

**European Society for Photobiology
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Report of Rossana Del Vecchio

Report on the project

“INFLUENCE OF UV RADIATION ON THE PRODUCTION OF PIGMENTS BY GREEN MICROALGAE”
by R. Del Vecchio.

The influence of ultraviolet-visible light on the production of photoprotective compounds (mycosporine-like amino acids, MAAs) was investigated for selected species of phytoplankton and cyanobacteria. This research was conducted in collaboration with Dr. Francesco Ghetti and Dr. Costanza Bagnoli at the Institute of Biophysics of the Italian National Research Council, Pisa, Italy) during a two-week period (December 9-20, 2002).

Support for this research was provided by the European Society of Photobiology (ESP) (awards to young photobiologists for short visits in European Photobiology Laboratories).

Green microalgae (*Dunaliella salina* and *Chlorella kessleri*) and a cyanobacterium (*Synechococcus* sp.) were continuously exposed to polychromatic light for extended periods of time (up to 120 hr). Combined long pass cut-off filters were employed to select different light regimes: a) 280 nm + quartz; b) 305 nm + 225 nm; c) Sanalux (S) + Tempax (T) glass; d) 400 nm + quartz. An example of the lamp output is reported for the S+T case (Fig. 1).

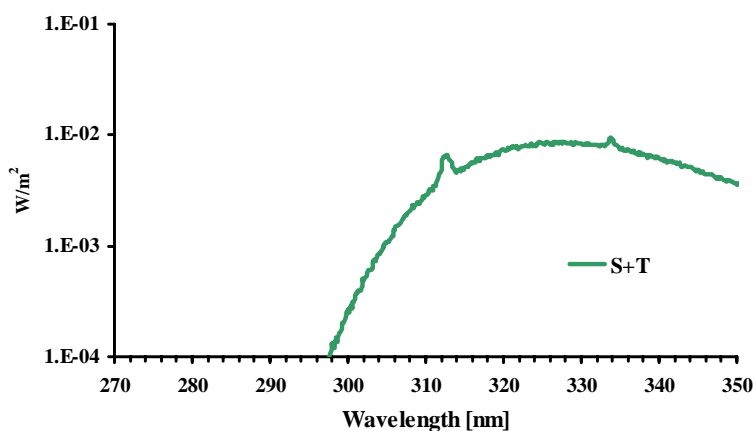


Figure 1. Lamp output with S+T filters.

During the light exposure, an aliquot of the exposed cultures was sampled every 24 hr and the following measurements were conducted:

- i) cell counts;
- ii) PAM measurements;
- iii) following filtration of cell culture on the GF/F filter, the absorption spectrum of the total particulate material ($a_{tot}(\lambda)$) retained on the GF/F filter was measured (Yentsch and Phynney, 1989; Mitchell, 1990);
- iv) following methanol (MeOH) extraction of the soluble particulate material, the absorption spectrum of the non-MeOH extractable material (i.e., that retained on the GF/F filter) (particulate detrital material, $a_d(\lambda)$) was measured (Yentsch and Phynney, 1989; Mitchell, 1990);

- v) the absorption spectrum of the MeOH extractable material was also measured twice independently: 1) directly by measuring the absorption of the MeOH elute ($a_{\text{MeOH}}(\lambda)$); and 2) indirectly by subtracting the $a_d(\lambda)$ spectrum from the $a_{\text{tot}}(\lambda)$ spectrum, ($a_p(\lambda)$).

All the data presented here have to be considered very preliminary and still under analysis.

Although we expected production of MAAs upon exposure to different light fields, none of the species employed in this study (*Dunaliella salina*, *Chlorella Kessler* and *Synechococcus* sp.) seemed to follow this pattern (Figs. 2-3-4). Previous studies however had shown production of MAAs in *Dunaliella tertiolecta* (Hannach and Sigleo, 1998) and in *Synechococcus* sp. (Garcia-Pichel and Castenholz, 1993). This response, although small, appeared to be due primarily to PAR+UV-A radiation at least for *Dunaliella tertiolecta*. Unfortunately in this study only UV-B or PAR radiation was employed, making a direct comparison between these studies not entirely correct. On the contrary, no production of MAAs for *Chorella minutissima* and *sorokiniana* was previously reported (Xiong et al., 1997 and 1999).

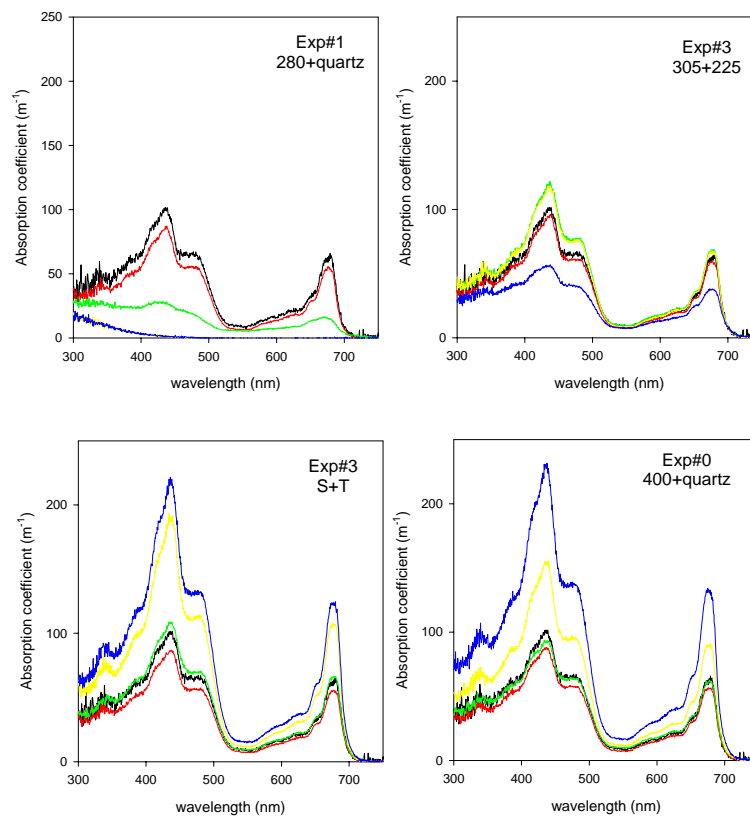


Figure 2. *Dunaliella salina*: absorption spectra of the total particulate material a_{tot} upon exposure to different light fields for 0, 24, 72, 120 hrs of irradiation

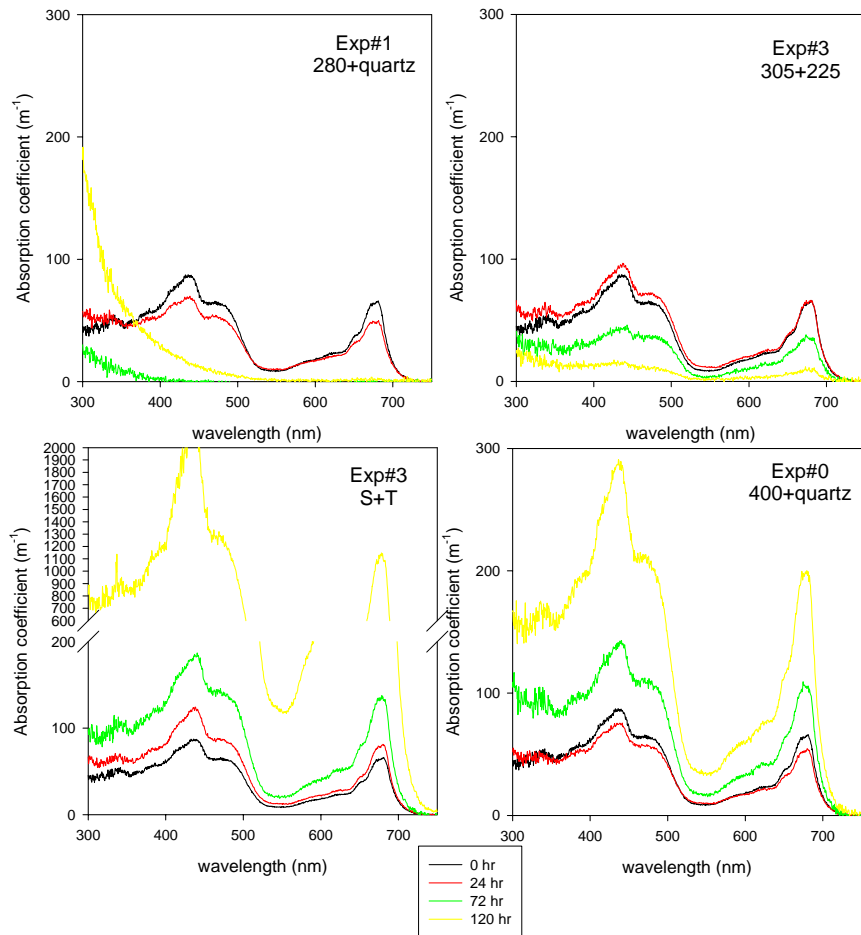


Figure 3. *Chlorella Kessleri*: absorption spectra of the total particulate material a_{tot} upon exposure to different light fields for 0, 24, 72, 120 hrs of irradiation.

From the literature it appears that the light induced production of MAAs is species-specific; not all the species respond to high levels of light by releasing photoprotective pigments as the MAAs. In addition, the light field employed in this study was depleted in UV-A radiation and was continuous in time (no light/dark periods), thus differing from literature protocols. Future work should be directed on studying the effect of UV-A+PAR and UV-A+UV-B+PAR on MAAs release. This approach will help understanding the role of UV-A versus UV-B on the MAAs induction. A far more interesting and challenging question that needs to be answered would be to understand the factor(s) controlling the species-specific response of MAAs induction, i.e. why some species do produce MAAs and others don't.

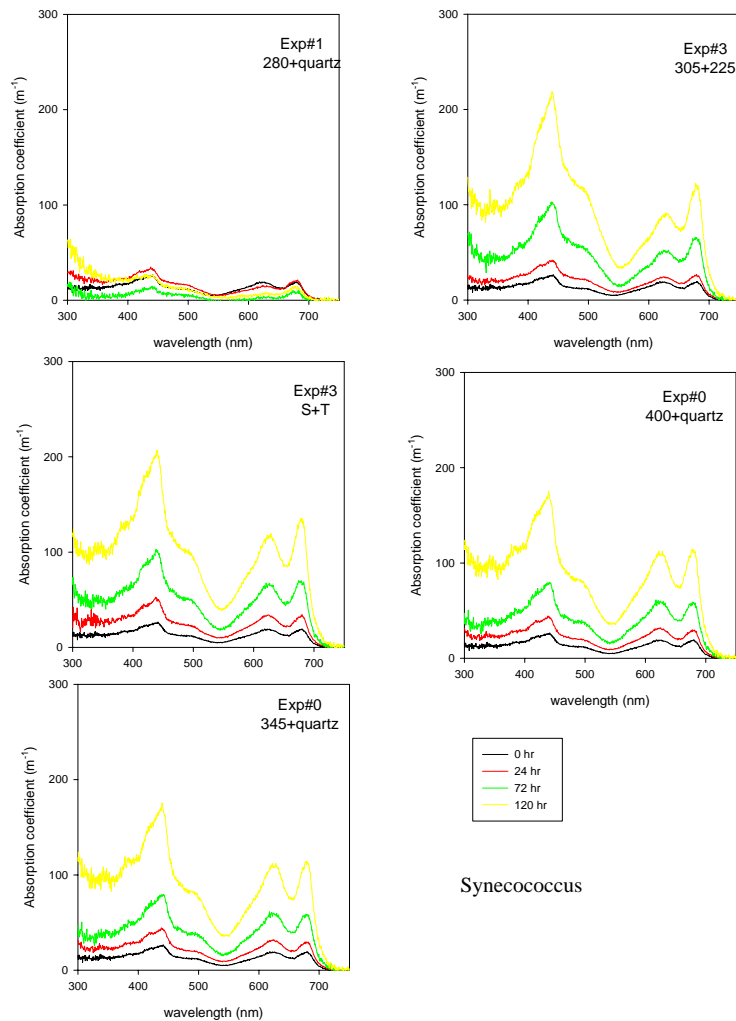


Figure 2. *Synechococcus* sp: absorption spectra of the total particulate material a_{tot} upon exposure to different light fields for 0, 24, 72, 120 hrs of irradiation.

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