

Biogeosciences Discuss., referee comment RC3  
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## Comment on bg-2022-98

Anonymous Referee #2

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Referee comment on "Dispersal of bacteria and stimulation of permafrost decomposition by Collembola" by Sylvain Monteux et al., Biogeosciences Discuss.,  
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Review of "Dispersal of bacteria and stimulation of permafrost decomposition by collembola" by Monteux, Marien and Krab (2022)

General comments:

The manuscript by Monteux et al is very well written and the described mesocosm experiment is sound and thoughtful. Unfortunately, the results did not match the expectations, but this does not reduce the scientific quality of the manuscript.

The experiment was designed to analyse the effects of presence of collembola on bacteria communities in newly thawed permafrost soil. Permafrost soil was cultured in vessels and collembola (*F. candida*) were added either from stock cultures on gypsum medium, permafrost medium or an arctic soil medium. The collembola were fed with either yeast or the natural community in the soil communities (to explore endozoochory), or were sprayed with suspension from permafrost soil or arctic soil (ectozoochory). The presence of Collembola resulted in significant changes in the bacterial community for the ectozoochory and ectozoochory control treatment only, and only when analysed qualitatively (presence/absence), but not quantitatively (community composition). CO<sub>2</sub> production was higher by 25% in presence of collembola (of which half could be attributed to a priming effect of Collembola on permafrost soil), but did not vary between Collembola treatments. These results are less impressive than expected and are summarized in a very pointed way in the very first lines of the discussion.

Further in the discussion the authors list a number of reasons why the results were the way they were: bacteria are not able to survive gut passage or on collembola skin, Collembola prefer fungi, etc. This is all true but makes the reader believe that the experiment just failed (sorry, that was my strongest impression).

In my opinion, the results should be stated in a more positive way. Collembola sprayed with arctic soil (and sprayed with permafrost, too) did change the bacterial community, and that is something! Obviously the community composition per se did not change within this short time frame, but the introduction of new microbial species was successful (in future experiments one could try to find out which strains were transferred successfully). Therefore, with enough time for the introduced microorganisms to multiply, community might change. One should argue that Collembola changed the microbial community despite the fact that they do not really feed on this group of microorganisms and despite the short time investigated. But it might be discussed why this can only be achieved with bacteria sprayed on the skin of Collembola but not those that travelled in the collembolan gut. Secondly, the presence of Collembola increased CO<sub>2</sub> release of soil microorganisms by ~15%. For this part of the discussion the same hints are valid as for the community: be more positive. Collembola presence affected soil microorganisms' activity. But what was it that affected microorganisms? It had nothing to do with introduction of new species, but maybe it was feeding or trampling by the collembola or predigestion of nutrients?

The authors mention all these things already, but the manuscript's sound is too much of an excuse for not-expected results than presentation of the findings. The authors' concerns are right and prove their ability of scientific writing, but they are too much in the focus in the present manuscript.

Specific comments:

- In general, the materials and methods (M&M) chapter could be more clear. I had to read it several times to understand which kind of soil was used for which collembola cultures.
- Hypothesis II and IV: Do you expect different bacterial strains transferred by ecto- and endozoochory, or the same strains in differing amounts? This is not clear in the hypothesis or M&M section.
- How many replicates did you have? I suggest it's five or six from the graphs in the appendix (the grey dots), but you don't write it in M&M. And how many replicates for the "Collembola without soil"-control?
- Why did you use permafrost soil from Alaska, but arctic soil from Sweden? Wouldn't it be better (or more realistic) to use arctic soil from a closer region? Could the distance between the sampling sites affect the ability of the arctic microflora to adapt to the permafrost soil?
- Were collembola in ectozoochory treatments obtained from stock cultures or from

permafrost soil cultures? Please make the section about your treatments more clear.

Small comments/typos:

- Line 264 "than" instead of "that"
- Appendix A2, 2<sup>nd</sup> table: What do you mean with "vs. control"? The no collembola-control or the respective controls?
- Appendix A3: In the figure caption you mix up "RRsoil" and "RRgross".