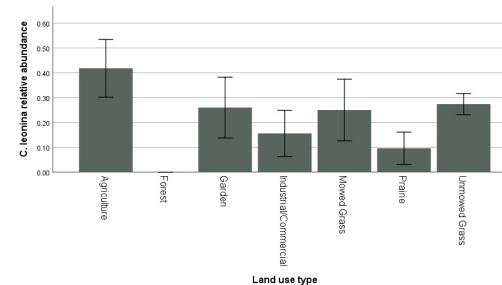


Figure 4. *Coccinella septempunctata* relative abundance with land use. There is greater relative abundance of *C. septempunctata* at agriculture sites.

Results

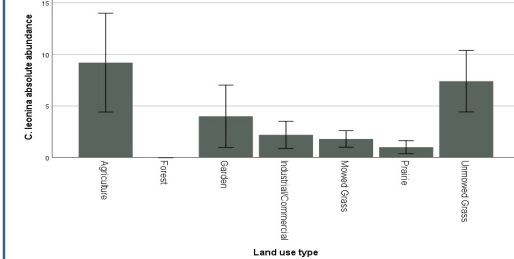


Figure 5. *Coccinella septempunctata* absolute abundance with land use. There is greater absolute abundance of this non-native lady beetle in agriculture sites.

Discussion

- *Harmonia axyridis* occurred in higher abundance in industrial/commercial and in agricultural sites.
- *Coccinella septempunctata* was found in greater abundance in all other sites except for forest sites.
- Studies suggest that both *H. axyridis* and *C. septempunctata* act as generalists which may give them a competitive edge over some native species (Hodek and Michaud 2008 & Pell et al. 2008).
- The combination of two non-native species are using different habitat niches could be responsible for the serious decline in native diversity locally and may explain why we have seen declines in native coccinellid species throughout the United States.



Literature Cited

- Hodek, I. Michaud, J.P. 2008. Why is *Coccinella septempunctata* so successful? (A point-of-view). Eur. J. Entomol. 105: 1-12.
- Pell, J.K. Baverstock, J. Roy, H.E. Ware, R.L. Majerus, M.E.N. 2008. Intraguild predation involving *Harmonia axyridis*: a review of current knowledge and future perspectives. BioControl. 53: 147-168.

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