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# LATITUDINAL DIFFERENCES IN TEMPERATURE ADAPTATION PATTERN OF PHYTOPLANKTON PHOTOSYNTHETIC ACTIVITY (ABSTRACT)

Tamiji YAMAMOTO

*Faculty of Applied Biological Science, Hiroshima University, Kagamiyama, Higashi Hiroshima 724*

Surface seawater was collected at 10 stations in the southern hemisphere (3 in the subtropical/tropical, 2 in the subantarctic and 5 in the Antarctic waters, respectively) during the "BIOMASS" cruise of R/V HAKUHO MARU, from November 22, 1983 to February 24, 1984. Carbon incorporation rate of natural phytoplankton communities was measured using $^{14}C$ radioisotope under different temperatures including the ambient temperature. The communities north of the Polar Front attained the maximum photosynthetic activity at the temperature *in situ* (5.8–16.5 $\mu$gC·$\mu$g chl. $a^{-1}\cdot h^{-1}$ in the subtropical/tropical water, and 5.0–5.4 $\mu$gC·$\mu$g chl. $a^{-1}\cdot h^{-1}$ in the subantarctic water). However, the pattern of the photosynthesis-temperature curves was different; the subtropical/tropical community showed a sharp decrease in photosynthetic activity (losing the activity at *ca.* 23°C and 40°C from the extrapolation of fitted curve) as compared with the subantarctic community (not losing the activity even at 0°C but at 30°C). These results were considered to reflect the difference in the seasonal variation of temperature in the respective waters; usually stable temperature condition is noticed in the subtropical/tropical region, while relatively marked seasonality exists in the subantarctic water. On the other hand, the photosynthetic activity of Antarctic phytoplankton south of the Polar Front increased *ca.* 1.5 times with rising incubation temperature up to *ca.* 10°C in comparison with those obtained at the temperature *in situ*, and then it decreased with the loss of the activity at *ca.* 20°C. This implies that photosynthesis of the Antarctic phytoplankton is suppressed by the low temperature of the inhabiting environment. However, the maximum photosynthetic rate (9.2 $\mu$gC·$\mu$g chl. $a^{-1}\cdot h^{-1}$) obtained at the temperature *in situ* was considerably high, and the range of the values obtained at the temperature *in situ* (1.8–9.2 $\mu$gC·$\mu$g chl. $a^{-1}\cdot h^{-1}$) was not significantly different from those obtained in the other two waters. Since natural selection has generally acted to maximize the growth rate of organisms, the organism possessing higher growth rate in the inhabiting environmental temperature could be considered to adapt itself to the ambient temperature. Although $^{14}C$ incorporation rate is not equal to the growth rate in a strict sense, the assimilation number can be accepted as an estimate of growth rate for phytoplankton; both the assimilation number and the growth rate are considered to be reciprocal if the community asynchronously grows in a steady state in nature. Therefore, it could be concluded that the phytoplankton community in the Antarctic Ocean as well as those in the otehr two waters have been adapted to the inhabiting temperature, respectively, although the suppression of the growth by the cold environmental temperature was found for the Antarctic community.

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