# Cold Tolerance in Plants

Shabir Hussain Wani • Venura Herath
Editors

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## Physiological, Molecular and Genetic Perspectives

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**Emeritus Professor Peter Langridge FTSE**

*Peter was born in Adelaide in 1953 to a Czech mother and a New Zealand father. He was brought up in Canberra where he studied at the Australian National University. When he graduated, he took up a job in Germany at the University of Freiburg. During his 4 years in Germany, he also met and married his German wife, Ursula, who is also a scientist. In 1984, he moved to the University of Adelaide. He became a Professor in 1996 and from 1998 was the inaugural Research Director of the Cooperative Research Centre for Molecular*

*Plant Breeding. In 2003, Peter became the Chief Executive Officer and Director of the Australian Centre for Plant Functional Genomics (ACPFG) when it was established and remained in this role until 2014. ACPFG was a major research centre based in Adelaide set up by the Australian Federal Government through the Australian Research Council and the Grains Research and Development Corporation. When he left ACPFG, Peter was appointed Emeritus Professor at the University of Adelaide; he is also an Honorary Professor at the Kazakh National Agrarian University. He is a Fellow of the Australian Academy of Technological Sciences and Engineering and an Honorary Fellow of Food Standards Australia and New Zealand (FSANZ) and James Hutton Institute, UK.*

*Since 2011, Peter has been chair of the Scientific Board of the Wheat Initiative. The Wheat Initiative was established by the G20 group of countries to provide global coordination of wheat research. The secretariat moved from Paris to Berlin at the beginning of 2018. Peter also chairs several science advisory committees for research organisations in Europe and North America. He chaired the steering committee for the CGIAR Research Program on Dryland Cereals and led a major review of biotechnology capabilities across the CGIAR system. In 2011, he chaired an expert scientific panel for the Australian Government on "Food security in a changing world". Peter is Editor-in-Chief of the Journal Agronomy (MDPI Publishers, Switzerland) and associate editor of eight other*

*journals. In 2011, he was selected as the South Australian Scientist of the Year, and he has received other awards in Australia and Europe.*

*Peter's research has focused on plant molecular biology and the science of plant breeding, and he has published over 300 research papers, books and reviews.*

# Preface

Human population is increasing at an alarming pace and believed to exceed 9.7 billion by 2050, whereas at the same time the agricultural productivity is decreasing due to the growing environmental constraints as a result of global climate change. Cold stress is one of the widespread abiotic stresses affecting crop productivity particularly in temperate regions. Plants have developed various anatomical, physiological and genetic strategies to cope with the cold stress. Conventional breeding methods have resulted in inadequate success in improving the cold tolerance of vital crop plants through inter-specific or inter-generic hybridization. Therefore, it is of the essence to speed up the efforts for unraveling the biochemical, physiological and molecular mechanisms underlying cold stress tolerance in plants. While quite a few programs have been taken up in leading global research institutes but the pace of development of cold stress tolerant cultivars is not up to the mark when compared to ever-increasing pressure of abiotic stresses including cold stress due to global climate change. Moreover, the intricate genetic mechanisms involved in plant adaptation to cold stresses have been a key obstacle for crop improvement using conventional plant breeding tools. Omics technologies including genomics, transcriptomics and proteomics have facilitated elucidation of complex mechanisms involved in plant adaptation to cold stress. Through this book "Cold Tolerance in Plants - Physiological, Molecular and Genetic Perspectives", we have tried our best to include chapters unfolding the implication of cold stress in plants under climate change scenario and the eventual scientific advancements being applied utilizing the existing high throughput omics technologies to come up with novel strategies to mitigate cold stress by unraveling molecular mechanisms responsible for cold stress in plants.

This book provides systematic and comprehensive reference material for researchers, teachers, and graduate students involved in abiotic stress tolerance studies in plants particularly cold stress using physiological, molecular and genomic tools by unfolding principles and application of recently developed technologies and their application in development of stress resilience in plants against cold stresses. The chapters are written by globally reputed researchers and academicians

in the field of plant stress biology. We express sincere thanks and gratefulness to our revered authors, without their untiring efforts this book project would not have been possible. We are also thankful to Springer Nature for providing such opportunity to complete this book project. We are also thankful to all our family members for their support during the entire book project completion.

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