

47th World Congress on Microbiology

September 10-11, 2018 | London, UK

Structure and co-occurrence patterns in microbial communities under acute environmental stress reveal ecological factors fostering resilience

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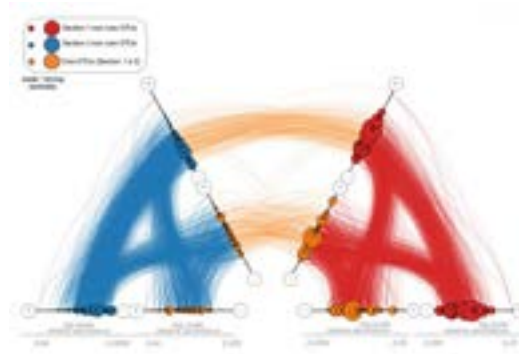
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Statement of the Problem: Understanding the factors that modulate bacterial community assembly in natural soils is a longstanding challenge in microbial community ecology. In this work, we tried to identify some of these factors by comparing two microbial co-occurrence networks representing bacterial soil communities from two different sections of a pH, temperature and humidity gradient occurring along a western slope of the Andes in the Atacama Desert.

Methodology & Theoretical Orientation: A topological graph alignment of co-occurrence networks was used to determine the impact of a shift in environmental variables on OTUs taxonomic composition and their relationships.

Findings: We observed that a fraction of association patterns identified in the co-occurrence networks are persistent despite large environmental variation. This apparent resilience seems to be due to: (1) a proportion of OTUs that persist across the gradient and maintain similar association patterns within the community and (2) bacterial community ecological rearrangements, where an important fraction of the OTUs come to fill the ecological roles of other OTUs in the other network. Actually, potential functional features suggest a fundamental role of persistent OTUs along the soil gradient involving nitrogen fixation.

Conclusion & Significance: Our results allow identifying factors that induce changes in microbial assemblage configuration altering specific bacterial soil functions and interactions within the microbial communities in natural environments.



Recent Publications

1. Diaz F P, Frugone M, Gutierrez R A and Latorre C (2016) Nitrogen cycling in an extreme hyperarid environment inferred from delta(15)N analyses of plants, soils and herbivore diet. *Scientific Reports* 6:22226.
2. Faust K and Raes J (2016) CoNet app: inference of biological association networks using Cytoscape. *F1000Research* 5:1519.

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3. Baldassano S N and Bassett D S (2016) Topological distortion and eorganized modular structure of gut microbial co-occurrence networks in inflammatory bowel disease. *Scientific Reports* 6:26087.
4. Louca S, Parfrey L W and Doebeli M (2016) Decoupling function and taxonomy in the global ocean microbiome. *Science* 353:1272–1277.
5. Lauber C L, Hamady M, Knight R and Fierer N (2009) Pyrosequencing-based assessment of soil pH as a predictor of soil bacterial community structure at the continental scale. *Applied and Environmental Microbiology* 75:5111–5120.

Biography

Dinka Mandakovic has her expertise in soil microbial communities' analyses and isolation of microorganisms associated to extreme environments. She has been working in studying microbial bacteria from the Atacama Desert since 2013, complementing the list of microbial taxa diversity from this extreme environment and assessing pipelines to isolate selective bacteria that could represent useful elements for biotechnological approaches. Recently, she has focused her research in the study of bacteria and fungi with potential attributes as plant growth promoting microorganisms, useful for crop cultivation under agricultural adverse conditions like drought.

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