Tomato: A model to study plant defensive signaling against phloem-feeding insects

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Contrary to chewing insects that cause extensive damage to plants, phloem-feeding insects, such aphids and psyllids, cause modest to almost non-perceptible mechanical damage to plants. However, phloem-feeding insects drain photosynthates, vector diseases, and introduce effectors that reduce yield. Phloem feeding elicits a different and specialized plant defensive response that limits insect performance. Several of these responses are conserved between different plants species, making the use of tomato as a model plant an efficient way to study plant-insect interactions. Oxylipins play an important role as signaling molecules and antibiotic compounds. Oxylipins are a large and diverse group of compounds primarily generated through oxidation of linoleic and linolenic acid by lipoxygenases (LOXs) and α-dioxygenases (α-DOXs), followed by secondary modifications catalyzed by six other enzymatic routes that give rise to at least one hundred compounds. The goal of this project is to utilize available genetic resources in tomato to unveil conserved molecular mechanisms responsible for defensive signaling against phloem-feeding insects in order to develop applied strategies to reduce insect-derived yield losses. To this end, we are exploring the impact of oxylipins on aphid and psyllid survival and reproduction. Additionally, we are studying the role of LOXs and α-DOXs expression in wild-type (WT) tomato plants and in the *spr2* mutant, which carries a loss-of function mutation in *fatty acid desaturase 7*. This mutant is characterized by elevated linoleic acid (LA) and depressed linolenic acid (LNA) levels and therefore is a valuable tool to study the relative importance of these fatty acid substrates in the synthesis of defensive oxylipins against phloem feeders.