Multiple drivers of seasonal and interannual variation in $P_{\text{max}}$: Implications for leaf photosynthesis of Artemisia ordosica

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Revealing the seasonal and interannual variations in leaf-level photosynthesis is a critical issue in understanding the ecological mechanisms underlying the dynamics of carbon dioxide exchange between the atmosphere and shrub ecosystem. *Artemisia ordosica* is a dominant shrub species in semi-arid area of northwest China. Photosynthetic gas exchange, leaf nitrogen content (LN), specific leaf area (SLA) and some environmental factors were measured simultaneously on clear days (rotated every 10 days) of the growing season from 2011 to 2018, to quantify the temporal variations and environmental controls of photosynthetic parameters. Our results demonstrated that mean value of light-response curve parameters, the maximum photosynthetic capacity ($P_{\text{max}}$), appear quality efficiency (AQE), respiration in dark ($R_d$), light saturated point (LSP) and light compensated point (LCP) had a gradual decline with the growth (spring> summer>autumn). Structural equation modeling (SEM) was used to elucidate the direct and indirect effects of biophysical factors on $P_{\text{max}}$. The driven factors of $P_{\text{max}}$ in growing season changed, but stomatal conductance ($g_s$) was the dominant factor in all stages. The $g_s$ was influenced by SLA and LN and the soil water content at a depth of 10cm (SWC$_{10}$) affected the $P_{\text{max}}$ in spring. In summer, $P_{\text{max}}$ was significantly positively related with $g_s$ and transpiration rate ($T_r$), and $g_s$ was influenced by SLA, LN and soil water content at a depth of 30cm (SWC$_{30}$). In autumn, $P_{\text{max}}$ was significantly positively correlated with $g_s$, while was significantly negatively correlated with air temperature ($T_a$). This simulation based on situ ecophysiological research suggest that $P_{\text{max}}$ of *A. ordosica* responded to the environment factors of seasonal and interannual variations, which is not the inherent genetic characteristics. Soil water content is the major environmental factor influencing $P_{\text{max}}$ in spring and summer, while $T_a$ is the major one in autumn. Knowledge of how environmental change will affect the photosynthesis of *A. ordosica* in the future is essential for their protection, adaptation strategies and carbon fixation prediction in shrub ecosystems.