

Identifying Weed Species on an Athletic Field Using DNA Barcoding the *rbcL* Gene



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Abstract

Photosynthesis is the process by which plants convert carbon dioxide and water into glucose and oxygen using sunlight. The *rbcL* gene is located in chloroplast DNA and encodes the large subunit of the RuBisCO enzyme. The RuBisCO enzyme is responsible for turning carbon dioxide into organic compounds by photosynthesis (carbon fixation). From research in the past we have learned the *rbcL* gene evolves very slowly but varies enough between species that it can be used for plant species identification. Since the *rbcL* gene is present among plant species but still contains minor sequence differences, it can be used as a general marker for identifying plants. Our specific research may be important because it can help the school manage potential invasive species and maintain a healthy turf. We are very curious about this topic as we want to know more about how to identify species based on factors other than visuals alone. In this study, we are using species' *rbcL* sequence as a DNA barcode to identify the weeds on the Garden City High School athletic field.

Introduction Hypothesis If different weed species have distinct *rbcL* gene sequences, then DNA barcoding will accurately identify weed species (and potential invasive species) on the athletic field that cannot be confidently identified using the iNaturalist app.

Independent Variable: The type of plant

Dependent Variable: The DNA



Samples	BLAST Results	Common Name
1	Taraxacum officinale	Dandelion
2	Stellaria media	Chickweed
3	Hygroamblystegium varium	Moss
4	Morus alba	Common Mulberry
5	Stellaria media	Chickweed
6	Plantago lanceolata	Plantain family

Discussion

The experiment successfully supported our hypothesis that if different weed species that have distinct *rbcL* gene sequences, then DNA barcoding will accurately identify weed species (and potential invasive species) on the athletic field that cannot be confidently identified using the iNaturalist app. By comparing the DNA sequences from the weed samples, we were able to identify different species that were difficult to identify using only physical characteristics or the iNaturalist app. This demonstrates how DNA barcoding can be a more reliable method for identifying plants especially when species look very similar or are in early stages of growth.

References

CBOL Plant Working Group. (2009). A DNA barcode for land plants. *Proceedings of the National Academy of Sciences*, 106(31), 12794–12797. <https://doi.org/10.1073/pnas.0905845106>

Cornell University. (n.d.). *Weed management*. Safe Sports Fields. <https://safesportsfields.cals.cornell.edu/pests/weed-management/>

Hollingsworth, P. M., Graham, S. W., & Little, D. P. (2011). Choosing and using a plant DNA barcode. *PLoS ONE*, 6(5), e19254. <https://doi.org/10.1371/journal.pone.0019254>

North Carolina State University. (n.d.). *Weeds in turf*. TurfFiles. <https://www.turffiles.ncsu.edu/weeds-in-turf/>

Penn State Extension. (n.d.). *Lawn and turfgrass weeds: Common chickweed*. Pennsylvania State University. <https://extension.psu.edu/lawn-and-turfgrass-weeds-common-chickweed>

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