Tree growth is correlated with hydraulic efficiency and safety across 21 tree species in a subtropical karst forest

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Abstract

Water availability in karst forests is temporally and spatially heterogeneous; thus, xylem hydraulic efficiency, safety and water storage are potential drivers of tree growth. We selected 21 tree species from a primary subtropical karst forest in southern China and analyzed the contribution of xylem hydraulic efficiency, safety, and water storage to the growth of karst trees. The results showed that large vessel diameter, strong connectivity between vessels and axial parenchyma, and high saturated water content (SWC) led to high xylem hydraulic conductivity (Ks). SWC traded off against embolism resistance (P50). Ks had the strongest relationship with the average diametral growth rate (DGR). In large trees, both high Ks and more negative P50 were associated with high DGR. Through a growth-size relationship model, DGR acceleration was positively correlated with embolism-resistance across species. This study shows that xylem hydraulic efficiency and safety influenced growth rate and growth dynamics in karst tree species.

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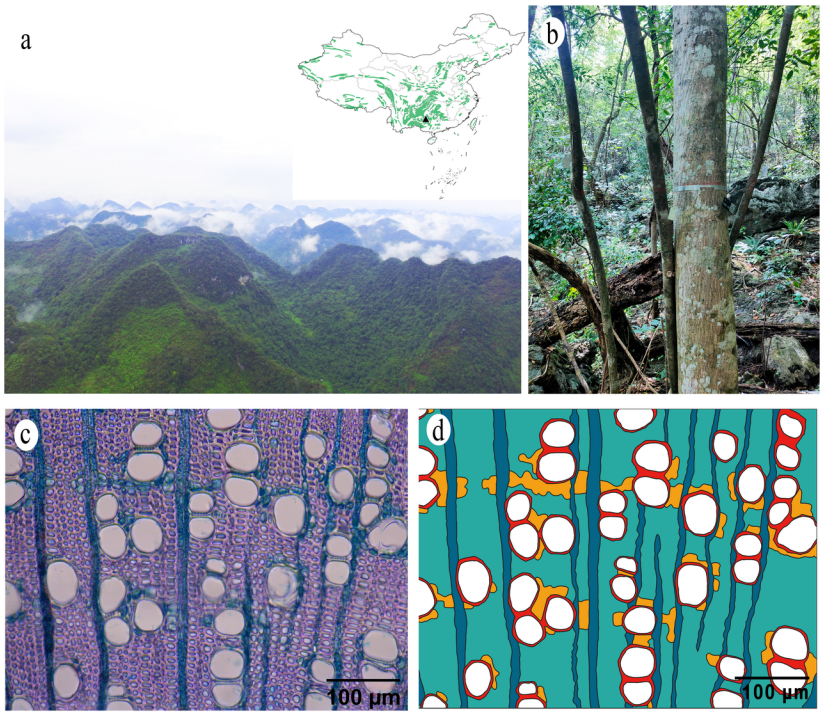
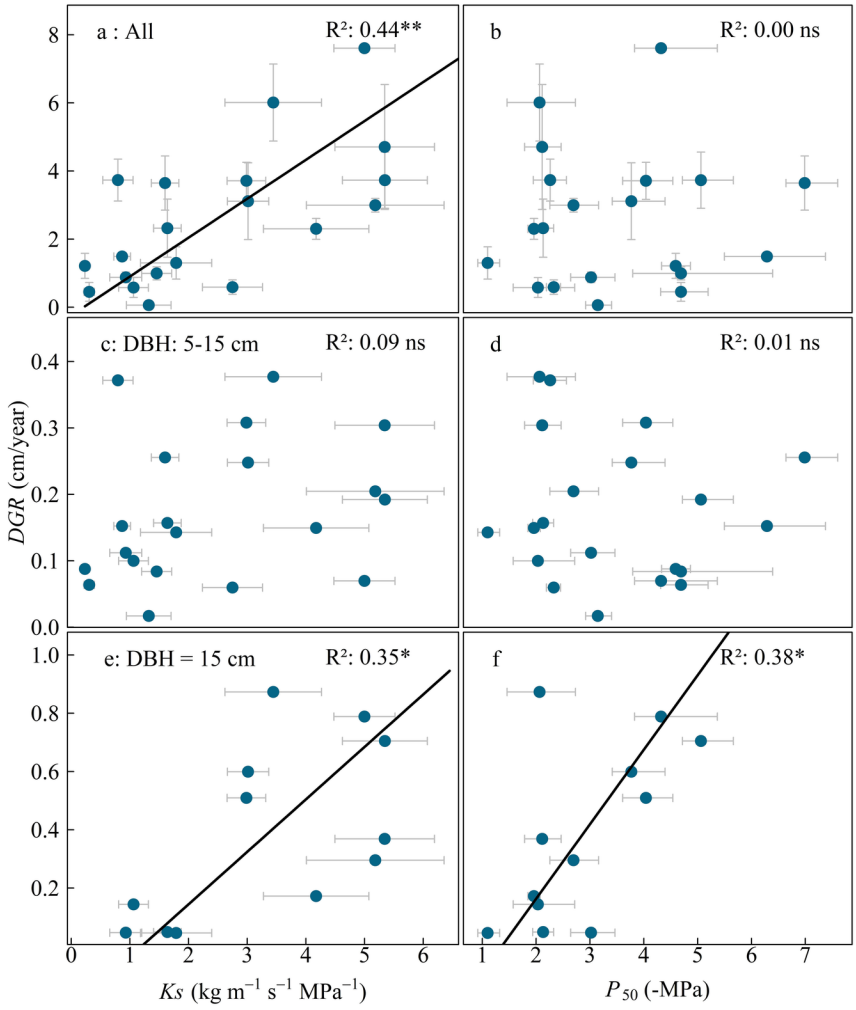
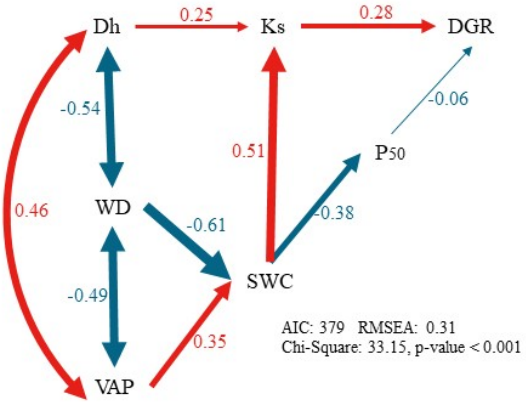




a: DBH: 5- 15 cm



b: DBH ≥ 15 cm