

Responses to short comment of Janine Fröhlich-Nowoisky

We thank Janine Fröhlich-Nowoisky for her corrections, which we implemented in the revised manuscript as detailed below (responses are in italic, text additions to the revised manuscript are in blue).

The statement in the introduction (page 2, line 39) "In screening experiments, fungi and lichen failed to show IN activity above -25°C, with the exception of *Fusarium acuminatum* and *Fusarium avenaceum* (Pouleur et al., 1992; Pummer et al., 2013)." is not supported by the literature since several studies found IN activity in other fungal species as well as lichen (e.g., Fröhlich-Nowoisky et al., 2015; Haga et al., 2013; 2014; Huffmann et al., 2013; Kieft 1988; Kieft and Ahmadjian, 1989; Kieft and Ruscetti, 1990; Moffet et al., 2015; Morris et al., 2013).

Thank you for pointing this out. We corrected the text and added the suggested references. The text reads now like this (page 2, line 38 – page 3, line 6 of the revised manuscript):

Screening experiments revealed IN activity of lichen samples from a variety of locations with freezing onset temperatures up to -5°C (Moffett et al., 2015), and even up to -2.3°C (Kieft, 1988). The IN activity was found to originate primarily from the mycobiont (Kieft and Ahmadjian, 1989), providing evidence for a fungal rather than bacterial source of IN activity (Kieft and Ruscetti, 1990). The sites seem to be proteinaceous, although they are less sensitive to heat and pH variation compared with ice nucleating proteins expressed by *P. syringae* (Kieft and Ahmadjian, 1989; Kieft and Ruscetti, 1990; 1992). In screening experiments, most fungi failed to show IN activity above -20°C with few exceptions such as *Fusarium acuminatum* and *Fusarium avenaceum* (Pouleur et al., 1992; Pummer et al., 2013; Haga et al. 2013; 2014). Yet, IN active fungi with freezing onsets as high as -5°C could be identified in bioaerosols (Huffman et al., 2013) and in soils (Fröhlich-Nowoisky et al., 2015). Heat resistance and insensitivity to pH variation suggests that the IN active entity is more similar to the ones of lichen than to bacterial ones (Pouleur et al., 1992).

Moreover, the authors cite Fröhlich-Nowoisky et al., 2015 (page 3, line 1) to support their statement "Surveys of the IN ability of pollen showed that only few types were active, the most active ones stemming from birch and conifer trees, yet, only at temperatures below -9°C". This should be corrected as Fröhlich-Nowoisky et al., 2015 performed a screening of soil fungi and found ice nucleation activity in the widespread soil fungus *Mortierella alpina*.

We removed the reference in this sentence and refer now to Fröhlich-Nowoisky et al. (2015) in the paragraph about fungi (page 3, line 5) in the revised manuscript.

References:

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