

# Invasive Southern Beetle Species on the Longwood High School Campus

## Effect of Climate Change

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### Abstract

Blister beetles, commonly found in warmer regions of North America, may possibly migrate to more northern areas if the current rising temperatures continue. By collecting beetle specimens, isolating their DNA, and using the Subway program to identify the species, our results indicate that there are several invasive beetle species present on our campus. Some of these species are occupying the northern edges of their usual habitat. Infestations of one of these invasive species, *Harmonia axyridis*, can cause harm to humans in the form of allergies, eye irritations, and asthma. These results suggest that rising temperatures may be a factor in the ranges of certain beetle species extending northward.

### Introduction

Warmer temperatures have increased the incidence of the Colorado potato beetle into the northern regions of several continents (1). In addition, when the beetles occupy warmer areas, they can produce an increased number of generations per year (2). Climate change has also hastened the spread of invasive species such as *Harmonia axyridis* in Britain (3). *Harmonia axyridis*, the Asian lady beetle, was first introduced into the United States to control aphids. However, over time, it has emerged as a harmful pest. Host species distribution is also affected by changing temperatures, and further promotes the spread of beetle species into more northern regions (4). We were interested in the effect of temperature changes on distribution of blister beetles, which cause painful blisters on the skin upon contact due to the exposure to the toxin cantharidin (5). In order to test our hypothesis, we collected twenty samples of beetles from the Longwood High School campus in Middle Island, NY and identified them using DNA preparation and sequencing followed by DNA Subway analysis.

### Materials and Methods

**Sample Collection:** Beetles were collected from a variety of areas on the Longwood High School campus by looking under rocks and using baited pitfall traps. Beetles were euthanized with ethanol and kept in ethanol at -20°C until DNA processing. Conventional silicon binding protocols were used to prepare the DNA. For PCR, 2 ul of the DNA was combined with prepared primer mix and Taq polymerase. The PCR temperatures and number of cycles optimum for producing the amplified DNA were entered into a program that ran the cyclor, as instructed by our Open Lab leaders. The COI primer was used to amplify the beetle DNA. A small portion of the amplified DNA was checked for quality by separating it via agarose gel electrophoresis. Samples of high enough quality were sent to a laboratory for Illumina next-generation sequencing. The online Subway program was used to identify beetle species to a high certainty. After identification of beetle species, the Bugguide.net site was used to identify the current distribution of each species in North America.

### Results

Twenty beetle samples were processed for DNA preparation and PCR analysis. Fourteen of these samples produced PCR products of high enough quality to determine species information with high certainty. (Table 1). No representative species of blister beetles were detected. However, we did discover several invasive species, as well as one species of beetle that appeared to be located in a northern region compared to its observed habitat map (*Harmonia axyridis*, Map 1). The invasive species included *Harpalus rubripes* is normally found on Long Island, according to its distribution map (Map 2).



*Harmonia axyridis*  
(Asian Lady Beetle)



*Harpalus rubripes*  
(Carabid ground beetle)

Table 1

Species Nomenclature	Common name	Range
<i>Harmonia axyridis</i>	Asian Ladybeetle	Throughout US and s. Canada, except absent from n. Rockies (1). Native to eastern Asia from the Altai Mountains to the east coast and Japan. (Currently) absent from much of the midwest and northern Canada.
<i>Eilythnia corrusca</i>	Winter firefly	NA to AK, western Mtn tops
<i>Heterotarsus carinula</i>	Marsenal beetle	South Korea
<i>Harpalus rubripes</i>	Pennsylvania ground beetle	mostly Holarctic, with some representation in the Oriental & Afrotropical Regions
<i>Calathus opaculus</i>	Ground beetle	Holarctic & Oriental
<i>Tasgvis melanarius</i>	Rove beetle	Native to w. Palearctic; adventive in NA and mostly limited to the coastal ne. US
Curculionidae sp.	True weevil/snout beetle	Canada and most of the US, except the northwest NS-FL
<i>Agonum placidum</i>	Agonum ground beetle	Widely distributed in North America: NF-BC to CA-GA & Mexico (2)
<i>Amara Torrida</i>	Sun beetles/Carabid beetles	native to n. Eurasia, adventive in NA and now widespread both in the east (NF-MB south to n.FL-n.LA-ne.OK) and in the west
<i>Amara aenea</i>	Sun beetles/Carabid beetles	native to n. Eurasia, adventive in NA and now widespread both in the east (NF-MB south to n.FL-n.LA-ne.OK) and in the west

Table 1: This table represents the BLAST search and identification results for the fourteen beetle species sequenced in this study, as well as the habitat range for each species.

### Discussion

In our study, we tested the hypothesis that recent higher average temperatures in the Long Island region has led to habitat shifts by specific beetle species. While no blister beetle species were detected in our samples, we did find several invasive species of beetles. These species have been noted in other studies to increase their habitat in response to warmer climate. The *Harmonia axyridis* (Asian lady beetle) may be expanding its territory into Long Island following higher temperatures, similar to the pattern seen in Britain (3). The online entomology community, Bugguide.net, represents a useful tool for determining whether our beetle samples are present in their normal, current geographical areas, or if they may be migrating north due to higher temperatures over the past several years. We used Bugguide.net, a constantly updated citizen science project used to map distributions of many thousands of insect species in North America and Canada. See Map 1 for the normal distribution of *Harmonia axyridis* in North America. The appearance of this species on Long Island does not seem to fit the normal distribution pattern and may represent a movement of this species to more northern areas. The Asian lady beetle was brought to North America for its use in controlling aphids. However, infestations can cause eye irritation and asthma in humans. Also, contamination of grapes with Asian lady beetles can degrade the quality of wine produced (6). Map 2 shows the normal distribution of *Harpalus rubripes* in North America and Canada. While *Harpalus rubripes* represents an invasive beetle species (it is a European species first detected in North America in the 1980's) there are no specific indications of harm caused by its presence in our environment. In conclusion, while our study did not detect species of southern blister beetles on the Longwood school campus, we did note the presence of several invasive species of beetles. At least one of these species (*Harmonia axyridis*) is considered a pest species and appears to be located unusually far north compared to its known distribution range, which may indicate the effect of higher average temperatures on beetle migration in North America.

### References

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