

Comment on soil-2021-110

Thomas Reitz (Referee)

Referee comment on "Pairing litter decomposition with microbial community structures using the Tea Bag Index (TBI)" by Anne Daebeler et al., SOIL Discuss.,
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I have read the manuscript "Pairing litter decomposition with microbial community structures using the Tea Bag Index (TBI)" submitted by Daebeler and colleagues with great interest and appreciate the work that have been conducted. The manuscript is well written and nicely condenses the performed analyses to the most relevant points. I have some questions and recommendations related to the initial draft of the manuscript, which should be addressed before publication.

One of the main points investigated by this study is the impact of the season on litter decomposition as well as on the related microbial community diversity and composition. I really appreciate this approach and agree with the authors that the investigation of decomposition over a complete year, i.e. including all seasons, has huge benefits, inter alia, for understanding decomposition dynamics and estimating annual rates. However, as for the three different soil types, it would be relevant to have an estimation of, how the four seasons differ from each other. Therefore, at least mean temperature and amount of precipitation for each of the seasons are crucial explanatory variables, which help to understand the obtained results. So far there is only a vague interpretation in this direction (e.g. in lines 203, 206ff, 216, 250) but it could be more refined by supporting weather data for each season from the "Agneshof" weather station.

The second major point is related to k and S . The description of S in line 196 is not correct. The stabilization factor S reflect the proportion of the hydrolysable fraction that is not decomposed, i.e. stabilized. Accordingly, the statements made in lines 213 and 320f are wrong. I further ask the authors to check their calculation of S , since the presented values in Figure 2 are rather high (besides the one for summer). If the calculations are correct, please discuss your results (S between 0.3 up to more than 0.5) with respect to the normal range for S (0.1-0.3) published by Keuskamp and colleagues (2013). For k it is stated (L197) that the decomposition rates are given in g per day. According to non-linear degradation, which is the basis for the Tea Bag approach, this is not correct. The decomposition rate, k , has a unit of relative weight loss per day, i.e. simply " d^{-1} ". Please also provide the unit at the y axis of figure 2. In the description of figure 2 it is mentioned that some k values could not be calculated since the rooibos tea was no more in the first

decomposition phase. I am wondering how the authors recognized that the first stage was already over and if so, why some rooibos samples obviously decomposed faster than all the others. On the other hand, I am curious about if and how it was checked whether the first decomposition phase of the green tea was completed at the low temperatures in the winter months. Otherwise S would be overestimated, which may partly explain the high values obtained for S .

I am also slightly confused about the soil sampling and the abiotic results. First of all, I guess that the information given in lines 109f and 132f are redundant!? Anyway, why does the number of collected composite samples vary between 1 and 3? How statistics can be performed with 1 sample? Regarding the results: Is there an explanation for the rather huge dynamics (up to 0.6% for Fluvisol) of the very slow changing soil property TOC?

Furthermore, the authors stated that red tea was a stronger selector of microbial colonizers than green tea due to a stronger relative enrichment of fungal orders (stated e.g. in lines 40ff, 315f). According to the underlying figure 3, indeed the mean relative differences in the abundance of the fungal orders is higher, but there is only one order that is enriched in each tea compared to the surrounding soil. The relative increase for prokaryotic orders is reasonably lower since there are simply more orders, both, in total as well as the ones enriched in the tea. If the differences of the significantly increased orders of bacteria are summed up, they will end up with even higher relative increase than fungal orders in both teas.

Finally, this directly leads me to the last point, which is related to the fact that an interesting finding is partly hidden. In the second hypothesis it is stated that the two different teas are colonized by different subsets of microbes, which was confirmed as stated e.g. in line 323. However, it should be more clearly stated that, while the majority of studied order were enriched or decreased in a more or less equal way in both teas, especially Rhizobiales and the fungal orders Hypocreales and Helotiales show contrasting colonization of green and rooibos tea. I consider this information as a very relevant one, since these orders could function as indicator species for future decomposition studies

Further points:

L44: What exactly is meant by "the active component of the microbial community"?

L93: Please provide a reference at the end of this sentence (instead of a double blank character)

L198: What about the statistic effects between seasons if you sum up the three soil types?

L198: Closing bracket is missing after Fig.2

L200: double parenthesis

L219: I recommend to reconsider the wording here. I doubt that the performed approach can really say which species are indeed "involved" in the decomposition for two reasons. (i) we only see a snapshots of the community after three months, which is likely not equal to the community in the weeks and month before. (ii) as stated later only (line265ff) a certain part of the detected community is really involved in the degradation, while others may only benefit from the generated products. Therefore I recommend to soften the wording here and in the whole manuscript.

L224: typo in shows

L268: "minority" might be not the best word for more than 30% of prokaryotes and about 15% of fungi. As stated before, the authors should be more careful in their interpretation and also consider taxa which may just be enriched in the community due to the usage of secondary products generated by decomposing taxa.

L272 (and elsewhere): consider to use "substrate or litter type" instead of "sample type"

L275: I might be wrong, but I asked the authors to recheck the explained-variance values since according to Fig S3 the fungal communities seems to show more differences between green and rooibos tea than the one of prokaryotes. If the values are, however, correct, the statement made in the sentence starting in line 315 does not fit.

L280: Here it should be proposed, which locally, rather stable factors do hide the commonly observed impact of different soil types (climate!?)

L289: typo in Beta[...]les

Table 1: please include information of vegetation for each site/soil

Table 1: is not really helpful and other things might be more important. Consider to put Table 1 in the Supplementary and instead Figure S2 or S3 into the main text

Fig S3 description: consider "obtained" instead of "contained"