

The present paper on ice nucleation activity is a thoroughly done study of the ice nucleating activity of 29 lichens found across Alaska. Homogenates of all of these show ice nucleating activity above -15 degC. Some even at relatively high temperatures at around -5 degC to -6 degC. The authors have made some preliminary experiments trying to narrow down the nature of this IN activity and compellingly show that in some of the species the activity is presumably due to proteinaceous ice nucleators whilst in others the IN activity is possibly due to polysaccharides or other non-proteinaceous substances as their IN activity not changing much after heat treatment. In general, it is surprising how stable the ice nucleation substances are which is in stark contrast to the rather instable bacterial INAs.

It is interesting that it does not seem as if the INAs in the lichens are related to the severity of the low temperatures in their habitat but possibly to other parameters - one could speculate about the humidity or water logging of the habitat. Another possibility could maybe that the occurrence of INAs in lichens is just an intrinsic property and not of any adaptive value in relation to low temperatures. This problem is not discussed by the authors. It could thus be interesting to test lichens from warmer climates to see if these also are showing IN activity.

Response: We thank the reviewer for carefully reading our manuscript, the positive comments, and the suggestion to test lichens from warmer climates. As pointed out by the reviewer, the important question about the ecological benefits of ice nucleation activity for lichen from an ecological perspective remains unknown. However, whether ice nucleation activity in lichen is an intrinsic property, provides advantages for water logging, or for freeze-tolerance cannot be answered with the available evidence and is outside the scope of the current work. However, we plan to systematically address the connection between ice nucleating activity and geographical distribution in lichen in future research.