

Diversity of Symbiotic Microalgae in Lichens

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Lichens are symbiotic organisms that are mainly composed of lichenized fungi (mycobiont) and photosynthetic microalgae and/or cyanobacteria (photobiont). It has long been regarded that one fungal species make symbiotic relationship with one microalgal species in a thallus. However, the specific relationship between the mycobiont and the photobiont has been challenged by recent studies. One species of mycobiont can make symbiotic partnerships with various photobiont species when they grow at geographically distant locations. Several different algal genotypes can be present in a single lichen thallus. In addition, the results of the algal community composition in lichens from King George Island, Antarctica indicated that each lichen thallus contained diverse algal species and the composition of algal community was mostly related to the mycobiont species.

In this study, the genetic diversity and composition of symbiotic microalgae populations in the widespread geographical distribution of the seven lichen genera, *Cetraria*, *Cladonia*, *Ocheloechia*, *Psoroma*, *Stereocaulon*, *Usnea*, and *Umbilicaria*, were investigated based on eukaryotic LSU rRNA gene. To understand the effect of geography and climate on microalgal diversity, samples were collected from bi-polar and sub-polar regions. The results revealed that each lichen thallus contained diverse microalgal OTUs as the previous studies. However, each mycobiont genus showed preference on specific lineage of microalgal species as a major photobiont partner, which is composed of phylogenetically related OTUs. Although some microalgal OTUs were detected from several regions including Southern and Northern hemisphere regardless of climate, most microalgal OTUs were recovered only from specific geographical region and climatic zone. Considering these results, we conclude that the composition of microalgal community in lichens are affected by mycobiont speceis, geography, and climate.