

## ***Interactive comment on “Role of needle surface waxes in dynamic exchange of mono- and sesquiterpenes” by J. Joensuu et al.***

**Anonymous Referee #2**

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General comments: Authors have measured whole shoot-level mono- and sesquiterpene emissions of Scots pine seedlings and analysed the needle surface waxes for the same compounds. The aim of the work was to determine if the same terpenes can be found on the epicuticles as in shoot emissions. This approach is needed to better understand the mechanisms how plant release BVOCs in the atmosphere and if there is a temporal storage of BVOCs on plant surfaces.

Main observations were that shoot emissions and wax extracts were dominated by monoterpenes and the proportion of some sesquiterpenes was higher in the wax extracts than in whole shoot emissions. Authors have discussed about the pathways of mono- and sesquiterpenes to needle cuticle also considering external sources. Their conclusion was the “any BVOCs found in the extract were most likely not a result of stomatal emissions but rather compounds that had been associated to the epicuticle”.

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However, whole discussion is based on the assumption that needle emissions are the only source of needle epicuticular mono- and sesquiterpenes. External redeposition is mentioned, but other possible external sources are not discussed. These might include e.g. emissions from the bark of studied branches or other branches and stem, but also emission from neighboring plants. Authors should mention these other pathways of needle deposition of BVOCs.

Specific comments:

P 4, L24. The analysis is based only on four seedlings, so crafted shoots representing the same genotype was a good choice.

P5, L12. Air flow in the shoot chambers was rather high. How much this may stimulate monoterpene and sesquiterpene emission from bark?

P 6, L 22-23. Three replicate samples were reported. How they were collected? Was each of those composed of 20 needles or were these 20 needles divided to 3 subsamples?

P10, L9. Redeposition plant's own BVOCs on epicuticular waxes might not be the only pathway. Adsorption of sesquiterpenes on epicuticular wax layer from external plant sources and their emission back to atmosphere is reported (Li & Blande 2015). As Scots pine bark is important monoterpene and sesquiterpene emitter (e.g. Ghirardo et al. 2012, Heijari et al. 2011). There could be a possibility that part of detected sesquiterpenes on epicuticular wax may originate from earlier sesquiterpene emission from bark of the focal plant and neighboring plants and adsorbed on needles?

P 14. Appendix B. Authors should discuss about potential reason for high variation in monoterpene content in replicate samples within each tree. As the same sample has high emission of all common resin monoterpenes (e.g. tree 2 s3 and tree 4 s2), it may suggest e.g. high bark emission from micro cracks near these needles. Together with high sesquiterpene content in some of the needle samples localized biotic stress by

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e.g. fungal pathogen or mites might also explain these.

#### References

Ghirardo et al. (2010) *Plant, Cell and Environ.* 33, 781–792 Li, T & Blande JD, (2015) *Global Change Biology* 21, 1993–2004 Hejjari et al. (2011) *Environ. Exp. Bot.* 71, 390–398.

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