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The physical and chemical factor of snow coverage related to breeding of snow algae during the thaw season in Japan

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It is known that the phototrophic microorganism called snow algae breed on the surface of the snow coverage in thawing season. When snow algae breed, the reflectance of a snow surface decreases and melting snow coverage is promoted. Therefore, it is important to reveal factors of their breeding in order to predict melting of snow coverage. As for breeding of snow algae, it is mentioned that solar radiation required for photosynthesis, the existence of the water in snow coverage, CO2, pH, and nutrient. However, it is not revealed what the most direct related factor is. Therefore, in this study, it aimed at revealing factors of snow algae breeding. In the melting snow coverage of Tohkamachi Experimental Station, Forestry and Forest Products Research Institute in Niigata Prefecture (altitude is 200 m) and Murodou in Tateyama in Toyama Prefecture in Japan (altitude is 2400 m), the seasonal variation of snow alagae was quantitatively revealed using the chlorophyll-a in snow coverage, and the chlorophyll-a was compared with the weather, snow coverage, and snow physics model data.

As a result of measuring the chlorophyll-a concentration on the surface of snow coverage, chlorophyll-a concentration increased notably between in February to march in Tohkamachi Experimental Station, and between in May to July in Tateyama. It is revealed that the time of snow algae breeding differs in both areas. This difference of their breeding time indicates that snow algae does not breed at a specific season, but breeding time is decided by environmental conditions, such as temperature of each area, and conditions of snow coverage.

When the chlorophyll-a concentration was compared with result of the snow coverage conditions is calculated by the snow physics model in Tohkamachi Experimental Station, it was suggested that all layers of the snow coverage change granular snow and snow coverage is melting four days or more through day and night is the conditions on which snow algae starts breeding. It is thought that to change granular snow is conditions for snow algae in the ground under snow coverage swim to the snow surface. It is thought that melting of snow coverage period four days or more through day and night is the conditions for snow algae which arrived at the snow surface breed stably.

When increment of the chlorophyll-a concentration was compared with the melting period through day and night in Tohkamachi Experimental Station, it was thought that the amount of snow algae breeding increased rapidly only by the case melting of snow coverage period over four days through day and night. In case of melting of snow coverage period four days or more through day and night, Chlorophyll-a concentration increased 15 [ug / m2] or more. However, in case of melting of snow coverage period three days or less through day and night, the value of Chlorophyll-a concentration is not more than 15 [ug / m2]. These results indicate that steady breeding of snow algae in snow surface may require four days or more periods, as mentioned above. Furthermore, when Chlorophyll-a concentration was compared with climate conditions, in year with the more amount of rainfall than the amount of solar radiation (2010), the values of Chlorophyll-a concentration became larger. This result indicates a possibility that rain is promoting breeding of snow algae.

From the above result, conditions to start breeding of snow algae on the snow surface in Japan were considered that all layers of snow coverage change granular snow and the continuous melting period of snow surface through day and night is specific or more days. Furthermore, the factors which determines the amount of snow algae breeding were considered to be the length of melting period of snow surface through day and night, and rain.

Keywords: snow algae, consentration of chlorophyll a, snow physics model, water content of snow