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Master Thesis Defense

Entitled

*MOLECULAR CHARACTERIZATION OF GERMINATION OF DATE PALM SEEDS MAINTAINED AT MICRO-
GRAVITY IN OUTER SPACE*

(International Space Station)

by

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Data & Venue

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Abstract

Over the past decade, the UAE has experienced unprecedented innovations in the space sector. Collaborating closely with universities and space agencies around the world, the country's efforts have advanced steadily but quietly under the public radar. The proposed research focuses on basic research to complement the UAE initiative to send date palms to Mars for future space missions. Plant growth analysis of date palm seeds was performed after maintaining at zero gravity in outer space in the International Space Station (ISS) and simultaneously under normal gravity at ground level. In this context, this work was carried out to analyze the molecular changes in the date palm seeds maintained at microgravity in comparison with the gravity seeds. Ninety seeds of different varieties of date palm were sent to space in collaboration with the UAE space agency and the seeds were returned after 6 months. The seeds returned from space did not show signs of germination and, therefore, the molecular mechanism of seed dormancy was investigated with transcriptomics. RNA was extracted from the date palm control and space-maintained seeds and transcriptome analysis was performed. From this analysis, all date palm seeds yielded Q30 values greater than 90%. The GC content of date palm seed samples ranged from 48 to 51%. The higher reads were observed in the Lulu space samples, whereas lower ones were observed in Mesalli seeds. The preprocessed and rRNA-removed reads were used for reference-based pair-wise alignment with the Date Palm NCBI reference genome. We have observed upregulated genes and downregulated genes in all the varieties. The functional profiling of the differentially expressed genes was identified in the Lulu, Majdool and Mesalli date palm seeds. We have found out there are differential gene expressions in all the date palm seeds studied, which might have prevented the seeds from germination. Thus, radiation and vibration damage might have affected both living and non-living components in many ways. We found that these factors affect seeds and their germination process. Also, maintaining seeds in space directly or indirectly affect the overall seed performance by changing the integrity of internal cell organelles.

Keywords: Date Palm, Space missions, Zero gravity, ISS, Transcriptome analysis, Lulu, Majdool, Mesalli.