Studies of Natural Rice Responses to Insect Pests

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Priority Area: Biotechnology/Genomics

2004 Progress Update:

Our overall goal is to understand natural plant resistance to insect pests, through characterization of molecular and biochemical events in rice plants. For these studies we have focused on plant responses to rice water weevil and beet armyworm. The specific objectives of our work are:

1) **Identify volatile chemicals released from leaves of insect-damaged rice plants.**
2) **Continue characterization of genes already identified as "insect-inducible".**
3) **Expand exploration for novel insect defense genes in rice.**

Previous work in my lab identified several rice genes whose activities are "induced" by the feeding action of insect pests and by signals that originate in insect digestive juices or oral secretions (saliva and/or regurgitant). With the help of Dr. John Bernhardt, we collected rice water weevil insects and tested feeding effects on rice plants.

We have completed the bulk of the work in objective number one. We have found that rice plants respond with considerably different release profiles of volatiles if they are damaged by beet armyworm or rice water weevil. This indicates that the plant can sense the type of physical damage occurring or unique elicitors that originate in the particular insect species. We are currently preparing a manuscript for publication describing the release profiles of these volatiles. By understanding the specific ways in which rice responds to these pests, it opens up the possibility of using the information to screen for plants (through molecular or biochemical methods) that have enhanced natural responses to insect pests.

We continue to characterize expression patterns of the genes we identified earlier as insect-inducible. As part of that effort, and to discover more genes of interest, we have recently initiated a likely collaborative effort to produce a DNA gene library from insect-damaged rice plants via Massively Parallel Signature Sequencing (MPSS). This MPSS technology is a powerful method to examine gene expression patterns within an organism. The production of such a library represents a tremendous opportunity to improve our view of overall gene expression patterns in insect-injured rice. This work would be carried out as part of a larger project with Drs. Guo-liang Wang (Ohio State Univ.) and Blake Meyers (Univ. of Delaware). The graduate assistant and primary investigator (P.I.) will be responsible for preparing rice plants/tissue for library production and for data analysis.

Key personnel working on this project in the past year have been the P.I. (K. Korth), Qin Wang (Program Associate I), and Hanna Barczynska (Program Associate) who worked as a one-half time employee. In the coming year, the bulk of the work will be performed by a graduate assistant and Qin Wang.

Papers published citing support by the Arkansas Rice Research and Promotion Board:

Wang, Q., Sullivan, R.W. Kight A., Henry R.L., Huang J., Jones A.M., and Korth, K.L. (2004) Deletion of the chloroplast-localized THYLAKOID FORMATION1 gene product in *Arabidopsis thaliana* leads to deficient thylakoid formation and variegated leaves. *Plant Physiology*, **136**:3594-3604.

Korth, K.L., & Thompson, G.A. (in press) Chemical signals in plants: jasmonates and the role of insect-derived elicitors in responses to herbivores in *Multigenic and Induced Systemic Resistance in Plants*, S. Tuzun and E. Bent, eds., Kluwer Academic/Plenum Publishing, New York.

Postscript: This project did not receive continued funding beyond this year of study.