The red seaweed Pterocladiella capillacea, an alga which occurs along the southeastern and southern Brazilian coastline, is an excellent source of agar. Ultraviolet radiation has become an increasing concern since discovering the ozone hole in Antarctica, which has resulted in the release of such atmospheric pollutants as chlorofluorocarbons, halocarbons, chlorocarbons, dioxins and carbon dioxide. At the same time, ecosystems around the world have also been polluted by the presence of heavy metals, and algae can, by their participation in many food chains, contribute to the contamination of other organisms. In particular, copper is found in low concentrations in algae species, and it is essential for metabolic processes such as photosynthesis. Based on its contribution to the important supply of agar, Pterocladiella capillacea was evaluated in this study to determine the effects of ultraviolet radiation (PAR+UVA+UVB), PAR+copper in different concentrations, and the combined effects of PAR+UVA+UVB + copper on morphology and cell organization. Control samples of P. capillacea stained with Periodic Acid-Schiff exhibited a positive reaction in the cell wall and floridean starch grains. On the order hand, P. capillacea-treated plants revealed a decrease in the density of floridean starch grains in the cells. When observed by transmission electron microscopy, P. capillacea control cells showed a somewhat vacuolated cortical region filled with numerous chloroplasts and some starch grains, all surrounded by a thick cell wall. The chloroplasts assumed the typical internal unstacked organization of red algae, i.e., evenly spaced thylakoids. Electron-dense lipid droplets described as plastoglobuli were observed between the thylakoids. However, after exposure to PAR+UVA+UVB for 3 h per day during a 7-day period, P. capillacea was observed to undergo ultrastructural changes, including irregularly shaped cortical cells with increased vacuolation and increased cell wall thickness with concentric layers of microfibrils. In addition, chloroplasts showed visible changes in ultrastructural organization, including irregular morphology (Figs. 1a-b). Plants of P. capillacea exposed to PAR + copper in different concentrations showed fewer ultrastructural changes; the thylakoid membranes showed no demonstrable ultrastructural damage (Fig.1c). However, the combination of PAR+UVA+UVB+ copper caused more dramatic changes than did PAR+UVA+UVB and PAR+copper treatments, with the cortical cells showing the greatest reduction in cytoplasmic cell volume. In addition, the chloroplasts were degenerated and disrupted (Fig.1d).

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Fig. 1: Figure 1: Transmission electron microscopy micrographic images of P. capillacea. a. Detail of cortical cell with many starch grains (S) and thick cell wall (CW). b. Observe the irregular shape chloroplast (C) and a presence of vacuoles (V). c. Observe the absence of changes in chloroplast. d. Note the degenerated and disrupted chloroplast.