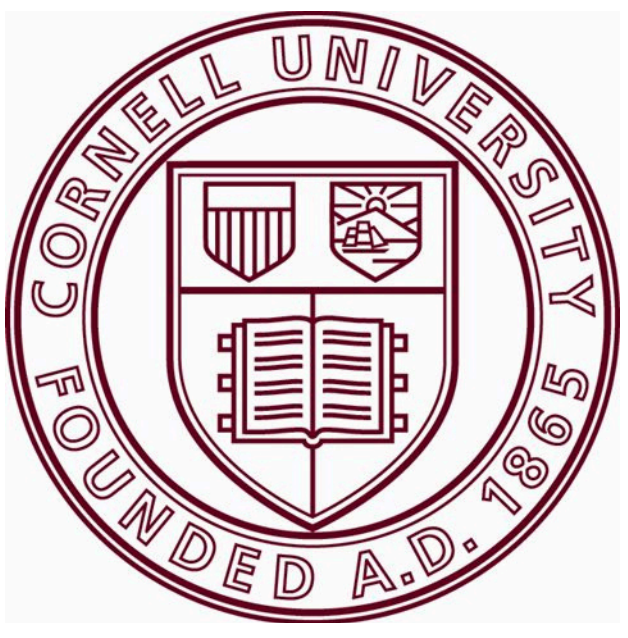




Analysis of Muscat Aroma in *Vitis vinifera* Fruit and Leaves



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Introduction

Muscat grapes (*Vitis vinifera*) are a singular class of grapes known for their distinctive aroma. As such, they are commonly cultivated for both direct consumption and winemaking, representing a \$1.6 billion market¹. Despite this, the exact compounds responsible for this flavor are not fully understood². This project aims to determine 1) the identity of these aroma compounds and 2) if the leaves of muscat grapes also have a different aromatic profile compared to non-muscats. 27 accessions from the USDA Grape Collections in Davis, California were chosen for this study.



Figure 1. Various grapes. Sauvignon Blanc, muscat (left); Neirette, non-muscat (right).

Materials and Methods

Extracting and Measuring Aromatic Profiles

- Collected representative samples of fruit and leaves from selected accessions across two years (2023, 2024)
- Analyzed samples with gas chromatography-mass spectroscopy (GC-MS) via solid-phase microextraction (SPME) to separate and identify aroma compounds

Processing and Analyzing Data

- Identified GC-MS peaks based on retention time and mass spectrum compared to NIST library (Figure 2)
- Measured area under peak as proxy for compound concentration in the sample tissue
- Identified compounds of interest via PCA (Figure 3)
- Confirmed statistical significance with two-sample t-tests

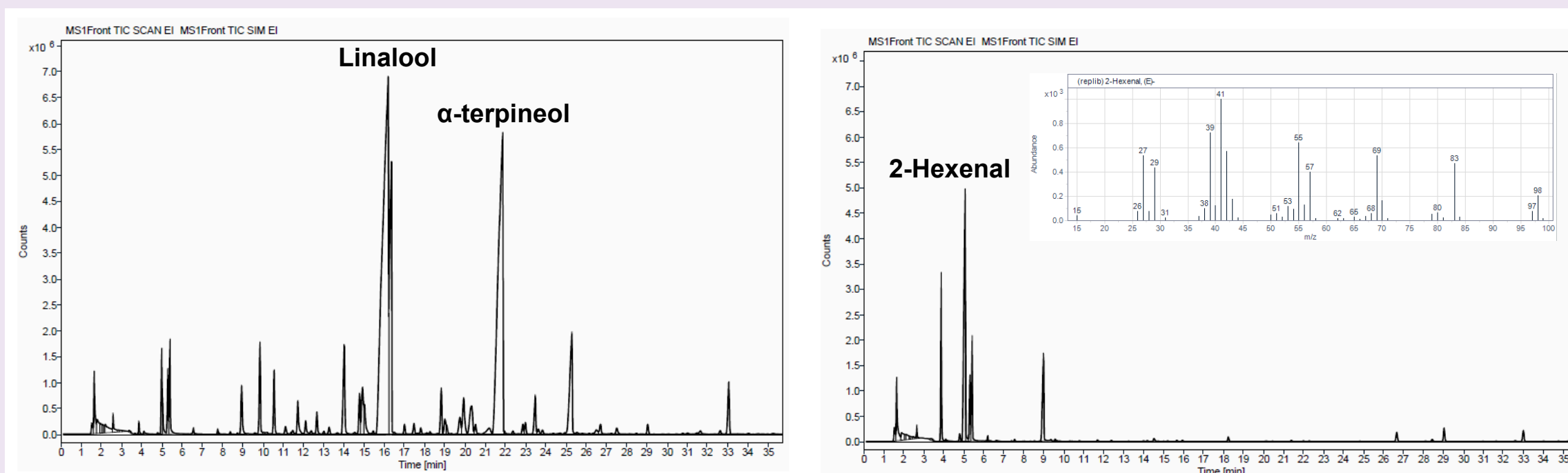


Figure 2. GC/MS peaks. Sauvignon Blanc (left) has a much more diverse chromatogram than Neirette (right), indicative of the more complex aromatic profile characteristic of muscats

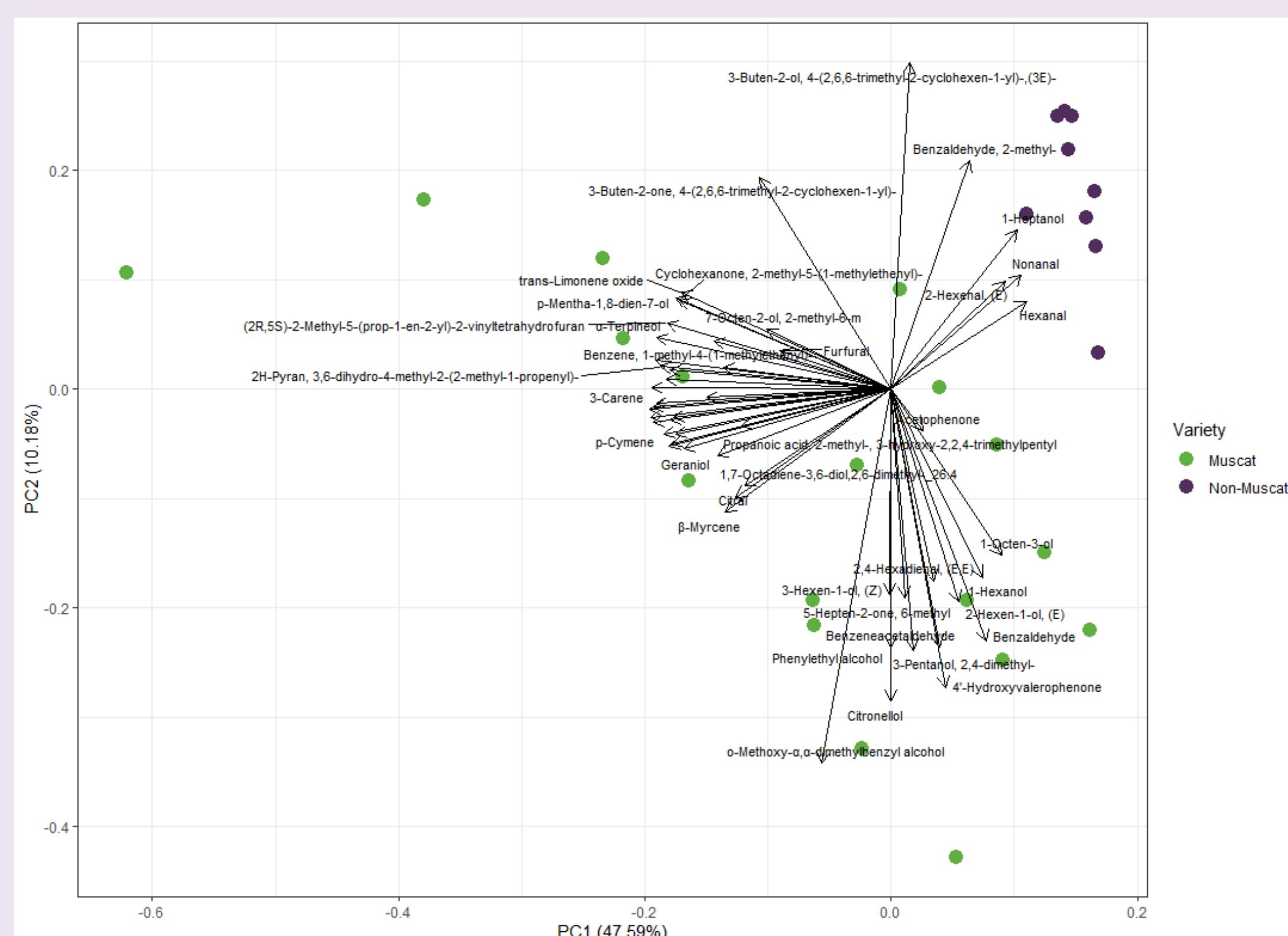


Figure 3. Biplot of juice samples. The vectors represent how much different aroma compounds distinguish the samples.

Results

These findings indicate that monoterpene compounds, especially linalool, β -myrcene, geraniol, and α -terpineol, are responsible for the muscat aroma, as they are present in much higher quantities in muscat grapes than non-muscat ones (Figure 4). This trend is, as expected, found in the fruit, but it is also present to a lesser but still significant extent in the leaves of muscat grapes (Figure 5).

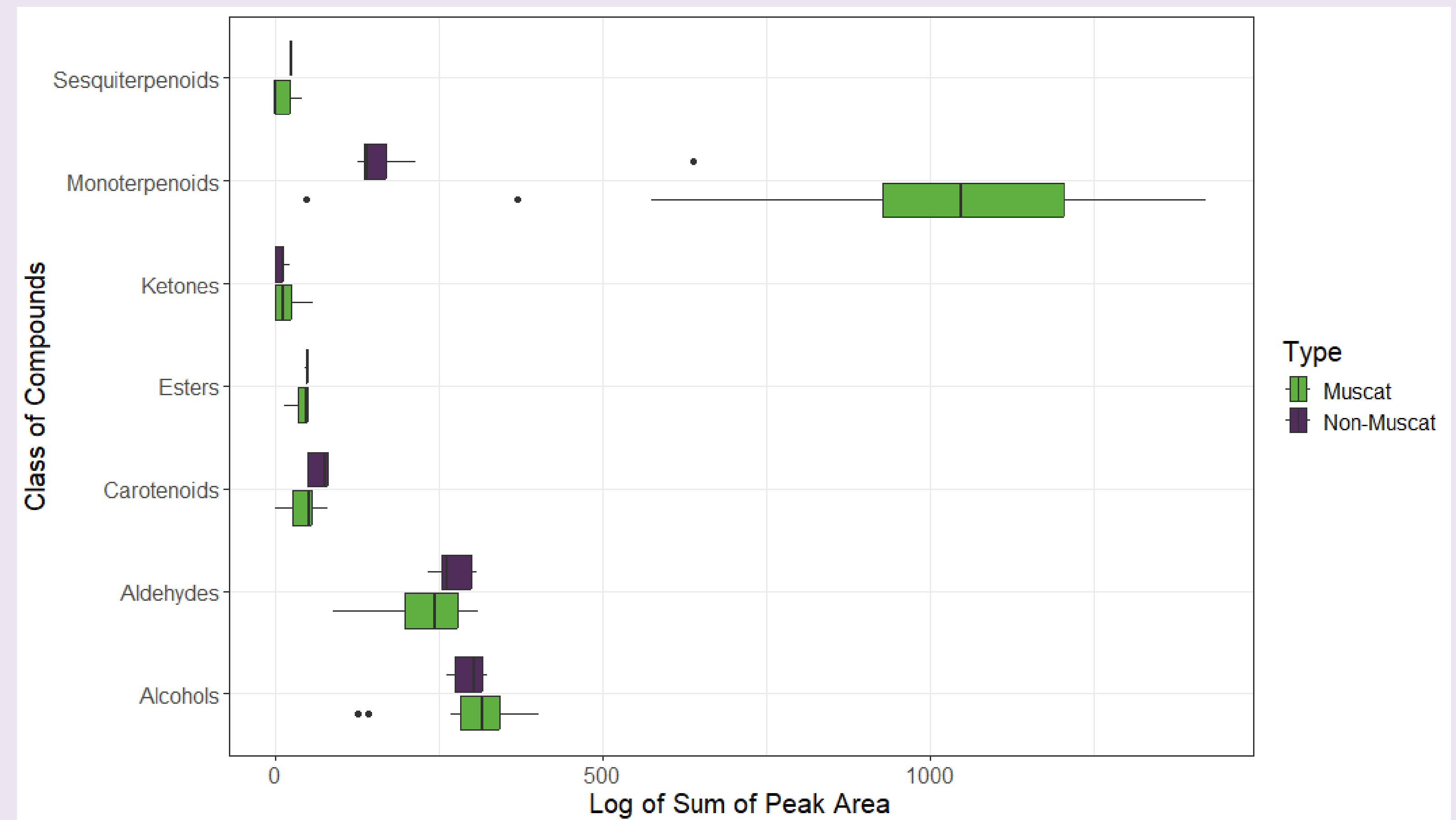


Figure 4. Boxplot of total peak area by compound class. Monoterpenoids are the sole significant difference, indicating that they are the cause of the muscat aroma.

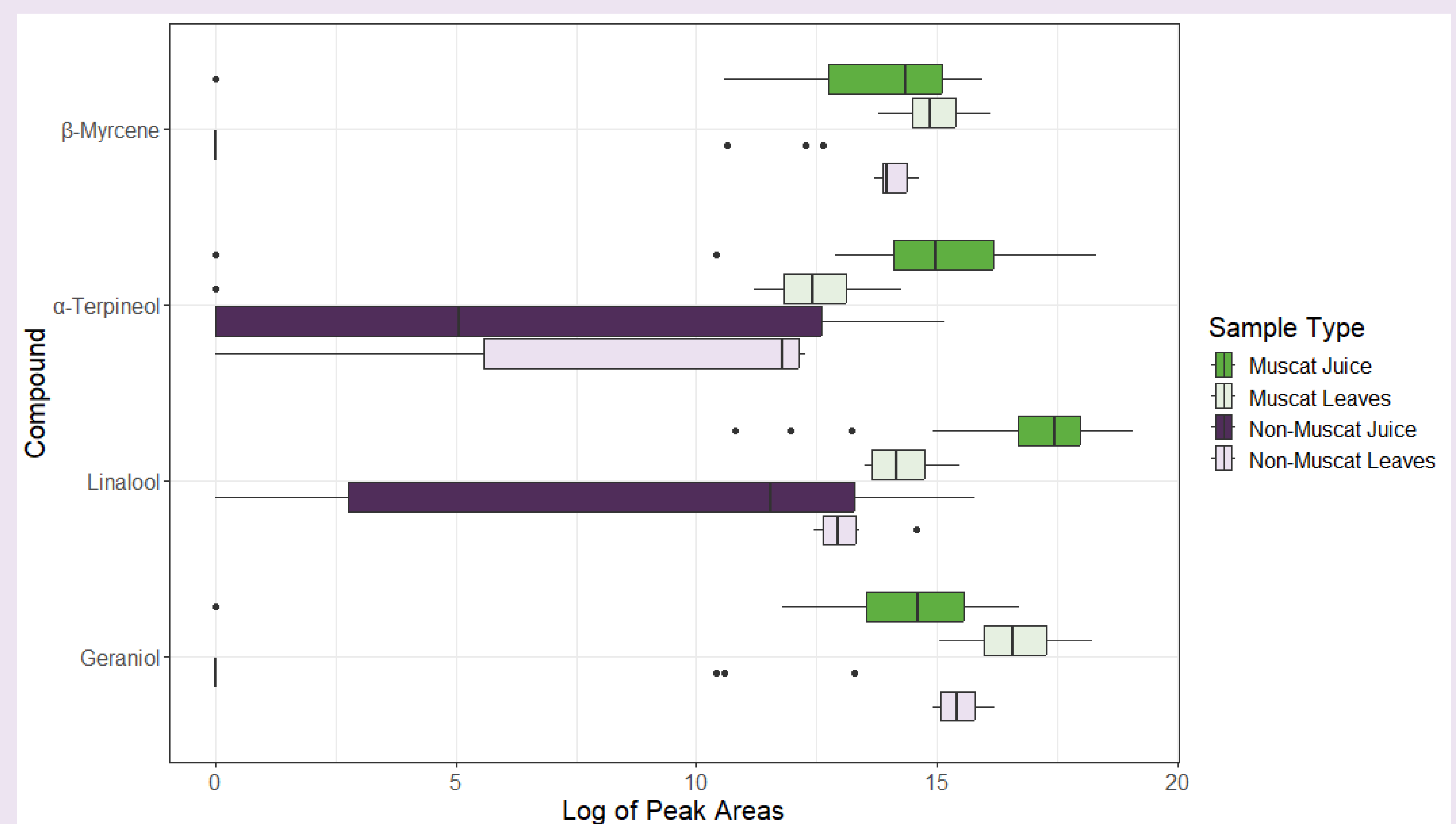


Figure 5. Comparison of peak area of select compounds in the juice and leaves of muscat and non-muscat grapes. All differences between muscats and non-muscats are statistically significant ($p < 0.05$) except for α -terpineol in leaves.

Discussion and Conclusion

- Monoterpene variation can be used to predict whether or not a grape variety will have muscat aromas
- Leaves can be sampled and tested as an accurate proxy for testing fruits, which is beneficial because it allows for earlier testing
- These discoveries will allow grape breeders to more accurately identify the characteristics of a given grape variety without needing to invest the time and resources to growing a sample to maturity
- In future research, the metabolic pathways regulating the presence and concentration of muscat aromas can be further explored

References

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- ²Yang, Y., Wheatley, M., Meakem, V., Galarneau, E., Gutierrez, B. and Zhong, G.-Y. (2024), Editing VVDX1 for the creation of muscat flavour in *Vitis vinifera* cv. Scarlet Royal. Plant Biotechnol. J. 22: 1610-1621. <https://doi.org/10.1111/pbi.14290>

Acknowledgments

I would like to thank Erin Galarneau, Maggie Woodruff, Kyle Wickings, and Kim Paul. Support for this project was provided by USDA NIFA award # 2021-68018-34652 Cornell AgriTech FACT REEU: Enhancing the Digital Agriculture Workforce Pipeline, and the Cornell AgriTech Excellence Fund.

