THESIS ABSTRACT

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Title Photoinhibition resistance in the red alga *Porphyra perforata*

In this study, the susceptibility of gametophytes of the marine red algae *Porphyra perforata* J. Agardh and *Porphyra nereocystis* Anderson to photoinhibition of photosynthesis by high intensity white light is compared. *Porphyra perforata* gametophytes inhabit the high intertidal zone of the shore where they experience severe desiccation in full sunlight during low tides. *Porphyra nereocystis* gametophytes grow epiphytically on the stipes of the giant kelp *Nereocystis luetkeana* (Mertens) Postels and Ruprecht where they do not normally experience either desiccation or full sunlight. In the laboratory, under conditions of full hydration and optimal temperature, *P. perforata* was found to be considerably more resistant to photoinhibition of photosynthesis by white light than was *P. nereocystis*. The photoinhibition resistance of *P. perforata* relative to *P. nereocystis* persisted after acclimation to low growth light intensity in culture and is, therefore, a genotypic photoadaptation of photosynthesis rather than a phenotypic response to growth light intensity.

By blocking photoinhibition recovery with the drug chloramphenicol, the reduced rate of photoinhibition exhibited by *P. perforata* relative to *P. nereocystis* was found to be the result of a reduced rate of damage to the chloroplast encoded protein of the PS II complex that is the primary site of photoinhibition. By elimination, the possible mechanisms that might reduce the rate of damage to this protein were narrowed to two: an alteration of the structure of proteins at or near the primary site of photoinhibition in the PS II complex that increases the stability of the primary site and/or an increase in the rate of radiationless decay of excitation at the reaction center of PS II that reduces excess excitation in the vicinity of the primary site.

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