

Role of the Phyllosphere microbiome in Sorghum Resilience

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Project Goals:

The research goal of this project is to determine the taxonomic, phylogenetic, and functional diversity of the microbiome of the sorghum aerial root mucilage and epicuticular wax, and how it changes under plant stress. Our overarching objective is to understand how sorghum interacts with the mucilage and wax microbiome and to determine plant-interactions that can be leveraged to support sorghum resilience and productivity.

Abstract:

During development, sorghum (*Sorghum bicolor*) produces several exudates on its external aerial surfaces (epiphytic phyllosphere). In particular, sorghum accumulates elevated levels of epicuticular wax on its stems and leaves to prevent water loss. Also, sorghum produces sugar-rich mucilage on its aerial roots to likely facilitate nutrient acquisition, including nitrogen fixation as has been reported in landrace maize. Here, we hypothesize that the epicuticular wax structure selectively filters for microbiome members that confer drought tolerance to the host and that the aerial root mucilage harbors a diazotrophic microbiota that supports nitrogen acquisition. Thus, we assessed the microbiome associated with the aerial root mucilage from N-fertilized and non-fertilized sorghum plants at two points in the growing season, and the epicuticular wax from plants under non-limiting and limiting water conditions.

Our initial results showed that Proteobacteria, Bacteroidetes, and Firmicutes are the dominant phyla in the aerial root mucilage compartment regardless of the fertilization treatment. The relative abundance of *Pantoea* was higher in the mucilage at an earlier stage of sorghum growth, whereas *Flavobacterium* and *Pseudomonas* were enriched in the mucilage later in the growing season. The dominant epicuticular wax microbial phyla were Proteobacteria and Firmicutes. We also identified *Sphingomonas* as a major taxon associated with the wax. To capture microbiome members hypothesized to be important for host resilience, we built a large bacterial collection by targeting a wide range of traits expected to be beneficial for the host plant during stress.

The outcome of this work will inform understanding of the interplay between the phyllosphere microbiome and plant exudates for sorghum resilience and productivity, and supports our long-term goal of translating our findings into sorghum cultivation for biofuel production and crop adaptation to stress.

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