C E R T I F I C A T E

We hereby certify that **Lucas William Mendes** participated in the **4th Latin American Congress on Microbial Ecology, ISME Lat 2025**, with the Oral presentation:

Rhizosphere Microbiome Functional Shifts Drive Drought Tolerance in Common Bean Genotypes

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Dr. Luisa I Falcón
President Organizing Committee
Ambassador ISME México
ISME Lat 2025

Dr. Luis E. Servín
Vicepresident Organizing Committee
Ambassador ISME México
ISME Lat 2025

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Rhizosphere microbiome functional shifts drive drought tolerance in common bean genotypes

Lucas William Mendes, Thierry Alexandre Pellegrinetti, Ana Vitória Reina da Silva, Izadora de Cássia Mesquita da Cunha, Caroline Sayuri Nishisaka, Eduardo Henrique Marcandalli Boleta, Lara de Almeida Losovoi, Maycon Cristiano Barbosa, Rodrigo Mendes, Siu Mui Tsai

Climate change-driven increases in temperature and reductions in water availability present critical threats to global food security. Harnessing the potential of the rhizosphere microbiome represents a promising strategy to enhance crop resilience under drought stress. In this study, we investigated the responses of four common bean (*Phaseolus vulgaris* L.) cultivars—two drought-tolerant (BAT477, SEA5) and two drought-susceptible (IAC Milênio, IAC-Carioca 80SH)—to 96 hours of drought stress in mesocosm experiments. We assessed plant physiological responses, nutrient dynamics, and the taxonomic and functional profiles of the rhizosphere microbiome using metagenomic approaches. Drought-tolerant cultivars maintained higher photosynthetic rates, stomatal conductance, and water use efficiency compared to susceptible ones. These physiological advantages were accompanied by selective recruitment of beneficial microbial taxa, particularly Actinomycetia, enriched in genes linked to osmoprotection (e.g., trehalose, glycine betaine, proline), oxidative stress mitigation, nutrient cycling, and biofilm formation. In contrast, susceptible cultivars displayed a reactive microbial response dominated by DNA repair and antioxidant defense genes. Overall, drought triggered a differential abundance of 1,864 microbial genes, revealing significant functional shifts in the rhizosphere. Upon rehydration, drought-tolerant cultivars exhibited partial recovery of photosynthesis (48–57%), suggesting microbiome-conferred resilience. These findings highlight the genotype-specific modulation of rhizosphere microbiota and underscore the role of microbial functions in supporting plant performance under stress. This study provides mechanistic insights into microbiome-driven drought tolerance and supports the development of microbiome-based strategies for sustainable agriculture in increasingly arid environments.