Biodiversity of Invasive Plants in New York

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Abstract

Invasive plants pose global ecological and economic threats, challenging accurate morphological identification. DNA barcoding helps in precise species identification, leveraging genetic makeup and reference libraries. This technology enhances our understanding of invasive plant species in New York. To classify species, DNA is extracted from plants in Stuyvesant Square Park, by using alcohol and centrifugation, and uploaded into a database for identification. Some samples, such as 4, 5, 6, 12, and 17, yielded no DNA extraction. Of those with DNA, most were invasive. 17/23 of our samples were invasive species, while the remainder were native. This makes about 74 percent of our samples invasive. DNA barcoding thus offers a vital tool for managing invasive species, promoting ecosystem health, and safeguarding human interests.

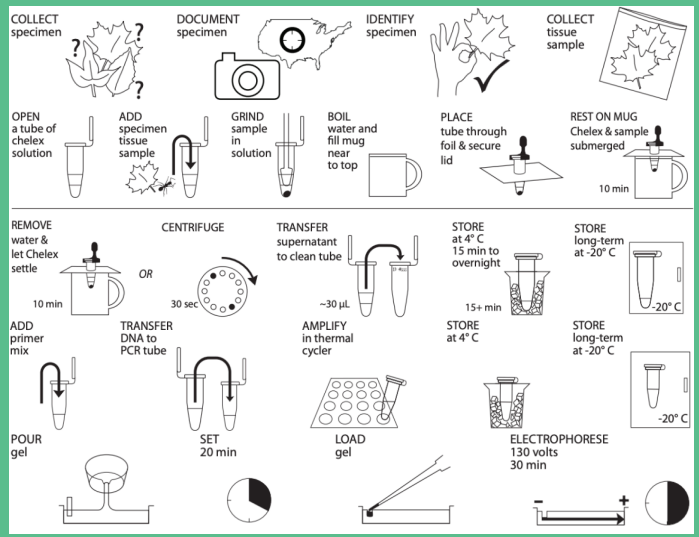
Introduction

Has anyone ever wondered if there is a way to identify invasive plant species in New York? Through DNA barcoding, the species of plants, fungi, and animals can be identified. The DNA barcoding database displays all the species' DNA code where many scientists can pinpoint the classification of living things. This is possible because DNA barcodes are short sequences of DNA strands displaying their identification code. Invasive plants have brought global attention for causing ecological damage and having a negative impact on the economy and human health. To begin the DNA Barcoding process, DNA from different plant specimens are collected from New York City parks. Next, the DNA of these specimens were completely extracted and isolated using alcohols and a centrifuge that remove impurities from the plant's DNA. Finally, with the isolated DNA removed and examined the DNA was uploaded into the database to discover which species it is most like. By using cross reference compared with online databases we have distinguished between different invasive plants throughout the experiment.

Materials

Leaf Samples	Pestles	Forceps	Micropipettes
Tube Rack	1.5 ml microfuge tubes	Heat Block	Centrifuge
Nuclei Lysis Solution	Protein Precipitation Solution	RNA Solution	DNA Rehydration Solution
Isopropanol	70% Ethanol	Goggles	Latex Gloves

Methodology



Results

Invasive Species of Plants in New York:

	Potential Species Name	Number of Mismatches	Is it Invasive?
Sample #1 (KFW-001)	Oenothera stricta	5	Yes, because it is not native to the United States, but instead in South America.
Sample #2 (KFW-002)	Jerusalem artichoke	0	No, because it is native to central North America.
Sample #3 (KFW-003)	Oenothera biennis	0	No, because it is native to central and eastern North America.
Sample #7 (KFW-007)	Hexastylis arifolia	0	No, because this plant is native to the United States.
Sample #8 (KFW-008)	Hydrangea serrata	0	Yes, because it is native to mountainous regions in Korea and Japan.
Sample #9 (KFW-009)	Helleborus orientalis	6	Yes, because it originated in Greece which is in Southern Eastern Europe.
Sample #10 (KFW-010)	Rosa multiflora	24	Yes, because this plant is native to East Asia in areas like China, Japan, and Korea.
Sample #11 (KFW-011)	Arnica louiseana	69	No, because it's native in the North American region. It can be found in Canada.
Sample #13 (KFW-013)	Ageratina altissima	3	No, because it is native to eastern and central North America.
Sample #14 (KFW-014)	Zelkova serrata	13	Yes, because this plant is native to Japan, Korea, eastern China, and Taiwan.
Sample #15 (KFW-015)	Ilex aquifolium	2	Yes, because the plant is native to western and southern Europe, northwest Africa, and southwest Asia.
Sample #16 (KFW-016)	Zelkova serrata	1	Yes, because the plant is native in Japan, Korea, eastern China and Taiwan
Sample #18 (KFW-018)	Stachys byzantina	2	Yes, this plant is invasive because it is native to Armenia, Iran, and Turkey
Sample #19 (KFW-019)	Zelkova serrata	2	Yes, because the plant is native to native to Japan, Korea, eastern China and Taiwan.
Sample #20 (KFW-020)	Nicotiana sylvestris	6	Yes, because the plant is native to native to the Andes region in Argentina and Bolivia, in South America.
Sample #21 (KFW-021)	Nicotiana forsteri	1	Yes, this is invasive because this particular plant is active to Queensland In Australia
Sample #22 (KFW-022)	Hedera helix	0	Yes, because the plant is native to most of Europe and western Asia
Sample #23 (KFW-023)	Stachys byzantina	2	Yes, because this plant is native to Armenia, Iran, and Turkey.
Sample #24 (KFW-024)	Ageratina altissima	2	No, because this plant is native to eastern and central North America.
Sample #25 (KFW-025)	Zelkova serrata	0	Yes, because this plant is native to Japan, Korea, eastern China, and Taiwan.
Sample #26 (KFW-026)	Alliaria petiolata	1	Yes, because it is native to Europe, western and central Asia, north-western Africa, Morocco, Iberia and the British Isles, north to northern Scandinavia, and east to northern Pakistan and Xinjiang in western China.
Sample #27 (KFW-027)	Lepidium draba	1	Yes, because this plant is native to West Asia and Southeastern Europe.
Sample #28 (KFW-028)	Nepeta	0	Yes, because is native to Europe, Asia, and Africa.

Discussion of Results

Upon collecting the leaves from Stuyvesant Square Park, the group used the DNA Barcoding database and identified the species name utilizing the DNA that was removed. Then, with the help of the internet, the group looked up the invasive plant species in New York and determined if the identified species was invasive or not. In some of the samples DNA couldn't be extracted (e.g.. samples 4, 5, 6, 12, and 17). Of the samples who's DNA was extracted, the majority were found to be invasive (17/23, ≈74%) and the rest native to their environment.

Conclusion

The hypothesis was supported given the plants in Stuyvesant Square Park had sequenced DNA which was similar to those of invasive species. The plants were predominantly native to European and Asian countries. However, there were six plant species identified which were native in North America. Overall, the method of extracting DNA was effective in helping to determine whether a plant species was invasive or not. If we only looked at the leaves or just the plants itself it would have been impossible to determine. In conducting the experiment, the group hopes that this information can be used to preserve the biodiversity of the native plants.

References

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