Barcoding Entomological Entities Taxonomically Living on Earth's Surface **B.E.E.T.L.E.S**



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Abstract

Invasive species of beetles can be detrimental to the ecosystem they inhabit. The problem addressed was the identification of beetle species on Long Island and whether or not these species are invasive. It was believed that through DNA barcoding, an invasive species of beetle would be identified. Beetles from Gardiner Park in Bay Shore, New York were collected. The process of DNA barcoding was then used to identify each beetle. The results were compared to GenBank and BOLD Systems to see if any invasive species were found. One beetle collected was identified as *Pterostichus vernalis*, which is native to Germany. Research will continue to determine if this non-native beetle is invasive and if it has the potential to be harmful to the Gardiner Park ecosystem. Six of the beetles with high bit scores and a large number of mismatches will be investigated to determine if they are novel.

Introduction

- Beetles can have both a positive and adverse effect on the environment they inhabit. Beetles are a valuable part of the ecosystem. Beetles account for a large amount of pollination and are a key part of the food web.
- Invasive beetle species are non-native to the area they inhabit and have adverse effects causing extreme problems with the biodiversity of an area, such as destroying trees and overpopulating, thus putting strain on food and space for all other organisms as a result (Brockerhoff et al., 2006).
- The question this experiment addressed was: Are there any invasive species of beetles in Gardiner Park on Long Island? Identifying new species of beetles can lead to developing better protection for our crops and trees to preserve biodiversity on Long Island.
- The hypothesis was that an invasive species of beetle will be found in Gardiner Park.

Materials & Methods

- **Sample Collection:** Beetles were collected from Gardiner Park in Bay Shore, NY, in early October, 2015. A transect line was set up with 5 quadrats from which species were collected (Figure 1). The beetles were found on the ground and picked up by hand or with tweezers and then placed in labeled tubes.
- **Documentation:** All of the collected beetles were frozen so that they could be preserved. Once frozen, pictures were taken of each organism with their sample number.
- DNA Barcoding: The DNA was extracted (Cold Spring Harbor DNA Learning Center, 2014). The CO1 gene was copied using PCR (Herbet, Cywinska, and Ball, 2003). After assuring the CO1 gene was present through gel electrophoresis, the DNA was sent for sequencing. The sequenced DNA was compared to GenBank and BOLD Systems DNA databases to identify the samples.

Results

- Of the twenty samples collected, nine resulted in good DNA extractions, and PCR amplifications that were sent to be sequenced. Samples NNG-005, NNG-006, NNG-016 were all non-native to the United States.
- NNG-005 (Figure 2) and NNG-006 were found to be *Pterostichus vernalis,* common to Germany and the Netherlands.
- NNG-016 (Figure 2) was found to be a *Tachinus fimetarius,* which has only been found in Germany.
- Samples NNG-001, NNG-002, NNG-003, and NNG-004 were found to be *Patrobus stygicus*, a common black beetle in the Northern Hemisphere.
- NNG-007 was identified as an Angochlora pura, commonly known as a flying ant found in the United States.
- NNG-010 was identified as *Isopode sp.*, commonly known as a pill bug.

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Figure 1: Transect line and quadrat sampling sites in Gardiner Park



to their habitat									
Sample ID	Collector Name	Soil pH	Soil Moisture (%)	Humidity (%)	Habitat Descrip- tion	Common Name	Bit Score	E Value	Mis- matches
NNG- 001	Aidan	7	100	59	Wetland	Beetle	792	0	51
NNG- 002	Aidan	7	100	59	Wetland	Beetle	931	0	54
NNG- 003	Jack	7	100	59	Wetland	Beetle	908	0	53
NNG- 004	Liam	7	100	59	Wetland	Beetle	913	0	54
NNG- 005	Jack	7	25	68	Forest	Bug	881	0	60
NNG- 006	Liam	7	25	68	Forest	Beetle	543	0	46
NNG- 007	Jack	7	35	64	Forest	Flying Ant	1139	0	8
NNG- 010	Liam	6	35	51	Forest	Pill bug	899	0	0
NNG- 016	Jack	6.6	35	51	Forest	Bug	798	0	83

Table : Details of collected specimen and information pertaining to their hebitet

Discussion

- resulted in having less than the amount of samples desired.
- unusable for sequencing.
- error could be reduced.

References

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• Using BOLD Systems it was found that two organisms were not native to North America. One organism, known as Pterostichus vernalis, was found to be native to Germany and the Netherlands (Koehler and Koehler, n.d. a). Another organism, Tachinus fimetarius, was found in Germany (Koehler and Koehler, n.d. b). This data supports the hypothesis because there were non-native beetles found in Gardiner Park. Figure 3 also shows how these species are related. • One problem with the experimentation was not finding enough beetles at the park because of a time limitation. This

• Another problem with the experiment was there was not enough SYBR green for all of the samples. The stain used in place of SYBR green was not visible enough to get results on whether or not DNA was present. This rendered 9 samples

• One improvement that could be made for conducting similar experiments in the future would be to conduct all of the DNA barcoding process in one day. This would allow for more care to be taken with each sample so that experimental

• The findings are significant because non-native species were identified and certain measures must be taken to make sure they do not destroy the ecosystem. If the organism is harmful to the ecosystem, it may need to be eliminated. • The data on which species were collected is different than other species documented by researchers on Long Island. Further documentation and research of the effects of non-native beetles in a local ecosystem will be conducted.