

PESTS OF STORED PRODUCTS

A ‘pest of stored products’ can refer to any organism that infests and damages stored food, books and documents, fabrics, leather, carpets, and any other dried or preserved item that is not used shortly after it is delivered to a location, or moved regularly. Technically, these pests can include microorganisms such as fungi and bacteria, arthropods such as insects and mites, and vertebrates such as rodents and birds. Stored product pests are responsible for the loss of millions of dollars every year in contaminated products, as well as destruction of important documents and heritage artifacts in homes, offices and museums. Many of these pests are brought indoors in items that were infested when purchased. Others originate indoors when susceptible items are stored under poor storage conditions, or when stray individual pests gain access to them.

Storage pests often go unnoticed because they infest items that are not regularly used and they may be very small in size. Infestations are noticed when the pests emerge from storage, to disperse or sometimes as a result of crowding or after having exhausted a particular food source, and search for new sources of food and harborage. Unexplained occurrences of minute moths and beetles flying in large numbers near stored items, or crawling over countertops, walls and ceilings, powdery residues below and surrounding stored items, and stale odors in pantries and closets can all indicate a possible storage pest infestation. Infestations in stored whole grains or beans can also be detected when these are soaked in water, and hollowed out seeds rise to the surface, along with the adult stages of the pests, and other debris. Other telltale signs are clumping or webbing of particles. It is important to recognize these pests and locate the sources of infestation as soon as possible, to prevent their establishment and spread.

This section will cover insects and mites commonly encountered in storage and these can be broadly grouped into stored food (or pantry products), and stored fabric (or closet) pests. However, many of these pests are not restricted to either group and will infest food, fabric, as well as many other similar items of plant or animal origin.

PESTS OF STORED FOOD/PANTRY PESTS

Pantry pests covered in this section are grouped into insects (beetles, moths) and non-insects (mites). The larvae of these moths and beetles are all pale-white or cream in color and may be difficult to distinguish, but the adults are easier to identify. The adult beetles will mostly be found with their grubs, feeding on the stored products, but the adult moths do not feed and will only lay eggs. Mites are very minute and will need magnification to be detected.

Generally, none of these pests cause harm when consumed in small quantities along with food materials. However, large infestations can significantly alter the appearance, taste, flavor and quality of food, as well as create favorable conditions for growth of secondary fungal and bacterial pathogens. Allergic reactions can be produced in sensitive people. Certain general pests such as ants are often attracted to food stored in pantries and may be toxic if consumed in large numbers.

INSECTS: BEETLES

Common name(s): Bean weevil, seed beetle, pulse beetle

Scientific name, classification: *Acanthoscelides* spp., *Callosobruchus* spp., **Order:** Coleoptera, **Family:** Chrysomelidae.

Distribution: Worldwide.

Description and ID characters: Small beetles, $\frac{1}{8}$ - $\frac{1}{4}$ inch in length, with stout, rounded oblong bodies, generally colored grayish brown or dark gray with mottled patterns. Although they are called 'weevils', they lack the characteristic elongated snout found in true weevils (Family Curculionidae). Larvae are small plump, yellowish-cream colored, legless grubs.

Best identifying features: Short elytra (hardened front wings that form a shell over the top of the body) with flattened ends, which do not cover the tip of the abdomen. Head is small, black and bent downwards. Entire body is clothed with fine, short hairs.

Eyes are large and protruding. Antennae are well developed, often as long as or longer than the front legs, with flattened leaf-like segments towards the tip. Adult beetles are capable of flight, and will fly out in large numbers when infested beans are disturbed.

Pest status: Important pest of stored legumes such as peas and beans, and occasionally grains and other foods. Will also attack legume pods on standing crops in the field.

Damage/injury: Adults and grubs bore into seeds and feed on the contents. Neat, circular exit holes can be seen on damaged seeds. Heavy infestation causes the stored beans to heat up, resulting in mold growth and change in flavor and taste. They can chew through plastic and paper bags to reach stored food.

Life history: Eggs are laid and stuck on to the surface of beans seeds, and can be seen as minute white spots. Each seed may have several eggs on its surface. Eggs can be laid on the beans in the field, before harvest. Emerging larvae bore into the seeds and feed on the kernels, and feed on several seeds before pupating. Larvae ready to pupate will chew a round hole on a seed to emerge as adults, and then pupate inside the seed. Pupae are small and dark brown in color. Duration of life cycle is highly dependent on temperatures, and takes 3-4 weeks at temperatures above 30°C; longer during cooler months. 5-6 generations are possible in a year.



Bean beetles

Photo: Patrick Marquez, Bugwood.org



Eggs, exit holes and adults on beans Photo: Originality1988

Common name(s): Rice weevil

Scientific name, classification: *Sitophilus oryzae*,

Order: Coleoptera, **Family:** Curculionidae. Two related species, the maize weevil or greater rice weevil *Sitophilus zeamais*, and the wheat weevil or granary weevil *Sitophilus granarius* are also very common; the 3 species are often mistaken for each other.

Distribution: Worldwide.

Description and ID characters: Small dark brown, reddish-brown or black elongated weevils, about $\frac{1}{16}$ inch in length. Larvae are small plump, yellowish-cream colored grubs.

Best identifying features: Pronounced snout projecting in front of the head, bearing elbowed antennae with club-shaped tips. Microscopic examination shows four reddish-brown or orange patches on the corners of the wings in rice weevils and maize weevils (marks on top of wings are fainter), which are also both capable of flight. The granary weevil lacks these marks, and is not capable of flight. Adults of all species will go motionless, withdrawing their legs close to their bodies and play dead when disturbed. Grubs of all species are small, 'C' shaped, plump cream colored, legless larvae.

Pest status: Important pest of several stored food grains, mainly rice, wheat, corn and their products such as breakfast cereals, macaroni, noodles, etc. Adult rice and maize weevils can attack standing grain crops in the field before harvest. All species can also attack other food materials such as dried fruits and nuts.

Damage/injury: Adults chew on grain and feed on the contents leaving the hulls if present, while the grubs develop within them. Together, they reduce the infested grain over time to a coarse, stale smelling powder. Individual infested grains have irregular feeding marks, and some are partially hollowed out. Heavy infestation causes the stored grains to heat up, resulting in mold growth and change in flavor and taste. They can chew through plastic and paper bags to reach stored food.

Life history: Females chew a small hole on the surface of a grain, lays a single egg within it and seals the hole with a waxy secretion. The hatching grub feeds within the grain till pupation, and emerges as an adult by breaking open the almost hollowed out grain. Duration of life cycle is highly dependent on temperatures,



Rice weevil adult
Photo: Joseph Berger, Bugwood.org



Rice weevil adult
Photo: Natasha Wright, Bugwood.org



Maize weevil adult
Photo: Natasha Wright, Bugwood.org



Granary weevil adult
Photo: Jennifer C. Giron Duque



Rice weevil larvae
Photo: Pest and Disease Image Library

and takes 3-4 weeks at temperatures above 30°C; longer during cooler months. Up to 10 generations are possible in a year.

Common name(s): Cigarette beetle

Scientific name, classification: *Lasioderma serricorne*, **Order:** Coleoptera, **Family:** Anobiidae.

Distribution: Worldwide.

Description and ID characters: Small reddish-brown, stout and rounded beetle, about $\frac{1}{16}$ inch in length, with an oval outline.

Best identifying features: Head and thorax bent downwards almost perpendicular to the body, head is not visible when viewed from the top. Elytra are almost smooth, or with very faint grooves. Body is clothed with fine, short hairs. Antennae are short and of uniform thickness throughout their length. Larvae are small plump, creamy-white, legless grubs with a small yellowish-brown head, and covered with yellowish-brown silky hairs.

Cigarette beetles are very often confused with the drugstore beetle, which belongs to the same family and often attacks similar stored products. However, drugstore beetles have elytra with deep lengthwise grooves; their antennae end in a 3-segmented club and their larvae have shorter hairs. If viewed together, drugstore beetles may be slightly larger and more elongated, while cigarette beetles may be shorter and rounded.

Both these beetles are also confused with another common beetle belonging to family Anobiidae, the common furniture beetle *Anobium punctatum*, which may be longer than both, darker in color, with a pronounced hump or upward projection on their pronotum, resembling a hood.

Pest status: Important pest of stored tobacco and various other dried herbs and spices, as well as many other stored products such as dried fruits and nuts, cereals, oilcakes, flour, bone meal, dried flowers, etc.

Damage/injury: Tobacco is the preferred food of cigarette beetles, which gives them their common name. All harvested, dried and processed forms of tobacco are attacked, which include raw dry bales, refined cigarettes, cigars, and chewing tobacco. Adult beetles and grubs bore through the leaves and leaving holes and ultimately reducing the tobacco to a fine powder. They also attack and destroy many other stored products in a similar manner.

Life history: Eggs are laid loosely on the stored product, and the hatching grubs and adults together feed on the material till it is exhausted. Pupation is also takes place among the food product. Mature larvae create a small cocoon with particles



Cigarette beetle adults
Photo: Pest and Disease Image Library



Cigarette beetle pupa, adult and larva on a damaged cigar
Photo: Clemson Univ.-USDA

of the substrate and their saliva, and pupate within it. Duration of life cycle is highly dependent on temperatures, and takes 3-4 weeks at temperatures above 30°C; longer during cooler months. 5-6 generations are possible in a year.

Common name(s): Drugstore beetle, bread beetle, biscuit beetle

Scientific name, classification: *Stegobium paniceum*, **Order:** Coleoptera, **Family:** Anobiidae.

Distribution: Worldwide.

Description and ID characters: Small reddish-brown, elongated beetle, about 1/8 - 1/16 inch in length, with elongated-oval outline.

Best identifying features: Head and thorax bent downwards almost perpendicular to the body, head is not visible when viewed from the top. Elytra have distinct and deep lengthwise grooves. Body is clothed with fine, short hairs. Antennae are short and end in a 3-segmented club. Larvae are small, plump, creamy-white, legless grubs covered with short, silky hairs.

Drugstore beetles are very often confused with the cigarette beetle, which belongs to the same family and often attacks similar stored products. However, cigarette beetles have elytra that are almost smooth or with very faint grooves; their antennae are of uniform thickness throughout the length, and their larvae are covered with long, yellowish-brown silky hairs. If viewed together, drugstore beetles may be slightly larger and more elongated, while cigarette beetles may be shorter and rounded.

Both these beetles are also confused with another common beetle belonging to family Anobiidae, the common furniture beetle *Anobium punctatum*, which may be longer than both, darker in color, with a pronounced hump or upward projection on their pronotum, resembling a hood.

Pest status: Important pest of various dried herbs and medicinal plants, as well as various other dried herbs and spices, tobacco, dried fruits and nuts, cereals, book bindings, leather, etc.

Damage/injury: These beetles have a preference for dried herbs and other medicinal plants and are common in prescription drug preparations, giving them their common name. However, they actually attack a wider range of stored products than cigarette beetles, and are even known to bore through aluminum, tin and lead sheets. They also infest bird or rodent nests near homes and buildings. Adult beetles and grubs bore through the stored product leaving small holes and ultimately reducing it to a fine powder. Adult beetles often chew small shot-holes on packaging



Drugstore beetle adults
Photo: Pest and Disease Image Library



Larvae of cigarette (above) and drugstore (below) beetles
Photo: Pest and Disease Image Library

of stored products to emerge, causing some of the powdery remains within to spill out.

Life history: Eggs are laid loosely on the stored product, and the hatching grubs and adults together feed on the material till it is exhausted. Pupation is also takes place among the food product. Mature larvae create a small cocoon with particles of the substrate and their saliva, and pupate within it. Duration of life cycle is highly dependent on temperatures, and takes 3-4 weeks at temperatures above 30°C; longer during cooler months. 5-6 generations are possible in a year.

Common name(s): Khapra beetle, cabinet beetle

Scientific name, classification: *Trogoderma granarium*, **Order:** Coleoptera, **Family:** Dermestidae.

Distribution: Worldwide.

Description and ID characters: Small dark brown, stout, rounded oval shaped beetle, about 1/16 inch in length.

Best identifying features: Closer observation will reveal that the body is covered with short, dense hair. Indistinct reddish-brown or lighter brown patterns may be present on the elytra. The head may be very slightly visible when viewed from the top, it is bent downwards and is almost fully covered by the pronotum. Antennae are short and end in a 3- or 5-segmented club. Larvae are about 1/4 inch long, with a yellowish-white, distinctly segmented body covered with short, stiff hairs. The hairs towards the tail end are longer. The larvae turn golden or reddish-brown as they mature.

Pest status: Important pest of stored products. One of the world's most destructive and invasive stored product pests, on quarantine list in many countries including the U.S. Any suspected occurrences should be reported to the state regulatory agencies.

Damage/injury: Khapra beetles attack a large number of stored products of plant and animal origin, but prefer grain and cereal products such as whole grains, flour, noodles, and similar items. The larvae are more damaging than the adults. In stored grains, they are known to feed partially on one grain before starting on the next one, and thus a single beetle can damage a large



Khapra beetle adults
Photo: Pest and Disease Image Library



Khapra beetle larva
Photo: James D. Young, USDA APHIS PPQ



Khapra beetle adult and larvae damaging stored wheat
Photo: Ministry of Ag. And Regional Development

quantity of the grain. Adult beetles readily chew through plastic and paper packaging to reach food sources. Heavy infestations can cause stored products to heat up leading to mold growth, and reduction in flavor and quality of food items.

Life history:

Adult beetles rarely fly and feed very little during their short lifespan of about 14-30 days. Eggs are laid loosely in the food source and the hatching larvae immediately begin to feed. They pass through several molts before turning into adults.

Development is highly influenced by environmental conditions, and the larvae can remain dormant for many years under unfavorable conditions. They can crawl into tiny spaces, which also protect them from insecticides or other treatments aimed at stored product pests. Khapra beetles prefer low humidity (less than 2%) and are poorly adapted to high humidity. This increases the risk of their spread in the hot and dry conditions in the arid southwest. Therefore it is very important to recognize the pest and take appropriate quarantine measures if they are noticed. Introduction and spread is almost always by human activities because the adults rarely fly.

Common name(s): Flour beetles

Scientific name, classification: *Tribolium* spp., **Order:** Coleoptera, **Family:** Tenebrionidae. The confused flour beetle *T. confusum* and the red flour beetle *T. castaneum* are the most commonly occurring species.

Distribution: Worldwide.

Description and ID characters: Small, slender, flattened and elongated, reddish brown beetles, about 1/8 inch in length.

Best identifying features: Both species are flattened, elongated reddish-brown bodies; head and thorax have minute punctures, elytra have lengthwise ridges and punctures between the ridges. The thorax is more-or-less rectangular in shape, and the margins lack teeth.

Confused flour beetles have antennae that gradually enlarge towards the tip and end in a 4-segmented club. The thorax is slightly broader towards the head than towards the abdomen, but edges are almost straight.

Red flour beetles have antennae that abruptly enlarge at the tip to form a 3-segmented knob. The thorax has rounded edges, and slightly wider at the middle.

Pest status: Important pest of a wide range of stored grains and their products such as cereals and flour.

Damage/injury: Do not usually damage whole grains, but found more in broken bits and flour, or grain previously infested by other pests. The damage is less due to feeding, but more due to contamination of the stored product with large numbers of various life stages, dead bodies, cast skins and fecal pellets. They also produce



Confused flour beetle
Photo: Sarefo



Red flour beetle
Photo: Natasha Wright

pungent substances during their activities that can seriously affect the quality of grain and result in reduced marketability and consumption by humans and livestock. Heavy infestations also cause heat buildup in storage containers, resulting in secondary mold growth.



Red flour beetles infesting corn
Photo: Western Australia Dept. of Ag.



Red flour beetle life stages
Photo: Pest and Disease Image Library

Life history: Eggs are laid loosely on the stored product, and the hatching grubs and adults together feed on the material till it is exhausted. Pupation is also takes place among the food product and pupae are not enclosed in cocoons. Duration of life cycle is highly dependent on temperatures, and takes 6 weeks at temperatures above 30°C; longer during cooler months. Up to 10 generations are possible in a year. Adults are very active and long lived, mostly surviving up to 1 year or more.

Common name(s): Saw-toothed grain beetle

Scientific name, classification: *Oryzaephilus surinamensis*, **Order:** Coleoptera,

Family: Silvanidae. A related species, the merchant grain beetle *O. mercator* is also very common; the 2 species are often mistaken for each other.

Distribution: Worldwide.

Description and ID characters: Small, slender, flattened and elongated beetle, colored dark-brown, about 1/8 inch in length.

Best identifying features: 6 saw-tooth like projections along both side margins of the pronotum (thorax). Short connecting segment between the thorax and abdomen. Elytra are elongated with rounded ends and rows of minute puncture-like depressions, and completely cover the abdomen. Prominent eyes and long antennae. Larvae are yellowish-white with brown head, and elongated worm-like body with sparse hairs. 3 pairs of short legs can be seen on the thorax.

The merchant grain beetle is almost identical, except for larger eyes that are located further away from the neck than in the saw-toothed beetle.

Pest status: Important pest of a wide range of stored products of plant or animal origin.



Saw-toothed grain beetle
Photo: Pest and Disease Image Library

Damage/injury: Attack a large number of stored products within the pantry and surrounding rooms. Feeding on germ region of stored seeds is reported to reduce germination. Adult beetles and grubs bore through the stored product, and leaving holes and ultimately reducing it to a fine powder. Adult beetles readily chew through plastic and paper packaging to reach food sources.

Heavy infestations can cause stored products to heat up leading to mold growth, and reduction in flavor and quality of food items.

Life history: Eggs are laid loosely on the stored product, and the hatching grubs and adults together feed on the material till it is exhausted. Most of the larvae are found in the top 2-3 inches of the stored material. Pupation is also takes place among the food product. Mature larvae create a small cocoon with particles of the substrate and their saliva, and pupate within it. Duration of life cycle is highly dependent on temperatures, and takes 3-4 weeks at temperatures above 30°C; longer during cooler months. 5-6 generations are possible in a year.



Saw-toothed grain beetle larva
Photo: Mohammed El Damir

Common name(s): Spider beetles

Scientific name, classification: *Ptinus* spp.,

Mezium spp., *Gibbium* spp., **Order:** Coleoptera,

Family: Anobiidae, subfamily Ptininae (sometimes

as family Ptinidae). The smooth spider beetle

Gibbium aequinoctiale, the American spider beetle

Mezium americanum and the whitemarked spider

beetle *Ptinus fur*, are common species.

Distribution: Worldwide.

Description and ID characters: Small, globular brown or black beetles, some with patterns, about 1/8 - 1/4 inch in length.

Best identifying features: Spider-like appearance due to relatively large, globular pear-shaped abdomens and long legs. Elytra fully covers the abdomen. Head is pointed downwards and is hidden when viewed from the top.

Smooth spider beetles are slightly over 1/8 inch in length, with shiny dark reddish-brown, abdomen and long, light-brown legs and antennae.

American spider beetles are about 1/8 inch in length. Head and thorax are dull yellow and hairy, thorax is almost cylindrical with blunt projections on either side, elytra are glossy dark reddish brown or black. Antennae and legs are long and slender, and pale yellow or light brown in color.



Smooth spider beetle
Photo: Sarefo



American spider beetle
Photo: Pest and Disease Image Library

Whitemarked spider beetles are about ¼ inch in length, and light reddish brown in color, with patches of white hairs on the elytra. Females have 2 white patches on each elytron that join to form two transverse bands. Legs and antennae are long, slender and pale yellow in color.

Larvae of all species are small, plump and C-shaped, legless grubs with light brown heads. Adult spider beetles are sometimes confused with bed bugs, but can be easily distinguished on closer examination.

Pest status: Scavenger and occasional pest of a wide range of stored products, predominantly cereal products.

Damage/injury: Spider beetles are general scavengers and feed on a wide variety of food items. Occasional infestation of wooden structures near food sources is reported, in wall voids and drop ceilings. Larvae cause a typical "scarring" of the wood in buildings in the formation of pupal cells prior to pupation. They do not bite or sting humans or pets, or spread diseases.

Life history: Eggs are laid in stored products, on outside of packaging or in debris found in cracks and crevices of storage structures. Larvae feed on the available food sources and bore into nearby wood or cardboard structures to pupate. Some species overwinter in the larval stage, and pupate in the following spring, while some are active year round. 2-3 overlapping generations are possible in a year.

Common name(s): Yellow mealworm

Scientific name, classification: *Tenebrio molitor*,

Order: Coleoptera, **Family:** Tenebrionidae.

Distribution: Worldwide.

Description and ID characters: Some of the largest stored product insects. Adults are shiny dark brown or black beetles, about ½ - ¾ inch long. They usually emerge in early summer and fly to lights.

Best identifying features: The thorax in adults is covered with fine punctures and the elytra have longitudinal grooves.

Larvae are slender, pale yellow at first and turning dark yellow and about 1 inch long when mature, with each segment bordered yellowish brown.

Pest status: Occasional pests of stored grains and other stored products.

Damage/injury: Mealworms feed externally on stored grains and do not bore into them or cause webbings. Therefore they are not considered serious pests, but they



Whitemarked spider beetle
Photo: Pest and Disease Image Library



Spider beetle larva
Photo: Pest and Disease Image Library



Yellow mealworm adult beetle
Photo: Clemson Univ.-USDA

can cause damage and contaminate the stored products with their feces and cast skins. However a severe infestation can destroy large quantities of stored products especially when unnoticed for a long period of time.

Life history: Adults emerge in late spring or early summer. Eggs are laid and glued to the food source. Larvae feed continuously through the summer and into the fall and overwinter as larvae. They pupate in spring, and emerge as adults in about 2 weeks. Due to overwintering in the larval stage, only 1 generation usually occurs in a year.



Yellow mealworm
Photo: Clemson Univ.-USDA

INSECTS: MOTHS

Common name(s): Angoumois grain moth

Scientific name, classification: *Sitotroga cerealella*, **Order:** Lepidoptera, **Family:** Gelechiidae.

Distribution: Worldwide.

Description and ID characters: Adult moths are small, slender, dark tan, buff or straw-colored moth, about $\frac{1}{3}$ inch in length and wingspan of $\frac{1}{2}$ inch.

Best identifying features: Back edges of both pairs of wings have a fringe of hairs. Both pairs of wings end in a finger-like projection, which is more distinct in the hind wings.

Larvae are creamy white with a dark head. Pupae are reddish brown and enclosed in a silken cocoon.

Damaged grains show circular holes, similar to those made by certain beetle pests of stored grains such as the rice weevil or maize weevil. Locating the adults is necessary to confirm the source of damage.

Pest status: Occasional pest of stored grains and other food products, and also of grains (especially corn) in the field.

Damage/injury: Damage is caused entirely by the larvae. They bore into the kernel of grains and usually spend the entire larval stage and pupation within the kernel. Damaged kernels are hollow and often have a round exit hole through which the adult emerged. Infested grains will not germinate. They have an unpleasant smell which makes them unfit for consumption by humans or livestock. Infestation can increase moisture content and temperature of the stored products, attracting mold and other microorganisms. The adult moths do not feed on or damage stored products, but only visit to lay eggs. Stored ear corn is much more susceptible to attack than shelled corn. Infestations can start in the field before the grains are harvested, or can be acquired from existing stored grains.



Angoumois grain moth adult. Note fringes along back edges of wings and finger-like projection at the tip of wings

Photo: CSIRO

Life history: Eggs are laid and glued to the surface of the grains, mostly while still in the field. The hatching larvae immediately bore into a grain kernel and seal the entrance hole. They live within the grain and continue to feed and hollow out the contents, passing through about 3 molts. Mature larvae chew a circular hole on the surface of the kernel, seal it with silk and then pupate in a silken cocoon within the grain. The adult moth emerges and flies out through the exit hole, and the cycle repeats. 4-5 overlapping generations usually occur in a year; many more in favorable conditions.



Angoumois grain moth larva in damaged grain (left); newly emerged adult near exit hole on a grain in an ear of corn (right). Photos: Clemson Univ.-USDA Coop. Extension

Common name(s): Indian meal moth

Scientific name, classification: *Plodia interpunctella*, **Order:** Lepidoptera, **Family:** Pyralidae.

Distribution: Worldwide.

Description and ID characters:

Adults are small shiny, moths, about ¼ inch in length with a wingspan of about ¾ inch. They are the more commonly seen stage and are attracted to lights.

Best identifying features: In newly emerged moths, the head and thorax are reddish brown in color. The top half of forewings are light-gray or tan, but bottom half is reddish brown or coppery border with dark stripes.

Edges of the forewings have fringes of dark gray hairs. Hind wings, usually seen only during flight, are uniformly light-gray or tan. Most adult moths soon lose their characteristic coloration as their delicate wings brush against surfaces, and therefore may appear uniformly tan or gray in color (see lower picture). Head is pointed, with prominent eyes and long slender



Indian meal moth (left) and larva (right)
Photo: Pest and Disease Image Library



Indian meal larvae and pupae
Photo: Purdue Univ. Extension

antennae. The moth rests with its forelegs slightly raised, giving the body a sloping appearance. Larvae vary from pale white, pale pink, light green to almost brown in color, and are about ½ inch in length. They have 5 pairs of short stubby ‘prolegs’ on the abdomen, which enable them to move about easily in their substrate. Pupae are brown colored, about ¼ - ¾ inch in length, and may or may not be enclosed in a silken cocoon.

The adult moths are the indicators of an infestation although they do not feed on or damage stored products. Larvae can move away from their food source, even climbing up walls, to different locations to pupate, and this can be misleading when trying to find the source of infestation.

Pest status: Important pest of a variety of stored products. Most common moth pest of stored grains.

Damage/injury: Damage is caused entirely by the larvae, by feeding on the food source, and spinning large amounts of silken webs. The webs serve to protect the larvae from

desiccation, but they attract fecal pellets, debris from the damaged food source, and cast larval skins, leading to far greater contamination than by the feeding itself. The webbings can cause great nuisance during processing of grains, and clogging of mill machinery. Infestation can also increase moisture content and temperature of the stored products, attracting mold and other microorganisms. Most larvae are located in the top 2-3 inches of the stored product. Adult moths cannot enter closed packages, and need an opening such as a hole or a seam to reach the food source to lay their eggs. The adults feed on nectar and do not damage stored products.

Life history: Adults mate in 2-3 days after emergence and eggs are laid directly on the food source. Larvae continue to feed within the food source, and can also move to other nearby sources. Pupation can also be within the food source, or in other distant locations. Duration of life cycle is highly dependent on temperatures, but is usually completed in 4-5 weeks under optimal conditions. Several overlapping generations are possible in a year.

Common name(s): Mediterranean flour moth

Scientific name, classification: *Ephestia kuehniella*, **Order:** Lepidoptera, **Family:** Pyralidae.

Distribution: Worldwide.

Description and ID characters: Adult moths are small, slender, shiny pale gray moths, about ½ inch in length and wingspan of ¾ to 1 inch. Larvae are small white or pinkish colored larvae, with dark head and small black spots all over the



Indian meal moth webbing
Photo: Clemson Univ.-USDA



Flour moth
Photo: Mark Dreiling

body. Pupation is in silken cocoons, often far away from the food source. Pupae are reddish brown in color.

Best identifying features: Forewings are pale pinkish gray with several dark spots, a broad dark band towards the middle, and two broken zig-zag lines towards the tips. Hind wings are uniformly pale gray or white, with a thin dark border all around. The moth rests with its forelegs slightly raised, giving the body a sloping appearance.

Pest status: Occasional pest of stored grains and other food products.

Damage/injury: Damage is caused entirely by the larvae, by feeding on the food source, and spinning silken webs. The webs along with fecal pellets, debris from the damaged food source, and cast larval skins, add to the contamination caused by the larvae and their feeding. Infestation can also increase moisture

content and temperature of the stored products, attracting mold and other microorganisms. They can also cause hindrances during processing of grains.

Adult moths cannot enter closed packages, and need an opening such as a hole or a seam to reach the food source to lay their eggs. The adults feed on nectar and do not damage stored products.

Life history: Female moths lay their eggs directly on the food source. Larvae on hatching immediately begin to spin their webs and feed voraciously on the food source till they are ready to pupate. Mature larvae will leave the immediate area near the food source to pupate. Life cycle, as with all stored product pests, is highly dependent on temperature, and is usually completed in about 7 weeks under optimal conditions. 4-5 overlapping generations can occur in a year.



Flour moth webbing
Photo: Clemson Univ.-USDA

INSECTS: PSOCIDS

Common name(s): Psocid

Scientific name, classification: *Liposcelis* spp.

is a common species, **Order:** Psocoptera,

Family: Liposcelidae.

These tiny, delicate, soft-bodied insects may occasionally be seen in stored products such as cereals, or paper and cardboard containers used to store these items. Damage is rarely significant. (See detailed description under 'Minor Household Pests').



Psocids on wheat grains
Photo: Pest and Disease Image Library

NON-INSECTS: MITES

Common name(s): Grain mite, flour mite

Scientific name, classification: Different genera. **Order:** Acariformes-Trombidiformes (Subclass Acari/Acarina), **Family:** Acaridae. *Acarus siro* and *Glycophagus destructor* are cosmopolitan species.

Distribution: Worldwide.

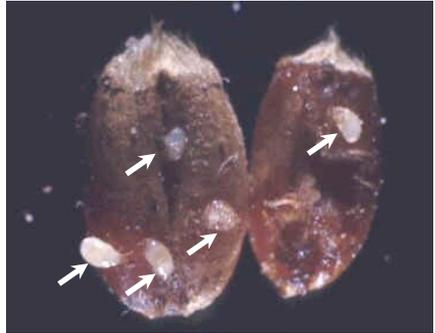
Description and ID characters: Tiny, microscopic arthropods with eight legs, about $\frac{1}{32}$ inch or lesser in length.

Best identifying features: Need magnification to identify. Might be barely visible with the naked eye, as minute, shiny, soft creamy white rounded particles. Colors may vary with the food source, from pale gray to pink.

Pest status: Occasional pest of a variety of stored products.

Damage/injury: The mites feed on different stored products of plant or animal origin including grain, flour, cereal products, cheese, dried fruit, hay, leather, dried herbs, etc. In severe infestations, the mites can be seen as a layer of fine powder over the host material and they give off a 'minty' or similar sweet-sickly odor when crushed. This renders food material unsuitable for consumption. Grain mites are known to transmit pathogenic microbes and produce substances called 'allergens' that can cause allergic reactions in some people.

Life history: Adult females lay eggs in the food material, and which hatch into larvae (with 6 legs), which then mature into nymphs and later adults (with 8 legs). Life cycle from egg to adult can be completed in about 14 days at normal room temperatures. These mites prefer warm, humid environments and thrive in poorly maintained pantries or food storage areas which have high moisture levels.



Grain mites on wheat grains
Photo: Pest and Disease Image Library



Grain mite among cereal particles
Photo: Canadian Grain Commission

PESTS OF FABRIC/CLOSET PESTS

BETTERLES

Common name(s): Carpet beetle

Scientific name, classification: *Anthrenus* spp., *Attagenus* spp., **Order:** Coleoptera, **Family:** Dermestidae. The black carpet beetle *Attagenus unicolor*, the furniture carpet beetle *Anthrenus verbasci* and the varied carpet beetle *Anthrenus flavipes* are common species in the southwest, and throughout the U.S.

Distribution: Worldwide.

Description and ID characters: Small, dark, rounded oval shaped beetles, about 1/8 inch in length, some with patterns, resembling lady beetles. Larvae are short, plump worm-like grubs covered with long hairs.

Best identifying features:

Black carpet beetles are shiny black or dark brown, with brown legs. Larvae are light or reddish brown, and elongated, about 1/4 to 1/2 inch in length, much longer than the adults. They are smooth and shiny and carrot-shaped, the body broader towards the head and tapering towards the other end, ending in a tuft of long hairs. The rest of the body is also covered with shorter, sparser hair.

Furniture carpet beetles are patterned with black, white, brown and tan scales, which fall off as they age, and older adults often look uniformly dark brown or black, with white undersides. Larvae are pale yellow, turning dark brown with distinct light and dark stripes, as they grow. Their bodies are broader towards the head and taper towards the rear, ending in a tuft of hairs. The rest of the body is also covered with long, dense tufts of hair.

Varied carpet beetles are similar to furniture carpet beetles, with black, white, brown and yellow patterns, that may fade as they age making the adults look uniformly brown or black. Larvae are plump dark yellowish brown grubs, broader towards the rear end, slightly larger than adults, and covered with long, stiff bristly hairs. If disturbed they will freeze and hold their hair upright, appearing like a small clump of fibers on their substrate.

Larvae of all species leave numerous cast skins which are also covered with bristles or hairs and they damage larger continuous areas, and these can help to determine if the causes of damage are carpet beetles or clothes moths. Clothes moth larvae leave behind smaller, thin and delicate cast skins and webbings or cases, and their damage is in



Black carpet beetle adult and larva
Photo: Clemson Univ.-USDA



Furniture carpet beetle adult, larva
Photo: André Karwath



Varied carpet beetle adult and larva
Photo: Clemson Univ.-USDA

the form of small holes distributed over the fabric, which are not as extensive as damage by carpet beetles.

Pest status: Occasional pest of fabrics and similar items, rarely of stored food. Can produce allergic reactions in sensitive people.

Damage/injury: Damage is caused entirely by the larvae, by feeding on the food source. They attack various kinds of fabrics and similar products, with a preference for those of animal origin, such as silk, wool, leather, furs, feathers, hair, felt, bristles in brushes, taxidermy mounts, etc. Fabrics of plant origin such as cotton and jute are also readily attacked, as well as upholstery, carpets and tapestries and similar materials. Blended fabrics containing synthetic and natural fabrics are attacked, but purely synthetic fabrics such as polyester or nylon are not usually attacked. Damage occurs more in dark hidden and undisturbed spots such as cracks and crevices of furniture, inside rolls of carpets or rugs, or in folds and hems of clothing. Larvae are also known to attack various food substances.



Carpet beetle damage on a sweater
Photo: Clemson Univ.-USDA

Some people are allergic to the larvae, and their hair or bristles, and experience intense irritation, itching and other symptoms on the skin and respiratory tracts. In most cases, these reactions were the result of individuals becoming sensitized to the larvae by long-term exposure.

The adults do not feed on fabrics or stored goods, but fly outdoors to feed on plants with abundant pollen and nectar, and therefore are often transported indoors with flowers. They come indoors only to lay eggs. If they cannot gain access indoors, the beetles are known to infest outdoor habitats such as nests of birds and other small animals. Most infestations indoors are caused by adults that are brought in on infested material, or cut flowers. Once indoors, the adults can fly within a home or building, seeking spots to lay their eggs, such as in air ducts, closets, under furniture or under baseboards.

Life history: Eggs are laid directly on the food source, the preferred ones being woolen carpets or furs. The hatching larvae feed voraciously, and remain in dark, undisturbed spots on the food source. Larval periods can vary widely in duration, sometimes extending up to 3 years, but are completed in about 3 months under favorable conditions. As they near pupation, the larvae move away from the immediate food source, to escape cannibalism, which is exhibited when several larvae exist in close contact. Many species will overwinter or undergo a period of dormancy just before pupation. Pupation may be in or near the food source, or in a concealed spot, or even within the last larval skin, if no shelter is available. Adults usually emerge in late summer to early fall. They live for about 2 weeks, within which they mate, locate suitable spots and lay eggs. Up to 2 overlapping generations may occur in a year.



A coat damaged by case-making clothes moths
Photo: Dawn Gouge



A floor rug damaged by carpet beetles. Note the larva towards the center of the picture.
Photo: Dinakar Radhakrishnan

MOTHS

Common name(s): Clothes moth

Scientific name, classification: *Tinea* spp., *Tineola* spp., **Order:** Lepidoptera, **Family:** Tineidae. The webbing clothes moth *Tineola bisselliella* and the case-making clothes moth *Tinea pellionella* are most common.

Distribution: Worldwide.

Description and ID characters: Small, slender and shiny yellowish-gray moths, about ¼ inch in length and wingspan of ½ inch, much smaller than moths that infest stored foods.

Best identifying features:

Webbing clothes moths are more yellowish with a golden sheen, and their wings are fringed with golden hairs. The head has a tuft of reddish brown hairs.

Case-making clothes moths are more grayish or silvery in color, with faint dark spots on their wings. The head has a tuft of yellow hairs.

Adults of both species are weak flyers and try to avoid light. They are usually found in dark, undisturbed areas of closets. When disturbed, they try to escape by running, rather than flying and if necessary they will flutter.



Webbing clothes moth
Photo: Olaf Leillinger



Case-making clothes moth
Photo: ©Entomart



Webbing clothes moth larva creating web
Photo: Guido Gerding



Case-making clothes moth larvae with cases
Photo: ©Entomart

Larvae of both species are similar in appearance, small white or cream colored caterpillars with a dark brown head, about ½ inch in length. Webbing clothes moth larvae are mostly found under a web of silk, fabric debris and feces, whereas case-making clothes moth larvae are always enclosed in a silken, spindle shaped case that they carry around as they move.

Larvae leave behind small, delicate cast skins and webs or cases, and small holes distributed over the fabrics. These can help to distinguish their damage from that

caused by carpet beetles, which leave behind larger, shell-like cast skins covered with long bristles or hairs, and large contiguous areas of damaged fabric.

Pest status: Occasional pest of fabrics and similar items, but rarely of stored food.

Damage/injury: Damage is caused entirely by the larvae, by feeding on the food source. All kinds of fabric including cotton, silk, wool, furs, feathers, hair, felt, bristles in brushes, taxidermy mounts, upholstery, carpets and tapestries and similar materials of animal or plant origin are attacked. Wool is probably their most preferred food. Blended fabrics

containing synthetic fabrics along with cotton, silk or wool are also attacked, but purely synthetic fabrics such as polyester or nylon are not usually attacked. Damage occurs more in hidden spots on the fabrics, such as under collars and cuffs, in folds and hems, cracks and crevices of furniture and rolls of carpets or rugs. Fabrics stained with perspiration, urine, or food have higher chances of being attacked. The adults do not feed, and exist solely to reproduce. They visit stored products only to lay eggs and do not cause any other damage. Clothes moths have also been reported to live in bird nests, and also feed on cobwebs and other fibers.

Life history: Adults mate soon after their emergence, and the females lay clusters of eggs, which they stick to the food source with a glue-like substance. They die soon after egg laying, males may live slightly longer than females but for a month at most. The eggs hatch into larvae that immediately begin to feed, and the webbing larvae make webs and the case-making larvae make their cases. The webs and cases are mostly similar in color to the substrate color, because they contain fibers from the substrate. Webbing larvae extend their web tunnels as they move about, and the webs accumulate their feces, debris and fibers. The case-making larvae remain within their case throughout their larval period, the case increasing in size as they grow. They carry the case around with them as they move on the substrate, extending their heads out from either end of the case to feed. Webbing larvae pupate in silken cocoons on the food source, but case-making larvae often move away from their feeding sites to pupate in cracks or crevices nearby. Life cycles are temperature dependent, but are usually completed in 4-6 months, and up to 2 generations are possible in a year.



Webbing clothes moth, larva, pupa, damage
Photo: Clemson Univ.-USDA



Case-making clothes moth larval case
Photo: Kathryn Robinson



Case-making clothes moth pupa
Photo: ©Entomart

Note: Mothballs should not be used to control fabric pests. Mothballs contain either naphthalene or paradichlorobenzene, both of which are toxic and can produce harmful effects when inhaled.

Sources, further information:

Food and fabric pests

<http://www.ipm.ucdavis.edu/PMG/menu.house.html#DESTROY>

Recognizing and controlling insect pests of stored products

<http://citybugs.tamu.edu/factsheets/household/food-fabric/ent-2007/>

Stored product pests in the home

<http://extension.uga.edu/publications/detail.cfm?number=B1378>