Invasive Lady Beetles & The Disappearance of New York's State Insect

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Abstract

Our study sought to establish the prevalence of invasive versus native lady beetle species in New York City and the Northeast. We collected and analyzed DNA samples from lady beetles found in Red Hook, Prospect Heights, and Connecticut in an attempt to establish species diversity and discover whether any of the samples were native lady beetles, which have been driven to near extinction due to competition from invasive species like *Harmonia Axyridis*. DNA analysis was essential for this project, since *H. Axyridis* closely resemble native species. Four out of five of the samples collected were confirmed to be *H. Axyridis* by DNA sequencing, backing up our hypothesis that the invasive beetles have nearly driven out native species.

Introduction

Native lady beetle species, including the nine-spotted ladybug (*Coccinella Novemnotata*), New York's state insect, once thrived in New York City and the Northeast. But in recent years populations have plummeted due to a loss of habitat and competition for food and resources. *Harmonia axyridis,* commonly called the Asian Lady Beetle was introduced as aphid control to the United States over a century ago, and populations in the northeast have increased dramatically in recent decades. *H. Axyridis* has outcompeted *C. Novemnotata* and other native species, and now makes up much of the lady beetle population in the region. We sought to gage the prevalence of *H. axyridis* compared to the native species that have all but disappeared.

Materials & Methods

Our study collected five samples from three locations: a home in Connecticut, an apartment in Prospect Heights, and a park in Red Hook, Brooklyn.
To establish sample species using DNA barcoding we used the technique known as Rapid DNA Isolation, following a standard protocol.[3]

Table 1: Sampling locations, appearance, and species identification from sequencing

Sample Collection location	Collection Environment	Appearance	Sequencing results
Prospect heights	Indoors	Red/Orange beetle	H. Axyridis
Connecticut	Indoors	Red/Orange beetle	H. Axyridis
Red hook	Outdoor, Athletic field	Red, large beetle	Not conclusive, likely **not** H axyridis
Connecticut	Indoors	Red/orange beetle	H. Axyridis
Connecticut	Indoors	Red/orange beetle	H. Axyridis

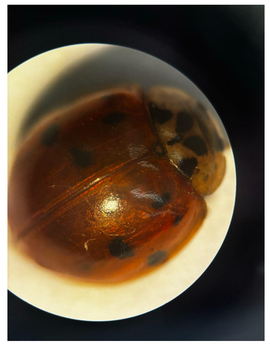

Figure 1. Image of specimen collected from site in Connecticut

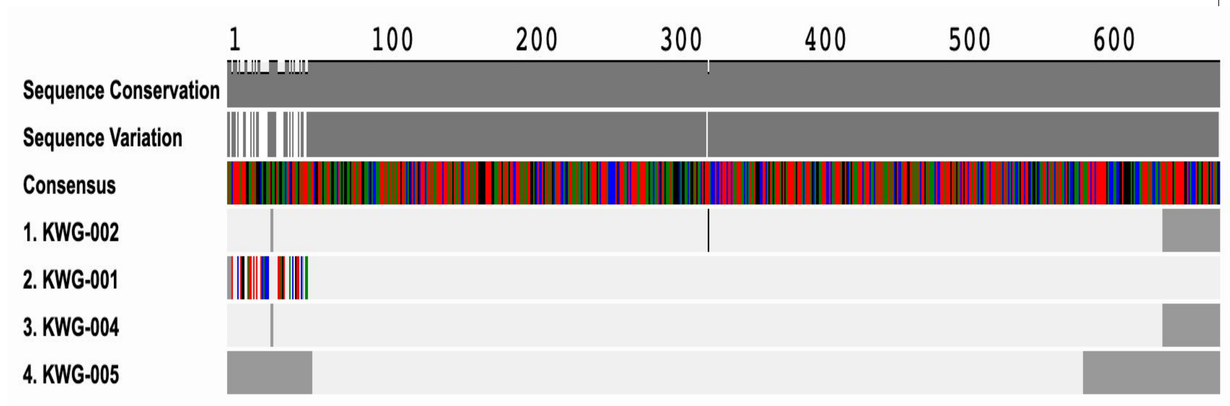

Figure 2. Sample barcode matching

Results

- Our sample from a Prospect Heights apartment's DNA sequence matched with both *Eurydema gebleri*, a kind of stink bug, and *Harmonia Axyridis*. It is more likely that the sample is *H. Axyridis* based on its size and color.
- Our sample from a Red Hook park did not have any conclusive matches because of an error during the PCR which led to losing most of the sequence, but since it was far larger than all of the other ladybugs and was much more red, it is likely that it was not also *H. Axyridis* or *E. gebleri*.
- Our three samples from Connecticut matched only with *H. Axyridis,* as predicted.
- The samples collected in Connecticut appear to match only with *H. Axyridis*, whereas the sample from Prospect Heights is likely *H. Axyridis* but also matched with *E. gebleri*.
- Therefore, we can confidently state that 4 out of 5 of our samples were the invasive H*armonia axyridis*, while the fifth was likely not, but we are unable to identify what exact species it is

Discussion

Despite the lack of conclusive DNA evidence, we believe that the sample collected in Red Hook (KWG-003) was the only non-invasive sample, due to its color difference from the other four insects. KWG-003 was also the only sample found outdoors, as the four suspected invasive species were all found in home infestations. This follows the typical behavior pattern of *Harmonia axyridis*, which are known to take shelter in homes during the colder months. Our lack of sample diversity, despite multiple trips to green spaces densely populated by other insects, can be attributed to several factors. Firstly, the timing of our study. Ladybugs primarily emerge in late-spring, and due to the confines of our study, our last sample collection happened in late April, meaning most of our samples were collected indoors where insects had sheltered for the winter. Secondly, the variable, and often cold weather this spring may have killed or delayed the emergence of lady beetles. Finally, the difficulty of finding non-invasive lady beetles validates our hypothesis. Our initial hypothesis took into consideration that we may find few or none native samples, simply because *H. Axyridis* has been so successful in competing with native species. Further research, with a larger sample size is needed to prove our hypothesis that native lady beetle species are nearing extinction in the New York area, with alterations based on where our study struggled. Further research should be conducted in late spring and summer months to ensure maximum ladybeetle activity, and sequencing measures should be improved to prevent the loss of valuable data due human error.

References
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