ScienceDirect

ISBN: 978-0-323-90943-3

Frontiers in Plant-Soil Interaction
Molecular Insights Into Plant Adaptation

2021, Pages 567-587

Chapter 21 - Emerging roles of osmoprotectant glycine betaine against salt-induced oxidative stress in plants: a major outlook of maize (*Zea mays* L.)

Akbar Hossain [1], Biswajit Pramanick [2], Karma L. Bhutia [3], Zahoor Ahmad [4], Debojyoti Moulick [5], Sagar Maitra [6], Adeel Ahmad [7], Tariq Aftab [8]

[1] Bangladesh Wheat and Maize Research Institute, Dinajpur, Bangladesh
[2] Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University, Pusa, India
[3] Department of Agricultural Biotechnology & Molecular Breeding, College of Basic Science and Humanities, Dr. Rajendra Prasad Central Agricultural University, Pusa, India
[4] Department of Botany, University of Central Punjab, Punjab Group of College Bahawalpur, Bahawalpur, Pakistan
[5] Plant Stress and Metabolomics Laboratory, Assam University, Silchar, India
[6] Department of Agronomy, Centurion University of Technology and Management, Paralakhemundi, India
[7] Institute of Soil and Environmental Science, University of Agriculture Faisalabad, Faisalabad, Pakistan
[8] Department of Botany, Aligarh Muslim University, Aligarh, India

Available online 25 June 2021, Version of Record 25 June 2021.

https://doi.org/10.1016/B978-0-323-90943-3.00015-8

Abstract

Maize (*Zea mays* L.) is the third most important cereal after rice and wheat. As a C_4 plant in the family Poaceae, maize can be grown under a wide range of agroecological conditions. Earlier evidence showed that as a result of wide intraspecific genetic variation, it is moderately sensitive to saline stress. Soil salinity is a serious threat worldwide, particularly in coastal- and arid–saline ecosystems of the world. According to the biphasic model of salinity-induced growth reduction, osmotic stress during the first phase and ion toxicity during the second phase are responsible for reduced growth in most of the cereals, but in the first phase in maize, ion toxicity, and the accompanying growth to the excessive Na^+ accumulation in the leaves. An understanding of the physiological, biochemical, genetic, and molecular mechanisms of maize against salinity stress is desirable to alleviate the hostile effect of salinity stress on maize. Conventional breeding approaches have been found to be less effective for improving maize tolerance to salinity stress. Numerous studies have revealed that enhancement of osmoprotectants in plant cells, particularly glycine betaine (GB), has been found to be most effective for the osmotic adjustment of plants during salinity stress. The chapter aims to highlight the role of osmoprotectant GB against salt-induced oxidative stress in maize.

Keywords

Maize; salt stress; osmoprotectants; physiological; oxidative stress