

SOIL NUTRIENT CONDITION RELATED TO THE DISTRIBUTION  
OF TERRESTRIAL ALGAE NEAR SYOWA STATION,  
ANTARCTICA (EXTENDED ABSTRACT)

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In general the duration and the amount of available water are the most crucial factors in limiting the distribution of terrestrial Antarctic biota. The soil nutrient condition is also a factor affecting the biota. The present study aims at the examination of the relation between the water content with nutrients and the terrestrial epipsammic algae and coexisting free living algae in the soil.

For this purpose four sets of soil samples were collected in the vicinity of Syowa Station (69°00'S, 39°35'E), Antarctica. One was sampled along a transect cutting across the beach of a fresh water lake, Lake Minami, East Ongul Island. The second set was collected along an outward line from the center of the presently occupied Adélie penguin rookery and the third along a similar line selected in an abandoned Adélie rookery in Ongulkalven. The last was taken at sterile sites in East Ongul Island.

The chlorophyll *a* concentration was measured according to the standard method by UNESCO (1966). Measurement of phosphate and nitrate concentrations in the water

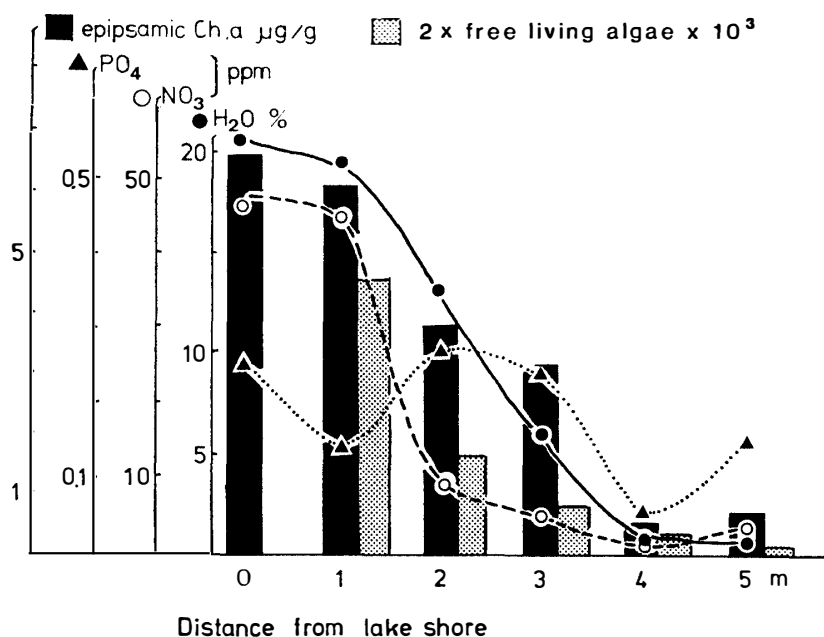


Fig. 1. Distribution of epipsammic and free living algae and the related environmental condition in a lake shore near Syowa Station, Antarctica.

extract of soil was made with a conventional colorimeter, Central Kagaku Co., HC 1000. For the counting of free living algae cells the BBM agar plate method was employed.

In the lake shore samples, a positive correlation between the water content and the chlorophyll concentration in the soil was observed. Concentration of chlorophyll *a* which was derived mainly from epipsammic algae and negligibly from free living algae was high in the soaked soil and decreased in the dry soil distant from the water body (Fig. 1). The number of the free living algae mainly comprising Chlorophyceae and Xanthophyceae was large at the station close to the shore line and decreased in the dry soil distant from the shore. However, free living algal cells were not found in the shore line sample. The nitrate concentration was correlated positively with both water and chlorophyll and was high in the soaked soil. Contrarily the phosphate concentration was higher at the sites of 2–3 m distant from the shore than at the shore line. Moreover, a positive relation between the water content of the soil and the chlorophyll *a* concentration was comprehensively observed over the data obtained from the Syowa Station area (Fig. 2). A positive correlation among nitrate, water and chlorophyll was also comprehensive (Fig. 3). The phosphate must have been introduced through the wind-borne salt spray from penguin rookeries, and the distribution of nitrate in the present samples seemed to be the product of nitrogen fixation by cyanophyta.

Studies of soil samples obtained from areas including Adélie penguin rookeries showed that chlorophyll concentration was high in the eutrophicated soil around the rookery compared with the intact soil of East Ongul (Fig. 4). There was no difference

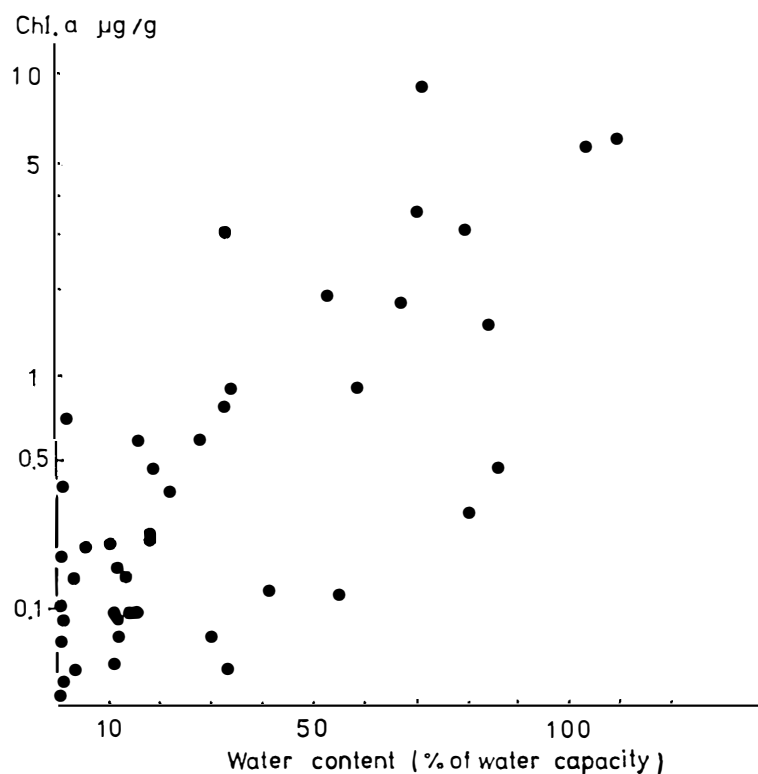


Fig. 2. Relationship between the soil water content and the chlorophyll *a* concentration of terrestrial algae.

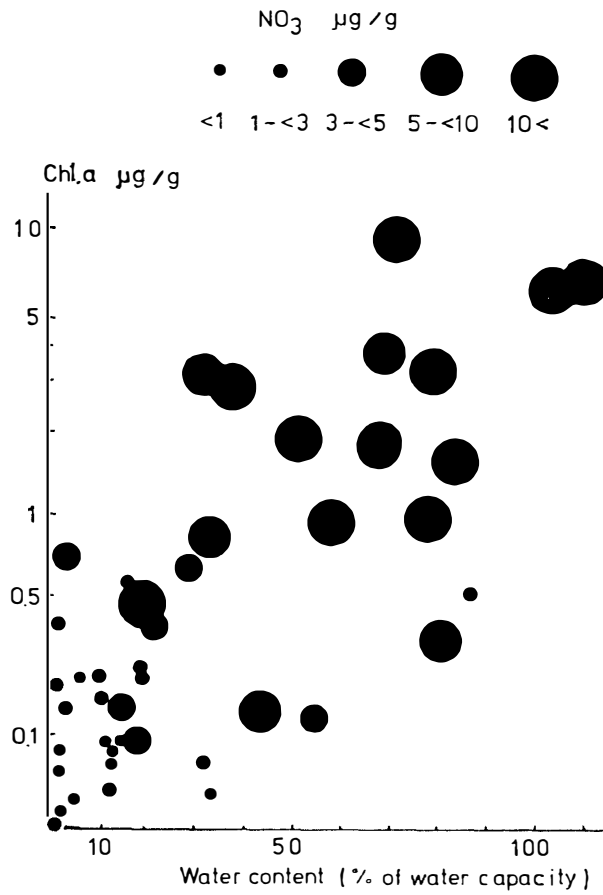


Fig. 3. Relationship between water content, NO<sub>3</sub> and chlorophyll a concentration.

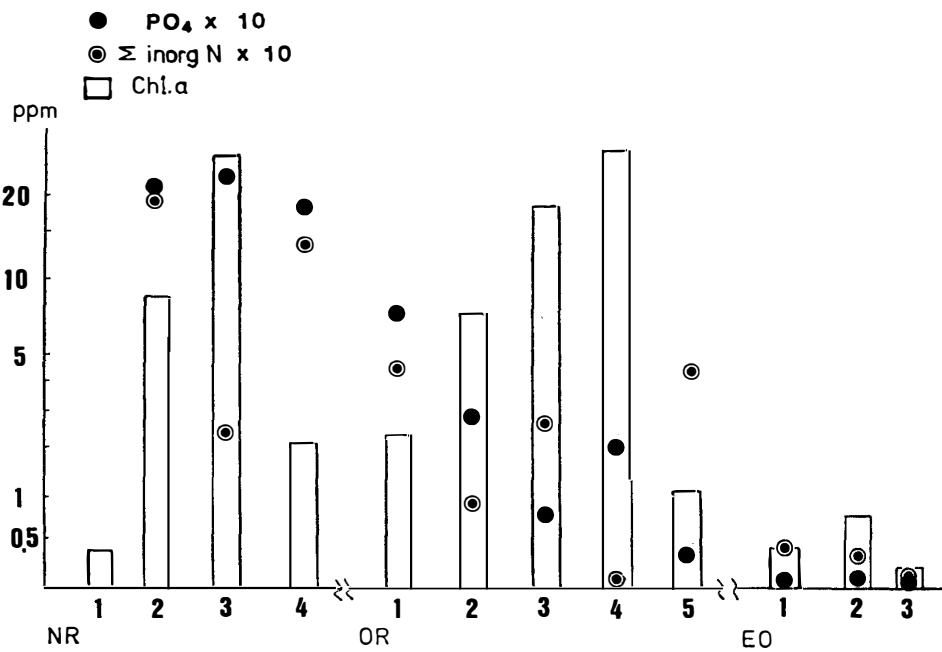


Fig. 4. Distribution of epipsammic algae and the related nutrient condition of soils in a presently occupied (NR), an abandoned (OR) penguin rookeries in Ongulkalven and at sterile site (EO) in East Ongul Island.

in the chlorophyll concentrations, which were high, between the soil around the present rookery and that around the abandoned rookery though the remarkable difference in the phosphate and nitrate concentrations was observed (Fig. 4). Further examinations are needed to know the relation between the chlorophyll concentration and the amount of phosphate and nitrate. Although the high concentrations of phosphate and nitrate were detected from the central parts of both new and old rookeries, the chlorophyll concentration in these parts was low. As for this point, the present authors reported that the oxalic acid and acrylic acid contained in the Adélie penguin excrement prevented the growth of algae (AKIYAMA *et al.*, 1986). In the culture of the soils outside of rookeries and of the intact area of East Ongul Island, *Stichococcus*, *Koliella*, *Klebsormidium*, *Chlorococcum*, *Tetracystis*, *Myrmecia*, *Dictyosphaerium*, *Pleurochloris*, *Botrydiopsis*, *Heterothrix* and others appeared commonly. However, free living algal cells did not grow in the culture of soils in the center of penguin rookeries.

#### References

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(Received March 26, 1986; Revised manuscript received September 19, 1986)