
PANTRY PESTS

Integrated Pest Management in the Home

Stored-product pests are usually brought into the home in an infested package of food. Initially, infestations are easy to overlook, because the insects involved are quite small, especially in the egg and larval stages. Often the first indication of an infestation is small moths flying about or beetles in or near a package of food.

IDENTIFICATION AND LIFE CYCLES

The most common insects infesting food in the home are in the orders Lepidoptera (moths) and Coleoptera (beetles). Adult moths and adult beetles are easy to distinguish from one another, but their similar-looking larvae are a little more difficult to identify. Use a hand lens to examine the legs of the larvae. Beetle larvae are either grublike and legless or have only three pairs of legs, all located close to the head. Moth larvae have three pairs of true legs plus additional leglike structures farther down the abdomen. Both larvae and adults of beetles feed on foodstuffs, whereas only the larval stage of moths eats stored products.

Meal Moths

The most common species of meal moths found in the home pantry is the Indianmeal moth, *Plodia interpunctella* (Figure 1). All damage is done by the larvae, which attack a wide range of products including cereal and cereal products, flour, cornmeal, rice, dried fruit, dehydrated vegetables, nuts, chocolate, candies, and other confections. When infestations are heavy, mature larvae can often be found in parts of the house far from the original food source, because they move quite a distance to pupate.

The Indianmeal moth is a fairly distinct small moth— $1/3$ to $2/5$ inch long with a wingspan of about $3/5$ inch—with reddish brown forewings that have a coppery luster on the outer two-thirds and with whitish gray on the inner or body portion. The female moth lays its eggs singly on food material. Eggs hatch within a few days into small whitish caterpillars.

Larvae of the Indianmeal moth spin a web as they grow and leave behind silken threads wherever they crawl. When fully grown, the larva is about $1/2$ inch long and white with a greenish or pinkish hue. This larva spins a silken cocoon (Figure 2) and transforms into a light-brown pupa, from which the adult moth later emerges. During warm weather, the Indianmeal moth takes about six to eight weeks to complete egg, larval, and pupal stages.

Don't confuse Indianmeal moths with clothes moths, which are smaller and have more hair than pantry moths. For more information see *Pest Notes: Clothes Moths* listed in References.

Pantry Beetles

While there is only one major species of moth that feeds on food products in the home, several species of beetles commonly attack a wide variety of foods:

- The warehouse beetle (*Trogoderma variabile*)
- The sawtoothed grain beetle (*Oryzaephilus surinamensis*) and the merchant grain beetle (*O. mercator*)
- The confused flour beetle (*Tribolium confusum*) and the red flour beetle (*T. castaneum*)



Figure 1. Indianmeal moth.



Figure 2. Indianmeal moth larva spinning its cocoon.

- The drugstore beetle (*Stegobium paniceum*) and the cigarette beetle (*Lasioderma serricorne*)

Other beetles that feed primarily on seeds or whole grains include the lesser grain borer (*Rhyzopertha dominica*), the bean weevil (*Acanthoscelides obtectus*), the granary weevil (*Sitophilus granarius*), and the rice weevil (*S. oryzae*). These seed beetles aren't covered in detail here, but their management is similar to the other pantry beetles.

Warehouse Beetle. The warehouse beetle feeds on a wide variety of foods including cereals, candy, cocoa, cookies, cornmeal, fish meal, pet foods, flour, nuts, dried peas and beans, pastas, potato chips, spices, dead animals, and dead insects.

Adult beetles have oval bodies that are about $1/8$ inch long with a brown and

PEST NOTES

Publication 7452

University of California
Agriculture and Natural Resources
Statewide Integrated Pest Management Program

March 2013

yellowish pattern on the wing covers (Figure 3). Female beetles lay up to 90 eggs within the infested food, and larvae emerge and feed on the food. Each larva is about 1/4 inch when fully grown and has numerous stiff setae, or hairs, that emerge from dark-colored plates on the last few segments of its abdomen as well as a tail of long, thin hairs that extends from the tip of the abdomen. Larvae are very active and seek out new food sources to infest. In warm temperatures, the entire life cycle from egg to adult can be completed in 45 days.

The setae of this beetle are shed within the infested food product and can be irritating to the mouth, esophagus, and digestive tract if ingested; consequently any food found infested with this beetle should be discarded.

Sawtoothed Grain Beetle and Merchant Grain Beetle. The sawtoothed grain beetle (Figure 4) and the merchant grain beetle are slender, flat, brown beetles that are about 1/10 inch long. Both beetles have six sawlike tooth projections on each side of the thorax, the section between head and abdomen. The sawtoothed grain beetle has smaller eyes than the merchant grain beetle and a larger area just behind the eyes. In both larval and adult stages, these beetles feed on all food of plant origin, especially grain and grain products such as flours, meals, breakfast foods, stock and poultry feeds, coconut, nutmeats, candies, and dried fruit; it's also common to find these beetles infesting pet food, bird seed, and rodent bait.

The biology of both beetles is nearly identical, and they are managed in the same manner so it isn't necessary to distinguish between the two species. The adult beetles live an average of 6 to 10 months, but some individuals may live as long as 3 years. The female beetle of both species drops her eggs loosely among some food material or tucks the eggs in a crevice in a kernel of grain. When the small, slender, white eggs hatch, the emerging larvae (Figure 5) crawl about



Figure 3. Warehouse beetle larva (left) and adult (right).



Figure 4. Sawtoothed grain beetles.



Figure 5. Larvae of the sawtoothed grain beetle.

actively, feeding here and there. They become fully grown in about two weeks during summer weather and then construct delicate cocoonlike coverings by joining together small grains or fragments of foodstuff with a sticky secretion. Within this cell, the larva changes to the pupal stage. Development from egg to adult may take from three to four weeks in summer.

Confused Flour Beetle and Red Flour Beetle. The confused flour beetle (Figure 6) and the red flour beetle (Figure 7) are very similar in appearance and can be most easily distinguished by examining the antennae; the antennae of the red flour beetle end abruptly in a three-segmented club, while the confused



Figure 6. Confused flour beetle.



Figure 7. Red flour beetle.

flour beetle's antennae gradually enlarge toward the tip, ending in a four-segmented club. Adult beetles of these two species have shiny reddish-brown bodies that are about 1/7 inch long, flattened, and oval. These beetles have a very wide food range including cereals, damaged grains, grain products, shelled nuts, dried fruit, chocolate, drugs, and herbarium and museum specimens.

The biologies of these two species are very similar; their average lifespan is about one year, but some have been known to live almost four years. The females lay their small white eggs loosely in flour or other food material. The eggs, which are coated with a sticky secretion, become covered with flour or meal and readily adhere to the sides of sacks, boxes, and other containers. They hatch into small wormlike larvae that are slender, cylindrical, and wiry in appearance. When fully grown, each larva is 3/16 inch long and white, tinged with yellow. At this stage, it transforms into a small pupa. At first white, the pupa gradually changes to yellow and then brown; shortly afterward it transforms into a beetle. In summer, the period from egg to adult averages about six weeks.

Drugstore Beetle and Cigarette Beetle.

The drugstore beetle and the cigarette beetle (Figure 8) closely resemble one another, but the cigarette beetle is more common. Both beetles are about 1/8 inch long, cylindrical, and uniformly light brown. The easiest way to distinguish between the two is by the wing covers; those of the drugstore beetle have longitudinal grooves, while wing covers of the cigarette beetle are smooth.

The cigarette beetle feeds on cured tobacco, cigarettes, and cigars. It also feeds on dried herbs, spices, nuts, cereals and cereal products, dried fruit, seeds, and animal products such as dried fish and meats, hair, and wool. In the home this beetle is most commonly found in pet foods, cereals, nuts, and candy. It may also infest dried pepper arrangements, wreaths, and spices such as chili powder or paprika.

The cigarette beetle lays its eggs in the food substance. The small yellowish-white grubs are covered with long, silky, yellowish-brown hairs and are about 1/6 inch long when fully grown. The pupae are within a closed cell comprised of small particles of the food substance cemented together with a secretion from the larvae. The period from egg to adult is about six weeks.

The drugstore beetle is a very general feeder, consuming a great variety of stored foods, seeds, pet foods, spices, and pastry mixes and has been said to "eat anything except cast iron." It gets its name from its habit of feeding on almost all drugs found in pharmacies. In the home, however, the most common materials this beetle infests are pet foods, drugs, and cereals. The drugstore beetle lays eggs in almost any dry organic substance. After hatching, the small white grubs tunnel through these substances and, when fully grown, pupate in small cocoons. The entire life cycle may take place in fewer than two months.

DAMAGE

Pantry pests damage food by contaminating it with their bodies and their by-products. The larval stage of the Indianmeal moth produces frass (excrement) and webbing, and some beetle

larvae produce secretions that give food a disagreeable odor and taste. Setae (hairs) from the warehouse beetle can irritate the mouth, throat, and stomach of people who eat infested products. In addition, pantry pests might introduce microbes into the food that could produce mycotoxins (highly carcinogenic compounds), especially if the food is stored in warm, humid conditions.

MANAGEMENT

Getting rid of food-infesting moths or beetles takes continuous, persistent effort at removing and cleaning up the infestation, especially if it has been present for a while. Some pests are capable of living for many weeks without food; thus the threat of reinfestation exists until they die off or are killed. It is best, at least for several months after eliminating the infested products, to store any susceptible food in airtight containers or in a refrigerator or freezer. Also, as a general practice, storing infrequently used food items (e.g., pancake flour, grains, spices, and so forth) in the freezer prevents infestations from developing.

Pheromone traps are available in many retail stores to monitor and trap Indianmeal moths and other pantry pests (Figure 9). Insecticides aren't recommended for any of the pantry pests.

Detection

If you find small moths or beetles crawling or flying around your kitchen, look for the food source of these pests and remove it immediately. If you locate the infestation before it spreads to other packages, control may be relatively easy. The source is commonly a package damaged at the store or an opened one that is little used or forgotten. The best thing to do with the package is seal it up and dispose of it, removing it from the house immediately.

Cleaning an Infestation

Most commonly, by the time the insects are noticed, they have already spread to other food packages. Carefully inspect all packages, especially those that have been opened or are exposed. Destroy any that give the slightest indication of infestation. Other than the insects themselves, tell-



Figure 8. Cigarette beetle.



Figure 9. Pheromone traps can be useful for monitoring Indianmeal moths.

tale signs include webbing in tight places of a package or tiny holes in the container. Insects are less likely to invade packages that have their original seal but more commonly infest those that have been opened or that have been on the shelf for a long time. Before replacing noninfested packages, wash shelves with soap and water, scrubbing corners and crevices or vacuuming them with a crevice attachment to remove eggs and pupae.

Pheromone Traps

Pheromone traps are readily available for several different pantry pests, although pheromone traps specifically designed for the Indianmeal moth won't attract beetles. There are some traps (e.g., Pantry Patrol) that attract several different pantry pest species, including the Indianmeal moth, red flour beetle, confused flour beetle, warehouse beetle, and cigarette beetle.

Use pheromone traps to detect pests that remain in the house after the source of the infestation has been removed. Pheromones are chemicals produced by an organism to affect the behavior of other members of the same species. In the case of the Indianmeal moth, a sex pheromone attracts adult male moths into the trap where they get stuck on the sticky sides;

these traps won't attract the female moths but may reduce their ability to produce eggs if the traps catch males before they can mate. The pheromones used to attract the flour beetle species are aggregation pheromones that attract both sexes. Food oil lures are also contained in some traps.

Place the traps in the area of a previous infestation and check them weekly. Most traps remain effective for about three months. Whenever you catch a new batch of moths or beetles in traps, it is time to inspect food packages again for an infestation.

Prevention and Sanitation

Most home infestations of pantry pests maintain themselves on spills in the crevices of cupboards and drawers or in opened packages of food stored for long periods of time. Following a few general guidelines when storing food products will help you avoid many potential problems:

- Don't put exposed food on shelves. Place it in containers with tight-fitting lids; plastic bags aren't adequate.
- Regularly clean shelves, bins, and all other locations where there is any possibility of flour or other food particles accumulating. Certain pests need only small amounts of food to live and breed. Soap and water are great for cleaning flat areas, and vacuuming with a crevice attachment will help clean cracks, edges, and corners.
- Don't mix old and new lots of foodstuffs. If the old material is infested, the pest will quickly invade the new.
- Clean old containers before filling them with fresh food. They may be contaminated and cause a new infestation.
- Don't purchase broken or damaged packages of food materials. They are more likely to become infested.
- Construct storage units so that they are tight and can be easily cleaned.
- Store bulk materials, such as pet foods, in containers with tight-fitting lids.
- Keep storage units dry. This is important because moisture favors

the development of pantry pests, while dryness discourages them

- Some pantry insects breed in the nests of rodents and insects and may migrate from these into homes. Eliminate any nests found in or near the home.
- Pantry pests can also breed in rodent baits. Be sure to frequently check and discard infested baits.

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ILLUSTRATIONS: Figs. 1-5 and 7, J. K. Clark; Fig. 6, Clemson Univ.; Fig. 8, D.-H. Choe; and Fig. 9, C. A. Reynolds.

University of California scientists and other qualified professionals have anonymously peer reviewed this publication for technical accuracy. The ANR Associate Editor for Pest Management managed this process.

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This material is partially based upon work supported by the Extension Service, U.S. Department of Agriculture, under special project Section 3(d), Integrated Pest Management.

Produced by **UC Statewide Integrated Pest Management Program**
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University of California
Agriculture and Natural Resources

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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