

The applicability of lichens as indicator of radiocaesium fall-out following the Fukushima Daiichi nuclear accident

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Lichens are symbiotic organisms consisted of fungi and algae. A number of studies was carried out after the nuclear weapons tests and Chernobyl accident, and demonstrated that lichens were useful for indicator of radioactive fallout because (i) they spread in almost all terrestrial habitats e.g. on rocks, tree barks, and soils, (ii) they could take up large amount of radionuclides directly from their thallus due to lack of root system and retain them, and (iii) they were long-lived. It is necessary to understand the behavior of radiocaesium released into the environment from the Fukushima Daiichi nuclear power plant (FNPP) on March 2011, because it is considered to migrate in the ecosystem over a long period. For this purpose, some indicators of initial amount of deposited radiocaesium are required to be compared. Though, the amount of deposited radiocaesium on the topsoil gradually decreases by weathering, while lichens are expected to retain radiocaesium for long time. However, very little work is currently available on the concentration of radiocaesium in lichens and there is no experience of applying lichens to indicator of fall-out in Japan.

In this study, an applicability of lichens as an indicator for amount of deposited radiocaesium was discussed based on the following investigations related to the Fukushima Daiichi nuclear accident. The lichens were widely collected from the area in Fukushima prefecture (mainly west side) and Kanto region affected by the accident since December 2012. Lichen species were focused on parmelioid lichens which were widely distributed around FNPP. (1) After the lichens were removed from barks and dried, the concentrations of ¹³⁴Cs and ¹³⁷Cs in the lichens were measured with a CsI scintillation detector or a Ge semiconductor detector and compared to amount of ¹³⁷Cs deposited on the topsoil on June 2011 and air dose rate. (2) The retention capability of radiocaesium was evaluated by comparing radiocaesium concentrations in lichens to those of barks of lichen habitat.

The radiocaesium concentrations in lichens tended to be higher than those of barks, indicating that parmelioid lichens had retention capability of radiocaesium than tree barks. It was observed that the radiocaesium concentrations in lichens increased with increasing the amount of ¹³⁷Cs deposited on the topsoil and air dose rate. These results suggested the applicability of parmelioid lichens as an indicator of radiocaesium fall-out in Fukushima.

Keywords: Fukushima daiichi nuclear accident, Parmelioid lichens, radiocaesium