南極産菌類の低温適応戦略

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Cold adaptation strategy of Antarctic basidiomycetous yeast

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Microbes growing at subzero temperatures encounter numerous growth constraints. However, fungi that inhabit cold environments can grow and decompose organic compounds under subzero temperatures. Thus, understanding the cold-adaptation strategies of fungi under extreme environments is critical for elucidating polar-region ecosystems.

Although the response to cold stress has been widely studied in bacteria and plants, little attention has been paid to fungal cold-adaptation strategies that are essential for survival at near subzero temperatures. Studies to date on fungal adaptation to low temperatures have examined whether or not the fungi growing under these conditions exhibit the physiological traits that are beneficial for survival in polar regions: accumulation of glycerol and trehalose in the cell, secretion of antifreeze proteins and extracellular polysaccharides, and a high ratio of unsaturated fatty acids in the membrane (1). In this study, I used capillary electrophoresis-time of flight mass spectrometry (CE-TOFMS) to analyse the metabolite responses to cold stress in two strains of the Antarctic basidiomycetous yeast *Mrakia blollopis* under subzero temperatures.

Here, I report that two strains of the Antarctic basidiomycetous yeast *Mrakia blollopis* exhibited distinct growth characteristics under subzero conditions: SK-4 grew efficiently, whereas TKG1-2 did not. I analysed the metabolite responses elicited by cold stress in these two *M. blollopis* strains by using CE-TOFMS. *M. blollopis* SK-4, which grew well under subzero temperatures, accumulated high levels of TCA-cycle metabolites, lactic acid, aromatic amino acids, and polyamines in response to cold shock. Polyamines are recognised to function in cell growth and developmental processes, and aromatic amino acids are also known to improve cell growth at low temperatures. By contrast, in TKG1-2, which did not grow efficiently, cold stress strongly induced the metabolites of the TCA cycle, but other metabolites were not highly accumulated in the cell. Thus, these differences in metabolite responses could contribute to the distinct abilities of SK-4 and TKG1-2 cells to grow under subzero temperature conditions.

References

1. Robinson CH. 2001 Cold adaptation in Arctic and Antarctic fungi. New Phytol. 151, 341–353.