Biogeosciences Discussions

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Comment on bg-2022-239

Anonymous Referee #1

Referee comment on "Lichen species across Alaska produce highly active and stable ice nucleators" by Rosemary J. Eufemio et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-239-RC1, 2023

Eufemio and colleagues collected 29 lichen samples across Alaska. Each lichen sample was identified as a separate species and each lichen sample was found to have ice nucleation active. The most active lichens initiate freezing at -6C. Their activity is highly resistant to freeze-thaw cycles and moderately resistant to heat treatment. Interestingly, two classes of ice nuclei were found. They are active at different temperatures. The authors assume that the nuclei active at higher temperature are from the mycobiont component and the nuclei active at lower temperatures are derived from the photobiont component.

Overall, this manuscript is very well written and interpretation of results and conclusions are overall well justified. I only have two major comments:

- The authors do not provide methods on how the 29 lichens were taxonomically identified. Details of how the identification was made need to be included in the methods section.
- The authors appear to make a leap when assigning the more active nuclei to the mycobiont and the less active nuclei to the photobiont. However, to me it seems as likely that both classes of ice nuclei consist in the same molecule (be it a protein or something else) derived from the mycobiont and the classes are simply due to different aggregate sizes of the same monomeric molecule produced by the mycobiont. Since there seems to be no experimental results pointing to either the authors hypothesis or the hypothesis I propose here, I would not refer to these classes as mycobiont and photobiont in the manuscript. I would only speculate that they may and then just refer to them as classes A and B or some other neutral naming in the rest of the manuscript.

Minor comments

- The sentence in lines 81-83 could be improved. “to gain insight into possible atmospheric influences” is vague and it could either mean influence of the lichens on the atmosphere or influence of the atmosphere on the lichen”. Please rephrase.
- Line 58, I would specify how many of the 29 lichen samples were analyzed using TINA in this sentence.
- I am just wondering how the sampling was done. Since each sample turned out to be a different species, I guess that the authors specifically looked to find a different species at each sampling site? If sampling was random, I would have expected that the same lichen species would have been found more than once. I suggest to clarify the sampling strategy to make it easier to understand why each sample turned out to be a different species.
- I wonder if the authors could comment on what kind of ice nuclei the grinding of the lichens released. I guess that the method was chosen to include both cell wall-bound non-secreted molecules as well as secreted molecules. However, I think it would be good to add a sentence somewhere specifying what the authors expected to be in the tested samples: only secreted molecules or all molecules independently of being secreted or not.