Photosynthesis Research **78:** 119–132, 2003.

Regular paper

Effects of solar radiation on the Patagonian rhodophyte *Corallina officinatis* (L.)

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Received 12 November 2002; accepted in revised form 26 June 2003

Key words: Corallina, PAM fluorescence, photoinhibition, photosynthetic yield, Rhodophyceae, solar ultraviolet radiation

Abstract

Experiments were conducted in Patagonian waters (Argentina) to assess the impact of solar radiation (PAR, 400–700 nm, and UVR, 280–400 nm) upon two strains of the red alga *Corallina officinalis* Linnaeus, characteristic of the mid and lower intertidal zone, during March 2000. Fluorescence parameters were determined using a pulse amplitude modulated (PAM) fluorometer. The two strains had different initial optimal quantum yields but similar strong decreases in the quantum yield when the algae were exposed to short-term solar radiation and similar recovery characteristics in dim light. The quantum yield had the lowest values at noon, but it increased in the afternoon / evening hours, when irradiances were lower. PAR (irradiance at noon about 500 W m^{-2}) was responsible for most of the decrease in the yield ($\sim$ 50%) on clear days, with UVR accounting for a significant increment. However, on cloudy days the UVR component caused an even more pronounced decrease. In their natural environment, specimens in the shade had a higher effective quantum yield than in sun-lit areas. Fluence rate response curves indicated that thalli from the mid intertidal had a pronounced nonphotochemical quenching at intermediate and higher irradiances; however, this was not observed in the thalli from the lower intertidal. Fast induction and relaxation kinetics showed obvious differences between the two strains, but also demonstrated a rapid adaptation of the species to the changing light conditions as well as a fast decrease of PS II fluorescence upon exposure to solar radiation. All photosynthetic pigments were bleached during exposure to solar radiation over a full day. Strong absorption in the UV-A range, most likely due to mycosporine like amino acids, was determined in both strains. The study of the differential sensitivity to solar radiation and recovery capacity of these *Corallina* strains, as well as the presence of protective compounds, suggests that a combination of mechanisms allow these algae to adapt to the relatively high radiation levels and fast changes in irradiance found in the Patagonian area at this time of the year.

Abbreviations: Fm – maximal fluorescence in a dark-adapted plant, all reaction centers are closed; Fo – initial chlorophyll fluorescence in a dark-adapted plant, all reaction centers are open; Fv – variable fluorescence = Fm – Fo; Fo′, Fm′ and Fv′ – the same for the light-adapted state; Ft – current fluorescence of a light-adapted plant; PAM – pulse amplitude modulated fluorometer; PAR – photosynthetic active radiation; PS II – Photosystem II; qN – non-photochemical quenching; qP – photochemical quenching