

Radiation tolerance in water bears

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Tardigrades (water bears) are tiny invertebrates forming a phylum and inhabit various environments on the earth. Terrestrial tardigrades enter a form called as “anhydrobiosis” when the surrounding water disappears. Anhydrobiosis is defined as an ametabolic dry state and followed by recovering their activity when rehydrated. Anhydrobiotic tardigrades show incredible tolerance to a variety of extreme environmental conditions such as temperatures (-273 °C to +151 °C), vacuum, high pressure (< 600 MPa), and chemicals that include alcohols and methyl bromide. In these views, there have been some discussions about their potential for surviving outer space. In the present study we demonstrated the survival limit not merely against gamma-rays but against heavy ions in the tardigrade *Milnesium tardigradum* in order to evaluate the effects of radiations on them. The animals were exposure to 500 to 7000 Gy of gamma-rays or 500 to 8000 Gy of heavy ions (⁴He) in their hydrated or anhydrobiotic state. The results showed that both of hydrated and anhydrobiotic animals have high radio-tolerance: median lethal dose (LD50/48 h) of gamma-rays or heavy ions in *M. tardigradum* was more than 4000 Gy, indicating that this species is categorized into the most radio-tolerant animals. We suggest that tardigrades will be suitable model animals for extremophilic multicellular organisms and may provide a survival strategy in extraterrestrial environments.