Biogeosciences Discuss., 7, C1455–C1458, 2010
www.biogeosciences-discuss.net/7/C1455/2010/

Biogeosciences Discussions

Interactive comment on "Chemical composition of volatile and extractive compounds of pine and spruce leaf litter in the initial stages of decomposition" *by* V. A. Isidorov et al.

V. A. Isidorov et al.

isidorov@uwb.edu.pl

Received and published: 21 June 2010

1. **Referee # 1 writes**: "... the loss of total monoterpene hydrocarbons within the first 77 days would be 58 μg/g(dw) for pine litter. But using the emission rate of about 1.9 μg/g(dw) $\times$ h (Table 1) would indicate that after 77 days about 3500 μg terpenes per g(dw) have had evaporated; much more than existent as total content at the beginning of the experiment...".

Reply to comment 1 above

Referee's estimations concerning the emission of terpenes [1.9 μg/g(dw) $\times$ 24 h $\times$ 77 d $\approx$ 3500 μg] would have been accurate, if the average daily temperature during the

first days of the experiment (17 November 2005 – 2 February 2006) had been equal to 20Ñ. Even though the relationship between temperature and terpene emission rate from litter was not determined, it can be safely assumed that at temperatures close to 0Ñ (or even lower, in the conditions prevailing in north-eastern Poland) this rate is much lower than the rate indicated in Table 1 relating to the temperature of 20Ñ. Average annual temperature in the experiment site is not excessively high either – it equals only 6.9 Ñ.

2. Further on Referee # 1 states. : " ... Assuming validity of mass balance and supposing *that the dead plant matter does not biosynthesize terpenes* implies that the differences shown for terpene concentrations (Table 2) are upper limits for the mean emission rates between the respective measurements. If so, an upper limit for the mean total monoterpene emission rates for pine litter between day 0 and day 77 would have been in the range of 0.03 μg/g(dw) $\times$ h. This may be due to low temperature during the first 77 days. Nevertheless, this is a very low emission...."

And below: "... these emissions cannot be both, high and long lasting. The capacity of the litter to emit such compounds is limited because *dead plant matter does not synthesize these compounds*"

Reply to comment 2 above

We concur with the opinion that the emission rate equal to 0.03 μg/g(dw) is rather low. This is most certainly related to low temperatures during the winter season. Also, we share the view that "....the dead plant matter does not biosynthesize terpenes". This, however, does not mean that "new" terpenes will not appear in such dead plant matter. Firstly, in living plant tissues terpenes are partially bound with carbohydrates and phenol carboxylic acids. Gradual hydrolysis of these compounds can lead to the release of products which contribute to the pool of volatile substances (i.e. terpenes). Secondly, it has to be remarked that terpenes are among the principal volatile metabolites of various fungi which take part in decomposition of litter. Specifically, Nilsson et al. (1996)

detected 17 monoterpenes and 29 sesquiterpenes in a group of 58 VOCs emitted into the gas phase by the representatives of a family of such fungi (*Penicillium* sp., cultures were grown on sucrose agar). Several dozens of terpene substances were also noted among VOCs produced by fungi isolated from pine and spruce litter in the course of our experiments (Isidorov et al., 2009).

Nilsson, T., Larsen, T.O., Montanarella, L., and Madsen, J.Ø.: Application of headspace solid-phase microextraction for the analysis of volatile metabolites emitted by *Penicillum* species. J. Microbiol. Meth. 25, 245–255, 1996.

All the necessary revisions and explanations will be included in the revised version of the manuscript.

Minor points:

1. In the superscript of Table 2 the units are μg/g(dw).
2. The formula showing the calculation of emission rates will be corrected.
3. The sentence written in the conclusion (p. 1742 lines 20-22) will be completed with a reference to a peer reviewed journal.
4. "3-Karene" will be changed to "3-Carene"

Referee #2 writes : "The non-volatile components are included, because the author believes they may be precursors to VOC emissions. No discussion or references to this hypothesis are included. The manuscript may be improved by inclusion of some discussion of the metabolic products or pathways of further degradation of litter".

Reply to Referee #2 comment above

We agree with the point that the manuscript could have been supplemented (and may be improved) by a chapter discussing the products of metabolic processes and pathways of litter degradation. However, the lack of such a chapter was related to the

fact that specifically these issues are addressed in our forthcoming publication. The publication will offer data concerning species dynamics of fungi participating in the decomposition of spruce and pine needle litter, as well as content of VOCs emitted into the gas phase by the predominant fungi species (*T. polysporum, Penicillum citrinum*, etc.). In the near future, we will have the pleasure of presenting this manuscript to BGS. Nonetheless, following Reviewer's recommendation, the revised version of the present manuscript will include additional bibliographical references (Fioretto et al., 2007; Leff and Fierer, 2008) supporting the hypothesis.

Fioretto, A., Papa, S., Pellegrino, A., and Fuggi, A.: Decomposition dynamics of *Myrtus communis* and *Quercus ilex* leaf litter: Mass loss, microbal activity and quality change. Appl. Soil Ecol. 36, 32–40, 2007.

Leff, J. W., and Fierer, N.: Volatile organic compound (VOC) emission from soil and litter samples. Soil Biol. Biochem. 40, 1629–1636, 2008.

Interactive comment on Biogeosciences Discuss., 7, 1727, 2010.