

Increase in Oxidative Stress at Low Temperature in an Antarctic Bacterium

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Abstract Association between cold stress and oxidative stress was demonstrated by measuring the activity of two antioxidant enzymes and the level of free radicals generated in two batches of cells of an Antarctic bacterium *Pseudomonas fluorescens* MTCC 667, grown at 22 and 4°C. Increase in oxidative stress in cells grown at low temperature was evidenced by increase in the activity of an enzyme and also in the amount of free radicals generated, in the cold-grown cells. The association between cold stress and oxidative stress demonstrated in this investigation bolsters the concept of interlinked stress response in bacteria.

Introduction

During the past few years, bacterial response to low environmental temperature has evoked a lot of interest. Investigations performed so far have engendered a plethora of information leading to several clues to the mechanism of cold adaptation [1]. This report highlights some of the observations on association of cold stress with oxidative

stress in an Antarctic bacterium *Pseudomonas fluorescens* MTCC 667.

The association between decrease in the environmental temperature and increase in the intracellular oxidative stress was first indicated by studies on various plant systems and subsequently also in the bacteria [2]. Features associated with oxidative stress response viz, enhanced expression of the gene encoding superoxide dismutase (SOD) and decrease in the intracellular level of reduced glutathione, were evidenced in *Escherichia coli* during prolong cultivation at low temperature [3]. Intracellular level of transcripts that encode thioredoxin reductase, another antioxidant enzyme, was found to be elevated in *Listeria monocytogenes* when it was grown at 10°C compared to that in a reference culture grown at 37°C [4]. The role of HtpG in acclimation of the cyanobacterial strain *Synechococcus* PCC 7942, to high and low temperature and also to oxidative stress was demonstrated [5]. Low temperature induced oxidative stress was observed also in some Antarctic fungi [6]. In the present investigation, specific activities of catalase and SOD in the sonicated cell homogenate of *P. fluorescens* MTCC 667, grown at 4°C, were compared to the same activities in cells, grown at 22°C. The intracellular level of free radicals in the two batches of cells was also measured using Electron Paramagnetic Resonance (EPR) Spectroscopy. Increase in the oxidative stress at low temperature was revealed using both the approaches.

Materials and Methods

Organism and Culture Conditions

The bacterial strain *P. fluorescens* MTCC 667, used for this investigation, was isolated earlier from soil sample,

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