

ORIGINAL ARTICLE OPEN ACCESS

Hydroxycinnamic Acid Amides Emerge as Multifunctional Molecules Involved in Regeneration and Volatile Signalling During Wound Responses

Carmen Grech-Hernández¹  | Andrade Cynthia¹  | Francisco Vera-Sirera¹  | Álvaro Luis Jiménez-Jiménez^{2,3}  | Marc Valls^{2,4}  | Nuria S. Coll^{2,5}  | Ismael Rodrigo¹  | José María Bellés¹  | María Pilar López-Gresa¹  | Purificación Lisón¹ 

¹Instituto de Biología Molecular y Celular de Plantas (IBMCP), Consejo Superior de Investigaciones Científicas (CSIC), Universitat Politècnica de València (UPV), Valencia, Spain | ²Centre for Research in Agricultural Genomics (CRAG), CSIC-IRTA-UAB-UB, Campus UAB, Bellaterra, Spain | ³current address: Instituto de Hortofruticultura Subtropical y Mediterránea "La Mayora", Universidad de Málaga-Consejo Superior de Investigaciones Científicas (IHSM-UMA-CSIC), Málaga, Spain | ⁴Department of Genetics, Microbiology and Statistics, Universitat de Barcelona, Barcelona, Spain | ⁵Consejo Superior de Investigaciones Científicas (CSIC), Barcelona, Spain

Correspondence: Francisco Vera-Sirera (fravesi@ibmcp.upv.es)

Received: 27 April 2026 | **Revised:** 17 September 2026 | **Accepted:** 28 September 2026

Funding: Universitat Politècnica de València, Grant/Award Number: PAID-06-25; Agencia Estatal de Investigación, Grant/Award Numbers: PID2020-116765RB-I00, PID2023-152361OB-I00, CEX2021-001172-S-20-8), PID2022-136922NB-I00, PRE2020-092086, CEX2025-001626-S; Generalitat Valenciana, Grant/Award Numbers: PROMETEU/2021/056, CIPROM/2024/41

Keywords: cell wall | healing | hydroxycinnamic acid amides (HCAAs) | regeneration | THT (hydroxycinnamoyl transferase) | tomato (*Solanum lycopersicum*) | wound response

ABSTRACT

Hydroxycinnamic acid amides (HCAAs) are phenylpropanoid-derived metabolites traditionally associated with antimicrobial defence and cell wall reinforcement during plant–pathogen interactions. However, their contribution to plant responses to mechanical injury, particularly in wound healing and damage-induced signalling, remains poorly understood. In this study, we investigated the wound-induced responses in tomato (*Solanum lycopersicum*) using a *35S::THT* system in which tyramine hydroxycinnamoyl transferase (THT), a key enzyme controlling HCAAs biosynthesis, is overexpressed. By integrating metabolite profiling, gene expression analyses, confocal microscopy, antioxidant capacity assays, and volatile organic compound (VOCs) analysis, we characterised local and systemic responses to mechanical damage. The *35S::THT* line displayed a stronger wound-induced accumulation of HCAAs compared to WT, with consistently higher levels of free amides and increased accumulation of tyramine-derived amides in the cell wall-bound fraction following wounding, which was associated with pronounced structural reinforcement at injury sites. Enhanced vascular lignification, increased suberization, and callose deposition were observed, collectively contributing to improved tissue regeneration capacity or associated with enhanced tissue regeneration capacity. These structural changes were accompanied by alterations in redox-related responses, supporting a role for HCAAs in modulating oxidative balance during wound repair. In addition to local effects, the *35S::THT* line emitted a specific wound-responsive VOC blend, capable of inducing defence-related gene expression in neighbouring wild-type even in the absence of direct injury, suggesting a role for HCAAs in airborne signalling and defence priming. Together, these results show that a metabolic background characterised by elevated HCAAs levels is associated with coordinated changes in structural reinforcement, redox responses, regeneration, and volatile-mediated communication during the tomato wound response. These observations support the idea that HCAAs may act as important integrative components linking local and systemic responses to mechanical stress.

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2026 The Author(s). *Plant, Cell & Environment* published by John Wiley & Sons Ltd.