Faiola et al., Atmos. Chem. Phys. Discuss., 14, C8112-C8113, 2014

Response to Anonymous Referee #1

We thank the reviewer for her/his supportive and constructive comments. We have revised the manuscript to address the reviewer's concerns, and believe the paper is stronger as a result. This response will address the concerns in the order they were raised. Reviewer comments are in bold italics.

General Comments

The article 'Chemical characterization of biogenic SOA generated from plant emissions under baseline and stressed conditions: inter- and intra-species variability for six coniferous species' by Faiola et al. present a laboratory study on how the composition of SOA from plant emissions is affected by herbivore stress. The article is well suited for the journal, and provides an original and substantial contribution to the field.

The article is very well written, the experimental conditions and results are explained in detail and the science is sound.

Thank you for these positive comments.

Conclusions: most of this section is used for addressing future study needs. However, I would like you to comment on the significance of your results in the light of the aims/motivations given in the introduction. I.e. do you think the observed differences in the SOA spectra due to stress could have an impact on the radiative properties and thus climate? What should be done to address this issue? Did the SOA yield change due to stress treatment and is this change more significant than the change in composition?

The conclusions have been revised to better highlight the significance of the results. A new second paragraph has been added to the section:

Previous work has shown that environmental stresses can have significant and widely-varying impacts on BVOC emission rates and emission profiles. Stressors may increase, or sometimes decrease, the amount of BVOCs emitted, and often induce emissions of compounds not emitted under baseline conditions. The work presented here builds on those previous efforts and shows that herbivore-induced emissions not only affect the amount of SOA subsequently formed as shown previously (Mentel et al., 2013), but also affect SOA composition. Both of these herbivore effects will likely impact the aerosol radiative properties. Changes to the amount of SOA produced would have direct impacts on light extinction. The radiative impacts of stress-induced changes to SOA composition, our primary focus in this work, are less clear. For example, the involvement of larger hydrocarbon precursors (>15 carbons) would likely decrease SOA hygroscopicit,y whereas the involvement of more oxidized precursors (e.g. methyl jasmonate) would likely increase SOA hygroscopicity The net impact is difficult to estimate without a more thorough quantitative understanding of herbivore-induced BVOC emission rates. In addition to radiative effects, it is also possible for new particle *formation mechanisms to be enhanced by herbivore-induced BVOCs. Recent findings have shown that biogenic emissions play a critical role in particle nucleation (Riccobono et al., 2014), and thus increases in herbivore-induced emissions could be expected to enhance particle nucleation in forests. These potential effects need further study, though controlled experiments will remain challenging due to the significant variability in plant behavior that have limited efforts to parameterize stress-induced emissions so far.*

Some of the reviewer's other suggestions about the impacts of the modified SOA fall outside of our intended scope for this work, and we choose not to speculate about potentially complex ambient behaviors. In the lab, the SOA produced in the post-stress experiments did increase in nearly all cases. This is not surprising - the stress treatment led to greatly increased VOC emissions, and this should lead to increased yield under absorptive partitioning theory. Within the context of the experiment this result is not novel. It is also not transferable to ambient conditions in any quantifiable way. By design, our experiments were conducted under extreme stress conditions, to ensure that any stress-induced change, if present, could be observed. This goal is described in Section 2.3.

Specific Comments

Page 25175, row 27. is -> in

This has been corrected.

Table 2. Some of the column titles should be explained (Bio/Aero chamber, T0, T1)

The column headers in Table 2 have been revised for clarity.

Figure 9. What does the dashed lines represent?

The three dashed lines on the figure have slopes of 0, -1, and -2. It is common to include these lines in Van Krevelen plots when investigating particle aging in chamber experiments. We have included them here to make it easier for readers familiar with such plots to compare our results with others published previously (Chhabra et al., 2011; Ng et al., 2011).

References

Chhabra, P. S., Ng, N. L., Canagaratna, M. R., Corrigan, A. L., Russell, L. M., Worsnop, D. R., Flagan, R. C. and Seinfeld, J. H.: Elemental composition and oxidation of chamber organic aerosol, Atmospheric Chemistry and Physics, 11(17), 8827–8845, 2011.

Mentel, T. F., Kleist, E., Andres, S., Dal Maso, M., Hohaus, T., Kiendler-Scharr, A., Rudich, Y., Springer, M., Tillmann, R., Uerlings, R., Wahner, A. and Wildt, J.: Secondary aerosol formation from stress-induced biogenic emissions and possible climate feedbacks, Atmos. Chem. Phys., 13(17), 8755–8770, doi:10.5194/acp-13-8755-2013, 2013.

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Riccobono, F., Schobesberger, S., Scott, C. E., Dommen, J., Ortega, I. K., Rondo, L., Almeida, J., Amorim, A., Bianchi, F., Breitenlechner, M. and others: Oxidation Products of Biogenic Emissions Contribute to Nucleation of Atmospheric Particles, Science, 344(6185), 717–721, 2014.