Three bacterial strains discovered on space station may help grow plants on Mars

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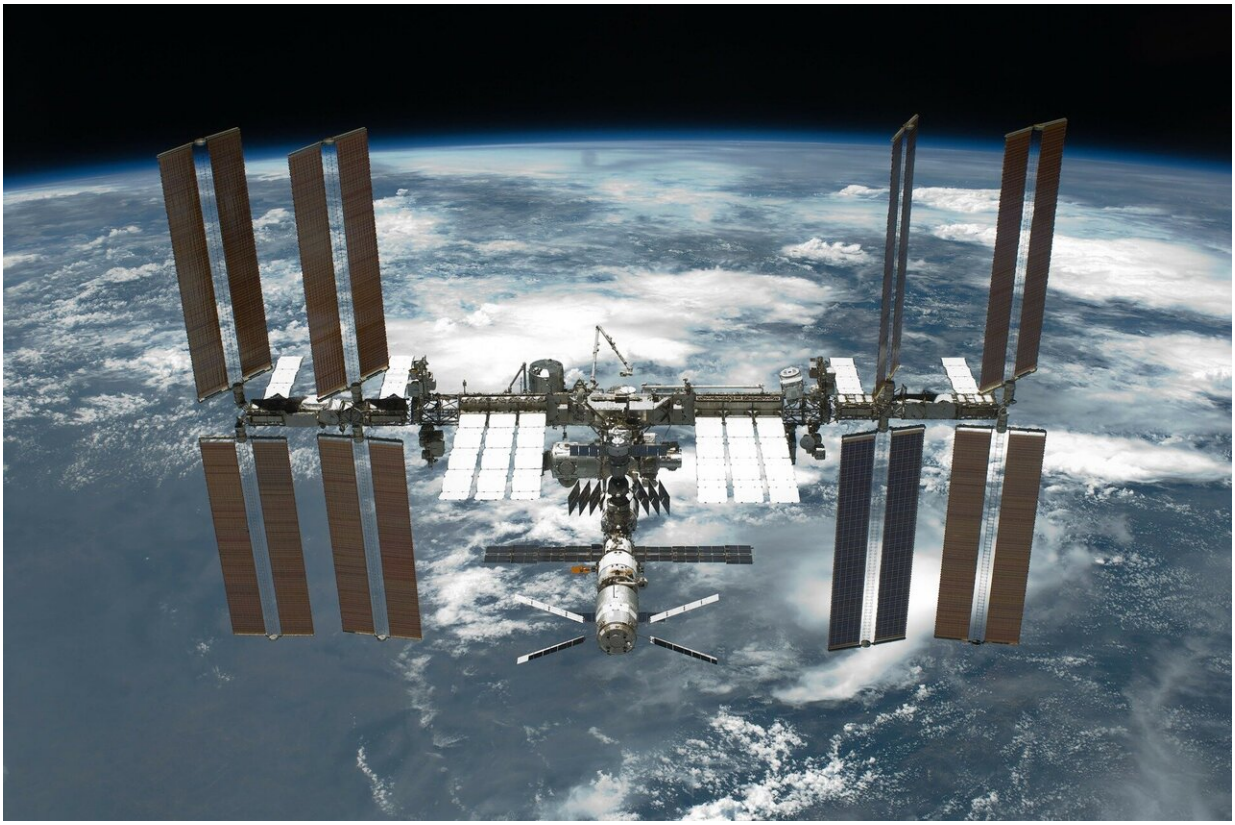

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In order to withstand the rigors of space on deep-space missions, food grown outside of Earth needs a little extra help from bacteria. Now, a recent discovery aboard the International Space Station (ISS) has

researchers may help create the 'fuel' to help plants withstand such stressful situations.

Publishing their findings to *Frontiers in Microbiology*, researchers working with NASA described the discovery and isolation of 4 strains of bacteria belonging to the family Methylobacteriaceae from different locations aboard the ISS across two consecutive flights.

While 1 strain was identified as Methylorubrum rhodesianum, the other 3 were previously undiscovered and belong to a novel species novel. The rod-shaped, motile bacteria were given the designations IF7SW-B2T, IIF1SW-B5, and IIF4SW-B5 with genetic analysis showing them to be closely related to Methylobacterium indicum.

Methylobacterium species are involved in nitrogen fixation, phosphate solubilization, abiotic stress tolerance, plant growth promotion and biocontrol activity against plant pathogens.

Potential for Mars missions

Now, in honor of the renowned Indian biodiversity scientists Dr. Ajmal Khan, the team has proposed to call the novel species Methylobacterium ajmalii.

Commenting on the discovery, Dr. Kasthuri Venkateswaran (Venkat) and Dr. Nitin Kumar Singh of NASA's Jet Propulsion Laboratory, (JPL), says that the strains might possess " biotechnologically useful genetic determinants" for the growing of crops in space.

However, further experimental biology is needed to prove that it is, indeed, a potential game-changer for space farming.

"To grow plants in extreme places where resources are minimal,

isolation of novel microbes that help to promote plant growth under stressful conditions is essential," they said.

Along with JPL, other researchers collaborating on this discovery are based at the University of Southern California, Los Angeles; Cornell University and the University of Hyderabad in India.

With NASA one day looking to take humans to the surface of Mars—and potentially beyond—the US National Research Council Decadal Survey recommends that the space agency use the ISS as a "test-bed for surveying microorganisms", according to Venkat and Singh.

"Since our group possess expertise in cultivating microorganisms from extreme niches, we have been tasked by the NASA Space Biology Program to survey the ISS for the presence and persistence of the microorganisms," they add.

"Needless to say, the ISS is a cleanly-maintained extreme environment. Crew safety is the number 1 priority and hence understanding human/plant pathogens are important, but beneficial microbes like this novel Methylobacterium ajmalii are also needed."

Expanding the ISS lab

As part of an ongoing surveillance mission, 8 locations on the ISS are being monitored for bacterial growths and have been for the last 6 years. These sample areas include where the crew assembles or where experiments are conducted, such as the plant growth chamber.

While hundreds of bacterial samples from the ISS have been analyzed to date, approximately 1,000 samples have been collected from various other locations on the space station but are awaiting a trip back to Earth where they can be examined.

According to Venkat and Singh, the eventual goal is to bypass this lengthy process and potentially find new novel strains using molecular biology equipment developed and demonstrated for the ISS.

"Instead of bringing samples back to Earth for analyses, we need an integrated microbial monitoring system that collect, process, and analyze samples in space using molecular technologies," Venkat and Singh said.

"This miniaturized 'omics in space' technology—a biosensor development—will help NASA and other space-faring nations achieve safe and sustainable space exploration for long periods of time."

More information: Swati Bijlani et al, Methylobacterium ajmalii sp. nov., Isolated From the International Space Station, *Frontiers in Microbiology* (2021). DOI: 10.3389/fmicb.2021.639396

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