GMPRC
GRAIN MARKETING AND PRODUCTION RESEARCH CENTER

RESEARCH Kernels

www.gmprc.ksu.edu October 2002

- **Pheromone Trap Type, Spatial Structure of Trap Captures, and the Number of Traps Lost Influence Contour Maps of the Distribution of Insects Caught in Traps.** Precision targeting is an important pest management where insect traps are placed throughout a facility, the numbers of insects caught in each trap are monitored over a specific time period, and this information is used to apply pest control and preventative actions when and where they are needed. Computer programs are used to develop maps showing the levels of infestation throughout the facility. The accuracy and robustness of the contour maps generated from warehouse beetle captures in two types of traps (FLITe-TRAK and Pherocon II [Trece, Inc.]) in a food warehouse were investigated in collaboration with Christian Nansen and Tom Phillips at Oklahoma State University. The two trap types differed in their total catch, catch range, and spatial distribution patterns. There were also significant differences among interpolation techniques, but no technique was distinctly more accurate. Loss or damage of traps had a significant impact on the contour maps generated and makes comparisons between sampling dates difficult. These results highlight the difficulties of interpreting pheromone trap monitoring information and provide valuable information for the development of more effective implementation and interpretation protocols. (Jim Campbell, telephone: 785-776-2717, email: campbell@gmprc.ksu.edu.)

- **Studies of the Insect Digestive System Identify New Targets for Pest Control.** Digestion was studied in the red flour beetle, cigarette beetle, and larger black flour beetle. Proteinases that help these insects to digest food were identified by using substrates and inhibitors. Several inhibitors were identified that significantly reduced the activity of digestive proteinases. Many times, inhibitors targeting different types of proteinases were needed to completely inhibit proteolytic activity. An approach that incorporates several different inhibitors may lead to safer, more effective control methods for pests of stored products. The use of digestive proteinase inhibitors can be particularly successful to control pests in areas where food is stored and/or human exposure is of concern.
(Brenda Oppert, telephone: 785-776-2780, email: bso@ksu.edu.

- **Genetic Studies of Head Blight Provide Information On the Different Strains in the Great Plains.** The fungus, Fusarium graminearum, causes Fusarium head blight when it infects wheat

and barley. This disease has caused billions of dollars in losses in the U.S. during the past ten years. We isolated samples of this fungus from the top, middle, and bottom portions from infected wheat heads in samples obtained during severe epidemics in Kansas in 1993 and in North Dakota in 1994. Using a DNA fingerprinting technique, we found an average of two strains of fungus in each of the infected heads evaluated indicating that heads had multiple infections. Although genetic diversity was high, there were no significant differences between the fungal populations from North Dakota and Kansas. These results suggest that these populations are parts of a single, well-mixed population that experiences frequent sexual recombination.
(Bob Bowden, telephone: 785-532-2368, email: rbowden@plantpath.ksu.edu)

- **Control of Beetle and Indianmeal Moth Populations in Pet Stores.** The effects of chemical and non-chemical control methods on the populations of stored-product beetles and Indianmeal moths were evaluated in eight pet stores. Food- and pheromone-baited traps were placed in a grid pattern in each store and trap catches were recorded every one to three weeks. Pest management procedures included sanitation (sweeping, vacuuming, and/or disposal of infested products), or sanitation in combination with an insect growth regulator, hydroprese 9% EC, or a pyrethroid, cyfluthrin 20 WP. Each treatment was replicated in two stores. Two stores were left untreated as controls. A total of 41,266 adult insects and 3,032 larvae belonging to 23 families and 7 orders were captured in the traps. Infestations were generally associated with bird seed, small animal foods, or spilled food. Sanitation in conjunction with hydroprene or cyfluthrin applications on targeted floor areas reduced beetle numbers but did not greatly reduce Indianmeal moth numbers. This research was part of a collaborative project with Rennie Roesli and Bhadriraju Subramanyam at Kansas State University and Kim Kemp at Nestle Purina Pet Care Company.
(Jim Campbell, telephone: 785-776-2717, email: campbell@gmprc.ksu.edu)

- **NIR Studies on Grain Sorghum.** Near-infrared spectroscopy (NIR) was used to predict crude protein, fat, starch, protein digestibility, and in-vitro dry matter disappearance using both whole grain and ground grain sorghum samples. Crude protein predictions were the most accurate followed by starch and protein digestibility. Predictions for fat and in-vitro dry matter disappearance were not well correlated with actual values. Results obtained from ground grain were better than those from whole grain.
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- **Development of DNA-Based Methods for Monitoring Flour Beetle Populations.** During our work with the red flour beetle, we have developed the most comprehensive genetic map for any beetle species. This map spans all ten chromosomes at an average resolution of about 400 kilobases. We have identified DNA sequence markers for potential use in fingerprinting populations of red flour beetles in mills and warehouses, for identifying infestation sources, and for determining the stability both of local infestations and regional populations. These DNA markers are now being evaluated for their ability to discriminate between field populations. We are in the process of standardizing the fingerprinting procedure, sampling beetles from mills, and determining the numbers and varieties of individual fingerprints. Preliminary indications are that the fingerprints will allow us to discriminate even between closely related families of red flour

beetles. Collaborators are Tom Phillips (Oklahoma State University) and Jim Campbell (GMPRC).
(Dick Beeman, telephone: 785-776-2710, email: beeman@gmprc.ksu.edu)

- **New Agricultural Engineer Joins GMPRC.** Dr. Paul Armstrong joined the Engineering Research Unit of GMPRC in July. Paul was originally from South Dakota and his family moved to Australia where he received a Bachelor's Degree in Engineering from the University of Southern Queensland. In 1982, he received a Master's Degree in Agricultural Engineering from Oklahoma State University and in 1989, he received his Ph.D. in Agricultural Engineering from Michigan State University. Before joining GMPRC, Paul was the Proprietor of Bioworks, Inc. in Stillwater, Oklahoma, where he developed instrumentation to measure the firmness, sizes, etc. of small fruit such as cherries. His research program at GMPRC will focus on grain quality instrument sensors. He is particularly interested in investigating the potential of micro sensors for real-time grain quality analysis.
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