Membrane fatty acid compositions and cold-induced responses in tetraploid and hexaploid wheats

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Abstract Plant cells often increase cold tolerance by reprogramming their genes expression which results in adjusted metabolic alternations, a process enhanced under cold acclimation. In present study, we assessed the changes of membrane fatty acid compositions along with physio- biochemical indices like H₂O₂ and malondialdehyde (MDA) contents and lipoxygenase (LOX) activity during cold stress (CS) phases in acclimated and non-acclimated durum (SRN and Gerdish) and bread (Norstar) wheat genotypes. During thermal treatments, MDA was an end product of lipid peroxidation via oxidative stress (H₂O₂ content) rather than LOX activity. LOX activity plays a double role in mechanism of cold tolerance in wheat, particularly at severe stress. With increase in severity of CS especially in non-acclimated plants, LOX activity decreased along with an increase in MDA and other responses helped increase or maintain unsaturated fatty acids (FAs) whereas in acclimated plants (moderate CS), increasing of LOX activity along with a decrease in MDA indicates probably its role in secondary metabolites like jasmonic acid signaling pathway. Significant increase of total FAs and particularly unsaturated FAs showed distinct cell endeavor to protect against CS in Norstar and Gerdish compared to SRN genotype. Results showed that an increase in double bond index and LOX activity and low MDA under CS could be reasons for plant cold tolerance.

Keywords Damage index · Durum · Cold acclimation · Cold responses · Fatty acids · Wheat

Abbreviations
DBI Double bond index
CA Cold acclimation
CS Cold stress
FA Fatty acid
FAMEs Fatty acid methyl esters
FM Fresh mass
GC Gas chromatography
JA Jasmonic acid
LOX Lipoxygenase
MDA Malondialdehyde
NBT Nitro blue tetrazolium
ROS Reactive oxygen species
TCA Trichloroacetic acid
UFAs Unsaturated fatty acids

Introduction

Cold stress (CS), like other types of abiotic and biotic stresses, induces oxidative processes in plant cells. These processes are initiated by reactive oxygen species (ROS), which interact nonspecifically with many cellular components, triggering peroxidative reactions and causing