ABSTRACT

Cellular concentrations of the major light-harvesting photosynthetic pigments chlorophyll *a*, chlorophyll c_2 and peridinin of the endosymbiotic dinoflagellate alga *Symbiodinium* (= *Gymnodinium*) *microadriaticum* Freudenthal were determined using algae freshly isolated from three species of hermatypic scleractinian corals (*Montastrea annularis*, *Agaricia agaricites* and *Acropora palmata*), three actiniarians (*Bartholomea annulata*, *Heteractis lucida* and *Lebrunia danae*), and a rhizostome scyphozoan (*Cassiopea frondosa*). Photosynthetically active radiation (400–700 nm) was determined from the surface to a depth of 50 m using a quantum radiometer coupled with selected filters and exhibited a 90% reduction in overall intensity together with marked attenuation of wavelengths greater than 550 nm over this bathymetric range.

Algae isolated from the different host species exhibited significant species-specific differences in the total cellular pigment content, cellular concentrations differing by almost an order of magnitude between extreme species. Generally, the more sciophilic cnidarian species harboured algae characterised by higher cellular pigment concentrations, however only minor differences were found to exist with respect to the pigment molar ratios indicating that the increased pigment content resulted from increases in the number rather than size of photosynthetic units per algal cell.

Algae isolated from the euryphotic coral *M. annularis* exhibited a consistent increase in the cellular content of all three major light-harvesting pigments in response to conditions of reduced irradiance. The accessory pigment peridinin showed the greatest

proportional increase based upon the molar ratios of the three pigments and indicates that photoadaptive adjustments of the light-harvesting apparatus of S. microadriaticum isolated from this species is achieved by an increase in the size of the photosynthetic unit. In contrast, algae from the euryphotic coral species A. agaricites showed little change in cellular pigmentation over a depth range of 0-50 m, the high cellular pigment concentrations found in this species only diminishing in shallow water colonies following a change in colony orientation that increases the intercepted irradiance. Similarly, algae isolated from the stenophotic coral A. palmata exhibited no changes in cellular pigmentation throughout this species natural bathymetric range (0-8 m) nor following the transplantation of colonies to depths up to 24 m (equivalent to a 70% reduction in irradiance intensity).

Determination of the iso-electric conformer pattern of the light-harvesting photosynthetic chromoprotein peridinin-chlorophyll a-protein (PCP) revealed no variation in the pattern of conformers present in algae isolated from different growth forms of the coral A. agaricites collected from depths of 1 to 60 m, with five conformers occuring in the acidic range characterised by pI values of 4.93, 5.08, 5.14, 5.26 and 5.46.

The consistent differences in the cellular concentrations of the three major photosynthetic pigments that were found to occur in algae isolated from different host species may be considered as supportive evidence for the segregation of S. microadriaticum into distinct 'strains' or 'varieties' however in view of the

electrophoretic uniformity of the PCP conformer pattern with that determined for algae isolated from other host species, an alternative hypothesis is proposed suggesting that the observed differences in algal pigmentation may arise from interspecific differences in the growth/division rate of the algae.