The Effects of Mesophication on Genetic Diversity of Epiphytic Bryophytes on Oak vs Maple Trees

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INTRODUCTION

- **Bryophyte** is the group name for Mosses, Liverwort, and Hornwort.
- Bryophytes are small flowerless green plants that do not have roots or vascular tissue and grow on all substrates.
- Bryophytes are epiphytes because they grow on other living plants for physical support such as oak and maple trees.
- **Mesophication** is the process of removing fire from a forest that is fire tolerant. e.g. shift in forest structure from sun-loving, fire-tolerant species (oaks) to shade- tolerating, fire-sensitive species (maples).
- Species supported by oaks (animals, epiphytic plants) may not be supported by maples.
- In this study, we assessed the biodiversity of epiphytic bryophytes on oak verses maple trees by identifying generalist and specialist bryophyte species by morphology and DNA barcoding.
- Three DNA barcoding regions- ***rbcl*** (large subunit of ribulose bisphosphate carboxylase), ***trnL-F*** (transfer RNA gene) and ***rps4*** (ribosome protein small subunit 4 gene) were selected to identify bryophytes on species level.
- The identification of epiphytic bryophytes will help us understand their relationship with the substrate and evaluate how processes like mesophication can impact bryophyte diversity.

METHODS

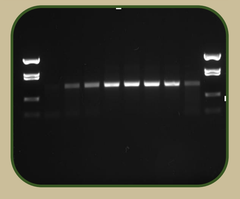
Sample Collection

- 28 bryophyte samples were collected
- 14 samples each collected from maple and oak trees, respectively.

Microscopy

- Images of branch and stem leaves were taken under 4x, 10x, and 40x magnification.
- Measurements were taken of both stem and branch leaves
- Images were then compared to a dichotomous key available at Flora of North America website.

DNA Barcoding



- Genomic DNA was extracted from 13 samples
- PCR reactions were set using primer specific to the three DNA barcoding regions
- Agarose gel electrophoresis was performed to confirm the three genes.

Literature Cited

Gregory J. Nowacki and Marc D. Abrams 2008. "The Demise of Fire and "Mesophication" of Forests in the Eastern United States". BioScience, Vol. 58 pages: 1-16

William E. McClain, Terry L. Esker, Bob R. Edgin, Greg Spyreas and John E. 2010. "Fire History of a Post Oak (Quercus stellata Wang.) Woodland in Hamilton County, Illinois". Castanea, Vol. 75 pages: 1-15

Jesse K. Kreye, J. Morgan Varner, J. Kevin Hiers and John Mola 2013. "Toward a mechanism for eastern North American forest mesophication: differential litter drying across 17 species". Ecological Applications, Vol. 23 pages: 1-12

PRELIMINARY RESULTS

Identification Through Morphology

Sample 20: Epiphytic Bryophyte collected from Oak tree

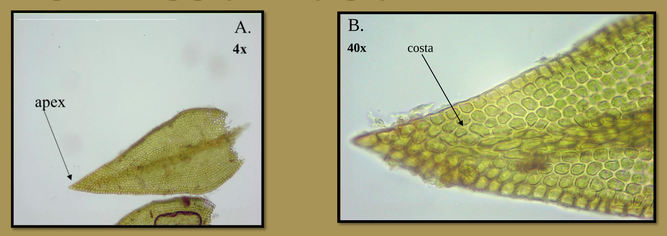


Fig 1: Branch Leaf: A) acute apex, and typically curved, length of 0.57 mm, B) costa ending near apex.

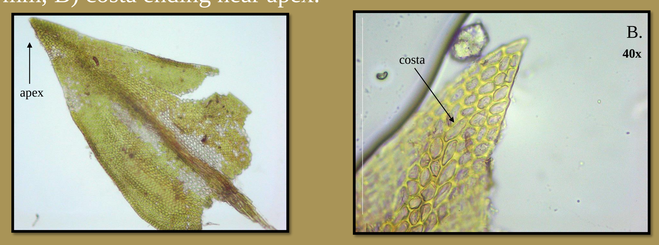


Fig 2: Stem Leaf: A) distinctly longer than broad, somewhat unequal apices, length of 0.55 mm, B) costa ending near apex.

Sample 6: Epiphytic Bryophyte Collected from Oak tree

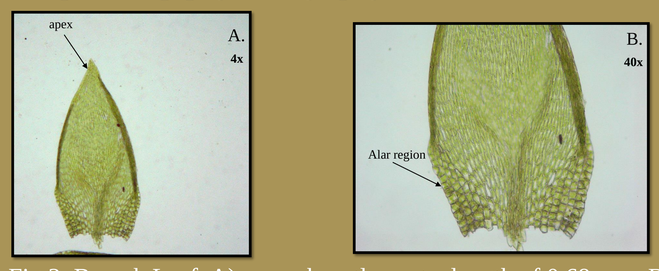


Fig 3: Branch Leaf: A) apex abruptly acute, length of 0.68 mm, B) alar region abruptly differentiated not or slightly reaching costa, ecostate.

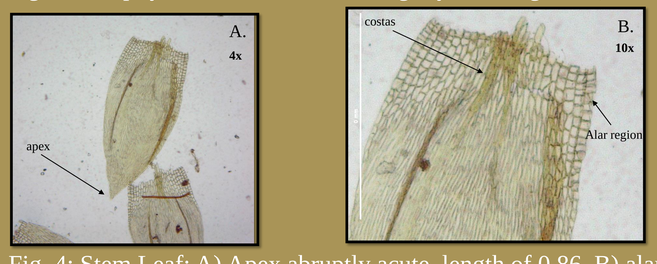


Fig. 4: Stem Leaf: A) Apex abruptly acute, length of 0.86, B) alar region abruptly differentiated not or slightly reaching costa, double costa

Identification through DNA Barcoding

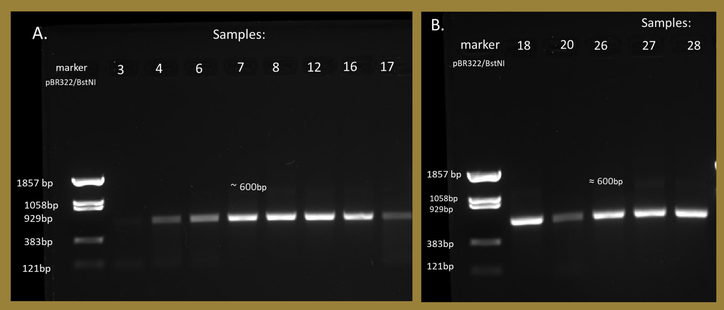


Fig 5: Gel electrophoresis image of *rbcl* gene in 13 bryophyte samples showing ~ 600 bp band size.

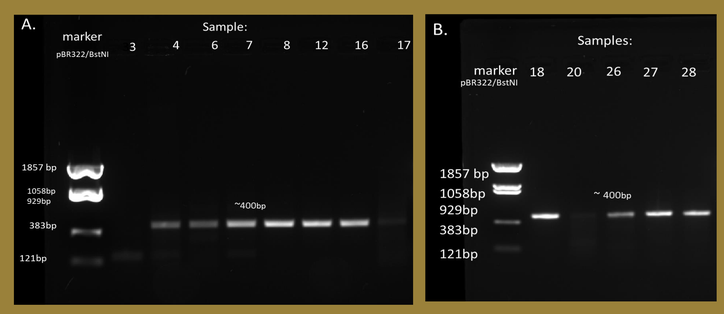


Fig 6: Gel electrophoresis image of *trnL-F* gene in 13 bryophyte samples showing ~ 400 bp band size.

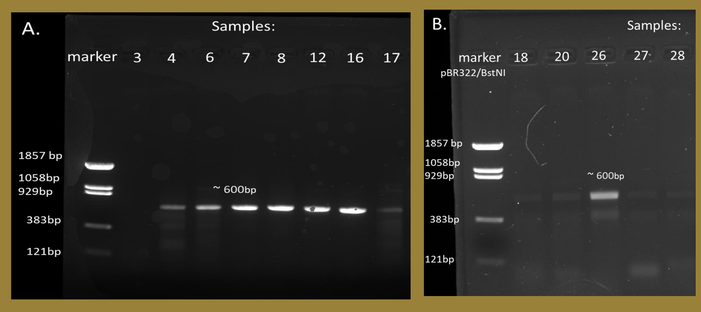


Fig 7: Gel electrophoresis image of *rps4* in 13 bryophyte samples showing ~ 600 bp band size.

DISCUSSION

- We identified thirteen epiphytic bryophytes that were confirmed by comparing the samples to a dichotomous key.
- Generalist epiphytic bryophytes *Leskea gracilescens (*samples 3, 16, 17, and 26*)* and *Entodon cladorrhizans (*samples 7, 8, 12, and 27*)* were found in both oak and maple trees.
- Specialist epiphytic bryophytes *Leskea australis (*sample 4) *Leskea polycarpa (*sample 20*)*, *Entodon seductrix (*samples 6 and 18*)*, *Entodon challengari (*sample 28*)* were found only on oak trees.
- Analysis of PCR products by gel electrophoresis confirmed the presence of *rbcl*, *trnL-F*, and *rps4* genes in bryophyte samples.
- We plan to continue identifying the remaining collected samples through morphology and DNA barcoding and assess biodiversity on a genetic level.
- In the future a phylogenetic tree will be constructed to evaluate the differences in bryophyte biodiversity in oak versus maple trees.

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