A novel, rapid method confirms leaf airspace unsaturation in hypostomatous leaves

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***Abstract*:**

The movement of water vapor and CO_2 within leaves influences plant function, stress responses, and terrestrial productivity and evapotranspiration. Recent investigations have challenged a foundational assumption of plant physiology, namely that leaf intercellular airspaces are saturated with water vapor. However, confirmation across taxa, particularly those with hypostomatous leaves, remains limited. We developed a rapid method wherein the nitrogen in air is replaced with helium, which allows transpiration rate to be manipulated independently of vapor concentration, enabling inference of intercellular humidity. We found airspaces of hypostomatous leaves to be consistently unsaturated, implying a dynamic resistance for water transport across mesophyll cell membranes that augments stomatal restriction of water loss, but not of CO_2 uptake. These results significantly reshape our understanding of plant-atmosphere interactions. Further investigations of the drivers and prevalence of leaf airspace unsaturation across diverse species and conditions will provide valuable insights into this novel mechanism for plant drought resilience.

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