

# Effects of *Epichloë* endophytes on the microbial communities and nutrient concentrations of *Achnatherum inebrians* roots

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This study investigated the impact of *Epichloë gansuensis*, a fungal endophyte that forms a long-term symbiosis with the grass *Achnatherum inebrians*, on fungal and bacterial communities, nutrient concentrations, and microorganismal-nutrient relationships associated with host roots. Both fungal and bacterial communities associated with the host root endosphere were characterized for plants infected with *E. gansuensis* (symbiotic) and for those that lacked a symbiosis with *E. gansuensis* (non-symbiotic) using high-throughput sequencing. Concentrations of multiple nutrients were measured in the plant roots, i.e., total carbon, total nitrogen, total phosphorus, total potassium, and organic carbon. In the roots of symbiotic and non-symbiotic plants, fungal communities were dominated by members within Ascomycota, Basidiomycota, and Mortierellomycota, while bacterial communities were predominantly composed by members within Pseudomonadota, Acidobacteriota, and Actinomycetota. The presence of *E. gansuensis* in plants increased the root concentrations of total carbon, total nitrogen, and organic carbon, but decreased the concentration of total potassium. There were 11 positive (3 fungi and 3 bacteria) and 2 negative

(0 fungi and 2 bacteria) significant correlations between microorganismal taxa abundance and nutrient concentrations. The abundance of the fungal phyla Aphelidiomycota, Glomeromycota, and Olpidiomycota were positively correlated with the concentrations of total carbon and organic carbon. The abundance of the bacterial phylum Methylophilum was positively correlated with the concentrations of total carbon, total nitrogen, and organic carbon, while negatively correlated with total potassium concentration. Furthermore, the abundance of bacterial phyla Actinomycetota and Nitrospirota were positively correlated with the concentrations of total potassium and organic carbon, respectively, while Pseudomonadota abundance was negatively correlated with the concentration of total potassium. Our findings emphasize the effect of a fungal endophyte, *E. gansuensis*, that is exclusively found in the aboveground organs of its host plants and absent from belowground plant organs on the concentrations of nutrients within plant roots and the existence of putative functional relationships between root-associated fungal/bacterial communities and root nutrients.