Exogenous phenylalanine application promotes chilling tolerance in tomato fruits during cold storage by ensuring supply of NADPH for activation of ROS scavenging systems

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Scientia Horticulturae 246: 818-825. (2019)

Abstract

In this experiment, the mechanisms displayed by exogenous phenylalanine application to confer chilling tolerance in tomato fruits (*Lycopersicon esculentum* cv. Izmir) during storage at 4 °C for 28 days were studied. Phenylalanine application at 5 mM significantly confers chilling injury tolerance in tomato fruits associated with membrane integrity maintenance reflected by a lower degree of electrolytes leakage and malondialdehyde (MDA) accumulation. Membrane integrity maintenance in tomato fruits in response to exogenous phenylalanine application at 5 mM may arise from lower H_2O_2 accumulation due to higher activity of reactive oxygen species (ROS) scavenging enzymes superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX) and glutathione reductase (GR), concurrent with higher endogenous lycopene and proline accumulation. In addition, higher phenols and flavonoids accumulation arising from higher phenylalanine ammonia-lyase (PAL) enzyme activity is concurrent with higher ascorbic acid (AA) accumulation giving rise to higher DPPH scavenging capacity, which may be vital for the maintenance of membrane integrity in tomato fruits treated with exogenous phenylalanine. Ensuring supply of reducing power NADPH by triggering of folates pathway demonstrated by higher methylenetetrahydrofolate dehydrogenase (MTHFD) enzyme activity may be responsible for activation of ROS scavenging systems in tomato fruits in response to exogenous phenylalanine application, contributing to membrane integrity maintenance. Accordingly, exogenous phenylalanine application may serve as a safe promising procedure to confer chilling tolerance in tomato fruits during cold storage.