

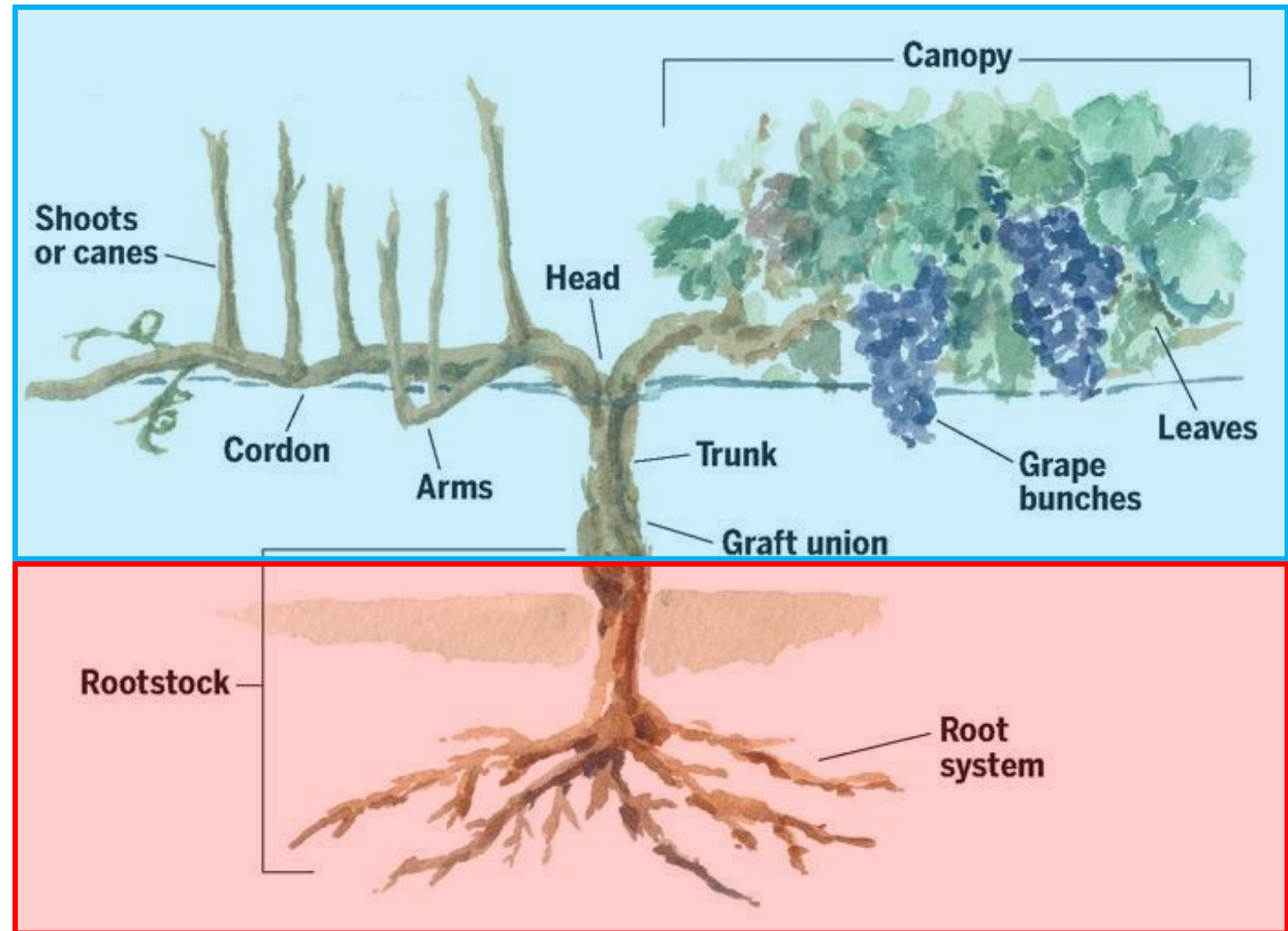
From roots to shoots, the impact of grafting on *Vitis* microbiota



Joel Swift
Miller Lab
Grape and Wine
Symposium
March 9th, 2022

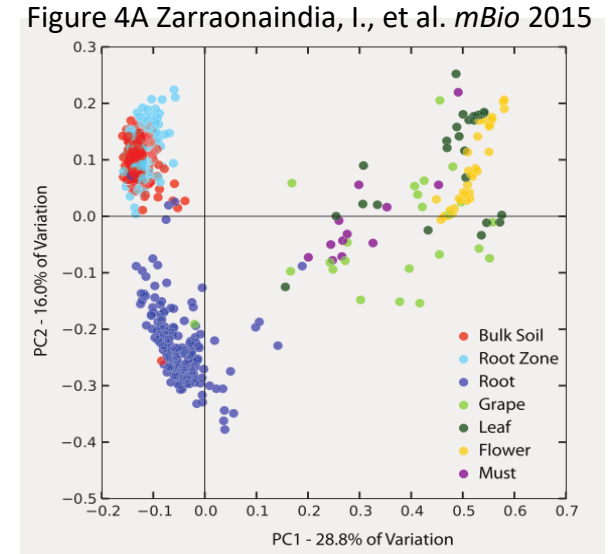


- I am interested in how the **root system (Rootstock)** impacts the **shoot system (Scion)** of grape vines.



Microorganisms and grapes - What do we know?

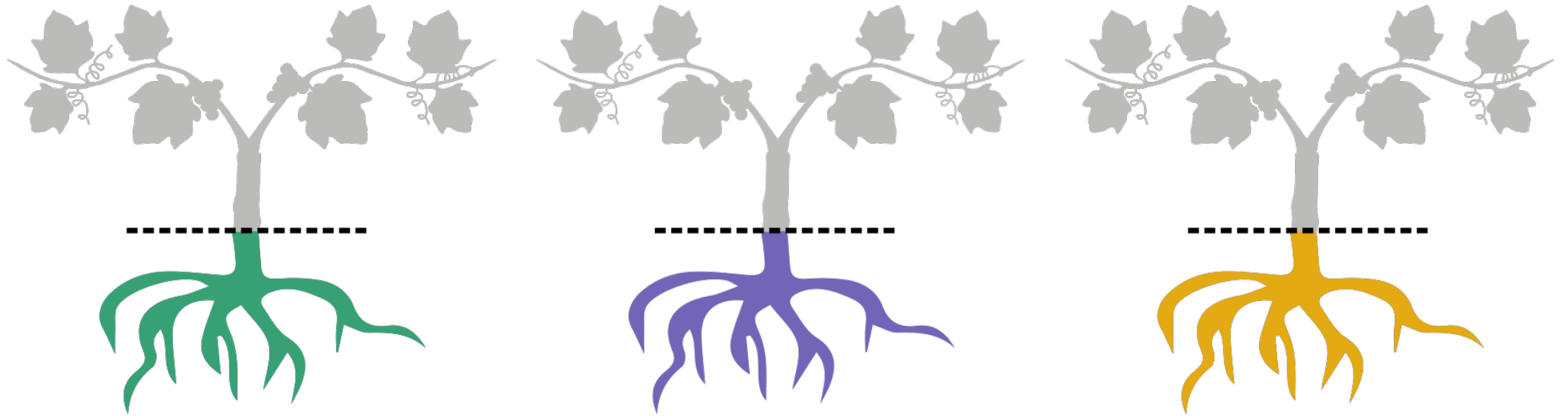
- Grapevine compartments have distinct bacterial fungal communities^{1,2}.



- Grape microbiota are influenced by a number of environmental factors (e.g. soil type, climate, terrain)^{3,4}.
- Grafting while ubiquitous in viticulture is under explored, to date studies have only examined microbiota of the roots in relation to grafting^{5,6}.

1. Zarraonaindia, I., et al. *mBio* 2015
2. Liu, D. and Howell, K. *Env Microbiol* 2021
3. Burns, K. N., et al. *Soil Biol Biochem* 2015
4. Bokulich, N. A., et al. *PNAS* 2014
5. Marasco, R. et al. *Microbiome* 2018
6. D'Amico, F. D. et al. *Front Microbiol* 2018

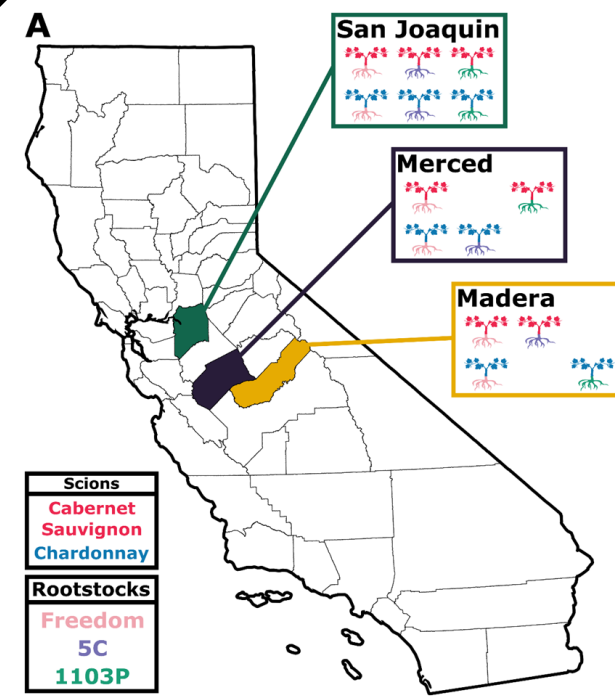
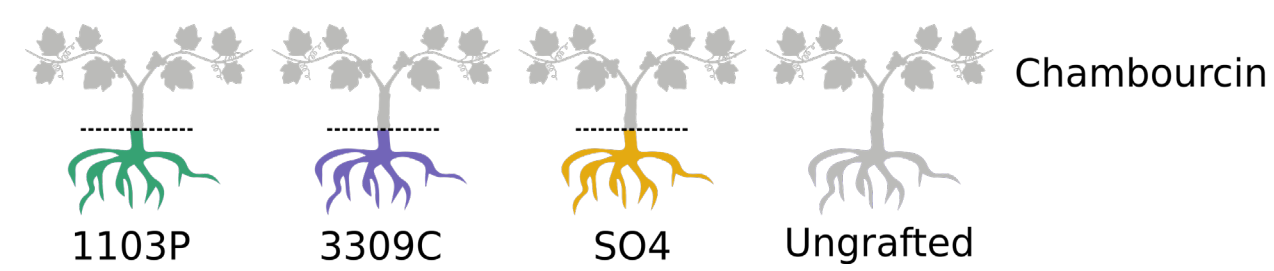
To build a complete picture of how root system genotypes control microbiota of the plant will require sampling above and below ground.

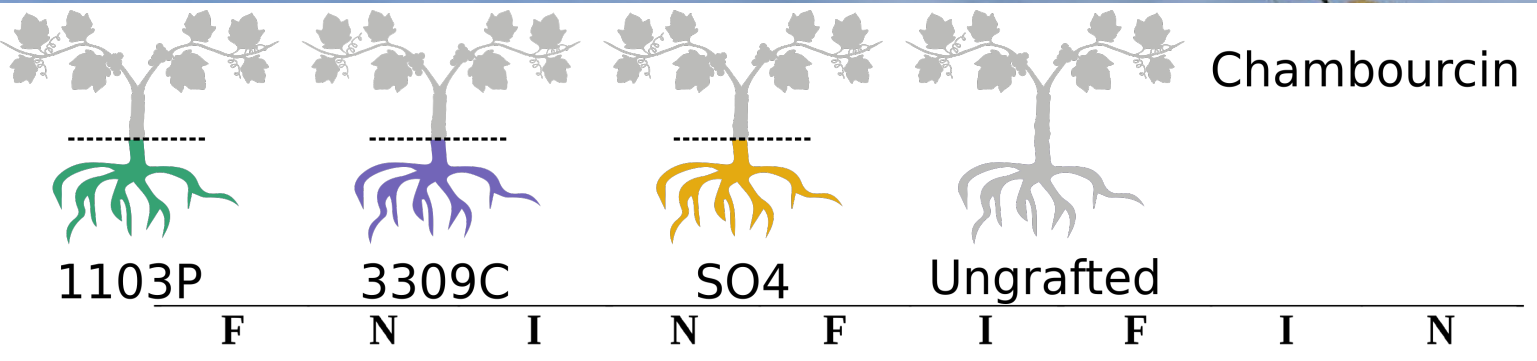


Research Outline

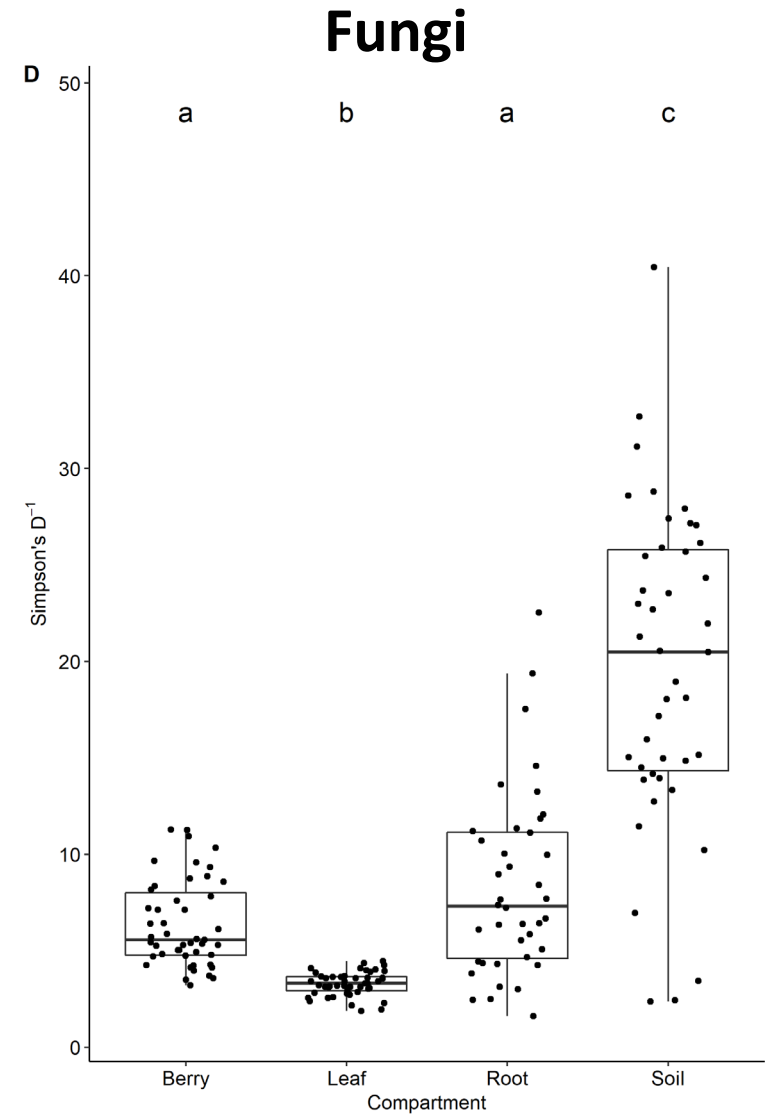
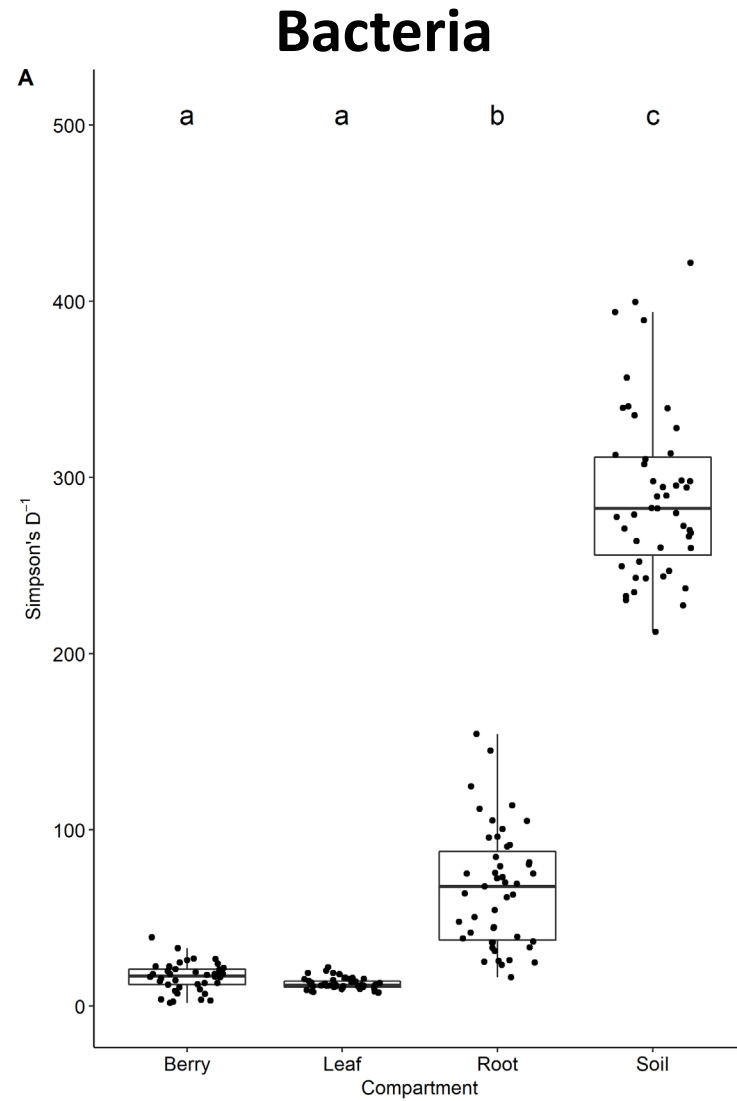
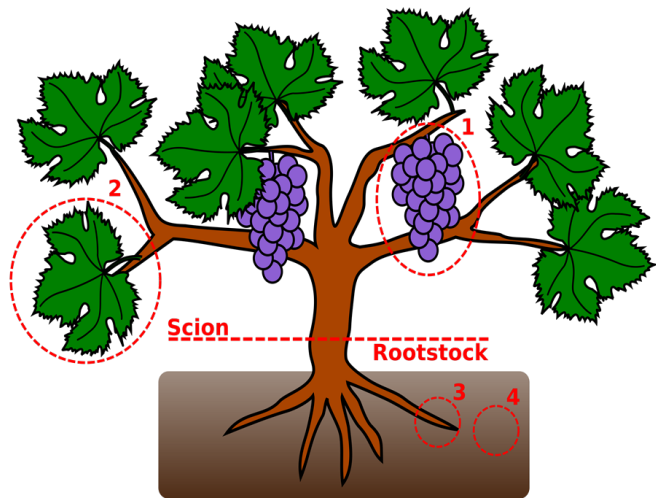
- Southwest Missouri
 - 2018 Harvest

- Central Valley California
 - Multiple time points, years, and vineyards



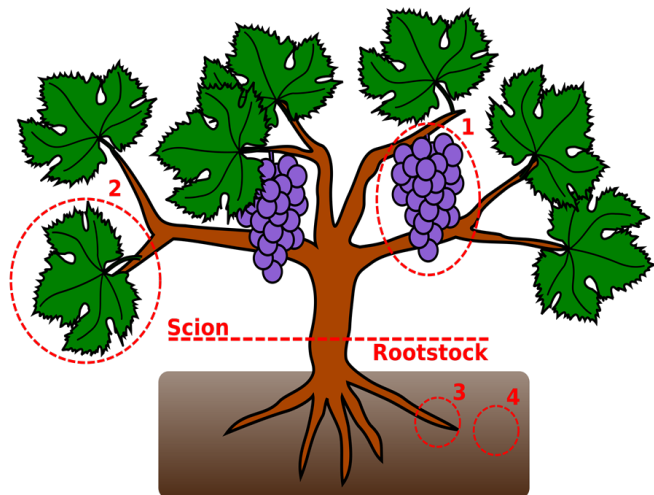
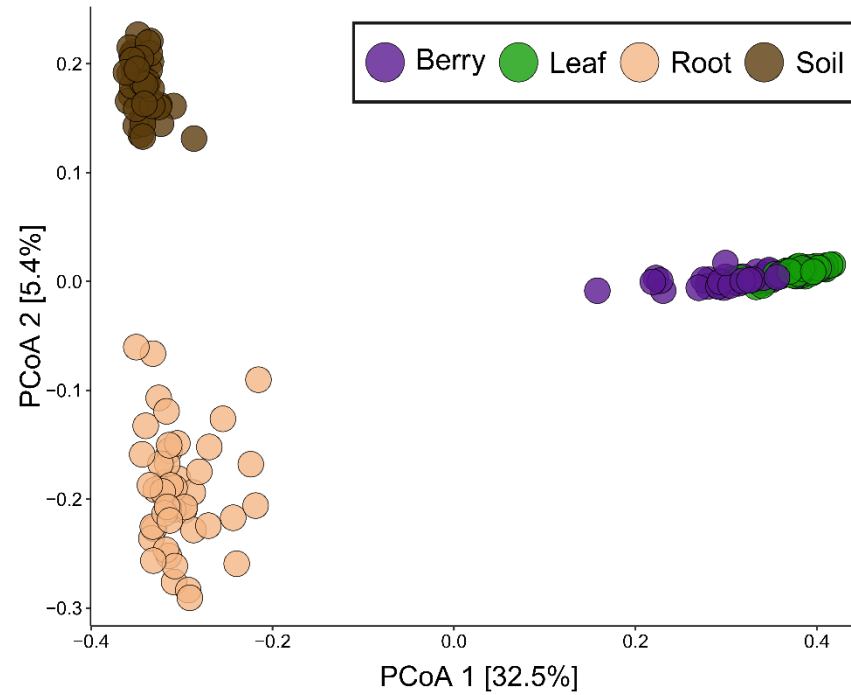


Grapevine compartments exhibit varying levels of diversity

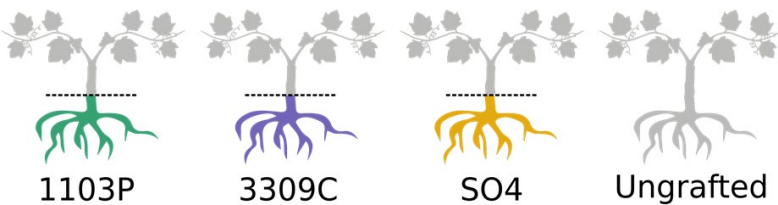
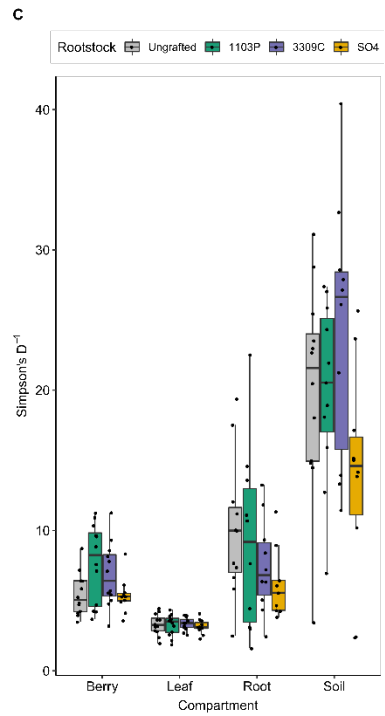
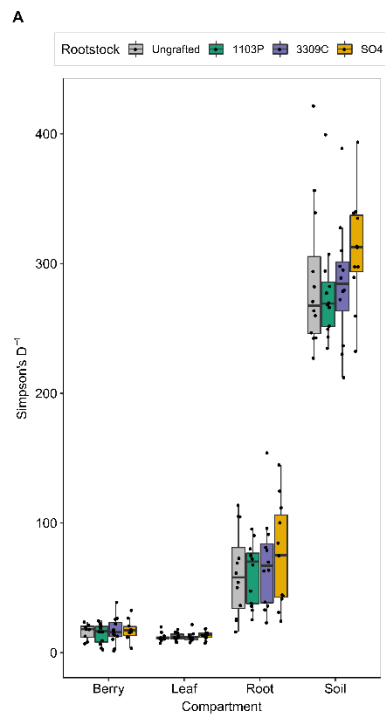


Grapevine compartments harbor distinct microbiota

Bacteria



Rootstock genotype has little effect on alpha and beta diversity metrics



Sour Rot

Phytopathology • 2018 • 108:1429-1442 • <https://doi.org/10.1094/PHYTO-03-18-0098-R>

Etiology

Grape Sour Rot: A Four-Way Interaction Involving the Host, Yeast, Acetic Acid Bacteria, and Insects

Megan E. Hall,[†] Gregory M. Loeb, Lance Cadle-Davidson, Katherine J. Evans, and Wayne F. Wilcox

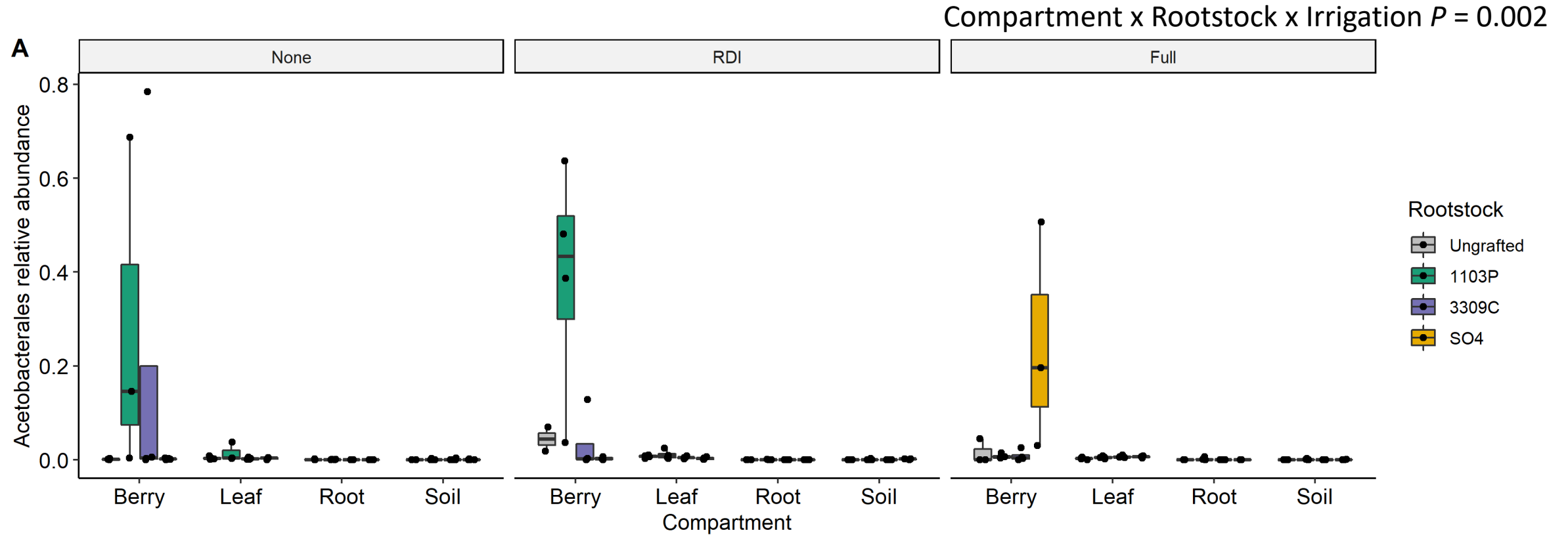
First and fifth authors: Section of Plant Pathology and Plant-Microbe Biology, School of Integrative Plant Science, and New York State Agricultural Experiment Station, Cornell University, Geneva 14456; second author: Department of Entomology, New York State Agricultural Experiment Station, Cornell University; third author: United States Department of Agriculture–Agricultural Research Service, Grape Genetics Research Unit, Geneva, NY 14456; and fourth author: Tasmanian Institute of Agriculture, University of Tasmania, Hobart, Tas. 7001, Australia.

Accepted for publication 28 June 2018.



Damaged host tissue + Yeast + Acetic acid bacteria + Drosophila = Sour Rot

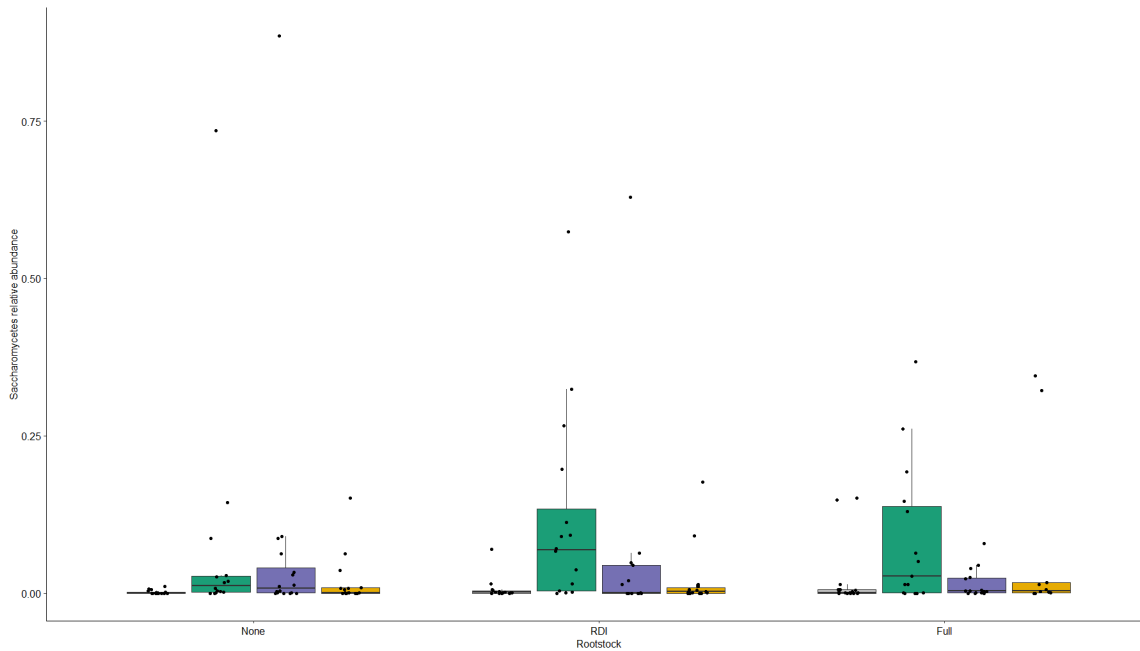
How do rootstocks influence the abundance of *Acetobacterales*?



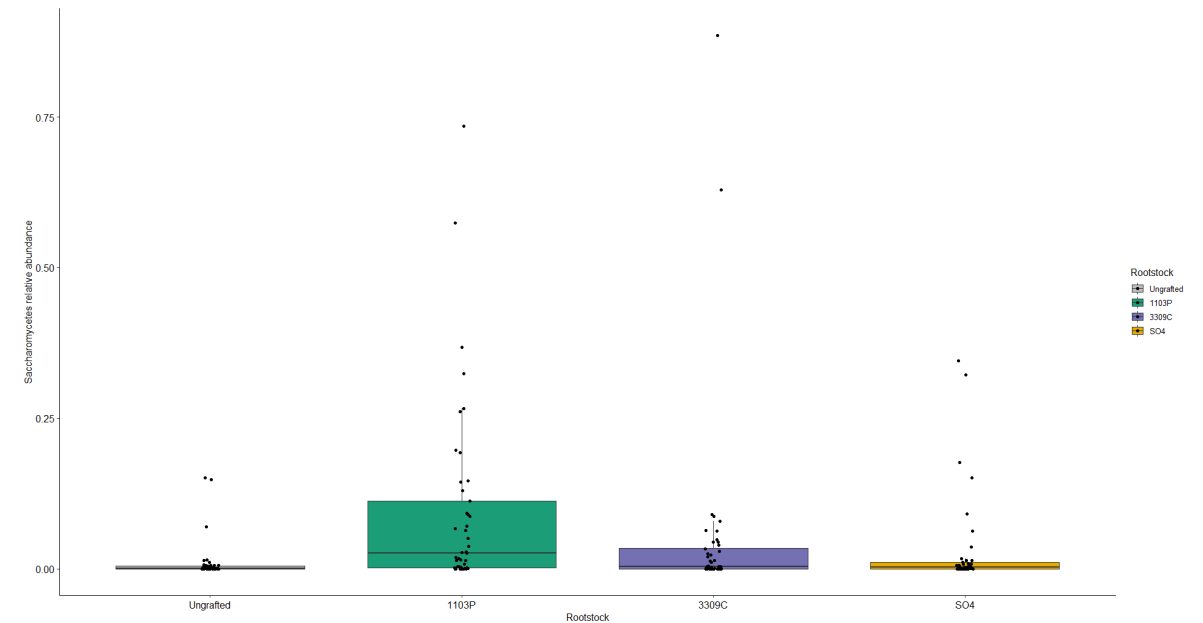
Damaged host tissue + Yeast + Acetic acid bacteria + Drosophila = Sour Rot

How do rootstocks influence the abundance of *Saccharomyces*?

Rootstock x Irrigation $P = 0.007$

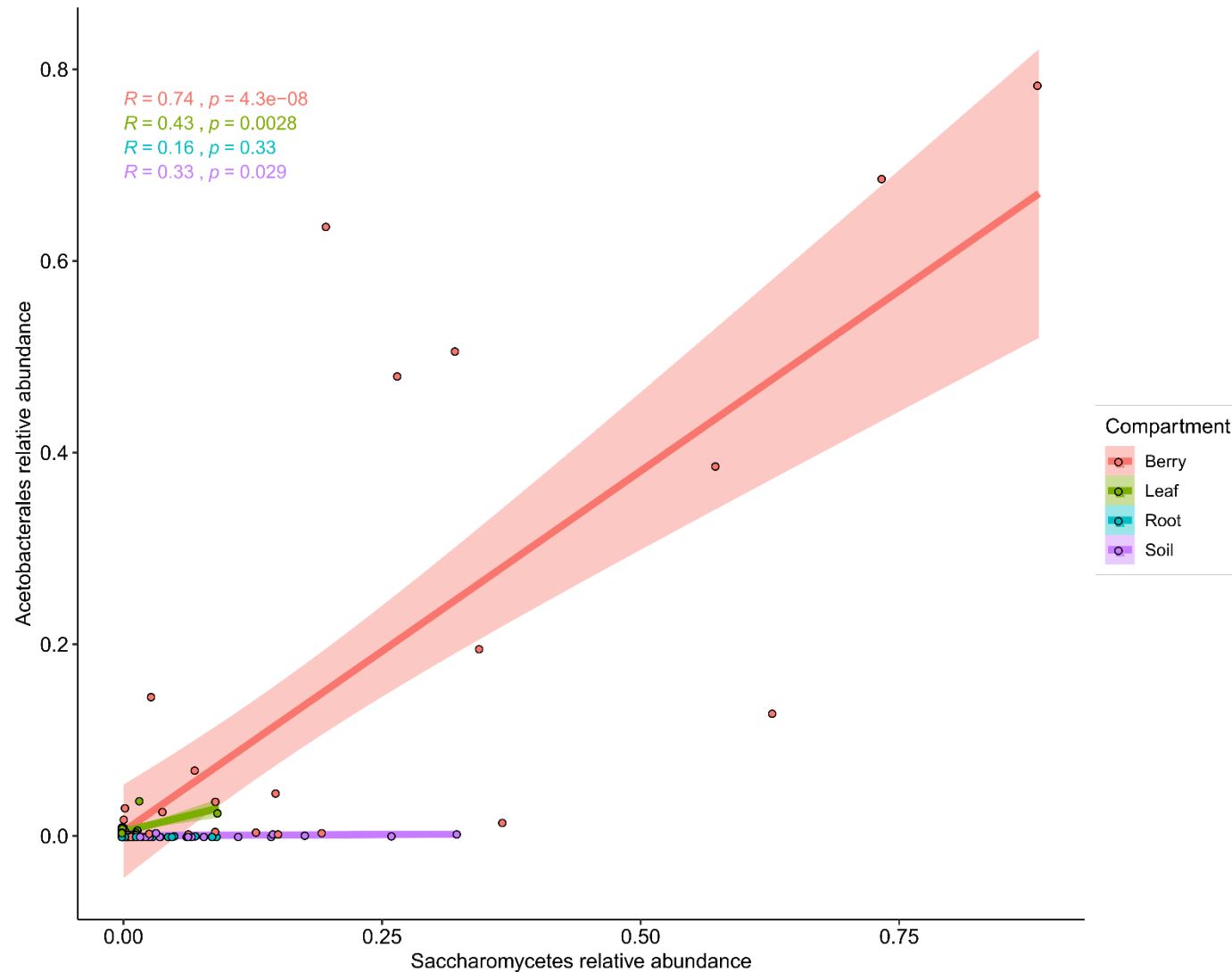


Rootstock $P = 0.006$



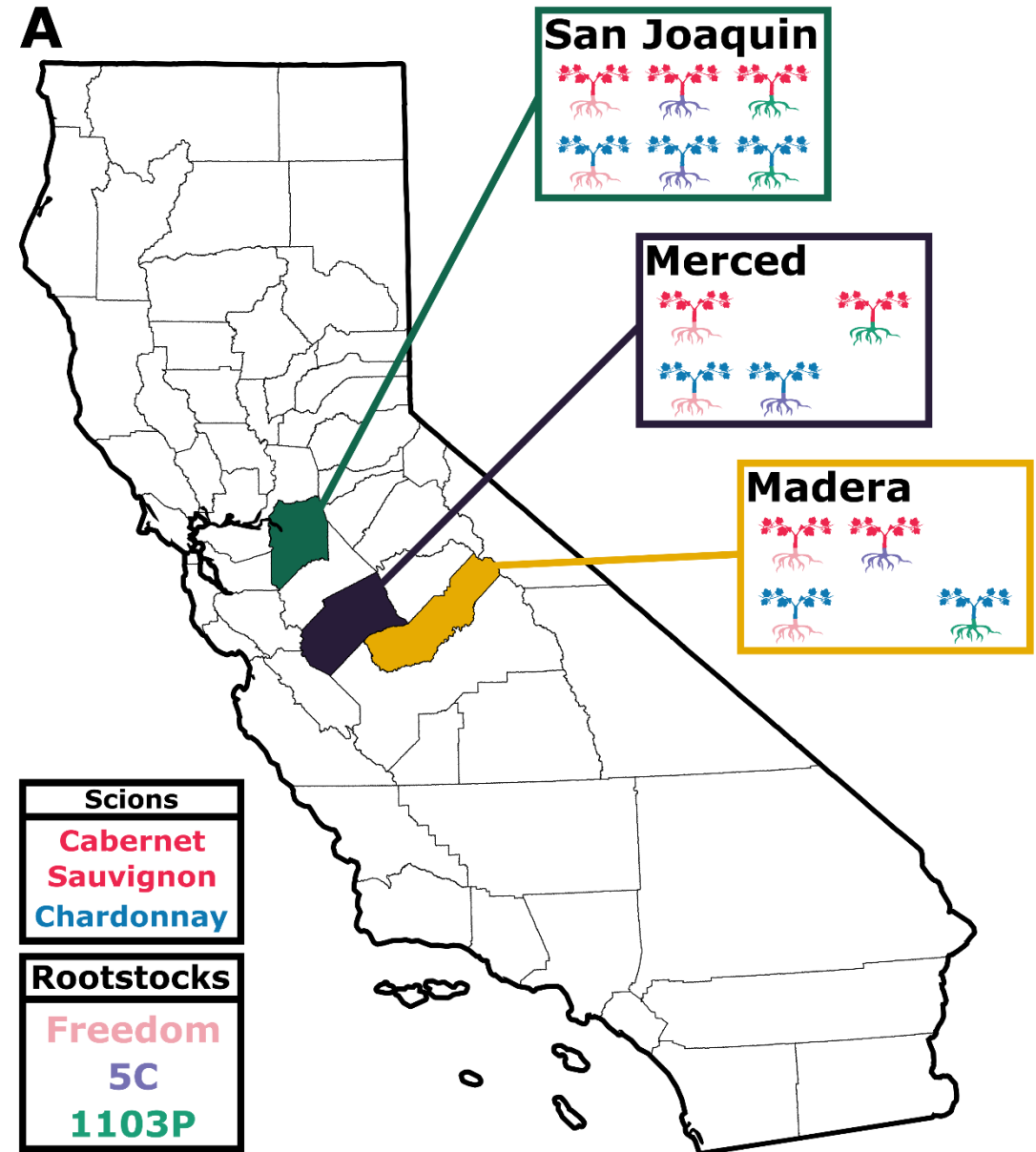
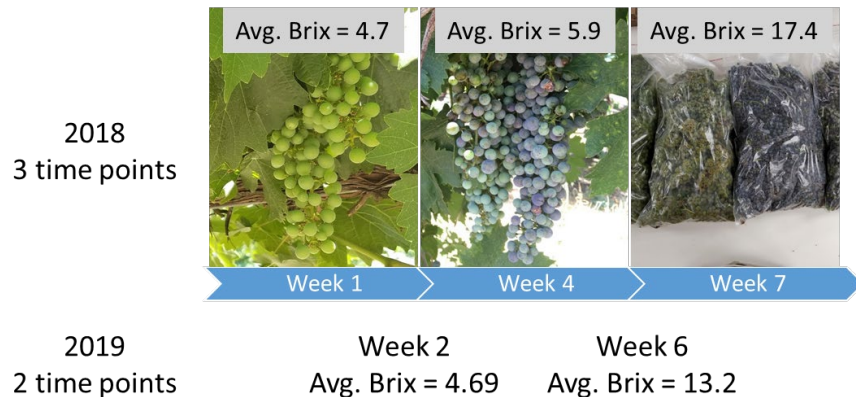
Damaged host tissue + Yeast + Acetic acid bacteria + Drosophila = Sour Rot

Strong correlation between the relative abundance of *Saccharomycetes* and *Acetobacterales*



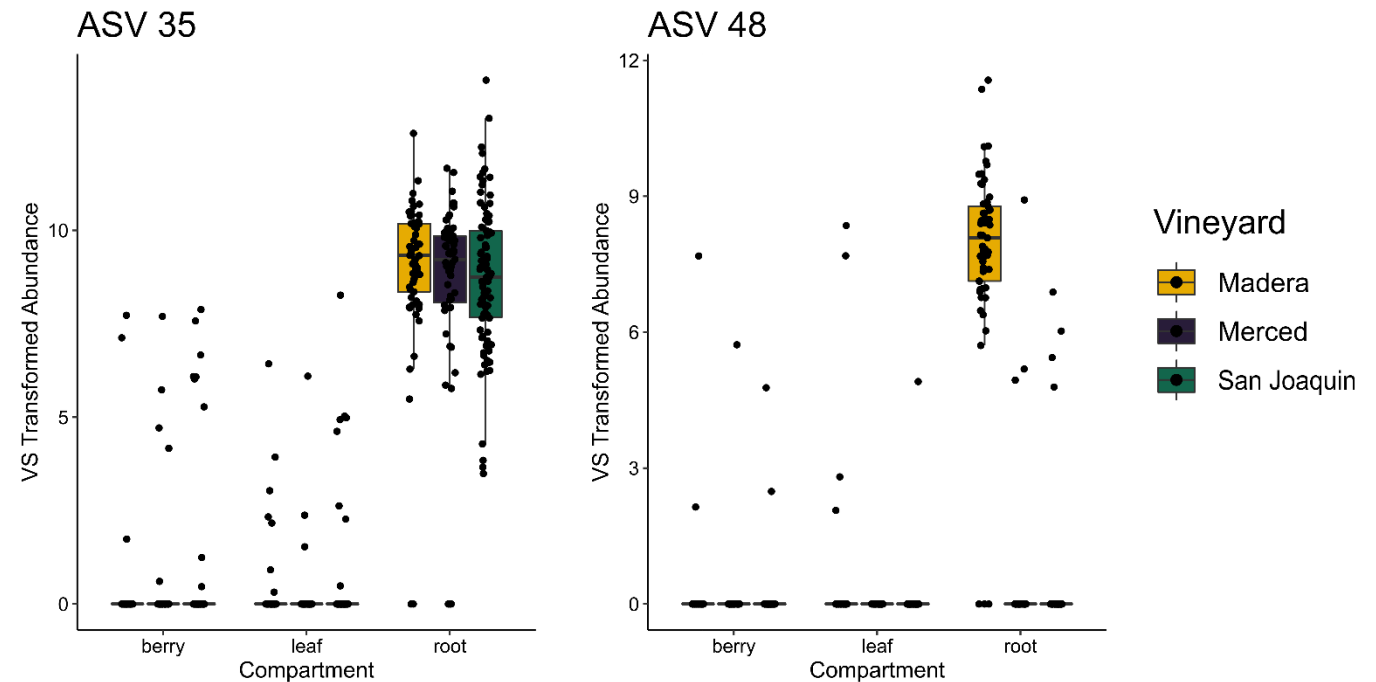
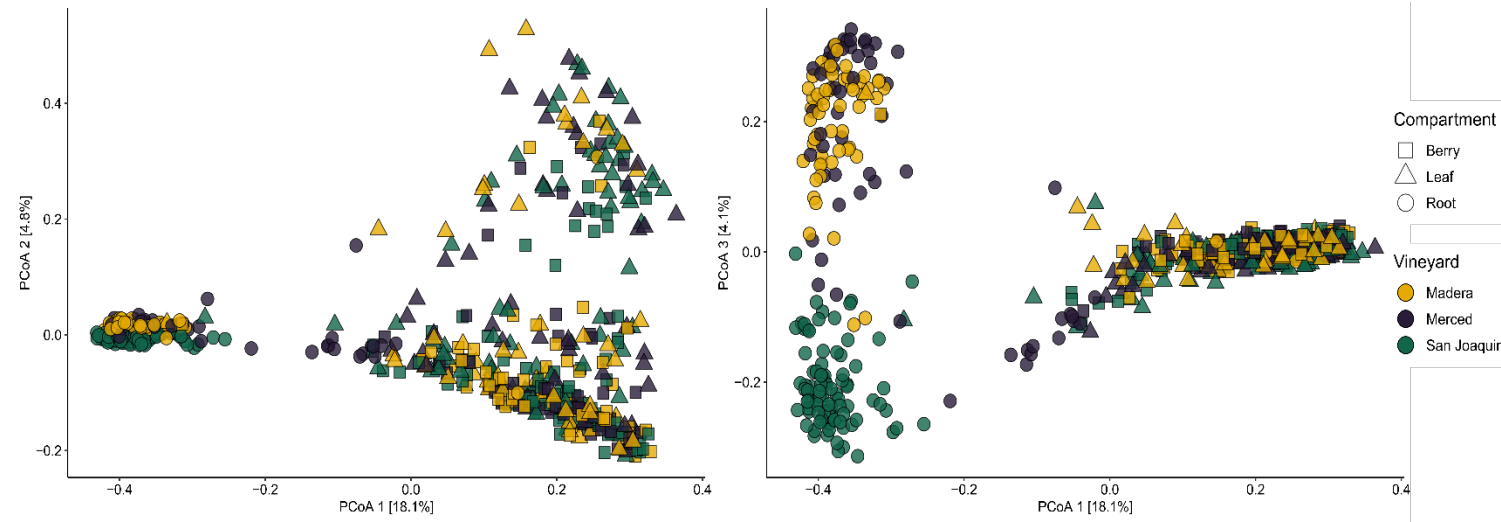
Central Valley California

- Three field sites (commercial vineyards) along a N/S transect (~110 miles).
- Collections made across the 2018 and 2019 summer growing season.



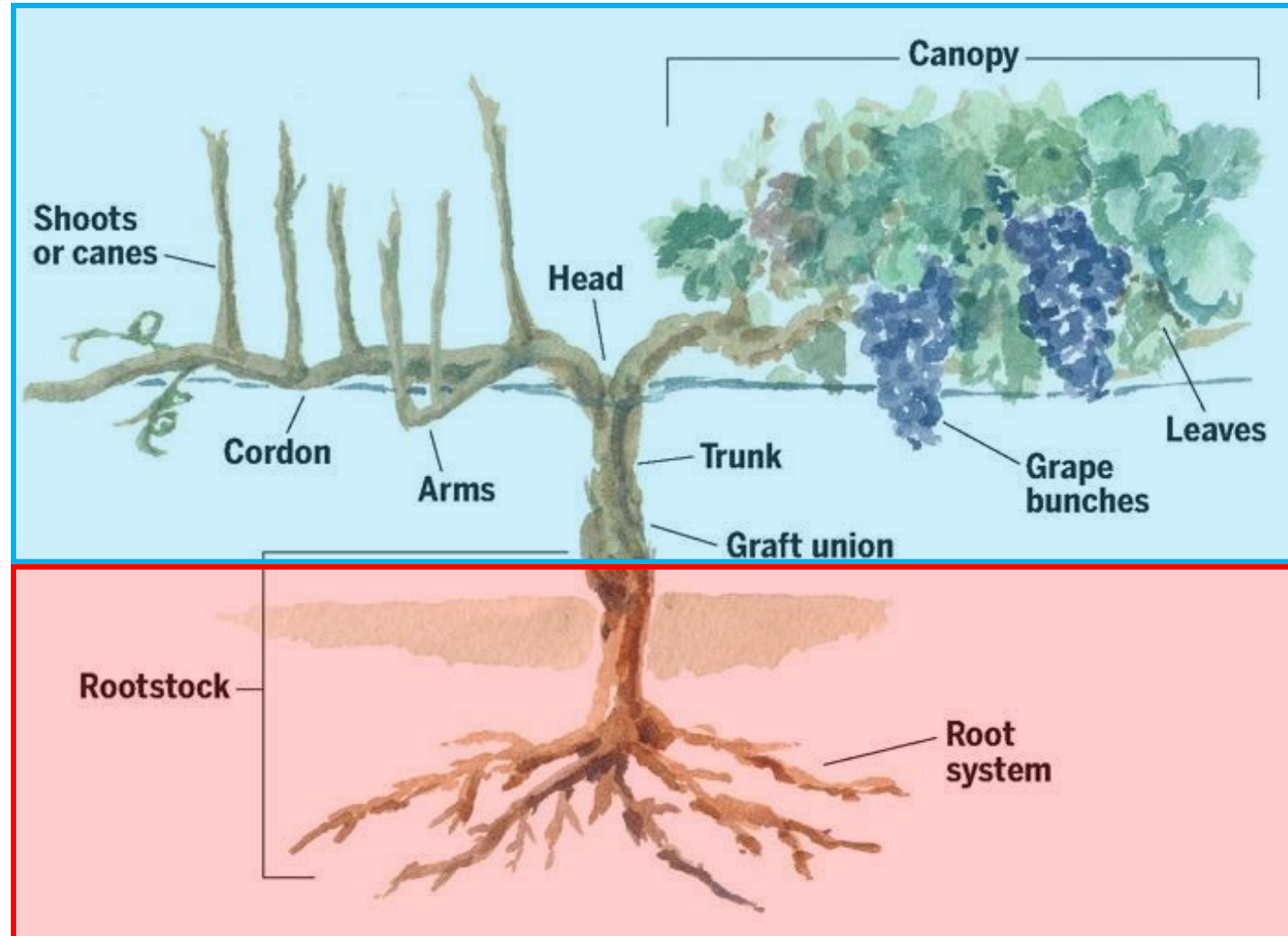
Preliminary results in California

- Vineyard and plant compartment are the largest drivers of bacterial composition.
- Root samples show clustering by vineyard (but not berries or leaves).
- Rootstock genotype had a small but measurable impact on bacterial composition ($R^2 = 0.04$).



Takeaways

- Compartments act as distinct habitats with particular suites of microorganisms.
- The influence of rootstock is small on global patterns but specific microorganisms show interesting associations.
- Across vineyards, soil and root microbiota display biogeographic patterning (terroir) while microbiota of the berries and leaves were conserved.



Acknowledgements



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