地衣の共生藻の光阻害防御機構である乾燥誘導性 NPQ は、地衣菌の生産するアラビトールによって促進される

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Lichen assist the drought-induced NPQ of their photobiont by arabitol

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Lichens have remarkable drought tolerance, and such ability enables them to survive in extreme environments that frequently fall in desication. We have investigated their highly effective thermal dissipation mechanism of excess light energy in photosystem II under drought conditions that is detected as non-photochemical quenching (NPQ). Drought-induced non-photochemical quenching (d-NPQ) plays a very important role in photosynthetic organisms inhabiting in extreme drought sites, because excess light under drought condition induces accumulation of ^{3}chl* and the resulting ^{3}chl* generates relative oxygen species (ROS). ROS causes photoinhibition and injures cells leading to cell deaths.

Recently, it was reported that the d-NPQ related energy transfer from PS II to a fluorescence quencher, F740, and an energy dissipation within 30 fs in dehydrated lichens. However, we found that photobiont *Trebouxia* sp. lost these abilities and became more sensitive against light stress once they had been isolated from a lichen body *Ramalina yasudae*. This phenomenon indicated the presence of physico-chemical interaction between the mycobiont and photobiont.

We analyzed the water-soluble materials obtained during the isolation process of *Trebouxia* from *R. yasudae*, and found that a pentane-1,2,3,4,5-pentol (D-Arabitol) was the major component. Therefore, we measured time-resolved fluorescence spectra and analyzed decay-associated spectra (DAS) of *R. yasudae*, isolated *Trebouxia* and arabitol-treated *Trebouxia*. As a result, isolated *Trebouxia* didn't show d-NPQ but arabitol-treated *Trebouxia* showed d-NPQ and energy transfer from PSII to F740 as in lichen. Based on these results, we can conclude that accumulated arabitol in lichen thalli accelerate energy dissipation in photobionts under drought conditions leading to the protection of them from photoinhibition.