



Mosquito Diversity:

An Urban & Suburban Cross-Section

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Abstract

Mosquitoes are one of the most dangerous animals in the world. Some are considered invasive species, like the Asian tiger and other types of species, can spread many devastating diseases, like West Nile Virus, Zika or Dengue. The ability to identify mosquito species in both urban and suburban areas is a critical element of risk assessment and implementation of preventative strategies. In this small study, we collected sixteen mosquito specimens during the peak season August - October. We identified several mosquitoes in NYC that are known to cause diseases, such as West Nile Virus, Western Equine and Japanese Encephalitis Virus. Additionally, all sixteen samples are considered invasive species, which make them a threat to New York's biodiversity, public health and economy.

Introduction

Mosquitoes are most active in New York in April through October, when the weather is wet and warm. They tend to lay their eggs near standing water places. In residential urban areas, standing water can accumulate near unused tires, cans, clogged gutters, and receptacles that collect water. This can be a haven for mosquito breeding. And since temperature plays a very important role in the viability of mosquitoes' range, life cycle, and survival, scientists are worried about rising temperatures due to climate change are changing the way mosquitoes behave and spread disease [4]. Recent studies estimated more than a billion people could be at risk of mosquito-borne disease due to climate change in the future [5]. We are already seeing the number of mosquito disease danger days increasing across the US, especially in urban areas [6].

Materials & Methods

- Sixteen (16) mosquito samples were randomly collected from three sites using light traps: A (Queens, NY) and B (Westchester, NY).
- Genomic DNA was extracted using CSHL DNA Barcoding Kit
- To identify species, we PCR amplified the *Mitochondrial Cytochrome Oxidase Subunit 1 COI* region
- An 800bp band was identified in all 16 samples using Gel Electrophoresis
- Samples were sent to Genewiz for Sanger sequencing
- DNA sequences were analyzed using BLAST & DNA Subway

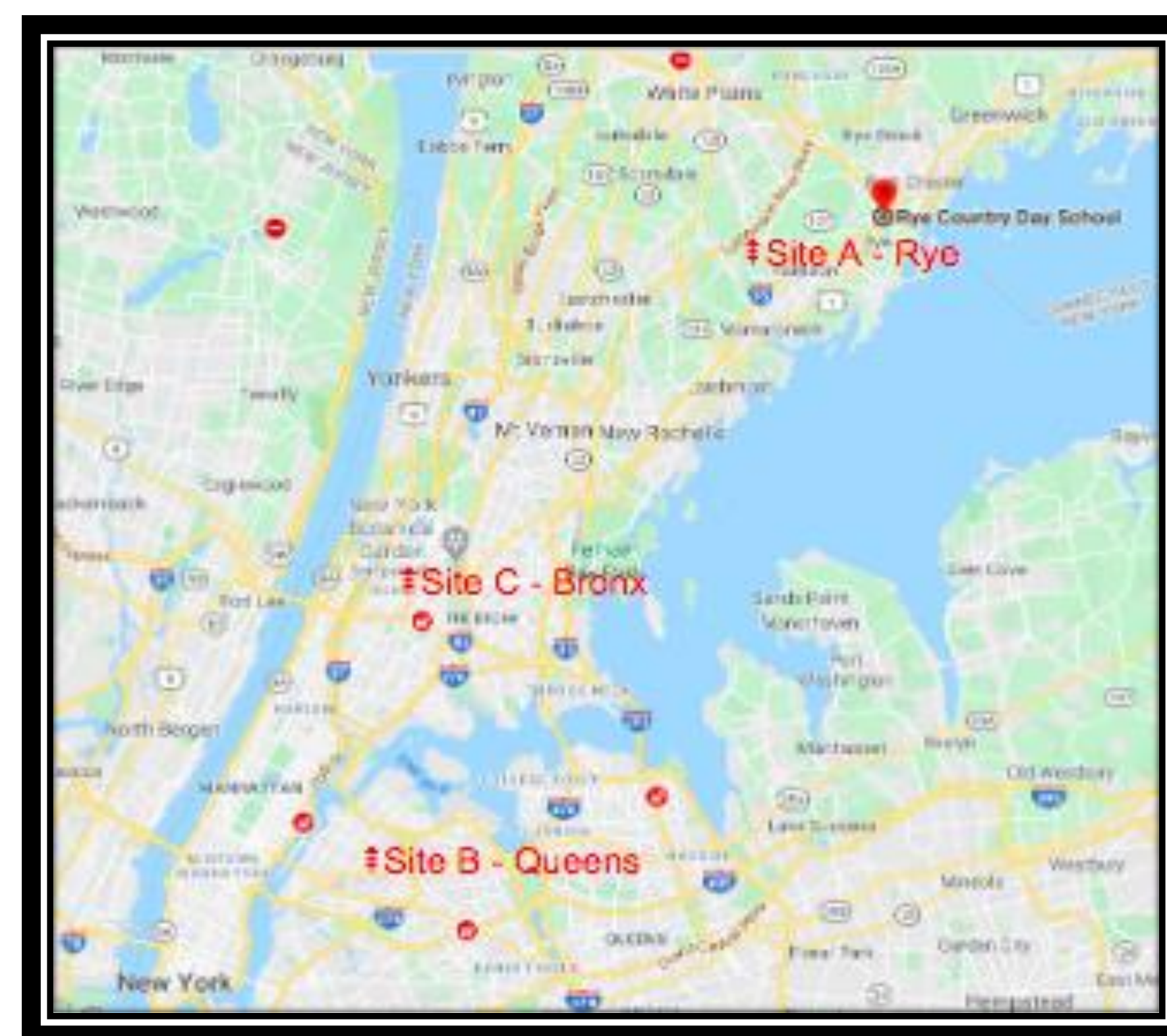


Image B : Sample Collection Site (A, B, C)

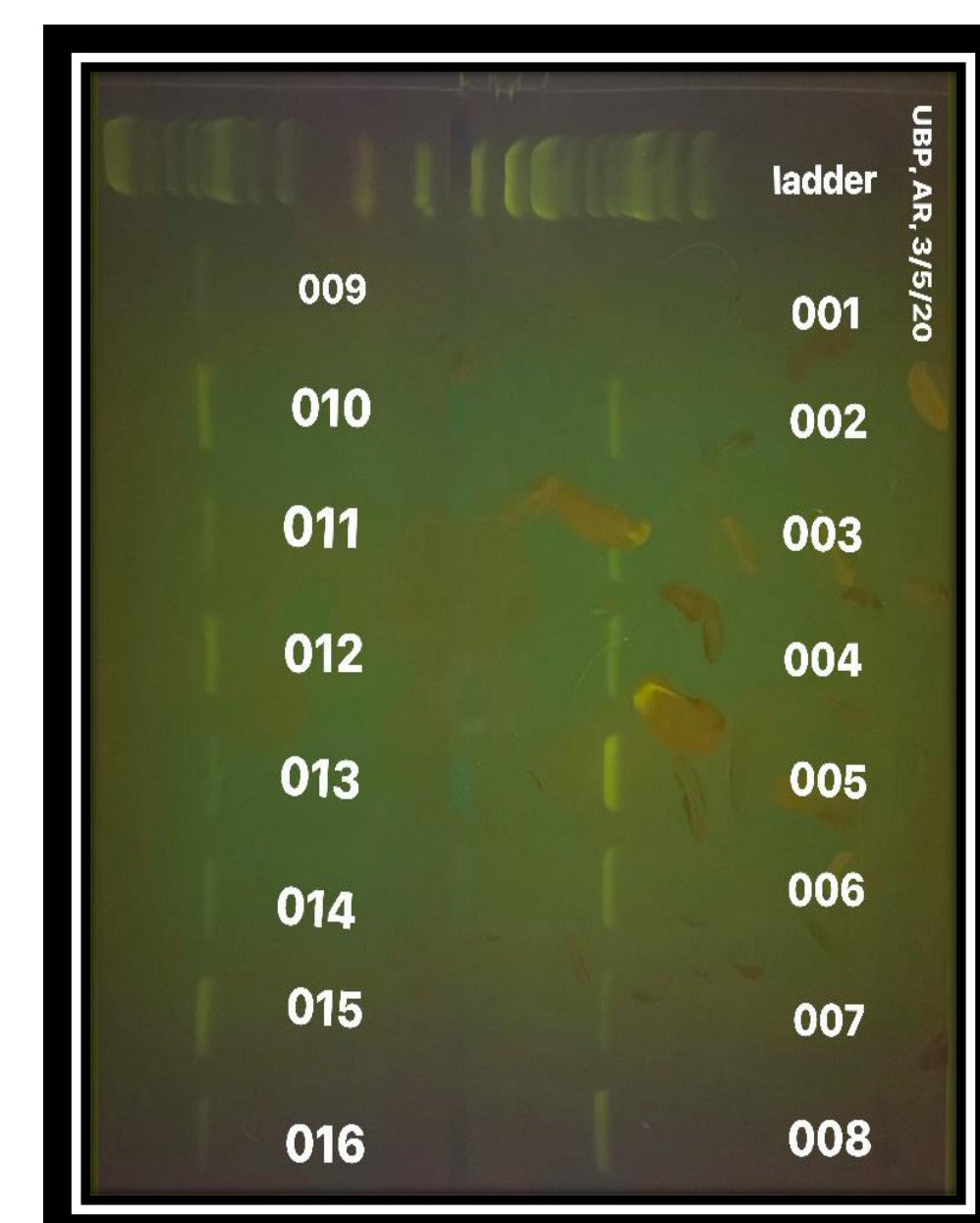


Image C: Gel Electrophoresis Image

sample #	Collection Site	DNA Length (bp)	BLAST Results	Biodiversity Impact
2	Queens, NY	529	Culex Pipiens Pallens	Invasive
3	Queens, NY	526	Culex Pipiens Pallens	Invasive
4	Queens, NY	552	Aedes albopictus	Invasive/Vector of Disease
5	Queens, NY	649	Aedes albopictus	Invasive/Vector of Disease
6	Queens, NY	544	Aedes albopictus	Invasive/Vector of Disease
7	Queens, NY	487	Culex Pipiens	Invasive
8	Queens, NY	644	Aedes albopictus	Invasive
9	Queens, NY	634	Culex Pipiens	Invasive
10	Queens, NY	650	Aedes albopictus	Invasive/Vector of Disease
11	Queens, NY	627	Culex Pipiens Molestus	Invasive
12	Queens, NY	651	Culex Pipiens Molestus	Invasive
13	Queens, NY	642	Aedes albopictus	Invasive/Vector of Disease
14	Rye, NY	638	Culex Pipiens	Invasive
15	Bronx, NY	654	Drosophila Repleta	Invasive
16	Bronx, NY	655	Drosophila Repleta	Invasive

Image A: Table of BLAST Results

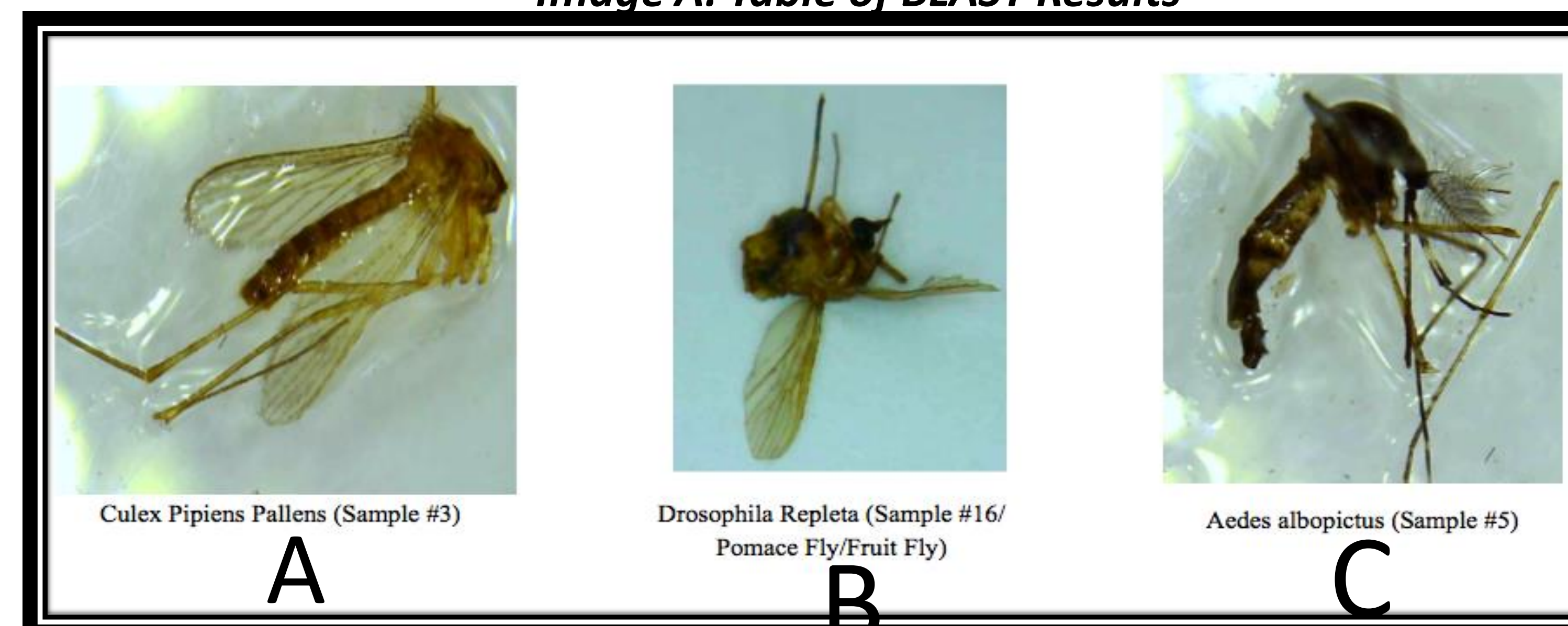


Image D: Most Common Species Found: A *Culex pipiens*, B *Drosophila repleta*, and C *Aedes albopictus*

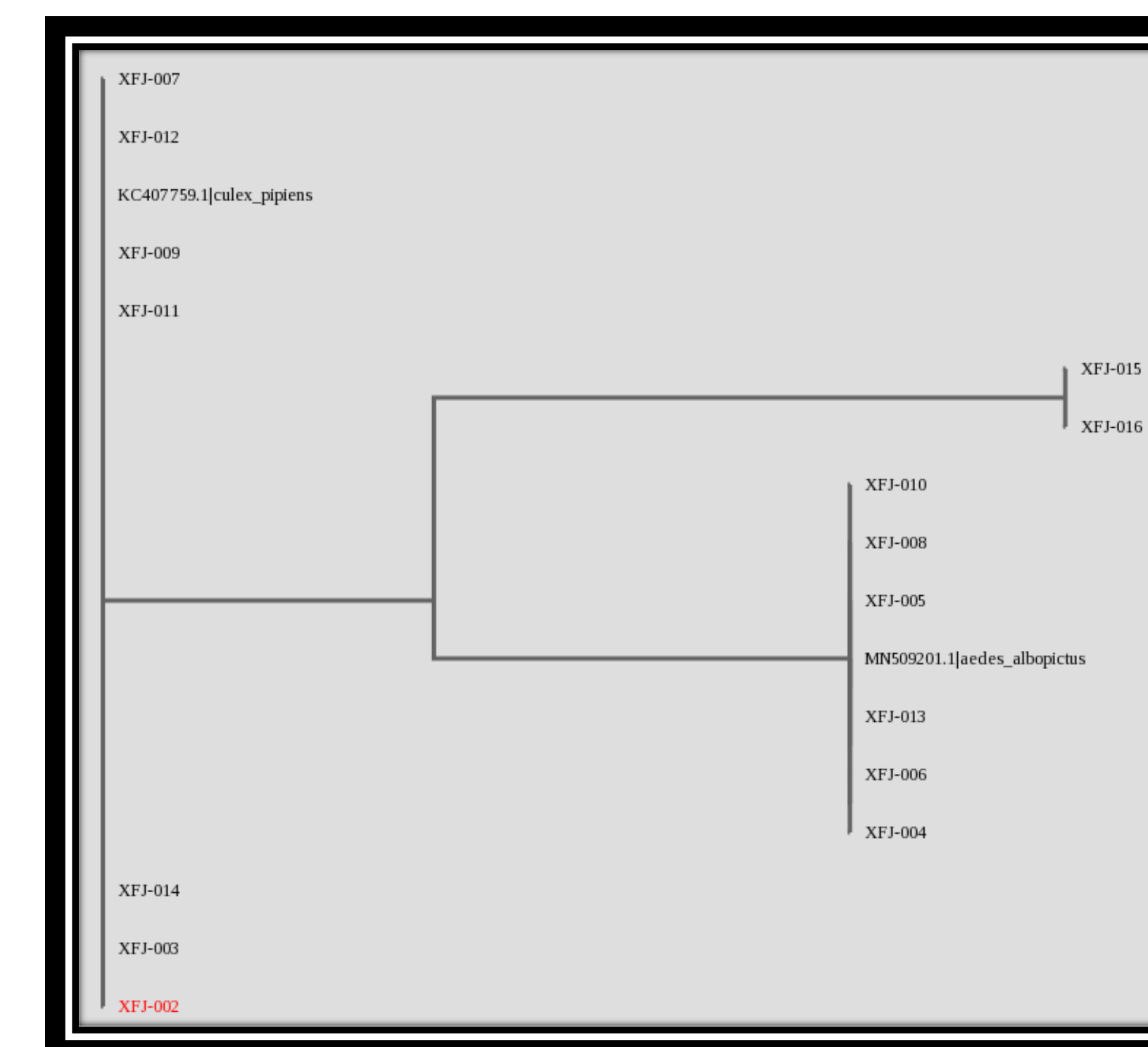


Image E: Phylogenetic analysis revealed three distinct species clusters

Discussion

In this small study, we were able to identify sixteen (16) mosquito specimens collected from three different sites in New York (Queens, Bronx, and Rye) using DNA Barcoding. Specimens were classified as invasive or vector of disease (see image A). According to the data, every specimen identified from all three sites are considered invasive (*Culex pipiens*, *Aedes albopictus*, and *Drosophila repleta*) according to the Invasive Species Compendium (CABI) database. Additionally, several specimens from Site B (Queens, NY) were identified as vectors of disease, including the Asian Tiger mosquito, known to be a vector of disease (West Nile Virus, Western Equine and Japanese Encephalitis Virus, Blue Tongue Virus) also known to be a threat to NYC's biodiversity. This data supports our hypothesis. Since this is a small sample size, we plan to collect additional specimens this Summer/Fall 2020, especially from Sites: A (Rye) and B (Bronx). We hope to identify additional mosquitoes from suburban areas that can also spread diseases.

References

- [4] How does weather affect mosquito activity? [Blog post]. (n.d.). Retrieved from Preventive Pest Control website: <http://www.preventivepestcontrol.com/weather-affect-mosquito-activity/>
- [5] Sadie J. Ryan, & Carlson, C. J. (2019, March 28). Global expansion and redistribution of Aedes-borne virus transmission risk with climate change (E. A. Mordecai & L. R. Johnson, Ed.). Retrieved December 7, 2019, from PLOS Neglected Tropical Diseases website: <https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0007213>
- [6] U.S. faces a rise in mosquito 'disease danger days'. (n.d.). Retrieved December 7, 2019, from Climate Central website: <https://www.climatecentral.org/news/us-faces-a-rise-in-mosquito-disease-danger-days-21903>