

Insights into the microbiome assembly during different growth stages and storage of strawberry plants



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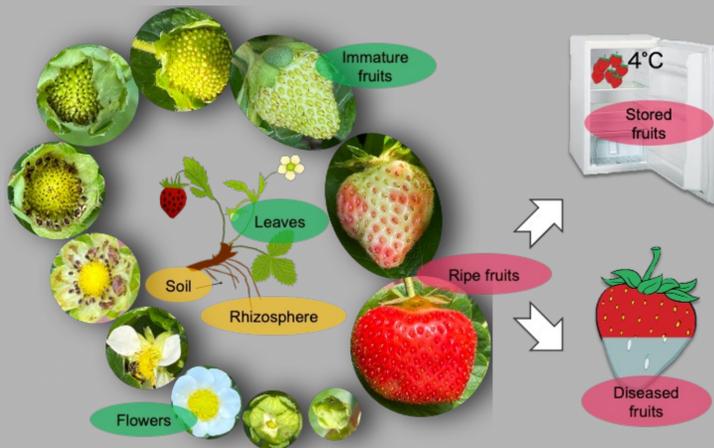
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INTRODUCTION

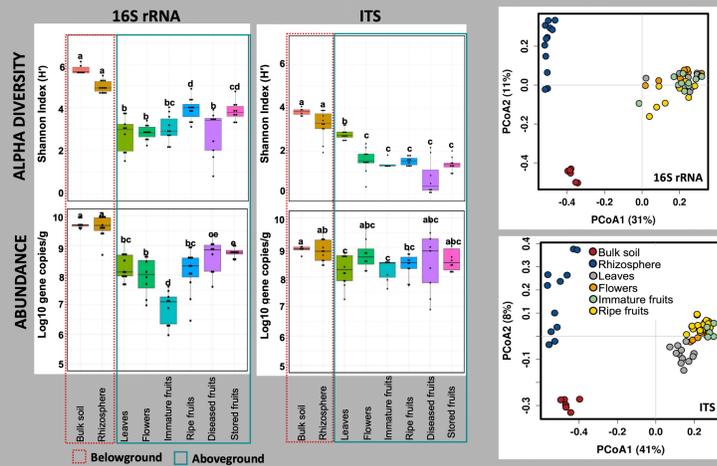
Plants are holobionts, and their microbiota play critical roles in growth, health, and abiotic stress resilience. Plant-specific microbiome assembly has previously been demonstrated for different plant species; however, how microbial communities are assembled along the fruit development and how this translates onto fruit quality and postharvest storage is less well known. We applied high-throughput sequencing of bacterial and fungal community, and real-time qPCR to investigate the fruit microbiome assembly in strawberry (*Fragaria x ananassa*) plants.

EXPERIMENTAL DESIGN

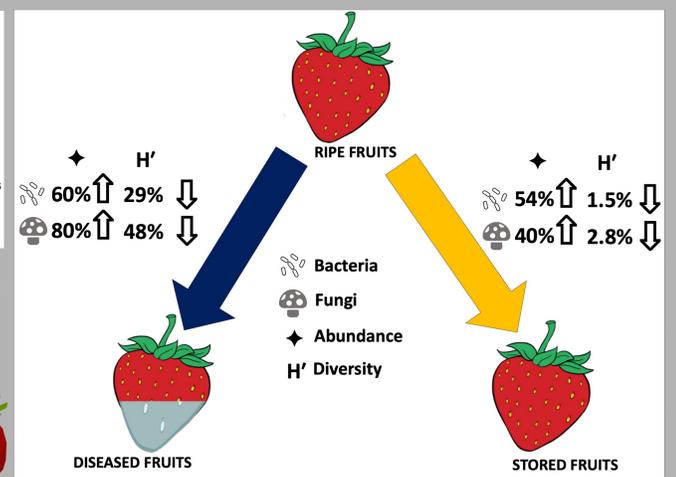
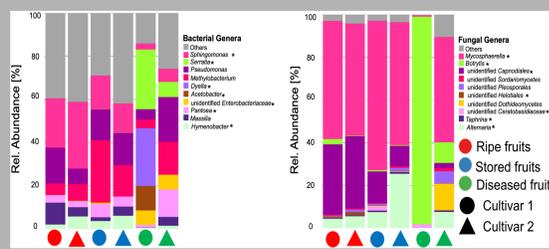


Belowground (soil & rhizosphere) and aboveground (leaves, flowers, immature fruits & ripe fruits) samples from two strawberry cultivars ('Mara des Bois' & 'White ananas') were analyzed. Additionally, diseased and stored fruits were considered.

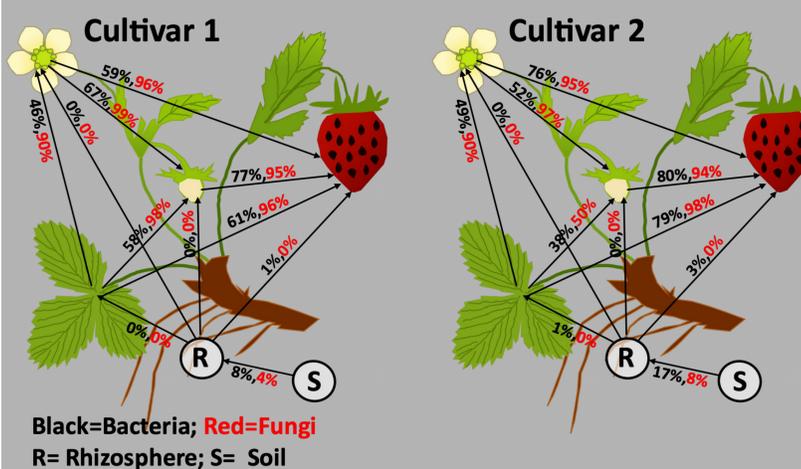
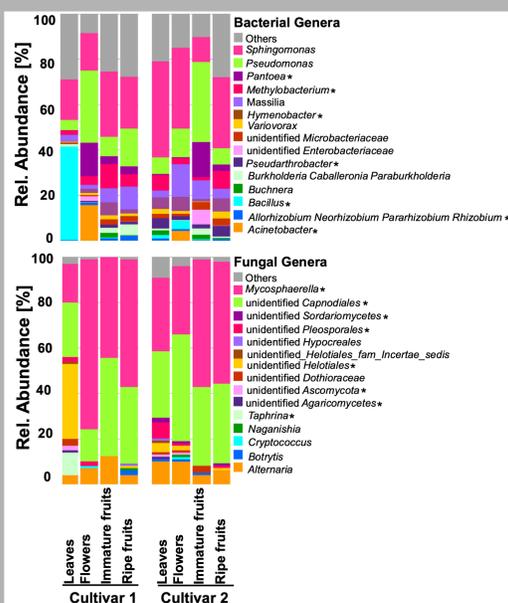
RESULTS



Microbial abundance and diversity were generally higher in belowground microhabitats. Moreover, the microbiome structure of belowground compartments was significantly different from that of aboveground. Interestingly, along fruit development bacterial abundances increased.



- Disease and fruit storage impacted the fruit microbial community.
- While bacterial diversity and abundance increased as the fruit matured, the diversity reduced due to disease and postharvest cold storage, but the total abundance significantly increased.
- Interestingly, a substantially high microbial abundance (~2 billion) was estimated to be contained in a fresh ripe strawberry fruit of average weight (16g).



Aboveground habitats shared a major part of their microbiome. Moreover, the fruit microbiome was especially assembled from the microbiota of leaves, flowers, and immature fruits. Moreover, *Sphingomonas*, *Pseudomonas* and *Mycosphaerella* dominated the aboveground microhabitats

CONCLUSIONS

- Strawberries carry a diverse and rich microbial load.
- The fruit microbiome is assembled along the fruit development (flower → Immature fruits → ripe fruits).
- Disease and postharvest storage induced microbiome shifts including increased *Enterobacteriaceae* and *Botrytis* abundances.
- Microbiome management and interventions during fruit development could result in more storable and healthier fruits.

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More from the EXCALIBUR project:



Kusstatscher, P., Cernava, T., Abdelfattah, A., Gokul, J., Korsten, L., & Berg, G. (2020). Microbiome approaches provide the key to biologically control postharvest pathogens and storability of fruits and vegetables. *FEMS Microbiology Ecology* 96 DOI: 10.1093/femsec/fiaa119



Berg, G., Kusstatscher, P., Abdelfattah, A., Cernava, T., & Smalla, K. (2021). Microbiome Modulation—Toward a Better Understanding of Plant Microbiome Response to Microbial Inoculants. *Frontiers in Microbiology*, 12, 803.



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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817946