Astrobiological Research on Tardigrades: Implications for Extraterrestrial Multicellular Life Forms.

Tardigrades are microscopic (0.1-1.0 mm in length) invertebrate animals that are distributed in various environmental conditions in many areas from polar to tropical regions throughout the world. They have been considered as an appropriate model for astrobiological studies based on their high survival ability under various types of environmental stresses. So far, researches have shown that tardigrades have high tolerance to ionizing radiation, wide ranges of temperatures, vacuum, and high pressures in anhydrobiosis, a state that organisms lack free water in the body, and they resume activity when water is added. In addition, a short-term flight experiment demonstrated that tardigrades in an anhydrobiotic state survived open space environments at low Earth orbit. Results from those exposure experiments indicate that tardigrades are well tolerant of extremely low temperatures, vacuum, and high pressures. On the other hand, ionizing radiation, UV radiation, and high temperatures could be the critical factors to limit habitable environments for tardigrades. Future astrobiological research on tardigrades might provide important insight into the possibilities of existence of extraterrestrial multicellular life forms or interplanetary transfer of multicellular organisms in an inactivated-state like anhydrobiosis.

Short abstract:

Tardigrades have been considered as a model for astrobiological studies based on their tolerance to extreme environments. Future research on tardigrades might provide important insight into the possibilities of existence of multicellular life forms.