

Short- and long-term effects of solar ultraviolet radiation on the red algae *Porphyridium cruentum* (S. F. Gray) Nägeli

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During spring 2002 and fall 2003 we carried out experiment in tropical southern China to determine the short- and long-term effects of solar ultraviolet radiation (UVR, 280–400 nm) on photosynthesis and growth in the unicellular red alga *Porphyridium cruentum*. During the experimentation, cells of *P. cruentum* were exposed to three radiation treatments: (a) samples exposed to PAR (400–700 nm) + UV-A (315–400 nm) + UV-B (280–315 nm) (PAB treatment); (b) samples exposed to PAR + UV-A (PA treatment) and, (c) samples exposed only to PAR (P treatment). To assess the short-term impact of UVR as a function of irradiance, we determined photosynthesis *versus* irradiance (*P vs. E*) curves. From these curves the maximum carbon uptake rate (P_{\max}) and the light saturation parameter (E_k) were obtained, with values of ~ 12.8 – $14.4 \mu\text{g C } (\mu\text{g chl } a)^{-1} \text{ h}^{-1}$, and $\sim 250 \mu\text{mol m}^{-2} \text{ s}^{-1}$, respectively. A significant UVR effect on assimilation numbers was observed when samples were exposed at irradiances higher than E_k , with samples exposed to full solar radiation having significant less carbon fixation than those exposed only to PAR. Biological weighting functions of *P. cruentum* were used to evaluate the UVR impact per unit energy received by the cells; the data indicate that the species is as sensitive as natural phytoplankton from the southern China Sea; however, it is much more resistant than Antarctic assemblages. When evaluating the combined effects of mixing speed and UVR, it was seen that samples rotating fast within the upper mixed layer were less inhibited by UVR as compared to those under slow mixing or in fixed samples. Growth of *P. cruentum* over a week-long experiment was not affected by neither UVR nor UV-A; additionally, low photoinhibition was found at the end as compared to that at the beginning of this experiment. Our results thus indicate that, although on short-term basis *P. cruentum* is affected by solar UVR, it can acclimate to minimize UVR-induced effects when given enough time.

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