SIG1-4

Fungal-bacterial interactions in an oxygen minimum zone and a deep-sea hydrothermal system of Mexico

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Purpose: Oxygen minimum zones and hydrothermal systems are deep-sea unique and extreme ecosystems where temperature, pressure, and nutrients play a key role modeling microbial communities. In these extreme environments microbial ecological interactions are fundamental for life, though these remain poorly studied. Therefore, in order to elucidate some of the microbial interactions, we evaluated long-term interactions among bacteria and fungi by using a set of growth indexes.

Methods: We isolated and identified fungi and bacteria from sediments collected in an oxygen minimum zone, infiltrations and hydrothermal vents in the Pescadero Basin (Gulf of California) at Western Mexico. Cross-kingdom interaction bioassays were implemented and documented with a select group of organisms for up to six months.

Results: Competition and cooperation patterns were detected, with competition and antagonism as the prevailing interactions. This was expected considering ecological theories such as the Hutchinson niche and the Red Queen. Microbial morphological changes and interaction types may be related to fluctuations in resource availability. Remarkably, the establishment of peculiar cross-kingdom interactions was detected. These interactions were characterized by morphological modifications, where fungi and bacteria merged growing in close proximity, forming digitiform projections.

Conclusion: The tested microorganisms dominantly established antagonic cross-kingdom interactions. Morphological modifications in some key interactions may represent a prokaryotic adaptive trait to colonize challenging environments. This study sheds light into the network of interactions co-ocurring into deep-sea unique ecosystems.