Solar UV-B effects on PSII performance in Betula nana are influenced by PAR level and reduced by EDU - DTU Orbit (11/08/2019)

Solar UV-B effects on PSII performance in Betula nana are influenced by PAR level and reduced by EDU: results of a 3-year experiment in the High Arctic

The long-term and diurnal responses of photosystem II (PSII) performance to near-ambient UV-B radiation were investigated in High Arctic Betula nana. We conducted an UV exclusion experiment with five replicated blocks consisting of open control (no filter), photosynthetic active radiation and UV-B transparent filter control (Teflon), UV-B-absorbing filter (Mylar) and UV-AB-absorbing filter (Lexan). Ethylenediurea (EDU), a chemical normally used to protect plants against ozone injury, was sprayed on the leaves both in the field and in an additional laboratory study to investigate if EDU mitigated the effects of UV-B. Chlorophyll-a fluorescence induction curves were used for analysis of OJIP test parameters. Near-ambient UV-B radiation reduced across season maximum quantum yield (TRo /ABS = Fv /Fm), approximated number of active PSII reaction center (RC/ABS) and the performance index (PIABS), despite improved leaf screening against UV-B with higher content of UV-B-absorbing compounds and a lower specific leaf area. EDU application counteracted the negative impact of UV-B on TR(o) /ABS, RC/ABS and PI(ABS). This indicates that the mechanisms behind UV-B and ozone damage share some common features. The midday depression was present in all treatments, but TR(o) /ABS and PI(ABS) were persistently lower in near-ambient UV-B compared to UV-B reduction. The recovery phase was particularly impaired in near-ambient UV-B and interactive effects between treatment × hour raised TRo /ABS, RC/ABS and PIABS higher in reduced UV-B compared to near-ambient UV-B. This demonstrates current solar UV-B to reduce the PSII performance both on a daily as well as a seasonal basis in this High Arctic species.

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