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Evaluation of O₃ Effects on Cumulative Photosynthetic CO₂ Uptake in Seedlings of Four Japanese Deciduous Broad-Leaved Forest Tree Species Based on Stomatal O₃ Uptake

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关键词	Japanese deciduous broad-leaved trees; net photosynthetic rate; net primary production; stomatal;
摘要	The current level of tropospheric ozone (O ₃) is expected to reduce the net primary production of forest trees. Here, we evaluated the negative effects of O ₃ on the photosynthetic CO ₂ uptake of Japanese forest trees species based on their cumulative stomatal O ₃ uptake, defined as the phytotoxic O ₃ dose (POD). Seedlings of four representative Japanese deciduous broad-leaved forest tree species (<i>Fagus crenata</i> , <i>Quercus serrata</i> , <i>Quercus mongolica</i> var. <i>crispula</i> and <i>Betula platyphylla</i> var. <i>japonica</i>) were exposed to different O ₃ concentrations in open-top chambers for two growing seasons. The photosynthesis-light response curves (A-light curves) and stomatal conductance were measured to estimate the leaf-level cumulative photosynthetic CO ₂ uptake (ΣPn_{est}) and POD, respectively. The whole-plant-level ΣPn_{est} were highly correlated with the whole-plant dry mass increments over the two growing seasons. Because whole-plant growth is largely determined by the amount of leaf area per plant and net photosynthetic rate per leaf area, this result suggests that leaf-level ΣPn_{est} , which was estimated from the monthly A-light curves and hourly PPFD, could reflect the cumulative photosynthetic CO ₂ uptake of the seedlings per unit leaf area. Although the O ₃ -induced reductions in the leaf-level ΣPn_{est} were well explained by POD in all four tree species, species-specific responses of leaf-level ΣPn_{est} to POD were observed. In addition, the flux threshold appropriate for the linear regression of the responses of relative leaf-level ΣPn_{est} to POD was also species-specific. Therefore, species-specific responses of cumulative photosynthetic CO ₂ uptake to POD could be used to accurately evaluate O ₃ impact on the net primary production of deciduous broad-leaved trees.

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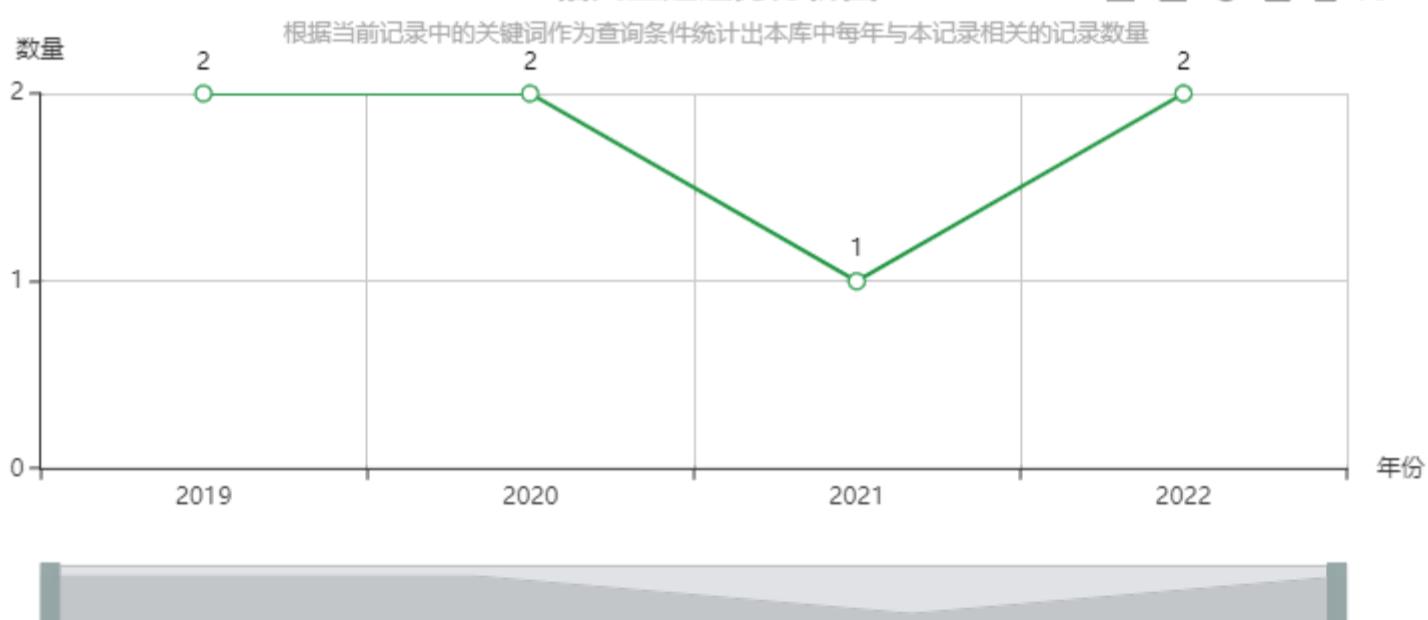
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