Molecular Defense Response to Greenbug Feeding in Wheat

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BACKGROUND

The greenbug is the most economically damaging aphid pest of wheat and sorghum. Annual losses to U.S. wheat production due to greenbug damage are more than $100 million. This pest is especially notorious due to periodic occurrence of new virulent biotypes. New greenbug strains being able to overcome all known host resistance of wheat have been found. One key to successful control of this pest is to understand the mechanisms of host resistance against the greenbug. However, our knowledge on resistance gene-mediated host defense against insect pests is still sketchy and fragmented, which is particularly true in cereal-aphid interactions. We have extensively studied the greenbug-wheat interactions at the plant level using greenbug resistant and susceptible near isogenic. We would like to know the molecular basis of these observations with our long-term goal to explore the molecular mechanisms of host resistance against aphid pests and develop novel methods of sustainable aphid control in cereal crops.

OBJECTIVE

- Identify genes involved in *Gb3*-mediated defense response against greenbug feeding in wheat.

RESULTS

Gene expression profiling was conducted using the cDNA-AFLP technology in *Aegilops tauschii* accession PI268210, a relative of wheat and the original donor of the greenbug resistance gene *Gb3* in wheat. In total, 141 DNA fragments were cloned and sequenced. Of these 141 genes, 122, 15 and four were up, down or transiently regulated, respectively, within 48h of greenbug infestation. Many of the up-regulated genes encode proteins or enzymes that are of importance in defense responses and signal transduction pathways against aphid feeding. Several genes involved in photosynthesis and carbohydrate metabolism were down regulated. A significant portion (15 percent) of the up-regulated genes belong to retro-elements. It seems that jasmonic acid and ethylene play important roles in signaling defense responses against the phloem-feeding greenbug. We also performed a preliminary expression profiling in two near isogenic wheat lines of *Gb3*. Several genes constitutively expressed only in the resistant line were identified. Sequences of 121 cDNAs from this study have been submitted to the GenBank database.

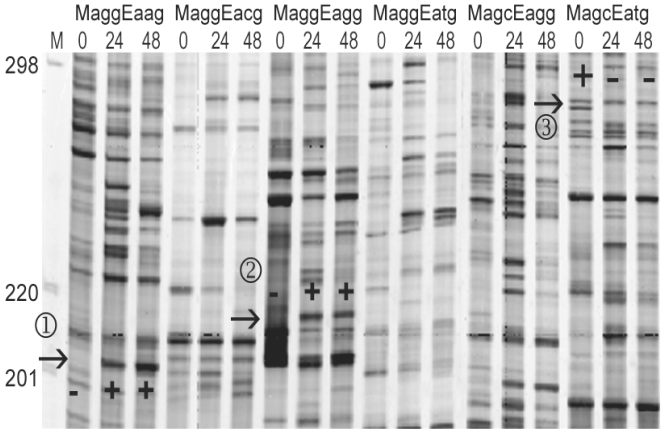

Fig. Gene expression profile showing altered expression of genes (arrowed) after greenbug infestation in *Aegilops tauschii*. + = gene present; - = gene absent. Selective primer pairs were show at the top. The two up-regulated genes (□ and□) were involved in defense pathways against greenbug feeding. The down-regulated gene □ is involved in photosynthesis.

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