

Effects of elevated temperature and CO₂ concentration on photosynthesis of the alpine plants in Zoige Plateau, China

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Abstract: Increasing temperature and carbon dioxide concentration are the important aspects of global climate change. Alpine ecosystem response to global change was more sensitive and rapid than other ecosystems. Increases in temperature and atmospheric CO₂ concentrations have strong impacts on plant physiology. Photosynthesis is the basis for plant growth and the decisive factor for the level of productivity, and also is a very sensitive physiological process to climate change. In this study, we examined the interactive effects of elevated temperature and atmospheric CO₂ concentration on the light response of photosynthesis in two alpine plants *Elymus nutans* and *Potentilla anserine*, which were widely distributed in alpine meadow in the Zoige Plateau, China. We set up as follows: the control (Ta 20°C, CO₂ 380 μmol·mol⁻¹), elevated temperature (Ta 25°C, CO₂ 380 μmol·mol⁻¹), elevated CO₂ concentration (Ta 20°C, CO₂ 700 μmol·mol⁻¹), elevated temperature and CO₂ concentration (Ta 25°C, CO₂ 700 μmol·mol⁻¹). The results showed that compared to *P. anserine*, *E. nutans* had a higher maximum net photosynthetic rate (Pn_{max}), light saturation point (LSP) and apparent quantum yield (AQY) in the control. Elevated temperature increased the Pn_{max} and LSP values in *P. anserine*, while Pn_{max} and LSP were decreased in *E. nutans*. Elevated CO₂ increased the Pn_{max} and LSP values in *E. nutans* and *P. anserine*, while the light compensation point (LCP) decreased; Elevated both temperature and CO₂, the Pn_{max} and LSP were all increased for *E. nutans* and *P. anserine*, but did not significantly affect AQY. We concluded that although elevated temperature had a photoinhibition for *E. nutans*, the interaction of short-term elevated CO₂ concentration and temperature can improve the photosynthetic capacity of alpine plants.

Key Words: elevated temperature; CO₂ concentration; light response; alpine plants