

The relationship between distribution of snow algae and vegetation: Mt. Naeba, Japan.

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Ecosystems of snowy mountains in Japan are composed of unique biological communities. Snow algae are typical microorganisms growing on the snow surface in such ecosystems. They photosynthetically grow in the low temperature condition of the snow surface. They can visibly be observed as colored snow and distribute widely from the lower coniferous or deciduous forests to the alpine zone above timber line. Growth and community structure of snow algae may vary in different vegetation since nutrients and light conditions on the snow surface are affected by the vegetation. However, there is little information on the relationship between snow algae and vegetation in mountain regions in Japan. This study describes spatial and temporal variations of snow algae across a mountain slope from lower forest to upper alpine zone and examines the relationship between snow algae and vegetation.

Fieldworks were carried out three times in mid-April (from 13 to 14 April), end of April (29 to 30 April) and early May (9 to 11 May) in 2019 in Mt. Naeba located in Niigata prefecture, Japan. Surface snow samples were collected at ten sites (S1-S10) of different elevations of the western slope of the mountain.

Chlorophyll a concentrations and chemical solutes in the snow samples were analyzed in a laboratory in Chiba University. The chlorophyll a concentration significantly increased from mid-April to early May. It was higher at lowest two sites (S1 and S2) in the end of April to early May, and was also higher at site S7 in early May. The higher Chlorophyll a concentration at the lowest sites are probably due to more abundant snow algae caused by longer duration of snow melt. However, the high chlorophyll a concentration at the higher site (S7) suggests that the factor other than snow melt duration affects the algal growth. The chemical solutes in the snow surface showed that PO_4^{3-} was higher at the sites where the chlorophyll a concentration was high. The difference of PO_4^{3-} concentration in the snow surface may be due to the vegetation at the sites. The vegetation are coniferous trees (Cedar and Abies Mariesii) at sites S1, 2, 7, are broad leaf trees (Beech and Birch) at S3, 4, 5, 8 and are above timber line at S9 and 10. The PO_4^{3-} concentration in the surface snow greatly increased only at the sites of coniferous trees, suggesting that PO_4^{3-} was supplied from the trees. Since PO_4^{3-} was one of the essential nutrients for snow algae, it is likely to induce the growth of snow algae in the forest. The coniferous trees are typical vegetation in the heavy snow area in mountainous regions of Japan, and thus they are likely to provide favorable conditions for snow algal growth in the regions.

Keywords: Snow algae, Vegetation, Snow mountains