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Effects of Solar UV Radiation on Morphology and Photosynthesis of Filamentous Cyanobacterium *Arthrospira platensis*

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To study the impact of solar UV radiation (UVR) (280 to 400 nm) on the filamentous cyanobacterium *Arthrospira* (*Spirulina*) *platensis*, we examined the morphological changes and photosynthetic performance using an indoor-grown strain (which had not been exposed to sunlight for decades) and an outdoor-grown strain (which had been grown under sunlight for decades) while they were cultured with three solar radiation treatments: PAB (photosynthetically active radiation [PAR] plus UVR; 280 to 700 nm), PA (PAR plus UV-A; 320 to 700 nm), and P (PAR only; 400 to 700 nm). Solar UVR broke the spiral filaments of *A. platensis* exposed to full solar radiation in short-term low-cell-density cultures. This breakage was observed after 2 h for the indoor strain but after 4 to 6 h for the outdoor strain. Filament breakage also occurred in the cultures exposed to PAR alone; however, the extent of breakage was less than that observed for filaments exposed to full solar radiation. The spiral filaments broke and compressed when high-cell-density cultures were exposed to full solar radiation during long-term experiments. When UV-B was screened off, the filaments initially broke, but they elongated and became loosely arranged later (i.e., there were fewer spirals per unit of filament length). When UVR was filtered out, the spiral structure hardly broke or became looser. Photosynthetic O_2 evolution in the presence of UVR was significantly suppressed in the indoor strain compared to the outdoor strain. UVR-induced inhibition increased with exposure time, and it was significantly lower in the outdoor strain. The concentration of UV-absorbing compounds was low in both strains, and there was no significant change in the amount regardless of the radiation treatment, suggesting that these compounds were not effectively used as protection against solar UVR. Self-shading, on the other hand, produced by compression of the spirals over adaptive time scales, seems to play an important role in protecting this species against deleterious UVR. Our findings suggest that the increase in UV-B irradiance due to ozone depletion not only might affect photosynthesis but also might alter the morphological development of filamentous cyanobacteria during acclimation or over adaptive time scales.