

***Streptomyces* territorial expansion in eco-holobiont and a novel strategy for plant microbial engineering**

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Plant-associated microbes colonize diverse niches where they form structured communities, forming what is known as the plant holobiont. However, the mechanisms by which belowground microbiota colonize and establish in aboveground plant tissues remain poorly understood. In this study, we tracked its movement within the plant and identified patterns of ecological expansion. *Streptomyces*, a filamentous Actinobacterium known for antibiotic and antifungal compound production, was observed to migrate systemically through the plant vascular system. This upward translocation enabled colonization of aerial tissues, where the bacterium where it contributed to plant defense, presumably through antimicrobial activity. against airborne pathogens. Conversely, the bacterium also exhibited downward movement toward the rhizosphere, indicating movement in both upward and downward directions within the host plant. Notably, *Streptomyces* was further dispersed via floral organs and pollinator interactions, showing that dispersal occurs not only within the plant but also via insect interactions. This highlights a revealing an ecological role that has not been clearly demonstrated before of *Streptomyces* as a mobile and adaptive symbiont capable of exploiting both plant vascular networks and insect vectors. In addition to its dispersal capacity, the population dynamics of *Streptomyces* were shown to be responsive to chemical cues. External application of glutamic acid significantly enriched *Streptomyces* populations in both the strawberry anthosphere and tomato rhizosphere. This suggests that specific metabolites may function as selective drivers of beneficial microbial recruitment, potentially through metabolic preference or chemotactic responses. Together, these results show that *Streptomyces* functions as a mobile and adaptive endophyte, and highlight the potential of metabolite-driven microbiome engineering for sustainable agriculture. This work provides a foundation for microbiome engineering approaches that leverage targeted metabolites to selectively enhance beneficial bacterial populations for sustainable crop production.

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