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Are lichens and cyanobacteria suitable candidates to test the theory of lithopanspermia?

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Lichens, endolithic- and endoevaporitic communities of cyanobacteria and bacteria has been exposed to real- and simulated space conditions to demonstrate likelihood of the lithopanspermia hypothesis, that postulates a viable transport of microorganisms between planets by means of meteorites, i.e. impact expelled rocks from a planets surface, which serve as vehicles for spreading living material from one planet or solar system to another (Nicholson et al. 2000, Benardini et al. 2003, Cockell 2008, Horneck et al. 2008, Valtonen et al. 2009).
Three experiments (LICHENS, Foton M2 mission, 2005, and LITHOPANSPERMIA, Foton-M3 satellite, 2007), have been performed in space, the first two on a short mission, onboard of Biopan of the Foton-M satellite recoverable capsule, and the third one in a long-term mission on the Expose facility of the ISS to test the survival of prokaryotic- and eukaryotic symbiotic organisms in relation to lithopanspermia. The first two experiments allowed for the first time the demonstration- and intercomparison of the high survival capacity of eukaryotic- and prokaryotic symbiotic organisms in space (the epilithic lichen species Rhizocarpon geographicum and Xanthoria elegans, endoevaporitic microbial communities, epilithic microbial communities with cyanobacterial akinetes of Anabaena, and a vagrant lichen species, Aspicilia fruticulosa). Exposure to different UV-conditions of a low Earth orbit (LEO, 300 km) were performed: solar extraterrestrial UV radiation, Mars simulated UV-climate, UV-B radiation and PAR, space vacuum at 10-6 mbar, microgravity and temperatures between -23°C and +16°C.
To check the resistance of the selected organisms to space before these missions, space simulation experiments were performed at INTA (Spasolab) and DLR (Institute of Aerospace Medicine), which were decisive to show the high survival capacity of these species to space vacuum (10-4 – 10-6 mbar), space UV radiation (200-400 nm) and extreme temperatures.
The results obtained after flight, showed a exceptionally high survivability of the epilithic lichen (de la Torre et al. 2007; Sancho et al., 2007), and of the vagrant lichen A. fruticulosa, giving us the opportunity to learn, that organisms adapted to tolerate extreme conditions on our planet, like epilitihic- and vagrant lichens, and resting state phototrophic organisms of microbial communities, could resist an interplanetary travel through space. This step have lead us to test the next objective: the survival to Mars environmental conditions. For this reason, the most resistant lichen species until now to harsh space conditions, A. fruticulosa, collected in the steppic highlands of Central Spain, were exposed in a Planetary Atmosphere and Surfaces Chamber (PASC, (Mateo-et al. 2006), CAB, Center of Astrobiology, INTA) to the following conditions: 1) Mars simulated UV-radiation (200-400nm) + temperature (-93ºC), 2) Mars simulated atmosphere (7mbar and CO2) + temperature (-93ºC), and 3) all these conditions together, Mars simulated UV-radiation (200-400nm) + atmosphere (7mbar and CO2) + temperature (-93ºC). Each test were performed during 120 hours. Analysis has to be performed to determine the photosynthetic activity with chlorophyll-a fluorescence, in order to demonstrate the high resistance of these organisms to conditions on other planets, like Mars.
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