Synergistic regulation between leaf N and P on Vcmax and Jmax of species in subtropical karst and non-karst forests of China

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Abstract

Gas exchange capacity of leaves is mainly restricted by the content of N and P and environmental factors. However, the effects of interaction between N and P and environmental factors on photosynthetic capacity in subtropical tree species remain unclear. We measured the gas exchange parameters (25 maximum carboxylation rate [Vcmax,25], and 25 maximum electron transport rates [Jmax,25]) and the chemical properties of leaves (leaf N, leaf P and N:P) in 9 local dominant species in the subtropical non-karst and karst regions of southwest China. Environmental factors (temperature [Temp] and soil moisture content [SMC]) of the study site were also monitored at the same time. We found that P restriction is common in different research sites. The results of the mixed linear model show that with the increase of leaf N content of karst species, the sensitivity of Vcmax,25 to leaf P increased significantly, and there was a significant interaction of N×P ($P < 0.001$). Non-karst species tend to N×SMC interaction ($P = 0.04$). The difference in N×P interaction on gas exchange parameters between non-karst and karst species might result from the decoupling phenomenon of N and P caused by climate change. Factors such as N sedimentation and soil P loss aggravate the N:P imbalance and lead to the decoupling effect between N and P elements, and continuously weaken the influence of N×P interaction on plant Vcmax and Jmax.

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