

## IPM for Clothes Moths and Carpet Beetles in Schools

### INTRODUCTION

The insects discussed in this chapter, clothes moths and carpet beetles, are sometimes referred to as fabric pests. They feed on wool, feathers, fur, hair, leather, lint, dust, paper, and occasionally cotton, linen, silk, and synthetic fibers. Most damage is done to articles left undisturbed for a long time.

### IDENTIFICATION AND BIOLOGY

#### Clothes Moths

The most common fabric-attacking moths are the webbing and the casemaking clothes moths. Both the webbing clothes moth (*Tineola bisselliella*) and the casemaking moth (*Tinea pellionella*) are common in Pennsylvania. The adults of both species are about 1/4 inch long and have a wingspan of about 1/2 inch. The webbing clothes moth is golden buff or yellowish gray with a satiny sheen, and the hairs on its head are upright and reddish. The casemaking clothes moth is similar in size and shape, but has a browner hue and three indistinct dark spots (which may be worn off with age) on the wings, with lighter-colored hairs on the head.

Adult moths of both species avoid light and attempt to hide when disturbed, which helps distinguish these moths from other small moths found in buildings (see Table 2). Clothes moths are occasionally seen flying in subdued light. Males fly more often than females, but both may fly considerable distances and can move from building to building in favorable weather. Adults can be seen flying at any time of year, but they are more common during the summer months.

The life cycles of the two moths are similar. Adult females lay an average of 40 to 50 eggs. Incubation takes from 4 days to 3 weeks, or sometimes longer. If conditions are good—meaning abundant food, temperatures around 75°F, and at least 75 percent relative humidity—a new generation can be produced in a month. It takes over a year when conditions are less favorable, and periods up to four years have been recorded in the laboratory. The larval and pupal stages combined may take from 45 days to more than a year to complete. At ordinary household temperatures, adult moths live from 2 to 4 weeks. The adults do not feed on fabrics.

**TABLE 2.**

Species	Distinguishing Characteristics
<b>Webbing clothes moth</b> <i>Tineola bisselliella</i>	Wingspan 1/2 inch, body length 1/4 inch Wings golden yellow without spots, hind wings rounded Body covered with shiny golden scales Tuft of reddish hairs on head
<b>Casemaking clothes moth</b> <i>Tinea pellionella</i>	Slightly smaller than webbing clothes moth Whitish head Wings black on first third, lower two-thirds creamy white, may have some spots on white area Larvae always in case Adults fly in dark areas
<b>Mediterranean flour moth</b> <i>Anagasta kuehniella</i>	Wingspan 4/5 inch Hind wings dirty white, forewings pale gray with transverse black wavy bars Forebody distinctly raised at rest
<b>Indianmeal moth</b> <i>Plodia interpunctella</i>	Wingspan 5/8 inch, 3/8 inch at rest Wings light gray at base with reddish-brown or bronze on outer half Favors dried fruit but will feed on many other stored products
<b>Angoumois grain moth</b> <i>Sitotroga cerealella</i>	Wingspan 3/8 inch Pale yellow forewings and gray pointed hind wings

Adapted from Olkowski, et al., 1991.

Most of the information for this chapter was modified from:  
*IPM for Schools: A How-to Manual*. United States Environmental Protection Agency. EPA 909-B-97-001. March 1997.  
*Clothes Moths*, The Ohio State University Extension Fact Sheet. HYG-2107-97.  
 Jacobs, S. B. *Clothes moths*. The Pennsylvania State University. Entomology-HP-17. 2000.

In heated buildings, female webbing clothes moths can mate and lay eggs any time during the year. The case-making clothes moth generally produces one generation each year.

The larvae of both moths are also similar (pearly-white, naked bodies and dark heads), but the casemaking moth larva spins a characteristic silken tube under which it feeds. These tubes can include parts of the fabric. Larvae of both species range from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch long when fully grown. Their fecal matter is often the same color as the material they consume.

### **Carpet and Hide Beetles**

Adult beetles are small and have short, clubbed antennae, but are otherwise varied in appearance (see Table 3). Their bodies are covered with small scales or hairs, which are visible with a magnifying glass. Larvae are brownish,  $\frac{1}{8}$  to  $\frac{1}{2}$  inch long, and characteristically hairy or bristly.

As with clothes moths, the larval stage is the most damaging. Females lay eggs throughout the year and the eggs hatch in less than two weeks. The larvae feed for varying periods, depending upon the species and environmental conditions. When ready to pupate, the larvae may burrow farther into the food or wander and burrow elsewhere. They also may pupate within their last larval skin or burrow into wood if no other location is found. Beetle larvae do not construct webs, but their shed skins and fecal pellets make it obvious where they have been feeding. The cast skins look so much like live larvae that under casual inspection they may seem to indicate a far larger infestation than is actually present.

Some adult carpet beetle species feed on pollen and nectar; they may be introduced into a school on cut flowers. They are sometimes mistaken for lady beetles, because some species are similarly round in shape.

## **DAMAGE**

### **Clothes Moths**

Adult clothes moths do not feed; only their larvae cause damage. Clothes moth larvae feed on pollen, hair, feathers, wool, fur, dead insects, and dried animal remains. Feeding holes are scattered over the material and are usually small. Clothing, carpets, furs, blankets, upholstery, piano felts, and myriad other items are subject to their attack. They will also feed on wool mixed with synthetic fibers. Only the wool is digested; the other fibers pass through the insect's gut. Clothes moths are attracted to stains on fabrics from food and human sweat and urine. Clothes moths most often damage stored goods, because the larvae are fragile and cannot survive in clothing worn regularly.

## **DAMAGE**

### **Carpet and Hide Beetles**

Carpet beetle holes are usually concentrated in a few areas and can be quite large, in contrast to clothes moth holes. As a group, these beetles cause far more damage than clothes moths, since the range of substances they consume is much wider. Carpet beetles damage materials made from wool, such as sweaters, uniforms, felt, and wool yarn. They also can destroy insect collections, furniture, and carpets. Hide beetles feed on animal carcasses and hides, and also damage furnishings, carpets, and fabrics. Some species also infest stored, dried foods such as cereal (see Table 3).

**TABLE 3.**

<b>Important Carpet or Hide Beetles and Their Food Sources</b>		
<b>Species</b>	<b>Description of Adults</b>	<b>Food Source</b>
<b>Furniture carpet beetle</b> <i>Anthrenus flavipes</i>	$\frac{1}{10}$ to $\frac{1}{5}$ inch long Definite cleft at rear Mottled with black, white, and yellow scales	Wool, hair, fur, feathers, bristles, horn, silk, animal excreta, stained linen, cotton, rayon, jute, softwood, leather, bags, dead mice, dead insects, dried cheese, old grain, casein, dried blood, and glue of book bindings
<b>Common carpet beetle</b> <i>Anthrenus scrophulariae</i>	$\frac{1}{8}$ inch long Blackish with varied pattern of white and orange scales on back Scalloped band of orange-red scales down middle of back	Carpets, fabrics, woolens, feathers, leather, furs, hairbrush bristles, silks, mounted museum specimens; adults found on blossoms; can enter building on cut flowers
<b>Varied carpet beetle</b> <i>Anthrenus verbasci</i>	$\frac{1}{8}$ inch long Mottled with white, brownish, and yellowish scales	Nests of bees, wasps, and spiders; carpets, woolen goods, skins, furs, stuffed animals, leather book bindings, feathers, horns, hair, silk, corn, red pepper, dead insects in collections
<b>Black carpet beetle</b> <i>Attagenus unicolor</i>	$\frac{1}{10}$ to $\frac{1}{5}$ inch long, oval Shiny black and dark brown with brownish legs	Feathers, dead birds, birds' nests, seeds, grains, cereals, woolen rugs, clothing, carpeting, felts, furs, skins, yarn, velvet, silk, upholstered furniture, milk powder, books, pet food, spilled flours, pollen
<b>Black larder beetle</b> <i>Dermestes ater</i>	$\frac{3}{10}$ to $\frac{2}{5}$ inch long Black with yellowish gray hair Black rounded and hook-shaped spots on underside of abdomen	Mouse carcasses in walls of building; partially burned food and other kitchen wastes in incinerators; pet food
<b>Larder beetle</b> <i>Dermestes lardarius</i>	$\frac{3}{10}$ to $\frac{2}{5}$ inch long Dark brown with pale grayish yellow hair Yellow band at base of wing covers with about six black spots	Stored ham, bacon, meats, cheese, dried museum specimens, dried fish, dog biscuits; can tunnel slightly in wood; reported to attack newly hatched chickens and ducklings
<b>Hide beetle, leather beetle</b> <i>Dermestes maculatus</i>	$\frac{1}{5}$ to $\frac{2}{5}$ inch long Black with white hairs on sides and undersides Apex of each wing cover comes to a fine point	Prefers hides and skins; used to clean carcasses; known to survive on smoked meat and dried cheese; larvae can tunnel short distances into wood
<b>Warehouse beetle</b> <i>Trogoderma variable</i>	$\frac{1}{8}$ inch long Brownish black	Prefers barley, wheat, animal feeds, grains, pollen; found in seeds, dead animals, cereals, candy, cocoa, cookies, corn, corn meal, dog food, fish meal, flour, dead insects, milk powder, nut meats, dried peas, potato chips, noodles, dried spices

Adapted from Mallis, 1992, and Olkowski, et al., 1991.

### DETECTION AND MONITORING

Look for holes in fabric, larvae, moth cocoons, cast skins of beetle larvae, or insect excreta in stored materials, or for small moths fluttering about in dimly lit areas. The fluttering flight itself is quite distinctive, and may be enough to distinguish clothes moths from food-infesting moths, which have a steadier flight.

Unlike moth larvae, carpet beetle larvae may be found wandering far from their food, particularly to pupate. They will sometimes burrow into wood, Styrofoam, and other objects in order to pupate. Also, unlike clothes moths, adult carpet beetles do not shun light and may be found crawling on windows. This is often the first place they are noticed.

These beetles and moths are easy to catch: cover the insect with a jar and slowly slide a card under the open end. Seal the jar and place it in the freezer overnight.

The dead insect can be examined with a magnifying glass or taken to your Penn State Cooperative Extension county agent or another professional for identification.

An inspection should include the following locations:

- around carpets or furniture covered or filled with susceptible materials; infestations may be under the slipcovers, where it is dark and quiet, or in the pads under the carpet
- around accumulations of lint and other organic debris, particularly under and behind furniture that is rarely moved; in wall and floor cracks; in cracks behind filing cabinets, shelves, or other built-in items that may not be flush with the wall; behind baseboards, moldings and window trim; and in cold air and heater ducts
- around stored animal specimens, feathers, garments, blankets, or other items made of susceptible materials

- around bags or boxes of dried milk, fish or meat meal, dog food, and similar products (note that carpet beetles can bore through cardboard and paper packaging)

If the infestation does not appear large enough to account for the number of pests found, or if cleaning up the infestation does not seem to diminish their number, then a further search should focus on less obvious sources:

- bird, wasp, bee, squirrel, or other animal nests on or very close to the walls of the building
- animal carcasses or trophies, insect collections, or leather or horn goods
- cut flowers, or blooming bushes near open, unscreened windows or doorways
- incompletely incinerated garbage

In some circumstances, sticky traps placed in areas where activity is suspected may be useful for monitoring. Hang them where you suspect there might be an infestation and check them daily. Sticky traps that contain an attractant called a “sex pheromone” are available for monitoring of the webbing clothes moth. A sex pheromone is a chemical signal that female moths give off to attract males.

## MANAGEMENT OPTIONS

### Physical Controls

#### Storage in Tight Containers

If clean materials are placed in tightly sealed containers, they will be safe from infestation. The problem with closets and similar storage areas is that they are almost impossible to seal effectively: the tiny, newly hatched larvae can crawl through any gap larger than 0.0004 inch.

Entomologist Roy Bry of the USDA Stored Product Insects Laboratory in Savannah, Georgia, suggests wrapping clean, susceptible materials in heavy brown paper and carefully sealing the package with heavy-duty tape. As long as the package is not punctured or torn, the contents should be safe from attack for years. Clean materials could also be stored in heavy-duty resealable plastic bags or heavy-duty plastic garbage bags (2.7 mils or thicker, or a double bag) sealed with tape (Bry et al., 1972).

All grains, cereals, and other similar susceptible substances should be stored in tight-fitting containers that deny beetles access. Containers can be placed in the freezer for a few days to help reduce the possibility of an infestation developing.

### Cedar Products

Cedar chests have long been thought to protect against fabric pests, but it has been known for many years that although cedar oil can kill very young clothes moth larvae, the oil does not affect eggs, pupae, adults, or larger larvae, and that cedar lumber loses its oil in only a few years (Back and Rabek, 1923; Laudani and Clark, 1954; Laudani, 1957). Moreover, commercial repellents made from cedar, cedar oil, or herbs cannot be counted on to give adequate control to protect goods (Abbott and Billings, 1935).

### Vacuuming

Accumulations of lint, human and animal hair, and other organic debris in cracks and crevices of floors, baseboards, closets, and shelves provide food for fabric pests. These areas should be cleaned thoroughly and regularly to prevent infestations. It is particularly important to clean under furniture that is rarely moved (desks, bookcases, cabinets); in closets where fabric items, furs, and feather-filled materials are stored; and inside and behind heaters, vents, and ducts.

### Caulking

Caulking or otherwise repairing cracks and crevices where lint and hair can accumulate will reduce the number of fabric pests that are able to live in the environment. Areas of particular concern are the spaces inside cabinets where shelves do not meet the wall and similar spaces in drawers holding susceptible materials. These same habitats are likely to be inviting to cockroaches, which can also damage stored products.

### Cleaning and Airing Fabrics, Carpets, and Furniture

Since many fabric pests are attracted to the food, beverage, perspiration, and urine stains in woolens and other materials, garments should be dry cleaned thoroughly before being stored. If materials cannot be stored in moth- and beetle-proof packages or containers, they should be shaken, brushed, and aired regularly. This will kill delicate moth larvae and cocoons. Vigorous brushing can remove moth and beetle eggs. Susceptible furniture and carpets that cannot be washed can be steam-cleaned.

Fabrics and other items badly damaged by beetles should be thrown away in sealed plastic bags or burned. If the item is salvageable, submerge it in hot soapy water (at least 120°F) for 2 to 4 hours to kill the larvae and eggs.

### Exposure to Heat

Heat can be used to kill all stages of the clothes moth hiding in cracks and crevices of an infested closet or storage space. Remove all materials from the space and place a heater in the center of the floor. Turn the heater to its hottest setting and monitor the temperature with a thermometer that registers temperatures over 120°F. Keep the temperature at 130° to 140°F for 1 to 4 hours to kill the insects (Ebeling, 1975). Make sure there are no materials in the area that can be damaged by the sustained heating.

### Exposure to Cold

Sudden changes in temperature from cold to warm can kill clothes moths. In the *Handbook of Pest Control*, Arnold Mallis (1982) suggests that “if articles infested with clothes moths were refrigerated at 18°F for several days, then suddenly exposed for a short time to 50°F, and then returned to 18°F, and finally held permanently at about 40°F, all moth life in them would be killed . . . . During the winter if furniture is placed outdoors at 0°F for several hours, it often results in good control.” Smaller items should be bagged and moved in and out of bin-type freezers that are normally kept at 0°F. Infested items can be placed in tightly closed plastic bags in a freezer for 2 to 3 days, since few insects can withstand this temperature. After that, they can be moved for long-term storage to closets or chests at room temperature.

### Removal of Animal Nests

Clothes moths and carpet beetles can sometimes move into buildings from the abandoned nests of birds, rodents, bats, bees, and wasps, as well as from the carcasses of dead animals. Remove nests in the eaves or close to the walls of the school. Problems with birds' nests usually occur after the nestlings have left. Nests should be removed before the cold weather sets in and the beetles begin searching for sheltered hibernation spots. Use traps instead of rodenticide to resolve problems with rats and mice. If rodents die in inaccessible places, their carcasses can become food sources for fabric pests and flies.

### Chemical Controls

#### Crack and Crevice Treatments

In older wooden buildings, these pests may be found throughout the structure hiding in crevices that protect them from treatment. Mallis (1997) suggests using silica aerogel or diatomaceous earth as a dust in cracks and crevices and voids. An insect growth regulator (IGR) may be needed in some cases. **Pennsylvania law allows pesticide applications in schools only by certified applicators, registered technicians, or by noncertified applicators or nonregistered technicians under the direct supervision of a certified applicator. The law also mandates a 7-hour reentry period for common access areas whenever pesticides are applied.**