New antifungal compound from ant farms

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Attine ants are farmers, and they grow fungus as food. Pseudonocardia and Streptomyces bacteria are their farmhands, producing metabolites that protect the crop from pathogens. Surprisingly, these metabolites lack common structural features across bacteria from different geographic locations, even though the ants share a common ancestor.

Now, researchers report in *ACS Central Science* they have identified the first shared antifungal compound among many of these bacteria across Brazil. The compound could someday have medical applications.

Attine ants originated as one species at a single location in the Amazon 50 million years ago. They have evolved to 200 species that have spread their farming practices throughout South and Central America. In exchange for food, bacteria at these farms produce small molecules that hold pathogenic fungi such as Escovopsis in check. However, these molecules differ from region to region, suggesting a highly fragmented and geographically limited evolutionary history for the bacteria. Monica T. Pupo, Jon Clardy and colleagues wanted to find out if any antifungal bacterial metabolites with broader distribution had been overlooked in prior investigations.

In a study of bacteria from ant nests at multiple sites in Brazil, the team discovered that nearly two thirds of Pseudonocardia strains produced a potent antifungal agent, which they called attinimicin. This discovery marked the first report of a specialized metabolite with broad geographic distribution produced by ant-associated bacteria. While this metabolite was safe for the fungal crop, it inhibited growth of fungal parasites, though—unlike many antibiotics—only in the absence of iron. It was also effective in fighting a Candida albicans infection in mice, comparable to azole-containing antifungal treatments that are used clinically, making it a potential drug candidate. The researchers ascertained attinimicin's structure and studied its evolutionary relationship to two similar bacterial peptides produced by Streptomyces—oxachelin A and cahuitamycin A.

The results suggest the associated genes in the two types of bacteria came from a common ancestor.

More information: Taise T. H. Fukuda et al. Specialized Metabolites

Reveal Evolutionary History and Geographic Dispersion of a Multilateral Symbiosis. *ACS Central Science*. January 20, 2021. DOI: 10.1021/acscentsci.0c00978

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