Seasonal changes of chytrid infection of glacier algae in Alaska

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Recent darkening of the glacier surface has accelerated the melting rate of the ice. One of the reasons for the darkening is blooming of glacier algae, which have dark-colored pigments in their cells. The blooming of glacier algae is likely controlled not only by environmental conditions of the glacier surface, but also by chytrid fungus infections. Chytrids are a group of fungi which produce zoospores having flagellum. Parasitic chytrids are known to have a great impact on aquatic ecosystems, controlling population dynamics of host species and sometimes causing host extinction (Kagami et al., 2006). Yet, the impacts of parasitic chytrids on glacier algae and ecosystems are still unclear. We have revealed that the prevalence of chytrid infection on glacier algae, *Ancylonema nordenskioldii* (Fig.1), was higher in cryoconite holes than on ice surface. However, it is unknown how the prevalence of infection changes throughout the melting period. The purpose of this study is to describe the seasonal changes of chytrid infection of glacier alga in summer (June, August, and September) in cryoconite holes and on ice surface on the bare ice surface of Gulkana Glacier in Alaska.

Microscopic observation revealed there were chytrids infection glacier algae throughout three months (Fig.2). In June, chytrids infection started as soon as the algae appeared on the ice surface. In August, the prevalence of infection was 21.8% in cryoconite holes, and continued to be high in September. On the other hand, the prevalence of infection on the ice surface significantly increased from August (9.1%) to September (26.7%). This is probably due to increasing of melting water on the ice surface in which chytrid zoospores actively move to find the host algal cells. Increases of melting water and prevalence of infection may have been caused by the collapses of cryoconite holes and/or the changes of physico-chemical conditions on the ice surface due to frequent covering of new snow. Furthermore, algal conditions may have influenced the prevalence of infection. The filament length of *A. nordenskioldii* significantly differed between cryoconite holes and the ice surface. In cryoconite holes, most of the algal filament consisted of a single cell, which had higher infection rate in August and September. On the other hand, on the ice surface, the filament length was longer, and increased from June to August and decreased from August to September. The prevalence of infection was higher for short filament on the ice surface as well. These results indicate that chytrid infection occurred throughout three months of the melting period on the ice surface but accelerated in the late of the season and caused the shortening of algal filament.

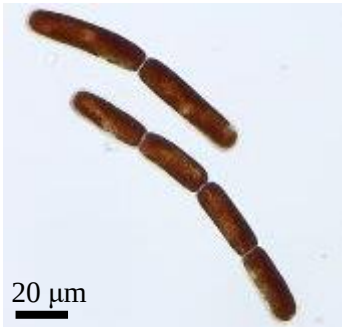

Figure.1 Glacier algae *Ancylonema nordenskioldii*.

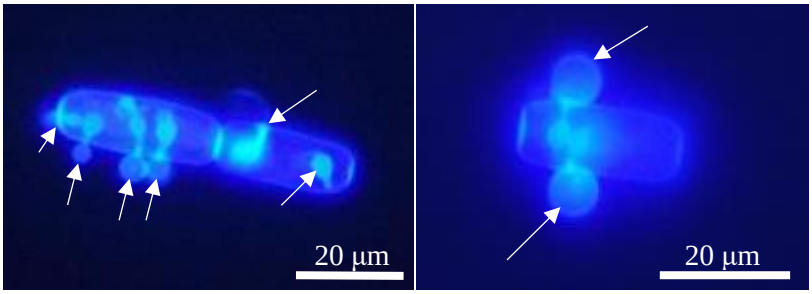

Figure.2 Chytrids infecting glacier algal cells under a fluorescence microscope. All arrows indicate chytrid fungi.

References

Maiko Kagami, Tek Bahadur Gurung, Takehito Yoshida and Jotaro Urabe, To sink or to be lysed: Contrasting fate of two large phytoplankton species in Lake Biwa, Limnology and Oceanography 51, 2775-2786, 2006.