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FUNCTIONAL CHARACTERIZATION OF A TOMATO GLUTHATHIONE S-TRANSFERASE GENE AND ITS IMPLICATION IN THE PLANT RESPONSE TO ENVIRONMENTAL STRESSES

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Mitigating the negative effects of abiotic stresses on crop productivity is pivotal in order to meet the global demand for food and other agricultural commodities. Abiotic stresses caused by deficiencies or excesses in environmental factors such as water, salt, light, and temperature can substantially reduce plant growth and productivity and even survival. Abiotic stresses were estimated to cause an overall yield loss of ~70% in key agricultural crops and global warming is even expected to further worsen food security.

Abiotic stresses induce in plant cells increasing levels of reactive oxygen species (ROS) that are critical for stress signaling and mainly affect chloroplast protein synthesis and photosystem II repair. A plethora of antioxidants and antioxidant enzymes protect plant cells from oxidative stresses caused by an excess of ROS accumulation, thus engineering the cell redox cycle for enhancing the ROS-scavenging capacity might contribute to empower plant stress tolerance.

Glutathione S-transferases (GSTs) is a multigene superfamily with diverse cellular mechanisms and metabolic functions and has been considered as one of the key members of plant stress modulation pathways.

Our goal is to investigates the role of a tomato glutathione S-transferase (GST - Solyc07g056420) gene in controlling plant stress response.

Tobacco lines overexpressing the Solyc07g056420 coding sequence (OE)

accumulated significantly higher levels of hydrogen peroxide in leaves and decreased leaf levels of flavonoids, chlorophyll A and antioxidant capacity compared with control plants. OE 40 days old plants underwent differential watering treatments, i.e. full reintegration of water lost by evapo-transpiration (FWR) and restitution of 50% of lost water (HWR). Under HWR conditions, OE plants showed a reduced occurrence of leaf injuries and responded to drought with a significantly higher increase in leaf chlorophyll A, chlorophyll B, hydrogen peroxide and antioxidant capacity compared to control plants.

These results suggested that the hyper-accumulation of H2O2 induced in leaves by the overexpression of the Solyc07g056420 coding sequence and compensated by the adjusting the antioxidant capacity might lead to an enhancement of plant responsiveness to drought.

Ongoing experiments will further investigate the functional role of the tomato Solyc07g056420 within the stress signaling network and its possible involvement in the modulation of plant response to other environmental stresses.