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Two Genes Control the Synthesis of Beetle Protective Coats. Chitin is the main chemical component of the cuticle (outer layer) which forms the protective outer covering of insects. The biosynthesis of chitin is a critical and precisely regulated step during molting as insects change from one life form into another. However, there is little information about the different functions of the two enzymes which produce this critically important protective material in insects. We used a technique called "RNA interference" to selectively eliminate the function of each of the two genes that produce these enzymes in the red flour beetle to see if different parts of the insect were affected differently. We showed that one of the genes is required for producing the chitin that covers the general body surface, while the other is required for producing the chitin that lines the digestive midgut. Without the first gene, the insects cannot shed their old skins and therefore die of entanglement in the old cuticle. Without the second gene, the insects cannot digest food and die of starvation. Studies such as these will lead to better understanding of insect growth and development and provide better strategies for disrupting the associated genes as a new form of insect pest control. (Dick Beeman, telephone: 785-776-2710; email: beeman@gmprc.ksu.edu)

A Healthier Life May Be As Close As the Nearest Sorghum Field. Grain sorghum is an ancient, drought resistant cereal grain grown around the world. In the U.S., sorghum production ranks third behind corn and wheat. Sorghum is grown primarily from southern Nebraska to Texas, with Kansas being the number one sorghum producing state. Recent research has shown that sorghum may have several components that could have a positive impact on human health. Some sorghum lines, those containing certain pigmented tissues in the seed, are high in compounds called anti-oxidants thought to protect against certain types of cancer; some varieties contain higher levels of these compounds than blueberries. Also, the wax surrounding the sorghum grain contains compounds called policosanols that may improve human cardiac health. Research is showing that these compounds can lower blood cholesterol levels. In addition to these benefits, sorghum is a gluten free food and is therefore safe for persons with allergies to wheat and other grains containing gluten. (Scott Bean, telephone: 785-776-2725; email: scott@gmprc.ksu.edu)

Three Genes Impact Latent Period in Wheat Resistance to Leaf Rust. Leaf rust in wheat is an important disease in the U.S. It occurs in almost all growing regions and causes significant yield losses every year. The fungal pathogen responsible for this disease seems to be capable of changing very rapidly so that plants with single resistance genes soon become sensitive to this disease. "Slow rusting" is a trait in some plants that may be a crucial component of durable resistance to this disease because its effectiveness may not be altered by the changes that take place in the pathogen. The "slow rusting" trait is often expressed in the form of a prolonged latent period during which the pathogen needs more time between the initial infection and the appearance of disease symptoms. Selection for a longer latent period is considered an effective approach to the development of wheat varieties that have improved resistance to leaf rust. We have identified three genes that increase the latent

period along with several molecular markers that can be used for marker-assisted selection of this important trait in the development of new varieties. (Guihua Bai, telephone: 785-532-7116; email: gbai@agron.ksu.edu)

Medical Technique Used to Successfully Detect Hidden Insect Infestations in Grain. Computed tomography is a medical technology that uses a computer to extract the information from many individual x-rays (called slices) through a patient to generate a 3-dimensional image of the subject being studied. We used computed tomography to scan Hard Red Winter wheat samples that had been infested with rice weevil pupae at densities of 0, 5, and 10 infested kernels per 100 g sample. A computer program was written to quickly analyze the length, width, and optical density of each suspect kernel and then calculate the number of infested kernels per 100 g. Computer detections were confirmed by visual inspection of the x-ray films. The average detection accuracy for the samples containing 5 infested kernels per 100 g was 94.4% (standard deviation of 7.3%). Similarly, the accuracy for detection of kernels in samples containing 10 infested kernels per 100 g was 87.3% (standard deviation of 7.9%). An average of 1.2 ($\pm$ 0.92) kernels was scored as false positives in 100 g samples that were uninfested. Thus, this technique may provide an accurate tool for detection of internal insect infestation. (Mike Toews, telephone: 785-776-2719; email: mtoews@gmprc.ksu.edu)

New Method for Measuring Insect Digestive Enzyme Activities Developed. Proteinases are enzymes that exist in the digestive tracts of most species and they promote the breakdown of proteins during the process of digestion. Current methods of detection for these enzymes are problematic due to low sensitivity and a lack of response to inhibitors (compounds in nature that slow or inhibit the activity of these enzymes). We developed a new overlay technique for measuring the activity of these enzymes when complex mixtures are separated using gel electrophoresis. In this method, a membrane that is impregnated with a substrate (a compound that the enzyme can attack such as an amino acid bound to p-nitroanilide) is overlaid onto the gel. Regions of the gel where proteinases are located are detected as spots on the membrane as the substrate is broken down. We also demonstrated that addition of inhibitors after the separation of proteinases by electrophoresis provided superior analysis of inhibitor activity using this technique. Such inhibitors may serve as important insect pest control tools in the future. (Brenda Oppert, telephone: 785-776-2780; email bso@ksu.edu)

Can Parasitoids Control Levels of the Indianmeal Moth in Retail Stores? Three species of parasitoid wasps that attack the eggs of insects such as the Indianmeal moth were evaluated for their potential to serve as biological control agents in retail stores. A single shelving unit was used in each trial and foraging activity was tracked using a grid of patches of susceptible eggs. Each shelving unit consisted of five shelves and measured 6 ft high by 5 ft wide by 2 ft deep. Shelves were either bare or were stocked with simulated packages. A total of 15 patches of eggs were placed in identical arrangements on each shelf and on the floor beneath the shelves. Approximately 500 female parasitoids were released in the center of the shelving unit and allowed to forage for 48 hours. Foraging success was measured by the percentage of the number of the eggs in the patches that had been attacked. The presence of the packages on the shelves didn't affect the foraging activities of two of the three species tested. The most effective wasp species was *Tricogramma deion*. This species caused approximately 70% mortality to Indianmeal moth eggs compared to the control. Since these parasitoid wasps are so small that they are barely visible, they may serve as an effective method for controlling levels of the Indianmeal moth in retail stores. (Paul Flinn, telephone: 785-776-2707; email: flinn@gmprc.ksu.edu)

U.S. Department of Agriculture, Agricultural Research Service, Grain Marketing and Production Research Center, 1515 College Avenue, Manhattan, KS 66502. Phone: 800-627-0388.