OPINION

Microbiome structure in coral colonies and sedimentation gradients

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ABSTRACT

Reef-building Corals interact intricately with a variety of microorganisms, including bacteria and symbiotic algae from the Symbiodiniaceae family. The context of the environment has varied degrees of influence on these coral-associated communities. By changing the amount of light available to symbiotic algae, inducing the coral's stress response, or acting as a reservoir for both harmful and necessary bacterial and algal symbionts, sedimentation can shape a coral's microbial community. We used 16S rDNA and ITS-2 amplicon sequencing to characterise the bacterial and algal communities linked to the massive scleractinian coral Porites lobata across pairs of sites along a naturally occurring sedimentation gradient in Fouha Bay, southern Guam, in order to investigate the impact of sedimentation on a coral's microbiome.

By taking samples from the perimeter and core of colonies as well as the neighbouring sediment, we also examine the impact of proximity to sediment on the coral colony scale. The Cladocopium C15 algal symbiont colonies of P. lobata frequently housed various genotypes within a single colony and were connected with a variety of genotypes. However, there was no evidence of structure among the various Cladocopium genotypes based on colony position or location along the sedimentation gradient. Although the diversity of bacterial communities varied across the sedimentation gradient, some uncommon taxa were more numerous at some sites than others. In coral colonies, Planococcaceae is more prevalent both at the colony's periphery and in its heart, which is closer to the river mouth. Near the river mouth, Peredibacter likewise exhibits significant abundance, but only in the silt and the colony's periphery. We discover that sediment, as opposed to a coral's location along the sedimentation gradient, has a greater impact on structuring bacterial populations at the colony scale. In comparison to the core communities, the edges are more similar to the sediment in appearance and are also richer in similar pathways, such as those engaged in nitrogen fixation. Additionally, we discover that Endozoicomonas predominates in centre samples as opposed to edge samples, confirming a role for this taxon in restricting bacterial diversity and organising bacterial communities in coral colonies. Together, these findings demonstrate the varied effects that sedimentation can have on distinct coral colony microhabitat sections.

Key Words: *Cladocopium; Sedimentation; Genotypes; Homogenise; Endozoicomonas; Microhabitat*

INTRODUCTION

Reef-building Corals have intricate connections with a variety of microorganisms, including a group of bacteria and symbiotic algae from the Symbiodiniaceae family. These connections can be made horizontally (acquisition from the local environment) or vertically (transfer from mother colonies through egg provisioning). Different tactics for adapting to changing environmental conditions can result from these transmission techniques. For instance, some horizontal transmitters switch out their main symbiont from an algal symbiont for one that is more stress-tolerant. In most cases, the coral host returns to its original symbiont species when the stressful event is over. In contrast, vertical transmitters can only modify the community's composition by altering the relative abundances of their algae symbionts.

Although the coral microbiome's bacterial component receives less attention than its algal counterpart, research into bacterial transmission has recently gained pace as a result of the realisation of the significance of these partners. Numerous advantages that bacteria can offer to coral include antibacterial substances to guard against diseases, ultraviolet light-absorbing pigments to lessen the effects of high light levels, and provisioning of crucial nutrients. Numerous coral species have shown evidence of vertical transfer of bacteria, most likely through the mucus layer that covers egg-sperm bundles. Additionally, bacteria can spread horizontally to the coral from a number of sources, including sediment and the water column, as well as less common but more interesting sources like fireworms and echinoderms.

Although it is believed that the water column is the primary source of bacteria for corals in their early life stages, sediment-dwelling bacterial communities are among the most taxonomically diverse in coral reef habitats. Additionally, bacterial taxa in the coral mucus layer exhibit

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higher similarity to sediment than to the surrounding seawater. Understanding bacterial establishment in corals is difficult due to the abundance of bacterial sources that may interact with different stages of coral life, and the precise function of reef sediment in these connections is still completely unknown.

The physiology of the coral host is directly impacted by high sediment load situations, such as reefs near river mouths, which alter the microbial population. Sedimentation may lead to the poor health of coral. The community structure of coral species changes significantly around river mouths.

Silt can have a direct negative effect on the coral host by removing sperm from the seawater surface during reproductive events and forcing the coral to expend energy shedding sediment in order to avoid being buried. As silt and clay particles block sunlight, suspended sediments can decrease the amount of light available, which in turn reduces photosynthesis in symbiotic corals. The availability of organic material and nutrients on reefs is increased by sedimentation, which also supports low oxygen settings. These environmental effects can change abiotic circumstances, some of which favour the development of dangerous bacteria, which in turn alter the coral microbiome. As is likely the case in the majority of cases of stony coral tissue loss disease, sediment can also transfer dangerous bacteria straight to the coral host.