Using Traps in Food Plants

Trapping stored-product insects is easy; interpreting trap-catch results is not

Traps for stored-product insect pests are routinely used in food-processing facilities, either by a pest control service company or by trained professionals in the food company.

Pheromone trap for flying moths and beetles. Photo courtesy of Fumigation Service & Supply.

Pest Management

Dr. Bhadriraju Subramanyam

The traps most commonly used are for beetles or moths that are associated with raw grains and processed foods. The traps for crawling insects contain a food attractant for capturing multiple species of beetles.

The traps for moths, depending on the company that manufactures them, has a sticky surface designed to capture multiple species of moths or a single moth species by using specific pheromone lures.

Pheromones are chemical signals used between members of the same species. There are two types of pheromones—sex and aggregation.

Sex pheromones are released by females of short-lived insects, such as Indianmeal moth and cigarette beetle, to attract males of the same species. Aggregation pheromones are produced by males of long-lived insects, such as the red flour beetle and lesser grain borer, to attract both males and females.

Feeding is generally required by males to produce the aggregation pheromone. Research has shown that release of food odors and aggregation pheromones together enhances trap catch of insects. Therefore, the commercial food attractant trap also recommends use of pheromones for certain insect species.

Although pheromones have been identified for more than 40 species of stored-product insects, they are commercially available for only 22 species. However, food and allied industries use pheromone traps primarily for the Indianmeal moth, flour beetles, cigarette beetles, and warehouse beetles, perhaps due to the common occurrence of these species in various settings.

Traps without any baits or lures also are available for use in stored, raw, agricultural commodities. These traps are called probe traps and have not been widely used by the grain industry. A company is now marketing a probe that can count insects electronically as they fall through the trap, reducing labor and time required for servicing the trap.

Recent developments in luring insects to a source with the use of attractants and killing them with a chemical (insecticide) offers a great potential for managing stored-product insects in the future.

The use of high concentrations of pheromones to disrupt mating of storage moths has been shown to be successful in pilot-scale tests but not in commercial facilities. Additional work is needed before traps can be used for managing stored-product insects.

The traps currently marketed and used for stored-product insects primarily serve to detect and monitor insects and are not intended for managing pest populations.

Data Gaps

One of the biggest challenges in using traps and associated attractants/pheromones for stored-product insects has been in the interpretation of trap catch.

What does it mean if you catch 10 as opposed to 50 insects of a species in a given trap?

Insect activity, insect population density, presence of competing food odors and odors from mates, and temperature, among other factors, influence insect capture in traps. Trap location with reference to an infestation also influences numbers captured.

There are differences among species in how they respond to a trap. In sticky traps baited with a sex pheromone lure, only males of moths are captured. It is difficult to know whether the captured males responded to the trap before or after they have mated with females, because males and females are capable of mating multiple times.

A trap for capturing female moths that is based on food attractants is being marketed by a company in the United States.

This trap is a result of work conducted by Dr. Christian Nansen and Dr. Tom Phillips at Oklahoma State University, Stillwater, OK. It is intended for capturing females and the researchers have found that it captures significantly more females than males.

This trap is being evaluated at KSU in a swine facility that has Indianmeal moths and Mediterranean flour moths, and a flour mill that has Indianmeal moths and almond moths. We are testing the traps with a female attractant alone against blank traps without any attractants or lures.

Our results have been less than encouraging. The commercial trap in many cases was no better than a blank and is capturing significantly more males than females. Because the trap tends to capture both males and females, capture of a female initially may attract males, possibly due to pheromone release by the captured female.

The availability of the female trap for moths is a great addition to our trapping tools, but more work is needed to verify the effectiveness of the female trap in suppressing populations in sanitary and unsanitary facilities and at various population densities of moths.

> Sequential contour maps are especially useful for understanding the impact of sanitation, crack/crevice treatment, fogging treatment, fumigation, or heat treatment on insects.

Recommended Trap Practices

Despite our limited understanding of biological and environmental factors that affect capture of insects in traps, traps with food attractants and pheromone lures must be used for detecting and monitoring stored-product insects in food-processing facilities, in trucks, warehouses, and retail stores.

The number of traps to use is based on the resources available for trapping and the time involved in servicing traps. The short answer is that it is better to use more traps (20 to 30 traps per floor) than less traps.

Grid fashion. Traps in food-processing facilities should be placed in a grid fashion on each floor and checked weekly or biweekly.

It is important initially to use food-baited traps for beetles and sticky traps with pheromones for moths to determine types and numbers of insect pests present.

Food products also should be sampled simultaneously to relate infestation of products with specific species relative to species captured in traps.

It is possible to catch large numbers of Indianmeal moth males in pheromone traps and not find any larval infestation in the food-processing facility.

Countour maps. Trap capture data can be plotted as mean numbers captured over time to see population trends. Another powerful way to visualize insect capture in traps involves using contour maps (see figure 1, page 46).

To generate contour maps, each trap location on floors should be identified using an x and y coordinate. The number of insects captured represents the z coordinate.

Several geostatistical software programs can generate contour maps from the x, y, and z data. Some of the popular programs are ArcView GIS and Surfer.

Contour maps are generated by interpolation techniques. Contour lines predict trap captures of insects at locations not sampled. Very little training is needed to generate contour maps.

The focal points of infestation (or high-trap capture) can be readily identified from examining the contour maps. Careful inspection of areas of the facility where high captures are noticed should reveal the source of an infestation. Identifying focal points of infestation is important for targeting pest control measures.

Instead of treating the whole facility, pest control can be focused in areas where there is a significant problem. Such an approach is especially important for identifying and controlling emerging infestations soon after a whole facility treatment with fumigants or heat.

Contour maps should be generated over time (sequential contour maps) from data collected weekly or biweekly. These maps give an indication of where new infestations are emerging and how an infestation is spreading within the facility.

Sequential contour maps are especially useful for understanding the impact of

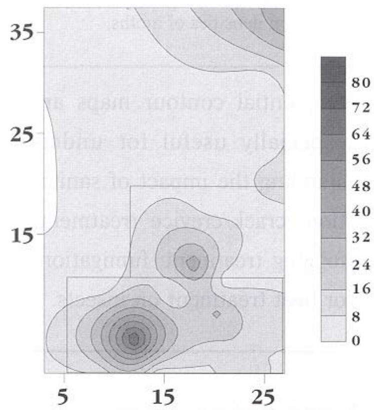

Fig. 1. An example of a contour map. The x and y axes show distance from left front in feet. The bar on the right hand side shows the number of insects captured/trapped in 30 days in a retail pet store.

sanitation, crack/crevice treatment, fogging treatment, fumigation, or heat treatment on insects. This is one way of gauging the effectiveness of your sanitation and pest management programs.

Outdoor trapping. It's also important to place traps outdoors, because stored-product insects have been shown to present outside food plants.

Outdoor trapping alerts you of potential infestation risks from pest populations, especially following fumigation or heat treatment of a facility.

Scientists are studying movement of insects between outside and inside of food-processing facilities by using special colors to mark insects.

There is ample evidence of stored-product insects occurring outdoors, but we understand very little about their movement between outdoor and indoor habitats.

Similarly, there are data being collected on insect movement within facilities and in response to food resources within a facility. All of these findings should improve our ability to interpret trap catch of stored-product insects.

Bhadiraju Subramanyam (Subi) is a professor in the Department of Grain Science and Industry at Kansas State University, Manhattan. He can be reached at 785-532-4092 or bhs@ wheat.ksu.edu.