Helper bacteria halt and disarm mushroom pathogens by linearizing structurally diverse cyclolipopeptides.

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Abstract

The bacterial pathogen Pseudomonas tolaasii severely damages white button mushrooms by secretion of the pore-forming toxin tolaasin, the main virulence factor of brown blotch disease. Yet, fungus-associated helper bacteria of the genus Mycetocola (Mycetocola tolaasinivorans and Mycetocola lacteus) may protect their host by an unknown detoxification mechanism. By a combination of metabolic profiling, imaging mass spectrometry, structure elucidation, and bioassays, we found that the helper bacteria inactivate tolaasin by linearizing the lipocyclopeptide. Furthermore, we found that Mycetocola spp. impair the dissemination of the pathogen by cleavage of the lactone ring of pseudodesmin. The role of pseudodesmin as a major swarming factor was corroborated by identification and inactivation of the corresponding biosynthetic gene cluster. Activity-guided fractionation of the Mycetocola proteome, matrix-assisted laser desorption/ionization (MALDI) analyses, and heterologous enzyme production identified the lactonase responsible for toxin cleavage. We revealed an antivirulence strategy in the context of a tripartite interaction that has high ecological and agricultural relevance.

Involved Units and Groups

Biomolecular Chemistry

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