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Abstract

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The role of salivary proteins from *Tetranychus evansi* in the mite-plant interaction*

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Herbivores and plants have been engaged in a tight co-evolutionary arms race, and saliva played important roles in this process. Some herbivore-derived small molecules or proteins called herbivore-associated molecular patterns (HAMPs) can be recognized by plants and thus trigger plant immune responses. Another type of salivary proteins, called effectors, utilize various strategies to suppress plant defense responses to establish successful feeding. The tomato red spider mite *Tetranychus evansi* is a worldwide pest of *Solanaceous* crops and causes enormous economic damage in many regions of the world. During the feeding process, *T. evansi* secretes saliva into plant cells through cheliceral stylets. Secreted saliva plays crucial roles in modulating plant-mite interaction, such as effectors Te28 and Te84 (Villarroel *et al.*, 2016). We previously identified 136 salivary proteins from *T. evansi* by transcriptome and LC-MS/MS analyses (Huang *et al*., 2018). However, the role of these salivary proteins in mite-plant interaction was unknown. Here, we identified a salivary protein involved in the mite-plant interaction (Cui *et al*., 2022). This protein encodes a protein disulfide isomerase (TePDI) and acts as a HAMP that triggers plant defenses by inducing ROS burst, callose deposition and plant defense-related genes in *Nicotiana benthamiana*. TePDI can be recognized by multiple Solanaceae plants such as tomato, pepper, and eggplant. TePDI-mediated cell death in *N. benthamiana* is dependent on the plant signaling molecules SGT1 (suppressor of the G2 allele of skp1) and HSP90 (heat shock protein 90). To better feed on plants, *T. evansi* inhibited TePDI-triggered cell death and plant defense responses by secreting effectors Te28 and Te84. Further analysis revealed that PDI from phylogenetically distinct herbivorous and non-herbivorous arthropods all triggered cell death and immune response in *N. benthamiana*. Moreover, silencing *PDI* gene in spider mites and whiteflies resulted in the reduced survival rate of both pests. Altogether, our study revealed that PDI is a double-edged sword. On the one hand, it is functionally conserved in herbivores and required for their survival; on the other hand, it is recognized by Solanaceae plants and enhances plant resistance against herbivores. Our findings indicate that plants utilize evolutionarily conserved HAMPs to activate plant defense and resist pest damage, providing a potential strategy for pest management.

Keywords: *Tetranychus evansi*, salivary protein, protein disulfide isomerase, plant-herbivore interaction

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