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Responses of photosynthetic properties and chloroplast ultrastructure of two moss crusts from a desert biological soil crust to supplementary UV-B radiation

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Our understanding of plant responses to supplementary ultraviolet-B (UV-B) radiation due to stratospheric ozone depletion has improved over recent decades. However, research on biological soil crusts (BSCs) is scarce and it remains controversial. Laboratory studies were conducted to investigate the influence of UV-B radiation on the Bryum argenteum and Didymodon vinealis isolated from BSCs, which are both dominant species in moss crusts found within patches of shrubs and herbs in the Tengger Desert of northern China. The aim of the current work was to evaluate whether supplementary UV-B radiation affected photosynthetic properties and chloroplast ultrastructure of two moss crusts and whether response differences were observed between the crusts. Four levels of UV-B radiation of 2.75 (control), 3.08, 3.25, and 3.41 W m-2 was achieved using fluorescence tube systems for 10 days, simulating 0, 6, 9, and 12% of stratospheric ozone at the latitude of Shapotou, respectively. We measured photosynthetic apparatus as assessed by chlorophyll a fluorescence parameters, photosynthetic pigment contents, and observations of chloroplast ultrastructure. Additionally, soluble proteins and UV-B absorbing compounds were simultaneously investigated. The results of this study showed that chlorophyll a fluorescence parameters (i.e. the maximal quantum yield of PSII photochemistry, the effective quantum yield of PSII photochemistry, and photochemical quenching coefficient), photosynthetic pigment contents, soluble protein contents, total flavonoid contents and the ultrastructure were negatively influenced by elevated UV-B radiation and the degree of detrimental effects significantly increased with the intensity of UV-B radiation. Moreover, results demonstrated that the negative effects on photosynthesis and chloroplast ultrastructure were more serious in B. argenteum than that in D. vinealis. These results may not only provide a potential mechanism for supplemental UV-B effects on photosynthesis of moss crusts, but also establish a theoretical basis for further studies of adaptation and response mechanisms of desert ecosystems under further ozone depletion.