

Abundant tardigrades found in snow pack in Mt.Gassan in Yamagata Prefecture, Japan

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Water bears are small invertebrates belonging to the phylum Tardigrada. They are typically 0.1 –1.0 mm in body length, and walk slowly with four pairs of legs. Tardigrades can shrink their body like a tun and become cryptobiosis, which enables to survive in extreme environments, such as low and high temperature, high pressure, under strong radiation. Their physiological mechanism of cryptobiosis is expected to be applied to medical and industry technologies, such as dry preservation of animal cells. They are commonly found on glaciers in polar or alpine regions. They actively live in cryoconite holes on glaciers and spend their entire lives on glaciers. In Japan, there is a heavy snow in mountainous regions due to strong monsoon westerly in winter, On the snow fields in Japan, there are various cold-tolerant organisms such as snow algae and invertebrates. However, no tardigrade has been reported on snow packs in Japan. In this study, we investigated mountain snow packs in Japan to search the presence of tardigrade and tried to reveal their life cycle.

The fieldworks were carried out on snow packs in the forest located in Mt. Gassan in Yamagata prefecture in Japan. Snow and moss samples were collected in a total of four times from April to October 2018, three times in snow season and once in no snow season. Mt. Gassan is an area with heavy snowfall in winter. Microscopic observation revealed that there were many tardigrades of the genus *Hypsibius* in surface snow. While only one species of *Hypsibius* was observed in snow samples, a total of two species including one species of the genus *Macrobiotus* were observed in moss of trees in the forest, and a total of six species were observed in moss of trees collected in no snow season. The species observed in snow is likely cold-tolerant tardigrade and preferably lives in the snow pack. Population density of tardigrades in snow was exceptionally higher on the green coloured snow due to algal blooming, but was little on white snow without algae. It was an average of 7.1×10^3 ind L^{-1} in green snow samples. The body length distribution of tardigrades shows that their size increased significantly from April to May in the snow pack, and the small sized larvae were observed only in the moss of trees collected in fall. Therefore, they live preferably in snow packs with green snow algae and grow up. When the snow disappears, they move to moss of trees and reproduce there. This life history seems to adapt to the area where heavy snow seasonally covers.

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