Traces Of Stowaway Earth Algae Could Survive On Mars, Study Finds

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Some hardy Earth microbes could survive long enough on Mars to complicate the search for alien life, according to a new study co-authored by University of Florida researchers.
Though scientists looking for life on Mars worry about contamination from stowaway spores clinging to spacecraft, the inhospitable Martian environment is actually an effective sterilizing agent: The intense ultraviolet rays that bombard the Martian surface are quickly fatal to most Earth microbes. However, the new study shows that at least one tough Earth species, a type of blue-green algae called Chroococcidiopsis, could live just long enough to leave a biological trace in the Martian soil – creating a potential false positive.

The study appears in the current issue of the journal Astrobiology and was co-authored by Charles Cockell of the British Antarctic Survey and UF research assistant professor Andrew Schuerger, a Mars astrobiologist and plant pathologist at UF's Institute of Food and Agricultural Sciences. Schuerger is one of several UF researchers associated with the Kennedy Space Center's Space Life Sciences Laboratory, where he investigates how Earth microbes might survive, grow and adapt in simulated Martian conditions.

"It's very possible that we could send viable microorganisms to Mars and then bring some of those same Earth bugs back with us," Schuerger said.

The researchers examined a dry-tolerant and radiation-resistant algae that thrives in Earth's most extreme conditions, from the hot, arid Negev

desert in Israel to the frigid Antarctic Ross Desert. This bacterium has not been found on the surfaces of spacecraft, but it represents a worst-case scenario for scientists.

“The only way to find out (if there’s life on Mars) is by going there and studying it, yet we take with us the potential to contaminate our own studies,” said John Rummel, NASA’s current Planetary Protection Officer. NASA created the Planetary Protection Office to safeguard against transferring potentially harmful organisms to or from Earth during space exploration.

“It’s the biological Heisenberg principle,” Rummel added. “Can we do the studies without contaminating what we’re looking at? So we have to have some idea of whether or not Earth life is likely to survive (on other planets).”

To test the limits of the algae’s endurance, the researchers subjected it to a simulated Martian atmosphere, re-created within a 5-foot-long stainless steel barrel-shaped chamber.

On Mars, average global temperature is -78 degrees Fahrenheit, atmospheric pressure is one-hundredth of the Earth’s and UV rays striking the surface are three times as intense as on the ozone-protected Earth – enough to produce a severe sunburn on exposed skin in minutes. Of these harsh conditions, the UV rays are the most powerful sterilizing agent, Schuerger said.

The researchers found that when exposed to the full spectrum of these rays, 99.9 percent of the algae in the chamber died within five minutes – significant when compared with the survival time of other microbes exposed to the same conditions: 15 seconds. However, the algae also left chemical traces of their existence that were detectable for several more hours. Those “biosignatures” included component molecules such as

chlorophyll and the measured activity of enzymes involved in cell membrane formation. Enzyme activity persisted for an hour, while traces of chlorophyll remained for up to four hours.

“This demonstrates that looking for biogenic signatures alone will complicate the process of looking for life,” he said. “You have to do both, you have to do a number of different procedures, and they have to complement one another.”

The algae also managed to survive when it was shielded from the direct onslaught of UV rays by a millimeter-thick layer of sand or rock. Such a scenario could occur if a robot lands on the Martian surface and its pads sink immediately into the sand, Schuerger said. However, though buried microbes may survive for some period of time, they are still subject to Mars’ low atmospheric pressure, high aridity and temperature extremes. Under those conditions, they wouldn’t necessarily grow or reproduce and are therefore unlikely to pose an ongoing contamination threat, he added.

Rummel agreed. "You might have a very lonely cyanobacterium waiting for something to happen."

The paper’s other authors include Daniela Billi of the University of Rome; E. Imre Friedmann of NASA’s Ames Research Center; and Dr. Corinna Panitz of the German Aerospace Center in Koln. Space Life Sciences Center.

Source: University of Florida