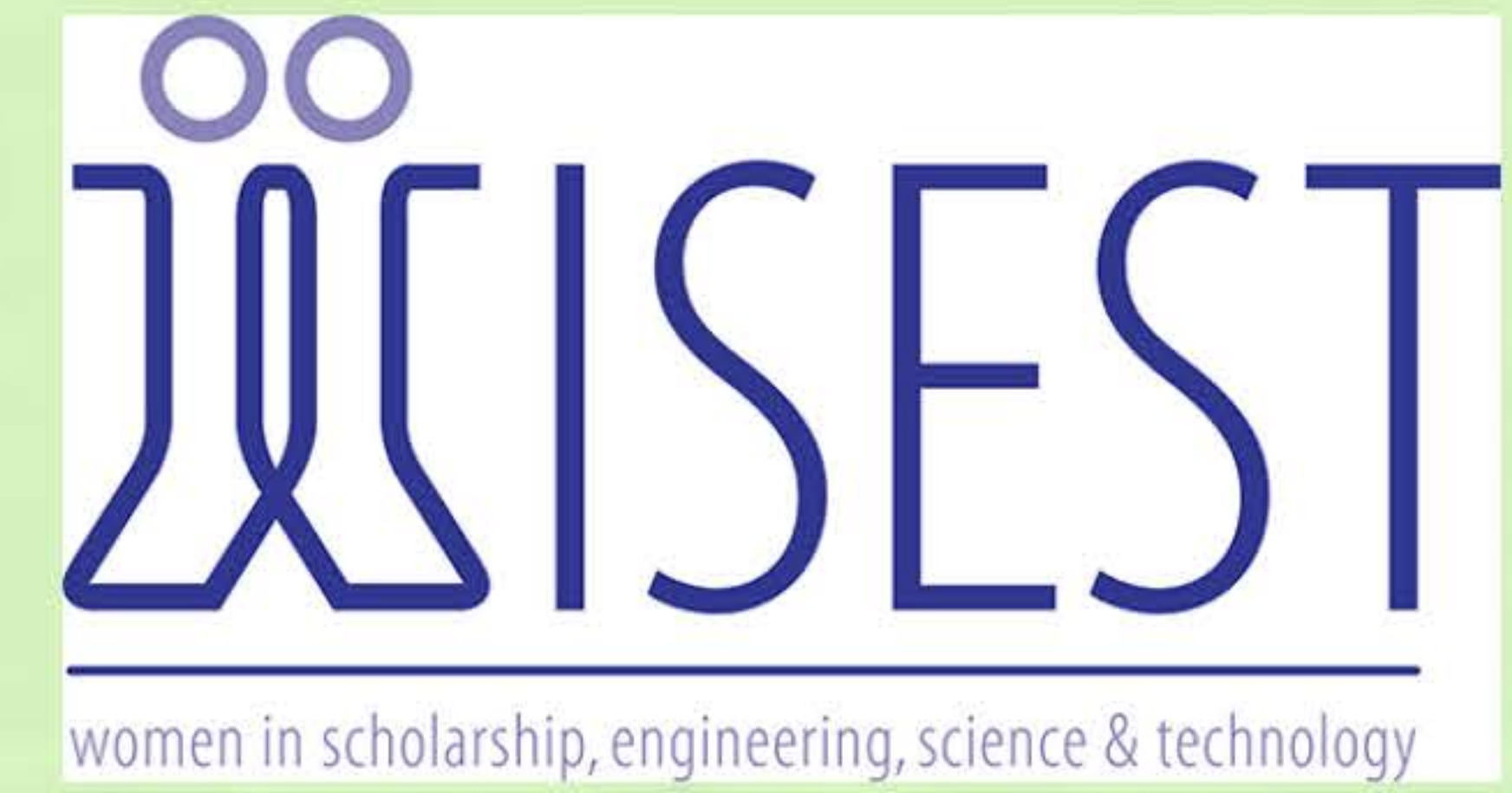# When AI Meets Lichenology: Comparing the Identification Accuracy of *Physcia aipolia*

Kateryna Vovchuk, Iyesha Wanigasinghe, Diane Haughland

Alberta Biodiversity Monitoring Institute, Faculty of Science, University of Alberta

Introduction

- Lichens are composite organisms comprised primarily of a mycobiont and a photobiont (Brodo et al., 2001).
- iNaturalist is a citizen science tool that is largely trained on field images and assists with species identification.
- Lichens are still under-represented on this platform (<1% as of 2022).
- A high number of lichen observations on iNaturalist are misidentified (Munzi et al., 2023).
- *Physcia aipolia* is our study organism, a common species in Alberta.
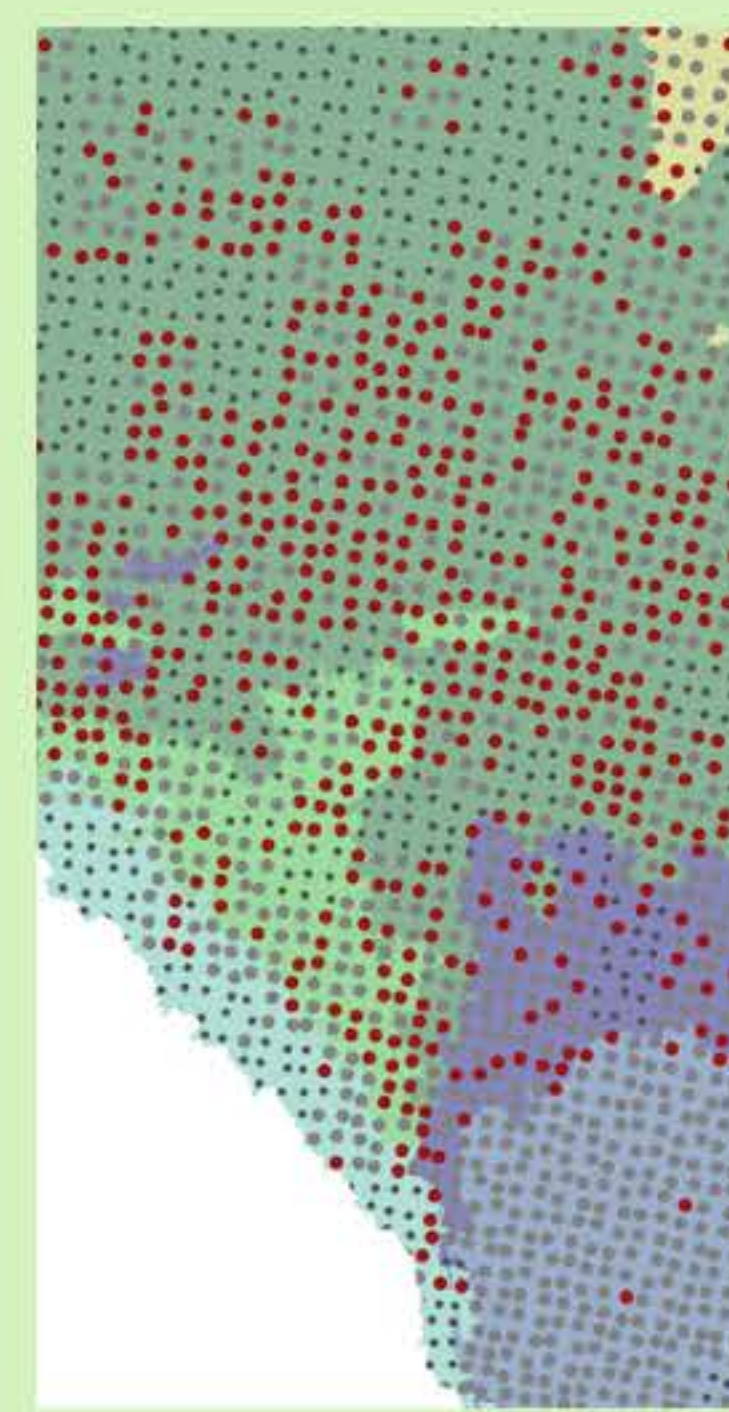- It has a lot of closely related species (*P. stellaris, P. dimidiata*, etc.) (Brodo et al., 2001).

Figure 1: *P. aipolia* occurence in Alberta (2003-2020) (ABMI 2024)

Objectives

- Test how different image perspectives of *P. aipolia* affect the ID success on iNaturalist.
- Compare the AI identification accuracy of herbarium vs. field images.

Methods

- Photographed a total of 414 images, featuring different perspectives of both herbarium and field images.
- Collected field images from Elk Island and Donalda.
- Embedded and extracted metadata in Adobe Bridge 2023 and ExifTool.
- Tested images in iNaturalist Application Program Interface (Vision API).
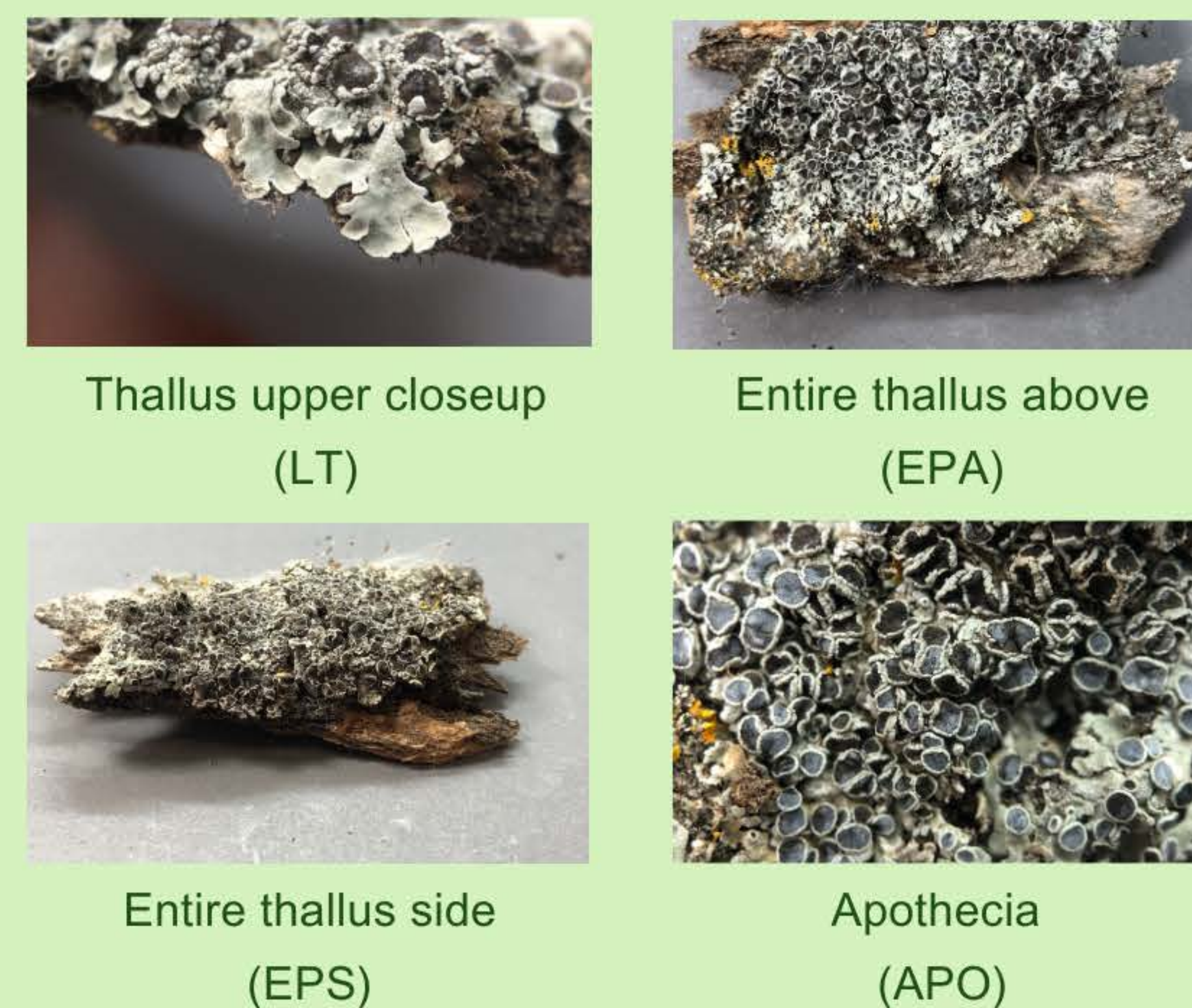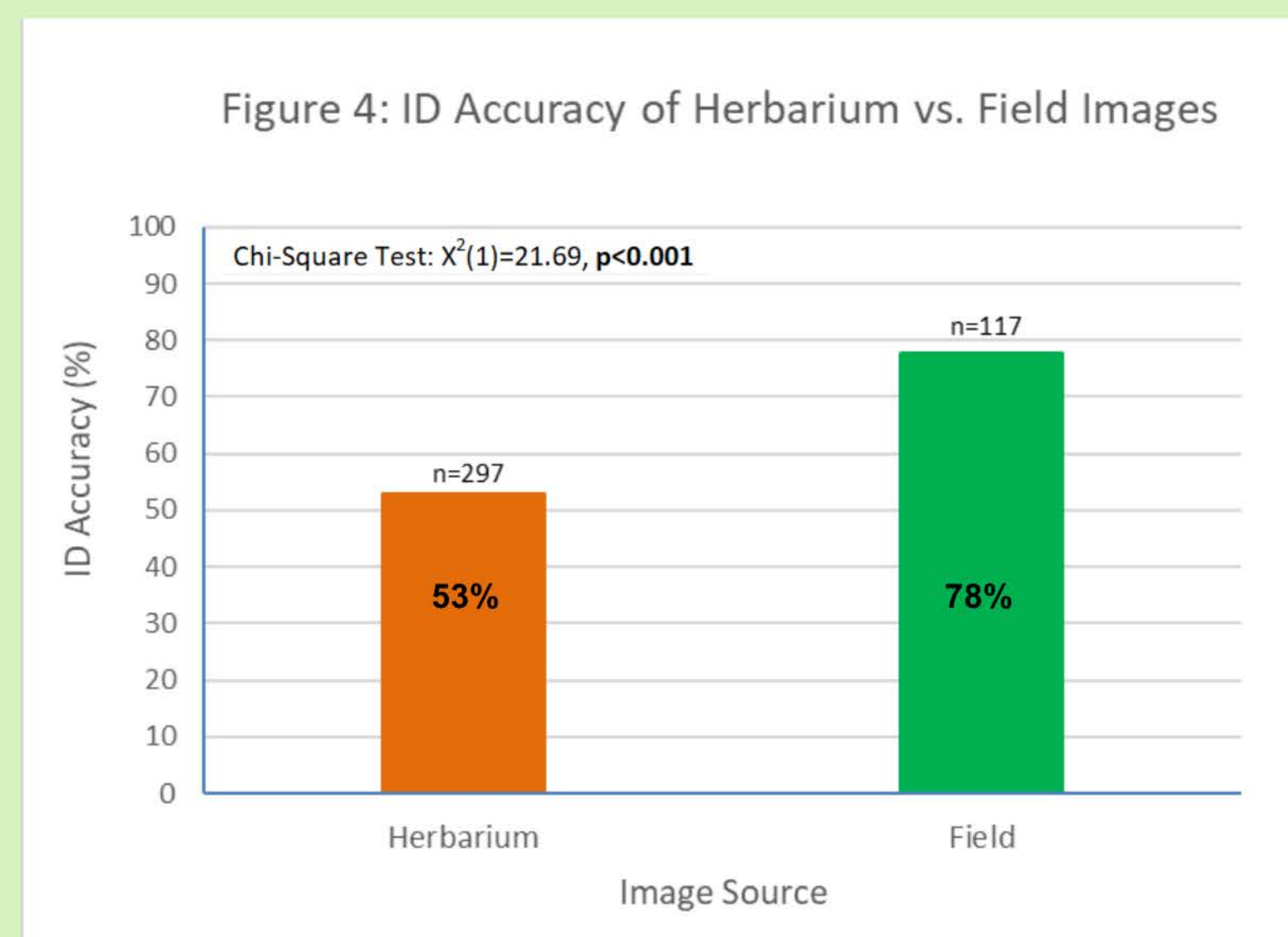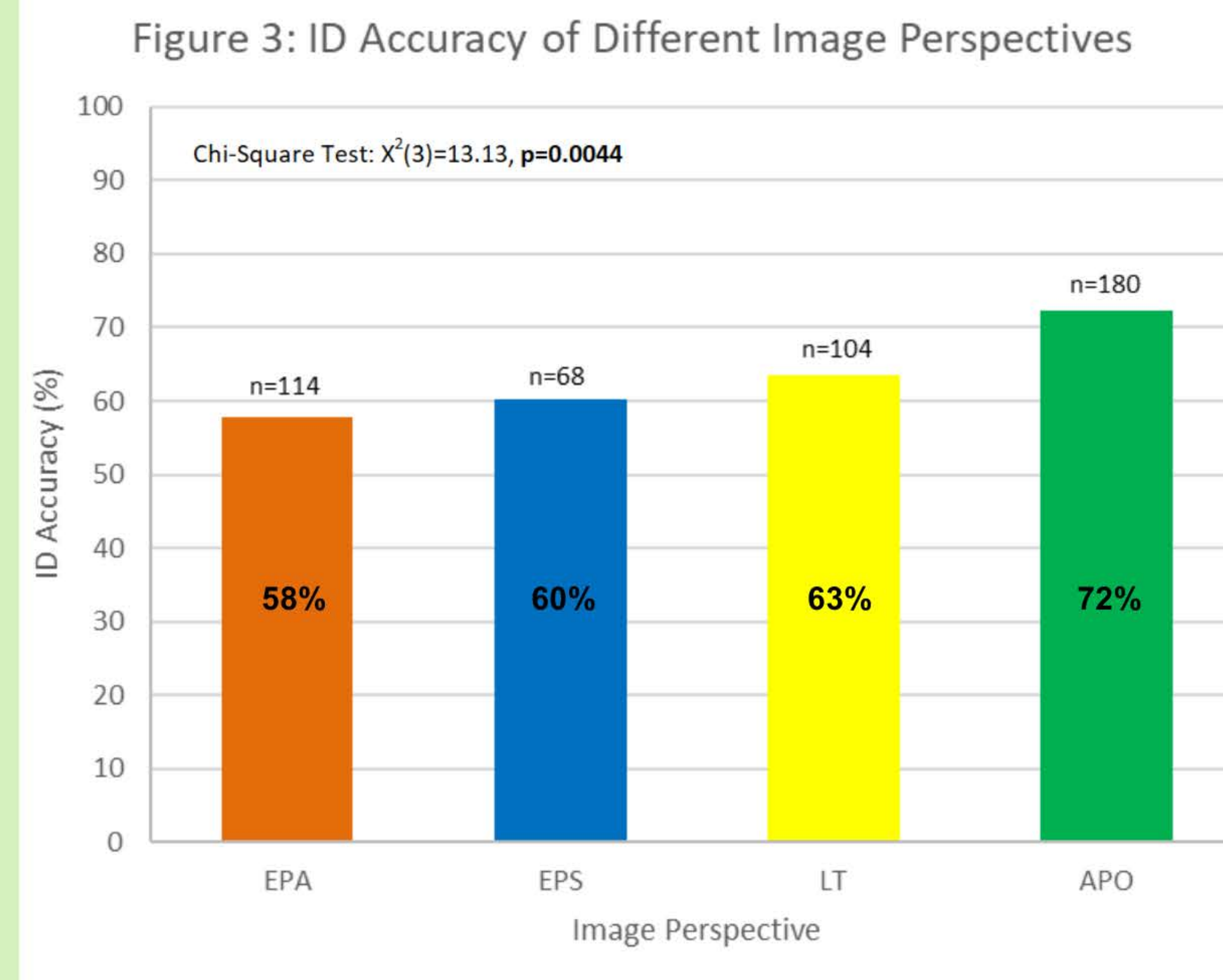
Thallus upper closeup (LT)

Entire thallus above (EPA)

Entire thallus side (EPS)

Apothecia (APO)

Figure 2: Different image perspectives

Results

- Overall ID accuracy to the species level is 59.9%.
- ID accuracy to the genus level is 69.6%.
- ~4% of all images (18) were identified as *P. phaea.*
- ~4% of all images (15) were identified as *P. stellaris.*

Figure 3: ID Accuracy of Different Image Perspectives

Chi-Square Test: $X^2(3)=13.13$, **p=0.0044**

EPA n=114: 58%
EPS n=68: 60%
LT n=104: 63%
APO n=180: 72%

(ID Accuracy (%) vs Image Perspective)

Figure 4: ID Accuracy of Herbarium vs. Field Images

Chi-Square Test: $X^2(1)=21.69$, **p<0.001**

Herbarium n=297: 53%
Field n=117: 78%

(ID Accuracy (%) vs Image Source)

Discussions and Conclusions

- APO is the best image perspective for correct identification of *P. aipolia*.
- Field images are identified 25% more accurately than herbarium images.
- Lichen herbarium images have not been tested as a potential source for AI algorithm training.
- Without destructive sampling, it is difficult to photograph all perspectives of one individual.

Future work

- Investigate how other image factors (image quality, lighting) impact ID accuracy.
- Investigate whether the observed result would be different for other species.
- Improve iNaturalist user-interface to prompt users to submit images from different perspectives.
- Use generated field and herbarium images for future AI training and testing.
- Once Computer Vision model (AI) is trained with expert validated images, it will have a huge potential in accurate lichen identification.

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- Parents Lyubov Milevska-Vovchuk and Viktor Vovchuk for supporting me throughout the way.

Resources

- ABMI biodiversity browser: https://beta.abmi.ca/biobrowser.html
- Brodo, I. M., Sharnoff, S. D., & Sharnoff, S. (2001). Lichens of north America. Yale University Press.
- iNaturalist: https://www.inaturalist.org
- Munzi, S., Isocrono, D., & Ravera, S. (2023). Can we trust iNaturalist in lichenology? Evaluating the effectiveness and reliability of artificial intelligence in lichen identification. The Lichenologist, 55(5), 193-201.