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The use of agricultural biotechnology to enhance tolerance of Micro-Tom tomato to salinity and drought

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This study aims at employing recent genetic engineering tools to control the expression level of selected JAZ genes, a new family of repressors of jasmonate signaling, in tomato in order to generate salt and drought-tolerant tomato plants able to grow under limited water availability and saline soil conditions, typical of some regions of the Kingdom of Saudi Arabia. During the course of the first year of the project, we successfully identified tomato JAZ-repressor genes (SlJAZ) involved in drought and salinity tolerance via phylogenetic analyses and to study their expression levels in response to several abiotic stress stimuli (i.e. Drought and salinity). Four SlJAZs were identified with potential role in abiotic stress tolerance of which only two (SlJAZ3/Sl03g122190 and SlJAZ3/Sl12g009220) were targeted for in planta transgenic analysis and mis-expression studies to elucidate their functional roles. We employed a transgenic approach to over-express and silence (Haiprin) the two selected SlJAZ genes in tomato miniature Micro-Tom plants. In this context, the Gateway® LR Clonase® system (Life Technologies) was used to catalyze the in vitro recombination between an entry pDONR clone (containing the SlJAZ gene flanked by attL sites) and a destination vector (Overexpression, pK7WG2.0; Hairpin silencing, pK7WG2.0) (containing attR sites) to generate an expression clone to be transformed into tomato via an Agrobacterium-mediated cotyledon-transformation strategy. Moreover, we established the experimental set-up to study the gene expression levels of all the currently known members of SlJAZs gene family by real-time quantitative RT-PCR in response to abiotic stresses. Initial expression profiling of all members of the JAZ genes in tomato indicated differential expression in response to abiotic stresses such as salinity, jasmonic acid, abscisic acid and drought. Furthermore, Yeast-Two Hybrid (Y2H) studies, where both the SlJAZ2 and SlJAZ3 have been used as prey (pGAD vector) and COI.1 as bait (pGBK vector), revealed that SlJAZ2, but not SlJAZ3, directly interacts with SlCOI1. Subsequently, a targeted large-scale Chemical Genomic Screen has been conducted to identify molecules inducing the SlJAZ2/SlCOI1 interaction, therefore acting as "Molecular glue" for the JA-Ile co-receptor complex. The screen is currently underway. This approach will open up new horizons of increasing tomato productivity in Saudi Arabia under harsh environmental conditions such as drought and salinity. At the same time, it will help the developing plant molecular biology and biotechnology platforms for transgenic crops with superior agricultural traits.

Biography

Mourad A M Aboul-Soud received his PhD from the University of Edinburgh, Scotland UK and completed 3-year of Postdoctoral studies from University of Nottingham (England, UK) and INRA (Bordeaux-France). He is a full Professor of Biochemistry & Molecular Biology at Cairo University and currently working as a Professor at the College of Applied Medical Sciences, King Saud University (Riyadh-KSA). His main area of research tracks are in the field of biological and environmental sciences, particularly in biochemistry, molecular biology, genetic engineering and environmental toxicology, both in plants and mammalian systems. He has been serving as an Editorial Board Member of journals such as Current Pharmaceutical Analysis, Arab Journal of Biotechnology, and acting as a Reviewer for several journals such as PLoS One, BMC Genomics, Environmental Geochemistry and Health etc.

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