Strong host and environment modulation of rhizosphere-to-endosphere colonisation in the pan-palaeotropical keystone grass species, Themeda triandra

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Abstract

Soil microbiota can colonise plant roots via a two-step selection process, which involves the recruitment of microbiota first from bulk soil into plant rhizospheres, then into root endospheres. This process is poorly understood in all but a few model species, which is surprising given its fundamental role in plant and soil ecology. Here we examined the microbial assembly processes across the rhizospheres and root endospheres in eight natural populations of the pan-palaeotropical C4 grass, Themeda triandra, in southern Australia. We assessed whether root endosphere colonisation patterns aligned with the two step-selection process. We also assessed the degree to which the assembly patterns of these rhizospheres and endospheres were influenced by deterministic processes. We show that two-step selection was the dominant recruitment dynamic across these natural T. triandra populations, and present clear evidence that host plants influenced microbial assembly via deterministic pressures that produced strong convergence of endospheres. Both endospheres and rhizospheres were influenced by local environmental filtering, including aridity. Our study improves our understanding of assembly processes of root endospheres, which is central to plant-soil interactions yet poorly understood in non-model species. We show that endospheres of native populations of a widely distributed, keystone grass (T. triandra) were strongly shaped by the host plant and displayed patterns consistent with the two-step selection process. These findings raise intriguing questions about the functions of this 'core' microbial endosphere, but our limited understanding of their ecology hinders our ability to harness these important relationships to, for example, improve plant propagation and revegetation practices.

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