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In situ effects of solar radiation on photosynthesis in the Patagonian Rhodophyte, *Porphyra columbina* Montagne

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Abstract

The effect of solar radiation (PAR, 400 – 700 nm UV-B, 280 – 315 nm and UV-A, 315 – 400 nm) on the photosynthetic performance of the Rhodophyte Porphyra columbina Montagne was studied in situ in Patagonia waters (Argentina). A pulse amplitude modulated (PAM) fluorometer was used to determine the fluorescence parameters. The species grows in the eulittoral on exposed rocks and falls dry during low tide. During exposure to full sunlight the photosynthetic quantum yield had its lowest values at noon, but it recovered when irradiances were lower. PAR (irradiance at noon about 500 W m^{-2}) was responsible for most of the photoinhibition on clear days, but UV-A, and UV-B even more so, accounted for a significant increment. Also in its natural environment Porphyra was strongly photoinhibited

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during exposure to unfiltered solar radiation. The species is adapted to low irradiances and shows a pronounced non-photochemical quenching at intermediate and higher irradiances as indicated by fluence rate response curves. But it showed rapid adaptation indicated by induction and recovery kinetics as well as fast induction curves. The photosynthetic pigments were bleached when exposed to solar radiation over a full day as compared to a dim light control. Strong absorption in the UV-A range is most likely due to mycosporine like amino acids. The pronounced sensitivity to solar radiation in situ and the recovery capacity of this rhodophyte species, as well as the abundance of protective compounds, suggests that this macroalga can adapt to the high irradiances and fast changes in solar radiation found in the Patagonia waters.