Robust estimates of cuticular conductance to water on a stomatous leaf surface

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Abstract

In leaf gas exchange measurements, cuticular conductance to water (g_{cw}) is indistinguishable from and included in stomatal conductance to water vapor (g_{sw}). Here we developed a simple technique to isolate g_{cw} by directly measuring leaf intercellular CO_2 concentration ($C_{i(m)}$) along with gas exchange during photosynthetic light induction. We derived stomatal conductance to CO_2 ($g_{sc(m)}$) from the $C_{i(m)}$ independently of g_{sw}. Plotting g_{sw} against $g_{sc(m)}$ during the early induction phase within ˜10 min, we found a highly linear relationship with a positive intercept. Assuming negligible cuticular CO_2 transport, complete stomatal closure occurs when $g_{sc(m)}$=0. Then, we considered the residual g_{sw} (i.e., intercept) as g_{cw}. Indeed, these g_{cw} estimates succeeded in correcting the calculation. Our technique, owing to its robustness and increased throughput, will allow for more rapid screening of crops, more reliable gas exchange analysis, and more accurate prediction of plant function under natural environmental conditions.

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