
CHAPTER 7

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 can digest keratin, the “hard” protein of which hair, horns, nails, claws, hoofs, feathers, and reptile scales are formed. These insects can also attack a wide variety of other natural materials and even some synthetic ones.

IDENTIFICATION AND BIOLOGY

Clothes Moths

The most common fabric-attacking moths are the webbing and the casemaking clothes moths. The webbing clothes moth (*Tineola bisselliella*) is common throughout the United States, while the casemaking moth (*Tinea pellionella*) is most common in the southern states. The adults of both species are about 1/4 inch long, and have a wingspan of 1/2 to 3/4 inch. The webbing clothes moth is golden buff or yellowish gray with a satiny sheen; 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 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 others (see also Table 7-1). They 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% 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 4 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.

In heated buildings, female webbing clothes moths can mate and lay eggs any time during the year. The casemaking clothes moth generally produces one generation each year in the northern U.S. and two generations in the south. This species particularly likes feathers, and may reduce stored garments, quilts, or down pillows to masses of frass (insect fecal material). The casemaking clothes moth also attacks other food and fiber, such as cayenne pepper, horseradish, ginger, black mustard seed, and hemp.

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 1/4 to 1/2 inch long when fully grown. Their fecal matter is often the same color as the material they consume.

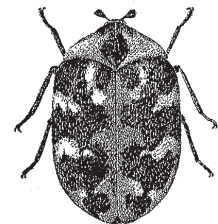
Carpet and Hide Beetles

Adult beetles are small and have short, clubbed antennae, but are otherwise varied in appearance (see Table 7-2). Their bodies are covered with small scales or hairs, which are visible with a magnifying glass. Larvae are brownish, and 1/8 to 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 after less than two weeks. The larvae feed for varying periods, depending upon the species and the environmental conditions. When ready to pupate, the larvae may burrow farther into the food or wander and burrow elsewhere. They may also pupate within their last larval skin or burrow into wood if no



Case-making Clothes Moth



Carpet Beetle

Table 7-1. Distinguish among Common Clothes Moths and Common Grain Moths

Please find this table at end of chapter

other location is found. Beetle larvae do not construct webs, but their shed skins and fecal pellets make it obvious where larvae have been feeding. The cast skins look so much like live larvae that under casual inspection there may seem to be a far larger infestation than is actually present.

Some adult carpet beetle species feed on pollen and nectar; thus, they may be introduced into the 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 a myriad of other items are subject to their attack. They will also feed on wool mixed with synthetic fibers. Only the wool is digested while the other fibers pass through the insect's gut. Clothes moths are attracted to stains on fabrics from food and human sweat and urine. It is mostly goods in storage that are damaged because the larvae are so fragile that they cannot survive in clothing worn regularly.

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, wool yarn, etc. They can also 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. (Table 7-3 provides more detailed information on the food preferences of both hide and carpet beetles.)

Table 7-2. Important Carpet or Hide Beetles (sometimes called Dermestids)

Please find this table at end of chapter

Table 7-3. Some Food Sources for Carpet and Hide Beetles

Please find this table at end of chapter

DETECTION AND MONITORING

Look for holes in fabric, for 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 them 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, so they are sometimes encountered on materials they do not actually eat. 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 a 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, etc; 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 you might have a problem and check them daily. Sticky traps that contain an attractant called a “sex pheromone” are available for the webbing clothes moth. A sex pheromone is a chemical signal that female moths give off to attract males. If you have a small infestation in a limited area, you may also be able to solve a webbing clothes moth problem using only these traps.

MANAGEMENT OPTIONS

There is rarely a need to use an insecticide to control clothes moths or carpet beetles. The following physical controls should be adequate.

Physical Controls

Storage in Tight Containers

If clean materials are placed into 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 because newly hatched larvae are so small they can crawl through any gap larger than 0.0004 inch.

Entomologist Roy Bry (USDA Stored Product Insects Laboratory in Savannah, GA) 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 Ziploc® 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 to 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). Commercial repellents made from cedar, cedar oil, or herbs cannot be counted on to give adequate control to protect goods either (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 (e.g., desks, bookcases, cabinets, etc.); 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.

Table 7-4. Length of Time Various Stages of the Clothes Moth Must Be Exposed to Heat to Produce 100% Mortality^{a,b}

Please find this table at end of chapter

These same habitats are likely to be inviting to cockroaches.

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 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 that might be hiding in cracks and crevices of an infested closet or storage space (see Table 7-4). 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 120°F for 4 hours to kill the insects (Ebeling 1975).

Exposure to Cold

Sudden changes in temperature from cold to warm can cause clothes moth mortality. 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.

Microwave Radiation

In laboratory studies, eggs, larvae, and adults of webbing clothes moths on wool were killed after 4 minutes at 2,450 MHz in a Sharp™ carousel microwave oven (Reagan et al. 1980). Although these tests indicate that microwave radiation is useful in destroying clothes moths, further work is necessary before a treatment procedure can be fashioned from this preliminary work. Additional studies should help determine the optimum depth of the material, since thick layers may shield the moths. Note that any clothing with metal buttons, zippers, or decorations should not be microwaved.

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, in the walls, 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. If there is a problem with rats and mice, these should be trapped rather than poisoned. If poisoned rodents die in inaccessible places, their carcasses can become food sources for fabric pests and flies. (See Chapter 12 for management of mice and rats.)

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Table 7-1. Distinguish among Common Clothes Moths and Common Grain Moths

Species	Distinguishing Characteristics
Webbing clothes moth (<i>Tineola bisselliella</i>)	<ul style="list-style-type: none"> • wingspan 1/2 inch, resting length 1/4 inch • wings without spots • body covered with shiny golden scales • usually with reddish hairs on head • adults fly in dark areas • cosmopolitan
Casemaking clothes moth (<i>Tinea pelfionella</i>)	<ul style="list-style-type: none"> • same size as webbing clothes moth but less common • more brownish than webbing clothes moth • often with three indistinct dark spots on the wings (on older moths they may have rubbed off) • larvae always in case • adults fly in dark areas • not common in northern states
Mediterranean flour moth (<i>Anagasta [=Ephestia] kuehniella</i>)	<ul style="list-style-type: none"> • wingspan 4/5 inch • hind wings dirty white, forewings pale gray with transverse black wavy bars • at rest forebody distinctly raised • cosmopolitan
Indianmeal moth (<i>Plodia interpunctella</i>)	<ul style="list-style-type: none"> • wingspan 5/8 inch, resting length 1/2 inch • broad grayish band across bronzy wings • favors dried fruit but will feed on many other stored products • cosmopolitan
Angournois grain moth (<i>Sitotroga cerealella</i>)	<ul style="list-style-type: none"> • same size as webbing clothes moth • pale yellow forewings and gray pointed hind wings • cosmopolitan

Adapted from Olkowski, et al. 1991

Table 7-4. Length of Time Various Stages of the Clothes Moth Must Be Exposed to Heat to Produce 100% Mortality^{a,b}

	95°F	97°F	99°F	100°F	102°F	104°F	106°F
egg			2 days		1 day		4 hours
larva			7 days	18 hours		3 hours	3 hours
pupa				1 day		3 hours	
adult	6 days	3 days	3 days	1 day	1 day	4 hours	

^aTests conducted at 70% relative humidity.

^bAdapted from Rawle 1951

Table 7-2. Important Carpet or Hide Beetles (sometimes called Dermestids)

Common Name(s)	Scientific Name	Description of Adults
Furniture carpet beetle	<i>Antrenus flavipes</i> (= <i>A. vorax</i>)	<ul style="list-style-type: none"> • 1/10 inch to 1/5 inch long • definite cleft at rear • mottled with black, white, and yellow scales
Common carpet beetle, buffalo bug, buffalo moth	<i>A. Scrophulariae</i>	<ul style="list-style-type: none"> • 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
Varied carpet beetle	<i>A. verbasci</i>	<ul style="list-style-type: none"> • 0 1/8 inch long • mottled with white, brownish and yellowish scales
Black carpet beetle	<i>Attagenus megatoma</i>	<ul style="list-style-type: none"> • 1/10 inch to 1/5 inch long, oval • Shiny black and dark brown with brownish legs
Black larder beetle, incinerator beetle	<i>Dermestes ater</i> (= <i>D. cadaverinus</i>)	<ul style="list-style-type: none"> • 3/10 inch to 2/5 inch long • black with yellowish gray hairs • black rounded and hook-shaped spots on underside of abdomen
Larder beetle	<i>D. Lardarius</i>	<ul style="list-style-type: none"> • 3/10 inch to 2/5 inch long • dark brown with pale grayish yellow hair • yellow band at base of wing covers with about six black spots
Hide beetle, leather beetle	<i>D. Maculatus</i> (= <i>D. Vulpinus</i>)	<ul style="list-style-type: none"> • 1/5 inch to 2/5 inch long • black with white hairs on sides and undersides • apex of each wing cover comes to a fine point
Warehouse beetle	<i>Trogoderma variabile</i>	<ul style="list-style-type: none"> • 1/8 inch long • brownish black

Adapted from Olkowski, et al. 1991

Table 7-3. Some Food Sources for Carpet and Hide Beetles

Beetle	Food Sources
Furniture carpet beetle (<i>Anthrenus flavipes</i>)	horse-hair filled furniture, wool, hair, fur, feathers, bristles, horn, tortoise shell, silk, animal excreta, stained linen, cotton, rayon, jute, Softwood, leather, bags, dried silkworm pupae and cocoons, dead mice, dead insects, dried cheese, old grain, casein, dried blood, and the glue of book bindings
Common carpet beetle (buffalo bug, buffalo moth) (<i>A. scrophulariae</i>)	carpets, fabrics, woolens, feathers, leather, furs, hairbrush bristles, silks, mounted museum specimens; found in a chipmunk nest in the California mountains; adults found on <i>Spiraea</i> , <i>Ceanothus</i> (a chaparral shrub), wild buckwheat daisy, and wild aster flowers; they enter homes on cut flowers
Varied carpet beetle (<i>A. verbasci</i>)	nests of bees, wasps, and spiders; carpets, woolen goods, skins, furs, stuffed animals, leather book bindings, feathers, horns, whalebone, hair, silk, fish manure, dried silkworm pupae, rye meal, cacao, corn, red pepper, and dead insects in collections
Black carpet beetle (<i>Attagenus megatoma</i>)	feathers, dead birds, birds' nests, bird manure, dry horse and cow carcasses, seeds, grains, cereals, woolen rugs, clothing, carpeting, felts, furs, skins, yarn, velvet, silk, hair-filled mattresses, upholstered furniture, wool-filled blankets, house insulation with sheep wool or cattle hair, meat, insect meal, kid leather, milk powders, casein, books, cayenne pepper, dried pupae of silkworms, pet food, spilled flours, and pollen (for adults, particularly of <i>Spiraea</i>)
Black larder beetle, incinerator beetle (<i>Dermestes ater</i>)	mouse cadavers in walls of building; partially burned food and other kitchen wastes in incinerators; pet foods
Larder beetle (<i>D. lardarius</i>)	stored ham, bacon, meats, cheese, dried museum specimens, stored tobacco, dried fish, dog biscuits; can tunnel slightly in wood; can penetrate lead and tin but not zinc or aluminum; pest of silkworm cultures; reported to attack newly hatched chickens and ducklings
Hide beetle, leather beetle (<i>D. maculatus</i>)	prefers hides and skins; used to clean carcasses; known to survive on smoked meat and dried cheese, but cannot live on fat alone; larvae can tunnel short distances into wood
Warehouse beetle (<i>Trogoderma variabile</i>)	prefers barley, wheat, animal feeds, grains, and pollen; also found in seeds, dead animals, cereals, candy, cocoa, cookies, corn, corn meal, dog food (dried and "burgers"), fish meal, flour, dead insects, milk powder, nut meats, dried peas, potato chips, noodles, spaghetti, and dried spices

From Mallis 1982