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Culture- and PCR-based surveys of lichen-associated bacteria

Common knowledge dictates that a lichen is formed solely by a fungus in symbiosis with an alga and/or cyanobacterium. However, many lichens are able to grow on extremely nutrient-poor substrates, raising the question of how they are able to maintain themselves without a substantial source of nitrogen and other crucial micronutrients. Though non-photosynthetic bacteria have never been accepted as an essential part of the lichen symbiosis, the metabolic processes that they perform may play a vital role in providing the fungi and algae with necessary nutrients and facilitating interactions between them.

As part of this study, both culture- and PCR-based surveys were conducted on lichens. Culture-based studies were conducted in the absence of molecular nitrogen, in order to isolate nitrogen-fixing bacteria for identification and characterization. PCR-based studies were conducted in a manner that more accurately shows the microbial diversity associated with each lichen, using a fast method known as RHAPSA-D (Ribosomal Heterogeneous Amplicon Pool Sequence Analysis using DOP-PCR bias). These analyses have revealed a number of interesting and potentially important bacterial lineages associated with lichens. These include a number of bacteria that are closely related to documented bacterial symbionts. Several hypotheses concerning the role of certain non-photosynthetic bacteria in the development, maintenance, and evolution of lichens are discussed.