GMPRC
GRAIN MARKETING AND PRODUCTION RESEARCH CENTER

RESEARCH Kernels

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- **Where Does All That Dust Come From?** Wind erosion of soils generates fine dust particles by three major processes. Loose material can be picked up from the surface, small dust particles can be rubbed off or abraded from large immobile clods and crusts, or smaller mobile soil aggregates can be broken up generating dust. Some of these dust particles are less than 10 micrometers in diameter (called PM10) and others are even smaller being less than 2.5 micrometers in diameter (called PM2.5) Particles in these two size categories are regulated as health hazards due primarily to their potential to cause lung damage. Studies of soil samples collected from nine states (AZ, CA, NV, CO, KS, NE, NM, OK, and TX) showed that the breakage of aggregates that contained large clay or sand fractions was one-third that of other soils. On average, 5% of the dust particles created were in the PM10 size range and 15% of these PM10 particles were in the smaller PM2.5 size category. Results confirmed that the dust produced from the breakage of mobile soil aggregates generated higher levels of the PM10 and PM2.5 particles than dust from loose materials or that was rubbed off large clods. Thus, management practices that generate larger, immobile clods should produce lower levels of the hazardous dust particles. (Larry Hagen, telephone: 785-537-5545, email: hagen@weru.ksu.edu).

- **Hessian Fly Larva Contain Potent Saliva.** Hessian fly is one of the major pests of wheat which can cause enormous economic loss. Several lines of evidence suggest that Hessian fly larva inject saliva into the wheat plants during feeding causing severe stunting and death to the young seedlings. We have isolated two genes that produce proteins that are contained in this saliva and we are studying these proteins to determine their functions during the infestation process. (Ming Shun Chen, telephone: 785-532-4719, email: mchen@oznet.ksu.edu).

- **How Does That Fungus Attack Wheat?** Wheat leaf rust disease is caused by a fungus called Puccinia triticina. In such diseases, there is a wealth of knowledge about how the plants are affected, but little is known about what genes the fungus uses to infect the plant. We have isolated at least 21 fungal genes that are likely to play a role in establishment of this disease in the wheat plant. Some of these genes are similar to virulence genes from other fungi. Knowledge of which genes the fungus needs to attack the plant may lead to alternative methods for controlling leaf rust

and other similar fungal diseases. (John Fellers, telephone: 785-532-2367, email: jpf@alfalfa.ksu.edu).

- **Update on Areawide Integrated Pest Management (IPM) Project for Stored Wheat.** Research conducted during the areawide IPM project for stored wheat is having a major impact on commercial grain storage in KS and OK. A new company is currently using the SGA Pro Expert System and the sampling technology developed in the areawide project to make management recommendations for elevators. SGA Pro uses a risk-analysis database and insect models to predict which bins will need to be fumigated, rather than fumigating all of the bins at an elevator. Grain elevators using SGA Pro's recommendations reduced the number of bins normally being fumigated by over 50%. (Paul Flinn, telephone: 785-776-2707, email: flinn@gmprc.ksu.edu)

- **How Can We Lure Those Pesky Beetles Into Our Traps?** Pheromone traps for red flour beetles are often reported to not be very effective for monitoring, but the reasons for this have not been well studied. We evaluated how effective Dome® traps baited with red flour beetle pheromone are at identifying the sources of infestation of beetles. Beetles were released from a single location into a large room. The first tier of traps only captured about 15% of the dispersing beetles. On average, mapping the distribution of pheromone trap captures located the source of infestation, but results were highly variable. Individual red flour beetle response to the traps in still air is quite low, but under moving air conditions there is a strong response to the pheromone/food oil combination. Variables such as beetle sex, mated status, age, pheromone age, and trap location are being investigated to determine their impact on trap capture. Our results indicate that the probability of capture is high after encountering a trap and that the strong influence of air movement on the number of insects trapped complicates the interpretation of pheromone monitoring programs. (Jim Campbell, telephone: 785-776-2717, email: campbell@gmprc.ksu.edu)

- **Hit Those Beetles Where It Hurts.** Plants contain compounds that inhibit the activity of enzymes called proteinases that insects need to digest their food. We have identified inhibitor combinations that, when ingested, have a negative effect on the growth of the red flour beetle. Genes encoding these inhibitors may be incorporated into seeds and provide enhanced protection against red flour beetle damage. We also found that the red flour beetle can compensate for individual inhibitors, but the inhibitor combination prevented the adaptive response. This information provides valuable insights into the regulation of digestive proteinases in the red flour beetle, and we are now proceeding to clone red flour beetle proteinase genes to further study the mechanisms of protein digestion in this storage pest. (Brenda Oppert, telephone: 785-776-2780, email: bso@ksu.edu)

- **Beneficial Wasps Carry An Insect-Killing Pathogen.** Parasitic wasps are naturally occurring suppressors of beetle pests in stored products. Certain female wasps feed on some of their hosts and deposit their offspring on others. We have found that when they attack a host that is infected

with an insect-specific disease organism they too become infected. The wasps can survive for several weeks after exposure to the disease and continue to attack their hosts and multiply while much of their internal tissue is transformed into the disease organism. They can transmit the disease to attacked beetle larvae or introduce inoculum into the pest populations after they succumb and their cadavers are scavenged or decompose. We expect to use beneficial wasps and the disease they carry to provide a natural, two-pronged attack on pest insects. (Jeff Lord, telephone: 785-776-2705, email: lord@gmprc.ksu.edu)

- **Chemicals Help Beneficial Insects Survive.** Dufour glands are small glands associated with the venom apparatus in female parasitic wasps (Hymenoptera). The morphology and chemistry of these glands were characterized in five parasitic wasps used to control stored-product insect pests. The chemicals found were highly complex mixtures and are thought to be involved in such things as mate attraction and marking of eggs and insect hosts to help them survive better in the stored grain environment. Dufour gland chemicals elicit a wide range of behaviors in many ants, bees, and wasps, and any knowledge of semiochemical roles of these chemicals in behaviors involving host location and successful parasitization by the grain insect parasitoids will help improve their effectiveness as biological control agents. (Ralph Howard and Jim Baker, telephone: 785-776-2706, email: howard@gmprc.ksu.edu)

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