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BOSS_CYANO EXPERIMENT ON THE EXPOSE-R2 SPACE MISSION: ENHANCED SURVIVAL OF CHROOCOCCIDIOPSIS BIOFILMS TO SPACE AND SIMULATED MARS CONDITIONS COMPARED TO PLANKTONIC COUNTERPARTS

Abstract

The Biofilm Organisms Surfing Space (BOSS) experiment is part of the EXPOSE-R2 space mission. In one part of the BOSS experiment three Chroococcidiopsis desert stains (CCMEE 057, CCMEE 029 and CCMEE 064), were exposed to Low Earth Orbit (LEO) in the dried state either as biofilms or multilayered planktonic samples. Cells were exposed for 16 months to space and Mars-like conditions outside the International Space Station. Exposure parameters included temperature variations, ionizing radiation, vacuum or simulated Martian atmosphere and pressure, and Mars-like solar UV irradiation. In parallel to exposure in LEO, replicates of the experiment were performed on the ground: Some were kept in the dark under ambient conditions, while others were exposed to stressors (extreme temperature cycles, Mars-simulated atmosphere or vacuum, and UV flux) mimicking those undergone during the EXPOSE-R2 space mission, based on data recorded in-flight. Cyanobacteria were analyzed post-flight using confocal microscopy, PCR-based assays and colony forming ability tests. Results are consistent with previous ground-based simulations of the mission1,2 and demonstrate an overall higher resistance of biofilms when compared to planktonic as suggested by their increased viability and lower amounts of DNA damage.

1. Baqué, M., Scalzi, G., Rabbow, E., Rettberg, P. Billi, D. Biofilm and Planktonic Lifestyles Differently Support the Resistance of the Desert Cyanobacterium Chroococcidiopsis Under Space and Martian Simulations. Orig. life Evol. Biosph. 43, 377–389 (2013).

2. Baqué, M., de Vera, J.-P., Rettberg, P. Billi, D. The BOSS and BIOMEX space experiments on the EXPOSE-R2 mission: Endurance of the desert cyanobacterium Chroococcidiopsis under simulated space vacuum, Martian atmosphere, UVC radiation and temperature extremes. Acta Astronaut. 91, 180–186 (2013).