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An undiscovered facet of hydraulic redistribution driven by evaporation—a study from a Populus tomentosa plantation

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摘要

Maintaining the activity and function of the shallow root system of plants is essential for withstanding drought stress, but the associated mechanism is poorly understood. By investigating sap flow in 14 lateral roots (LRs) randomly selected from trees of a Chinese white poplar (*Populus tomentosa*) plantation receiving three levels of irrigation, an unknown root water transport mode of simultaneous daytime bi-directional water flow was discovered. This mode existed in five LR s confined to the surface soil without attached sinker roots. In the longer term, the bi-directional water flow was correlated with the soil water content. However, within the day, it was associated with transpiration. Our data demonstrated that bi-directional root sap flow occurred during the day, and was driven by evaporative demand, further suggesting the existence of circumferential water movement in the LR xylem. We named this phenomenon evaporation-driven hydraulic redistribution (EDHR). A soil-root water transport model was proposed to encapsulate this water movement mode. EDHR may be a crucial drought-tolerance mechanism that allows plants to maintain shallow root survival and activity by promoting root water recharge under extremely dry conditions.

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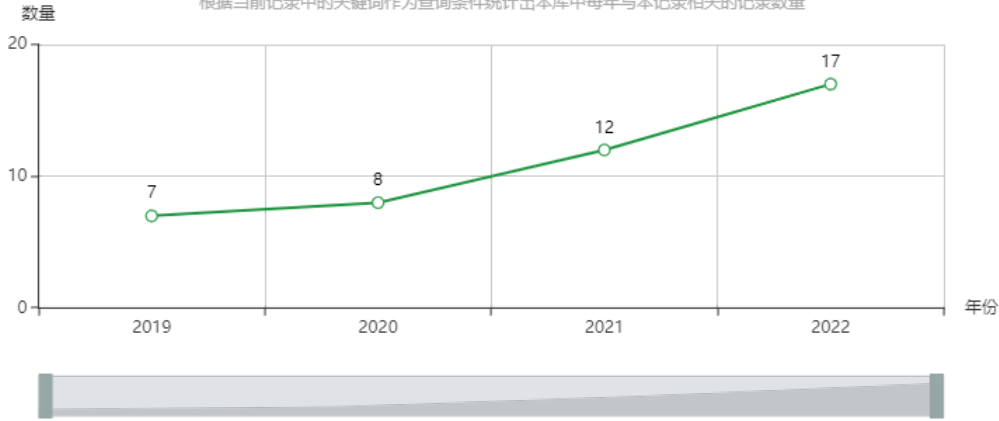
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