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REVIEW ARTICLE

Response to temperature stress in rhizobia

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Abstract

It is well established that soil is a challenging environment for bacteria, where conditions may change rapidly and bacteria have to acclimate and adapt in order to survive. Rhizobia are an important group of soil bacteria due to their ability to establish atmospheric nitrogen-fixing symbioses with many legume species. Some of these legumes are used to feed either humans or cattle and therefore the use of rhizobia can reduce the need for synthetic N-fertilizers. Several environmental factors shape the composition and the activity of rhizobia populations in the rhizosphere. Soil pH and temperature are often considered to be the major abiotic factors in determining the bacterial community diversity. The present review focuses on the current knowledge on the molecular bases of temperature stress response in rhizobia. The effects of temperature stress in the legume-rhizobia symbioses are also addressed.

Keywords: Heat stress, cold stress, symbiosis, chaperone, biological nitrogen fixation

Introduction

Biological nitrogen fixation (BNF) consists in the conversion of atmospheric nitrogen into ammonia by the nitrogenase enzyme complex. In the case of the legume-rhizobia symbioses, this process occurs in special structures, usually formed in the plant root, designated used in rotation with, for example, cereal crops, in order to increase the N levels available in the soil and consequently improve cereals yield. For instance, chickpea was seen to successfully increase N availability in cereal systems, such as wheat production (Aslam et al., 2003).

Changes in the rhizosphere environment, such