GMPRC
GRAIN MARKETING AND PRODUCTION RESEARCH CENTER

RESEARCH Kernels

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- **New Pollen Examination System Developed.** Developing embryos could provide important information concerning the quality traits of the plant being produced. However, these are often inaccessible in plants because they are located within seed pods or surrounded by seed coats. A new system for examining plant embryo functions was developed using immature pollen. Using rapeseed as a model, levels of the various plant hormones produced during embryo development were studied. Results showed that, while the absolute levels varied, the trends in hormone changes found using the immature pollen (called the microspore derived embryos or MDEs) were the same as those found in the actual embryos. This suggests that it may be possible to use the MDE system as a model for selecting varieties of alfalfa, soybeans, sunflowers, etc., as well as many other vegetable crops with superior quality traits and improved growth characteristics very early in the development process. (Dan Skinner, phone: 785-532-7247, email: dzolek@ksu.edu)

- **Pirate Bug Is a Potential Candidate for Pest Insect Control.** New methods for controlling insect pests must be developed because these insects are developing resistance to many of the insecticides currently used for insect control and regulatory restrictions are limiting the use of others. The large pirate bug is a candidate for use in the biological control of stored-product insects. Adults of this species are thought to use a venom to overcome their prey, and they readily feed on beetle and moth larvae that infest grain. We have developed and validated a computer model that simulates the growth patterns for the larger pirate bug. The model will be useful for optimizing rearing methods for this bug and for developing pest management practices that use this bug to control the levels of other insect pests. (Jim Throne, phone: 785-776-2796, email: throne@usgmrl.ksu.edu)

- **Migrating Insects Serve as the Main Source of Infestation in Grain Bins.** Newly harvested wheat generally is not infested by insects. The insect infestation levels are often determined by the numbers of insects immigrating into grain bins. Traps were used to monitor 34 grain bins on 12 different farms in Kansas for the numbers of insects entering through openings between the bin roof and the bin cap, and under the eve between the roof and the bin wall. These bins had capacities that ranged from 1,000 to 8,000 bushels. An average of 14 rusty grain beetles, 6 lesser

grain borers, 6 foreign grain beetles, and 22 hairy fungus beetles immigrated into these bins each day during the first month of storage. The numbers entering at the bin caps were several times larger than the numbers entering under the eve. Bin size did not influence the numbers found in the traps, however as many as 30% more insects may immigrate into larger bins under the roof eves because of the larger circumference. Computer models predicting insect infestation levels can increase the effectiveness and reduce the cost of insect pest management by insuring that pest management is done at the right time. Estimates of immigration rates can improve the accuracy with which insect densities are predicted and allow these models to be used more effectively in managing these insect pests. (Dave Hagstrum, phone: 785-776-2718, email: hagstrum@usgmrl.ksu.edu)

- **Insect Blood Proteins rapidly digested by Beneficial Insect Larvae.** Habrobracon hebetor is a parasitic wasp that attacks the larvae of many moths that are destructive agricultural pests. This wasp is especially effective in controlling populations of the Indianmeal moth (IMM), the most prevalent and damaging pest in stored commodities in the U.S. We are characterizing the digestive processes in the immature stages of this parasitoid as they feed on the hemolymph (blood) of the paralyzed host. In one aspect of the study, we found that the two major proteins in the IMM larval hemolymph are rapidly digested by proteinases in the midgut of the wasp larvae. Proteins similar to these blood proteins would be an excellent source of amino acids in an artificial diet for this species. This wasp is commercially available for use in pest management programs. However, a rearing method which utilizes artificial diets would facilitate a more widespread and profitable use of this beneficial insect. (Jim Baker, phone: 785-776-2785, email: baker@usgmrl.ksu.edu)

- **Successful Transformation of Sorghum and Bentgrass Produces Resistance to Stalk Rot.** Small pieces of genetic material from rice were transferred to cells from the embryos of sorghum and bentgrass seeds. The genetic material from rice contained the gene that codes for an enzyme called chitinase. This enzyme destroys materials such as the cell walls of certain fungi that are made out of the material called chitin. Transformed sorghum plants carrying this gene from rice showed significant resistance to infection by the fungus called Fusarium thapsinum. This fungus is responsible for causing sorghum stalk rot. (Dan Skinner, phone: 785-532-7247, email: dzolek@ksu.edu)

- **Mycoinsecticide Kills Stored Product Beetles.** Beauveria bassiana is an insect-attacking fungus that is used for control of soft-bodied insects in agricultural products and is labeled, without residue tolerance, for use on all raw agricultural commodities. It has a broad range of targets and has been found to infect a variety of stored-product beetles. The median lethal doses for adult lesser grain borers, sawtoothed grain beetles and rusty grain beetles are in the range of 100-150 parts per million on wheat. Dose rates in that range are effective against red flour beetle larvae, but not the adults. High humidity is not required to achieve infection of the beetles and is detrimental to residual activity. Spore survival was approximately 60% and 50%, respectively, at relative humidities of 39% and 75% RH on glass, wheat and concrete at 26ºC for more than 30

days. Survival was lower on wood. Beauveria bassiana is a safe biopesticide that is well suited to the stable environment of stored products. Unfortunately, this fungus will also kill both the adults and the larvae of some beneficial insects including the parasitic wasps that are present in grain. Therefore, the fungus should not be used in conjunction with wasp treatment for biological control. (Jeff Lord, phone: 785-776-2705, email: lord@usgmrl.ksu.edu)

- **Resistance Gene Analogs Are a Useful Tool for Locating Resistance Genes in Wheat.** Resistance gene analogs are pieces of genetic material that are very similar in structure to genes that code for specific disease resistance. Two resistance gene analogs, one for a resistance gene from tomato and another for a resistance gene in rice, were used to search for similar genetic sequences in the wheat variety, Jagger. Some 27 similar sequences were found on the A genome, 42 on the B genome, and 35 on the D genome. These genetic sequences will be further studied to determine which can be associated with specific resistance characteristics in wheat. Studies like this will eventually lead to the identification of genetic sequences that are responsible for disease and insect resistance in plants. This will make it possible to copy these sequences and transfer them to new varieties where specific resistances are needed. (John Fellers, phone: 785-532-2367, email: jpf@alfalfa.ksu.edu)

- **New Scientist Joins GMPRC.** Dr. Mark Casada joined the Engineering Research Unit in December 1999 to fill the position vacated by the retirement of Dr. Jack Chang. Dr. Casada received his B.S. in Mechanical Engineering and his M.S. in Agricultural Engineering from the University of Kentucky. After receiving his Ph.D. in Biological and Agricultural Engineering from North Carolina State University, Dr. Casada joined the faculty of the Department of Biological and Agricultural Engineering at the University of Idaho in Moscow. While at the University, Dr. Casada taught both graduate and undergraduate courses and conducted a research program focused on the storage and aeration conditions for wheat and corn. His main responsibilities at GMPRC include the study of grain handling and management techniques. (Mark Casada, phone: 785-776-2758, email: casada@usgmrl.ksu.edu)

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