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Use of root fungus Piriformospora indica on Date Palm improved growth and tolerance to salinity

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Statement of the problem: Date palms (Phoenix dactylifera L.) are considered one of the most resilient crops that can tolerate high levels of salinity and can survive long periods with limited water supply. However, its cultivation and production are challenging in the region due to the increased salinization of groundwater which is the main irrigation resource. Endophytic fungi are known to enhance plant growth and performance under salinity stress by enhancing the synthesis of secondary metabolites with novel properties. The purpose of this study is to investigate the growth, together with the biochemical and molecular properties of Phoenix dactylifera colonized with the mutualistic fungus Piriformospora indica, under controlled and stressed conditions. The transcriptome analysis using RNAseq technology of salt-stressed and colonized roots & leaves will recognize the genes, pathways, and biological processes involved in abiotic tolerance.

Methodology and Technology employed: We monitored plant growth parameters and physiochemical analysis between fungal-inoculated and control date palm seedlings challenged or not with salinity stress. The colonization of date palm roots with the mutualistic fungus Piriformospora indica, was performed to examine the molecular mechanisms and signaling pathways stimulated by the transcriptional activation of candidate genes. Finally, we overexpressed date palm LEA2 genes in Arabidopsis thaliana to functionally characterize their tolerance to salinity.

Findings: The study revealed that colonization of date palm seedlings with the beneficial endophyte P. Indica significantly reduced the detrimental effects of salinity stress by exhibiting enhanced growth through ion homeostasis, antioxidant activity, and several upregulated stress-responsive genes like LEA2, SOS1, and HKT1. The overexpression of LEA2 genes in transgenic A. thaliana plants improved salinity tolerance compared to the wild types at the physiochemical and molecular levels.

Conclusion & Significance: Our findings support the idea that the beneficial symbiosis between P. Indica and date palm stimulated transcriptional activation of candidate genes (including LEA2 genes) which can be exploited as an essential plant symbiont for improving date palm production.

Recent Publications:

1. Sabeem M, Abdul Aziz M, Kutty S, Brini F, Rouached H and Masmoudi K. Enhancing growth and salinity stress tolerance of date palm using Piriformospora indica. Plant Science (2022).
2. Shamim A, Loganathachetti DS, Chandran S, Masmoudi K and Mundra S. Salinity of irrigation water selects distinct bacterial communities associated with date palm (Phoenix dactylifera L.) root. Scientific Reports (2022).
3. Hazzouri KM, Flowers JM, Nelson D, Lemansour A, Masmoudi K and Amiri KMA. Prospects for the Study and Improvement of Abiotic Stress Tolerance in Date Palms in the Post genomics Era. Front. Plant Science (2020).

Biography

Miloofer Sabeem is currently a third-year Ph.D. student in Horticultural science at the United Arab Emirates University (UAEU) studying under the guidance of Professor Khaled Masmoudi. Her doctoral work explores the significance of the beneficial and symbiotic relationships between root endophyte Piriformospora indica and date palm (Phoenix dactylifera) for their tolerance to abiotic stresses, mainly salinity, drought, and heat in UAE. She uses a combination of physiological, biochemical, genetic, and transcriptomic approaches to analyze various levels of gene expression and underlying molecular mechanisms

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