

A novel uptake pathway allows plants to perceive volatiles with closed stomata

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Plants can perceive and respond to volatile organic compounds (VOCs) from their environment [1, 2]. VOCs are generally thought to be taken up by open stomata, thus severely limiting VOC perception under stress [3-5]. Here, we asked how plants may overcome this sensory limitation. We took advantage of the fact that the Crassulacean acid metabolism (CAM) plant *Kalanchoë laxiflora* opens its stomata at night and closes them during the day to assess the role of stomatal and non-stomatal VOC uptake independently of photosynthesis [6]. We find that 80% of the highly conserved green leaf volatile (Z)-hexenyl acetate is taken up by stomata, while 20% is taken up through a novel, non-stomatal pathway. The pathway shows a preference for lipophilic VOCs. Neither hydathodes nor residual stomatal conductance can account for non-stomatal uptake. We find that the non-stomatal pathway is sufficient for *K. laxiflora* to perceive exogenous VOCs and activate its defenses. Together, these results reveal a previously unrecognized route for volatile uptake and demonstrate how plants can perceive airborne chemical cues with closed stomata.

References

- [1] R. Escobar-Bravo, P.A. Lin, J.M. Waterman, M. Erb, *Natural product reports*, **2023**, *40*, 840-865.
- [2] A. Brosset, J.D. Blande, *Journal of experimental botany*, **2022**, *73*, 511-528
- [3] F.A. Maleki, I. Seidl-Adams, G.W. Felton, M.F. Kersch-Becker, J.H. Tumlinson, *Journal of Experimental Botany*, **2024**, *75*, 6872-6887.
- [4] N.M. Aguirre, J.M. Grunseich, A.F. Lima, S.D. Davis, A.M. Helms, *Plant, Cell & Environment*, **2023**, *46*, 2017-2030.
- [5] G. Arimura, T. Uemura, *Trends in Plant Science*, **2025**, *30*, 105 – 115.
- [6] S.F. Boxall, N. Kadu, L.V. Dever, J. Kneřová, J.L. Waller, P.J.D. Gould, J. Hartwell, *The Plant Cell*, **2020**, *32*, 1136-1160.