Molecular biological evaluation of climate warming effects on activity of the moss ecosystem and moss habitat microbes in Arctic regions

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Related International Research Project
Title: Climate warming effects on moss pathogenic soil borne pathogens
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Abstract: Mosses play an important role as primary producer in polar regions. Many dying moss colonies were found in the moss carpets of Sanionia uncinata in Svalbard. In our previous results it was suggested that some soil borne plant pathogens were involved in dying of the moss. Climate warming may enhance their activity and lead to dying of moss on Svalbard. Purpose of this study is to clarify effects of climate warming on activity of the soil borne plant pathogens in the moss on Svalbard. The fungal diversity and disease development will be evaluated in every summer from 2003 to 2006 under open top chamber conditions in the field.

Description of the Program
The global warming caused by elevated atmospheric CO₂ has potential effects on terrestrial ecosystems. However, little is known how it affects the moss ecosystems and the microbe-soil-moss root system in the polar regions, where mosses and microbes play an important role as primary producer and degrader, respectively. Increased atmospheric concentration of CO₂ will alter in advance the activity and diversity of mosses, fungi, and bacteria in the moss carpet, and resultantly the structure and function of the moss-soil-microbe system of the polar regions, because it is considered that the global warming has more significant effects on high-latitude regions of the northern hemisphere than on other places.

The aim of this research program is to evaluate the effect of global warming on microbial activity and diversity in the moss ecosystem by molecular biological techniques. In the field experiments at the Arctic regions such as Greenland, Svalbard, and northern Russia open-top-chambers (OTP) are set on the moss carpets. Every summer from 2005 to 2010 mosses and soils are sampled. Mosses are examined for their biomass and species composition. Disease development of mosses by soil pathogens is also evaluated. Soils and moss roots are subjected to DNA extraction and then polymorphism of microbial rDNA genes is analyzed by the molecular techniques such as PCR-DGGE (polymerase chain reaction-denaturant concentration gradient gel electrophoresis).