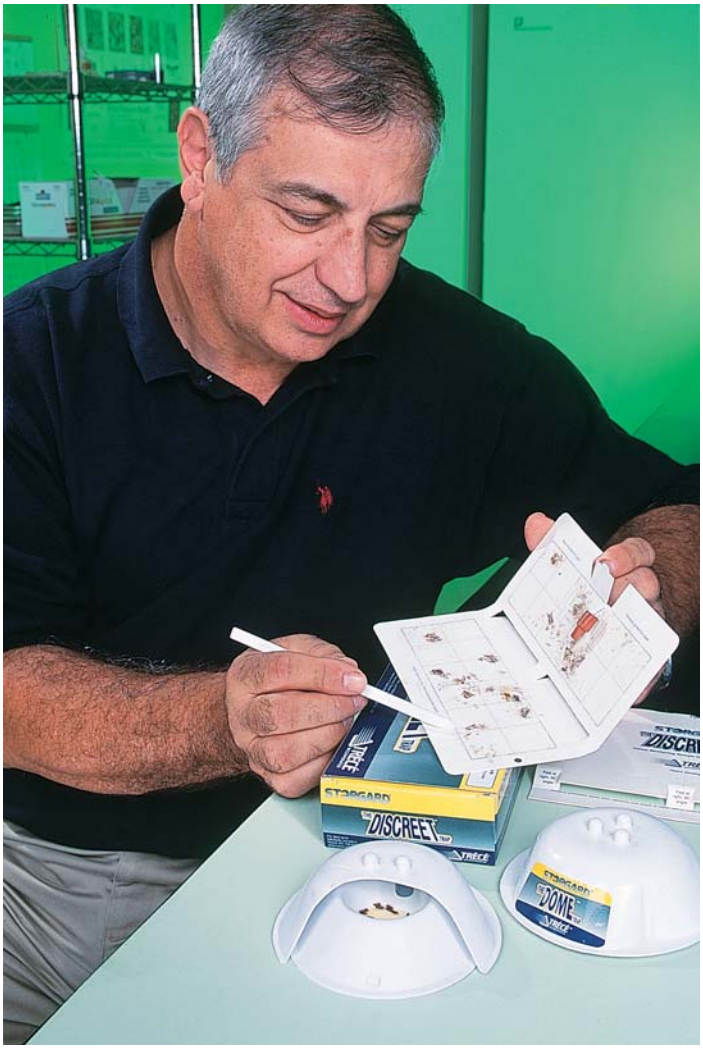
Fighting Insect Pests of Stored Foods

PEGGY GREB (K9724-1)



Entomologist Mike Mullen checks pheromone traps for captured Indianmeal moths as part of a program to develop an effective monitoring system for stored-product insect pests.

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Indianmeal moths trapped on a pheromone trap.

Anyone who has ever been to a picnic knows insects are drawn to food. That's why developing new methods to keep insects out of food in packages, warehouses, and processing plants is critical for food manufacturers.

New and innovative methods are needed because the industry is challenged to reduce pesticide use while ensuring that food products are insect-free. To meet these challenges, a team of ARS scientists at the Grain Marketing and Production Research Center in Manhattan, Kansas, is working closely with industry.

Keep Out, Bug!

Keeping food in containers is one of the oldest ways to protect food from insects. Ancient historical documents describe the use of crude containers, such as gourds, leaves, shells, animal skins, and even human skulls. In the 1800s, people turned to paperboard boxes, paper bags, and tin cans to preserve perishables. In the 1900s, the most popular materials for preserving food were aluminum foil, cellophane bags, and plastic.

Today, restrictions on pesticide use and having fewer sanitation personnel at various points along the distribution chain have made insect-resistant packaging even more important to consumers and to food or feed manufacturers.

Entomologist Michael A. Mullen, in cooperation with several food manufacturers, has conducted packaging studies on a variety of products, including cereals, raisins, baby foods, and dry pet foods. Mullen classifies insects as either invaders, which enter through existing openings, or penetrators, which can chew through packaging materials. (See "Pest-Proofing Food Packaging," *Agricultural Research*, March 1998, pp. 10–11.)

"Simply using a different glue pattern in the seals and closures of bags can help safeguard the product from insects. A glue pattern that forms a complete seal with no channels for insects to crawl through can help prevent insect entry into a package," says Mullen. Another method is to use tightly fitting overwraps to increase resistance to invasion.

But packaging is just one defense. "Food processors should follow good sanitation practices along with insecticide treatments," says ARS entomologist Franklin H. Arthur. In flour mills and food processing plants, insects that survive an insecticide treatment could live on food or crumbs left by poor sanitation. These surviving insects may become resistant to insecticides, making it harder to eliminate the infestation and prevent economic damage.

As an alternative to insecticides, Arthur is testing insect growth regulators (IGRs), chemicals that prevent insect larvae from becoming reproductive adults. To replicate food-storage conditions, Arthur creates "exposure arenas" by pouring concrete into petri dishes. These test arenas are used to study insect survival after exposure to IGRs and various insecticides. The chemicals are sprayed directly onto the concrete, and insects are exposed to the treated surfaces.

IGRs aren't toxic to humans, and they can suppress populations of important stored-product insect pests, such as the red flour beetle and the confused flour beetle. Arthur recently

evaluated a volatile formulation of the IGR hydroprene, known commercially as Pointsource, to control these two beetles. In laboratory tests, larvae of both beetle species exposed to Pointsource often failed to molt to the adult stage. Adult insects that did emerge were usually deformed and died quickly. Use of this product could be most effective in small, confined spaces in retail stores and homes.

Trapping the Enemy

Food products can become infested by insects during storage at any point from the manufacturer to the kitchen cupboard. Traps baited with nontoxic chemical lures called pheromones can reduce the need for insecticides by monitoring, detecting, and pinpointing insect infestations.

Mullen has developed an insect monitoring system using specially designed traps and pheromones. By establishing a grid of traps designed for crawling and flying insects and plotting the number of insects collected in each trap, he can map insect populations for facility managers. This allows precise identification of infested materials and helps target—and thus limit—use of chemical control methods.

Mullen and Alan K. Dowdy, formerly an ARS entomologist at the Grain Marketing and Production Research Center, worked cooperatively with Trécé, Inc., of Salinas, California, to develop a trap that can be hidden under shelves in retail stores, warehouses, food processing facilities, and home pantries. Commercially sold as Discreet Trap, it is expected to increase use of monitoring devices in retail areas and reduce the need for pesticides by pinpointing infestations.

Another trap, marketed by Trécé, Inc., as Dome Trap, was originally developed by Mullen. He and Oklahoma State University scientists later modified it to include a dust cover. Since dust can clog traps, making it possible for insects to escape, keeping dust out makes the traps more effective.

Traps allow warehouse and food-processing managers to make better management decisions about the timing and targeting of control practices. These controls, which include sanitation and crack-and-crevice sprays, are more cost-effective and have less environmental impact than widespread use of conventional chemical treatments.

Use of insect-resistant packaging combined with effective monitoring and the prudent use of pesticides will ensure that consumers receive the highest quality and safest food products possible.—By **Linda McGraw,** formerly with ARS.

This research is part of Crop Protection and Quarantine, an ARS National Program (#304) described on the World Wide Web at http://www.nps.ars.usda.gov.

Michael A. Mullen and Franklin H. Arthur are in the USDA-ARS Biological Research Unit, Grain Marketing and Production Research Center, 1515 College Ave., Manhattan, KS 66502; phone (785) 776-2782 [Mullen], (785) 776-2783 [Arthur], fax (785) 537-5584, e-mail mullen@gmprc.ksu.edu, arthur@gmprc.ksu.edu. ◆

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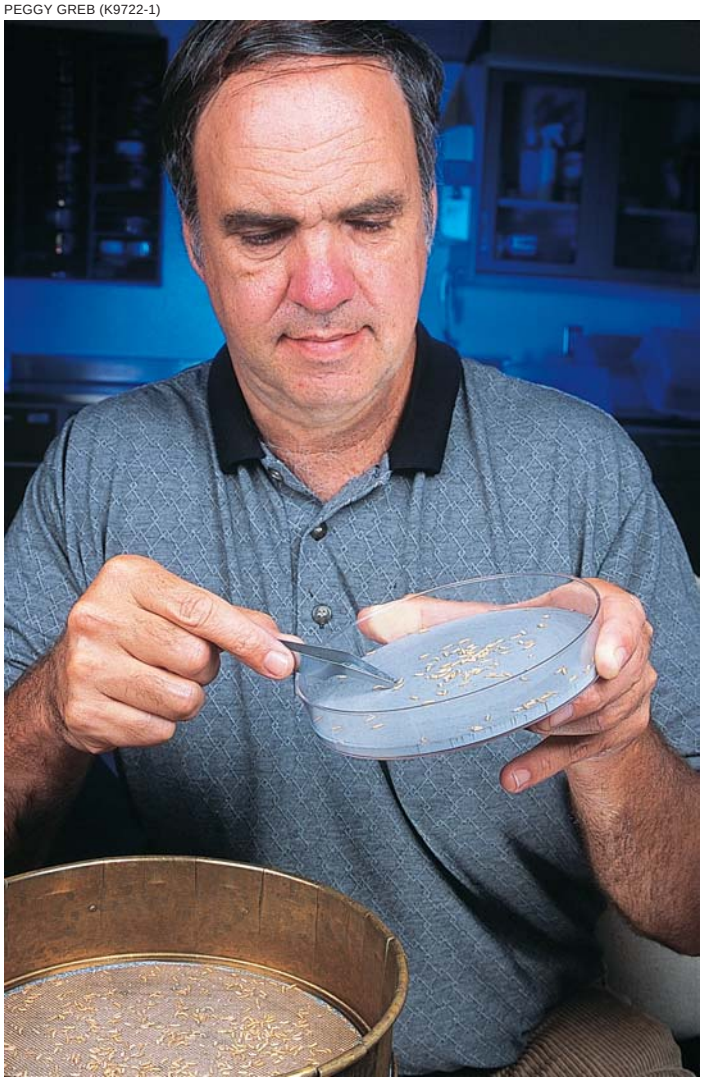

Entomologist Frank Arthur collects red flour beetle larvae for testing.

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Left: Red flour beetle larvae exposed to concrete treated with the insect growth regulator hydroprene failed to grow to adulthood. Right: Healthy adults on untreated concrete.