

## **Stored Product Insects**

Good hygiene practices during storage of stored products is of the utmost importance, as stored product pests will only need small heaps of product to nest in. The area around the product and the entire warehouse must be kept clean and swept and the sweepings must be disposed of to stop re-infestation.

When the product is already infested, the stored product must be encased in gas proof plastic sheeting and toxic gas, registered for this purpose, must be introduced for a specific time period according to label directions.

To ensure that no infestation of stored product pests occur a very good surface spray regimen coupled with a ulv treatment every two weeks must be done.

# Angoumois Grain Moth

*(Sitotroga cerealla)*

This is a cosmopolitan pest of whole processed products.

## Appearance

Moths are light khaki-coloured, with long fringes on the trailing wingspan of about 10 mm, but the size of the grain kernel in which are small, whitish caterpillars up to seeds on which they feed.

The adult angoumois grain moth is a

The front wing is a lighter colour than the hind wing. Both wings end in a thumb-like projection and have fringed rear margins.

## Biology

The eggs are white when first deposited, but soon turn red. Full grown larvae are 5mm long and white with a yellow head. The area near the head is slightly larger in diameter than the posterior portion of the insect.

The eggs (about 150 of them) are laid outside and the larvae develop inside the seeds, hollowing them out substantially, with practically no external signs of infestation.



grain seeds. It cannot develop in

a satiny sheen. The wings are narrow, edges. The moths usually have a size may vary (4 - 5 mm) according to the larvae had developed. The larvae about 7 mm long, secluded inside the

small buff to yellowish-brown moth.

Usually only one larva develops and pupates in a grain kernel but large kernels, such as maize, may harbour more than one larva. After pupation, moths emerge through pinhead-sized holes in the seeds. The moths leave the silken cocoon and the seed simultaneously.

The life cycle takes 5 weeks at optimal climatic conditions.

#### Habits

Only grain is infested. Moths do not feed; they live for only about a week or two. The moths can infest the grain on the crop fields.

#### Damage

Angoumois grain moth larvae Barley, maize, wheat and a variety of other seeds are also

Infestations often commence in pest are mostly limited to small little store sanitation and no pest

Their feeding causes a reduction infested grain smells bad and is



feed on a number of whole kernel grains. sorghum are particularly susceptible, but attacked.

the field, but serious infestations by this bulks of grain stored on the farm, where control are practiced.

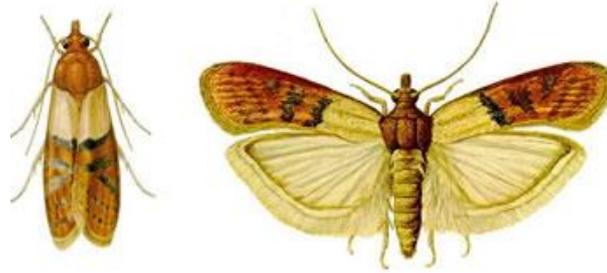
in grain weight and quality. Heavily less attractive for consumption.

#### Control

Prophylactic disinfestations by fumigation at the time when the grain is taken into storage are effective and with good sanitation further measures are seldom required.

## Indian Meal Moth

*Plodia interpunctella*



The Indian meal moth has a worldwide distribution and is the number one pest of dried fruits in storage. However, it can also infest a wide variety of other commodities, including grain products, nuts, powdered milk, candy, and pet food.

It can be a problem especially in packaged food items in vending machines and snack areas aboard ship. When infesting grain products, it prefers coarse flours and is commonly found in items like corn meal.

### Appearance

The fully-grown larvae are large compared to other common SPPs (about 13 mm). The most commonly seen "white worms" found in packaged dried fruits are nearly always the larvae of this moth. They also produce silk webbing, which further lowers the quality of the infested commodity.

The adults of this moth have a greyish band across the upper 1/3 of their reddish-bronze wings. The wings are folded over the abdomen when resting. The female moth lays between 100 and 300 eggs during her lifetime.

The moths can be distinguished easily from other grain pests by the forewing markings; the distal two-thirds are copper-coloured, and the basal parts are light khaki-coloured. The hind-wings are light grey. The moths have a wingspan of about 15 mm and about 6 mm long. The larvae, up to about 15 mm long, have a faint greenish tinge.

### Biology

Eggs are laid loosely in or on the food medium. The adult female moth does not penetrate the seed to lay her eggs. Consequently, the infestation is limited to grain close to the surface of the stack or the surface of the grain silo.

The larvae penetrate deeper into the grain. They only feed on the soft germ of hard seed but they tend to eat any part of soft seed such as peanuts. The fully grown larvae spin a cocoon in a hidden corner. The larvae spin continuously, eventually forming a thick, silken web over the surface of the infested material; this includes bags as well as mass storage of grain.

Populations build up progressively over three or four generations from October to March / April, when numerous larvae leave the grain and crawl around in search of suitable pupation sites. They pupate in silken cocoons in protected corners and crevices of bag stacks, warehouses and silo bins. Moths continuously emerging from pupae in the fabric of the building maintain a constant infestation pressure on the stored goods. The life cycle takes about 4 weeks at optimal climatic conditions.

### Damage

Infestation is limited to the upper most layers of stored grain. Only the germ part of hard seed will be eaten.

### Control

Once infested, grain can only be disinfested by fumigation. Space treatments of warehouses each day for a period of about 2 weeks after fumigation of grain stocks therein has started, are of great value in eliminating moths emerging from pupae in the fabric of the warehouse.

These treatments should be carried out at sunset, after all the moths have emerged for the day, but before mating and egg laying starts at dusk. Residual sprays over stack surfaces are of limited value, because natural enemies are eliminated, while the pest itself is not particularly effectively prevented from reinvesting the goods.



## Tropical Warehouse Moth

(*Ephestia cautella*)



This is a cosmopolitan pest, particularly troublesome in warm regions. It attacks a wide variety of stored seeds and other products, including processed products, and is of particular importance where materials are stored in bags.

### Appearance

The moths are dirty grey. The distal two-thirds of each forewing is darker grey than the basal one-third. Indistinct straight light and dark lines separate the dark and light areas on each wing. The hind wings are pale grey. The wingspan is about 15 mm and the moth is about 6 mm long. The larvae, up to 15 mm long, are dirty white, with a brownish tinge, and have two rows of dark spots on the back. The biology is similar to that of the Indian meal moth.

### Habits

The habits and behaviour is similar to that of the Indian meal moth. The eggs are laid loosely in or on the food medium. The adult female does not penetrate the seed to lay her eggs. The infestation is normally close to the surface of the stack. The larvae initially bore deeper into the seed. When the larvae are fully grown, it mostly emerges from the grain and spins a cocoon, whereupon the adult moth breaks out of the cocoon.

The adult moth does not feed and only lives for a week. Grain and oilseeds are attacked.

### Damage

The larvae cause damage to softer seeds, such as groundnuts and the soft germ part of other stored seeds. They move around freely between the grains of seed, spinning as they go, eventually covering the grain surface with webbing. They usually infest the uppermost two meters of stored grain. Moths do not feed; they live for only about a week.

Populations build up progressively over three or four generations from October to March/April, when numerous larvae leave the grain and crawl around in search of suitable pupation sites. They pupate in silken cocoons in protected corners and crevices of bag stacks, warehouses and silo bins. Moths emerging from pupae in the fabric of the building maintain a constant infestation pressure on the stored goods.

### Control

Once infested, grain can only be disinfested by fumigation. Daily space treatments of warehouses for a period of about 2 weeks after fumigation of grain stocks therein has started, are of great value in eliminating moths emerging from pupae in the fabric of the warehouse. These treatments should be carried out at sunset, after all the moths for the day have emerged, but before mating and egg laying starts at dusk. Residual sprays over stack surfaces are of limited value, because natural enemies are eliminated, while the pest itself is not particularly effectively prevented from infesting the goods.



## **Tobacco Moth**

*(Ephestia eutella)*



### Biology

The larvae of the tobacco moth infest many products such as cured tobacco and tobacco products, grain and grain products, dried fruits, nuts and cacao.

The adult moth is 8-11 mm long with wings closed. Its wingspan is 14-17 mm. The grey-brown forewings are striped horizontally in a wave-like fashion. The hind wings are greyish white. The larvae are whitish, tinged with yellow-brown or pink depending on nutrition, with light brown head and pro- thorax.

They are typical caterpillars with three pairs of legs on the thorax and five pairs of pseudopodia on the abdomen, and attain a length of up to 13 mm. The larvae are slightly hairy, with typical brown spots on each segment.

### Habits

Damage is caused by the larvae, which tunnel in the leaves and tobacco products, causing holes much larger than those of the tobacco beetle and polluting the substrate with excrement and silk. Higher grades of tobacco are preferred. The larvae pupate in sheltered places away from the product attacked. The pest spreads by flight or manually in infested products.

### Damage

The insects can be found in warehouses and other storage or processing places throughout the year. Tobacco residues, which are not removed and destroyed, serve as an important source of infestation.

### Control

Fumigation is essential and follow up treatment with residual sprays can control the pest. Certain heating and steaming procedures during processing of tobacco will also kill the insect.



# Grain / Granary Weevils

(*Sitophilus granaries*)



Grain weevils belong to the snout-beetle family and are characterized by the snout like elongation of its head, with its mouth section at the tip of the proboscis or rostrum.

## Appearance

Dark brown in colour with no membranous wings beneath its elytrum. Approximately 3mm long and is related to the size of the seed. Proboscis, with mouth segments at its tip.

## Biology

The female eats a hole into the seed kernel and lays her egg in the kernel. The egg hatches and the larvae bores deeper into the seed, where it moults a number of times, pupates and then emerges as an adult. The adult insect remains in the seed for a few days and then eats its way out to the outside.

The adult then mates and continues the life cycle. The adult lives for 7-8 months and does not infest grain out in the fields as it cannot fly. Development is about 4-5 weeks and the female can lay between 150-250 eggs. The granary weevil needs a temperature of 27-31° Celsius with high humidity.

## Damage

The adult insects escape holes are characteristic in the seed. Adult insects also eat the seed from the outside causing more holes.



# Maize Weevil

(*Sitophilus.zeamais*)



## Appearance

Black in colour with the length at 3-4mm. The size is related to the size of the seed.

## Biology

The female eats a hole into the seed kernel and lays her egg in the kernel. The egg hatches and the larvae bores deeper into the seed, where it moults a number of times, pupates and then emerges as an adult.

The adult insect remains in the seed for a few days and then eats its way out to the outside. The adult then mates and continues the life cycle.

The adult stage lasts 6-7 months and the product can already be infested in the fields. Development in 4-5 weeks at optimum climate. Female lays 200-250 eggs.

## Damage

The adult insects escape holes are characteristic in the seed. Adult insects also eat the seed from the outside causing more holes.





## Rice Weevil

(*Sitophilus oryzae*)



### Appearance

The rice weevil is matt black in colour. Four light spots along the elytrium. Length of 3mm depending on the size of the seed and it has wings for flying.

### Biology

The female eats a hole into the seed kernel and lays her egg in the kernel. The egg hatches and the larvae bores deeper into the seed, where it moults a number of times, pupates and then emerges as an adult.

The adult insect remains in the seed for a few days and then eats its way out to the outside. The adult then mates and continues the life cycle. Adult stage lasts 5-6 months and the product can already be infested in the fields. Development in 4-5 weeks at optimum climate. The female lays 200-300 eggs. Optimum climate of 27-31° Celsius is required.

Damage

The adult insects escape holes are characteristic in the seed. Adult insects also eat the seed from the outside causing more holes.



## Bean and Pea Weevils / Common Bean Weevil

(*Acanthoscelides obtectus*)



### Appearance

Plump little weevils with grey elytra 2.5-3mm long. The base of the abdomen protrudes beyond the elytra.

### Biology

Eggs are laid in mature pods on the lands or between the mature seeds in storage. These eggs are laid loosely and not fixed to anything. After hatching, the little larvae bores into the bean where it moults a number of times, pupates and creeps out as an adult insect.

In summer time, the adult insects remain inside the seed for only a few days, when they leave the seed, it is done through a neat round hole. In winter, they remain in the seed for the duration of the season. More than one individual can develop in every seed. The adult bean weevil does not eat or live longer than nine weeks after leaving the seed. Kidney beans, sugar beans, runner beans and cowpeas are all infested by the ordinary bean weevil, but not soybeans, lima beans, Hottentots' beans and velvet beans. Neither is grain attacked. Development is 6-8 weeks with about 50 eggs.

### Damage

One or more escape apertures in the seed. Otherwise the seed surface is undamaged in the light of adult insects not feeding and neither can the internal damage of the larvae be spotted.



# Cowpea Weevil

(*Calosobruchus maculatus*)



## Appearance

Plump little weevils of dull, reddish-brown colour. The rear points of the elytra are black. The base of the abdomen protrude beneath the elytra

## Biology

These are the most common of a number of pea and bean weevils which attack legume seeds exclusively. Moreover, the various species in this group are very specific as to the types and varieties of legume seed in which each is able to develop successfully.

The female attaches the eggs to the seed or pods. When the larvae hatch, they bore into the seed where they complete their life cycle. In summer time the adult insect remains in the seed for a few days only, but in the winter time they remain there until it becomes warmer..

The adult leaves the seed by way of a typical round, escape aperture. The adult does not feed and does not live longer than 2-3 weeks. The cowpea weevil can only breed in cowpeas and certain kinds of peas and not in beans nor in grains. Developmental time is 6-8 weeks. The amount of eggs that it lays amount to about 50.

## Damage

Round escape holes or apertures without any other visible damage to the seed. Eggs stuck to the seeds.



## Lesser Grain Borer

(*Rhizopertha dominica*)



This is serious pest of all kinds of cereal grains, with a preference for small grains. It mainly attacks whole grains, but may sometimes be found breeding in flour, particularly if stored for an extended period.

### Appearance

The adult is a polished dark brown to almost black beetle with a somewhat roughened surface. It is 3 mm in length and has a slender, cylindrical body shape, with the thorax forming a hood over the head. Each antenna ends in a three- jointed club. The larva is a longish cream coloured grub, with short hairs over the body and functional legs.



### Habits

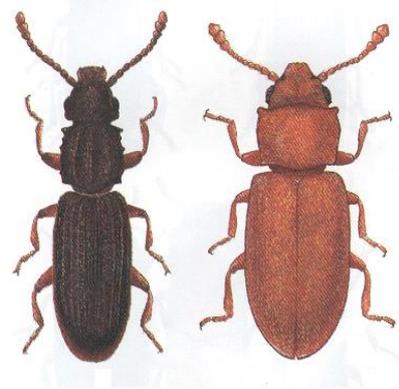
Adults live for 5-7 months and are strong fliers, so grain can be infested whilst still in the field. Eggs are laid loosely in the grain and after hatching, the 1st and 2nd instar larvae feed on the powdered grain left by the continuous boring of the adults. The 3rd larval instar, however, bores into the grain kernel where the life cycle is completed.

The life cycle takes 5 weeks at optimal climatic conditions.

### Damage

Both larvae and adults feed on and damage a great variety of cereal grains. This insect prefers a relatively high temperature. Therefore, it mostly infests grain types, which are harvested and taken into storage during the summer.

Adults continuously bore into successive grain kernels, producing a great deal of powdered grain, often showing through bags containing grain. The young larvae feed on the powdered grain until their third stage of development, when most of them bore into grain kernels to complete the metamorphic cycle within the grain.



### Control

Thorough sanitation is important to eliminate all possible havens where these insects may survive control actions. Grain can be disinfested by fumigation. Bulk-stored grain can be sprayed with residual insecticides during intake, or it can be stored in insect proof (i.e. airtight) containers to protect it against re-infestation.

## Trogoderma Beetle / Khapra Beetle

(*Trogoderma granarium*)



The khapra beetle, which is one of the most serious storage pests in tropical climates. This is classified as a notifiable beetle on stored commodities.

The adults are oval-shaped beetles, 2,5-3,5 mm long, shiny dark brown to black, with indistinct mottled markings on the wing covers. Females are generally conspicuously larger than males. The larvae are stoutly built, up to 6 mm long, pale yellowish, with long brown hairs situated in bands on the segments. The last three segments of the abdomen are covered with dense tufts of reddish brown hairs. The life cycle takes 5-6 weeks at optimal climatic conditions.

### Habits

Eggs are laid loosely in the food medium and the young larvae eat the soft germ portion of the seed. As they become larger, they also eat the hard endosperm. The larvae pupate within its skin. The larvae can enter a rest period which may last up to 4 years.

When the adult beetle emerges, it breaks out through a spilt along the back of the larva's old skin. The adult beetles do not feed and do not live longer than 2 - 3 weeks.

### Damage

Larvae eat large cavities into the grains. The larvae initially eat the soft germ part of the seeds but eat progressively into the hard endosperm as well. Larvae do not penetrate deeply into the grain bulk and come to the grain surface to cast their skins, thus littering the grain surface. Larvae penetrate into cracks and crevices in walls, roofs and floors and are particularly a problem in the storage structure.

They permanently inhabit cavities in the walls of concrete silo bins and, when the bins contain no grain, they live on grain debris accumulated in the cavities via small cracks and pores in the wall surface.

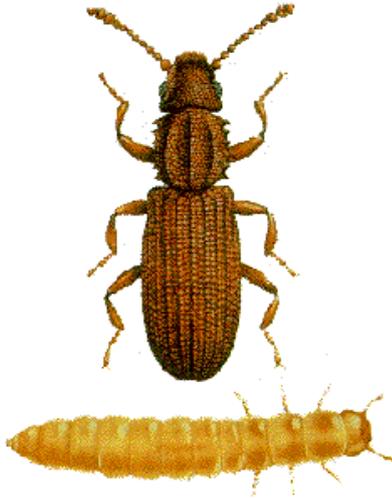


### Control

The only way to eliminate such an infestation is by fumigation. A permanent solution would be to cover the entire concrete surface with a suitable sealant, thus rendering the bin insect-proof. Adults do not live for longer than 2-3 weeks. The adults of some *Trogoderma* beetles are strong fliers, but the khapra beetle adult does not fly.

# Saw-Toothed Grain Beetle

*Oryzaephilus surinamensis* (L.)



## Appearance

Dull brown to black in colour, narrow physical build. Six serrated protrusions along both sides of the pronotum. 2.5-3mm long.

## Biology

Eggs are laid loosely in the food medium. When the time is right for the larvae to pupate, it covers itself within a delicate little cocoon made of food fragments which have been pasted together. Here it pupates, and then emerges as an adult beetle. The adult beetle lives from 6-7 months. Practically any stored commodity will be infested.

When whole grain becomes infested, some of the larvae bore through the episperm and into the germ, where it completes its development in the seed. Development is 3-4 weeks at optimum climate and the adult female can lay 200 eggs.

## Damage

There is no particular damage pattern associated with this beetle.



# Flat Grain Beetle

*(Cryptolestes pusillus)*



## Appearance

Shiny reddish-brown in colour, flat physical build. The feelers are almost as long as the body. The body is never longer than 2mm.

## Biology

Eggs are laid loosely in the food medium. When the time is right for the larvae to pupate, it covers itself within a delicate little cocoon made of food fragments which have been pasted together. Here it pupates, and then emerges as an adult beetle. The adult beetle lives from 2-3 months. Practically any stored commodity will be infested.

When whole grain becomes infested, some of the larvae bore through the epispem and into the germ, where it completes its development in the seed. Development is 3-4 weeks at optimum climate and the adult female can lay 330 eggs with the optimum climate between 28-30° Celsius.

## Damage

The damage pattern is tunnels and holes in the germ of the grain kernels. Large numbers of dead beetles.



## Flour Beetles

### Rust Red Flour Beetle

(*Tribolium castaneum*)



#### Appearance

Shiny, rust-red colour, flat physical build and approximately 3mm in length.

#### Biology

Eggs are laid loosely in the food medium, hatch and the larvae, after moulting several times, pupate and emerge as small adult beetles. The larvae mainly exist on fine grain particles, such as dust or flour, and therefore select the milled grain products.

Milled products of leguminous seeds and even whole legume seeds, however, also become infested. The adult insect lives for 6-8 months. The development is 4-5 weeks at optimum climate. And the female can lay up to 360 eggs.

#### Damage

No visible damage to seeds. Many dead beetles are found in the product as well as skins of the larvae. If the flour has been heavily infested, the colour becomes pinkish and a pungent odour develops due to certain excretions by this insect.



# Confused Flour Beetle

(*Tribolium. confusum*)



The confused flour beetle gets its name from the confusion of its identity and its irregular walking pattern as if drunk.

## Appearance

The adult is 3-4 mm long reddish brown with antennae gradually club like, club is 4-segmented. Compound eyes on the underside of the head. Sides of the thorax are almost straight, except for antennal and thorax differences, almost identical to the red flour beetle.

## Biology

The confused flour beetle female deposits 300-500 clear white sticky eggs on or amongst food materials in cracks, in bags or through the mesh of bags containing food.

The female lays 2-3 eggs per day but lives for 2-3 years. The eggs hatch in 5-12 days into brownish white larvae, which go through 7 to 8 instars and reach maturity in about 30 days under optimal conditions. The life cycle takes up to 7-12 weeks. In heated environments there may be 4-5 generations annually.

## Habits

These beetles are unable to feed on whole kernels or undamaged grain. They can attack grains, peas, beans, shelled nuts, dried fruit, spices, milk chocolate, drugs, and pepper and can infest rodent baits in bait stations. They are attracted to light even if they cannot fly.



# Cigarette / Tobacco Beetle

(*Lasioderma serricone*)



The tobacco beetle attacks many products such as cured tobacco and tobacco products, oilseed cake, dried fruit, various herbs and spices, nuts, rice and cacao.

## Appearance

The adult beetle is oval convex, reddish brown, 2 – 4 mm long. The head and prothorax are bent downwards so as to give the insect a strongly humped appearance. The antennae are serrated and of the same thickness from base to tip. The larvae are yellowish white and hairy. Their bodies are curved, up to 4 mm long, with light brown heads and three pairs of legs on the thorax.

## Habits

Adults and larvae can occur throughout the year in products in warehouses and other storage and processing facilities. Normally they avoid bright light and are most active during twilight. They spread by flight or manually in infested products. Tobacco residues, which are not removed and destroyed, serve as important source of infestation.

The larvae pupate in loose cocoons on firm parts of the food.

## Damage

Typical damage is in the form of pinhead-sized round tunnels bored into the leaves or processed products. Further damage is caused by population of the products with excrement. Most of the damage is caused by the larvae but the adult beetles will also tunnel into bales of tobacco. The higher grades of tobacco are preferred.

The cigarette beetle attacks a host of items like paprika, dry dog food, beans, biscuits, chickpeas, cigars, cigarettes, cocoa beans, coffee beans, cotton seed, flour, dried flours, dried fruits, furniture stuffing, leather and silk.

## Control

The pest can be controlled by fumigation or residual sprays. The insects are also killed by certain heat and steaming procedures during processing of tobacco or by storing at temperatures below 8°C for several weeks.



# Cadelle Beetle

(*Tenebroides mauritanicus*)



This is generally not a serious pest. It is a relatively large beetle, about 8 mm long, sometimes longer, compared to 2-3 mm for most other stored product beetles.

## Habits

It attacks stored grain but may also tunnel into wooden parts of storage structures. Its presence is usually indicative of neglect of basic sanitation.

## Biology

Eggs are laid in the cobs (maize) and development from egg to adult is completed in approximately 25 days at an optimum temperature of 32° Celsius. The upper temperature threshold for complete development is 37° Celsius, 70 % RH (relative humidity). The lower limit of development is 18° Celsius, 70 % RH.

The development from egg to adult varies from 25 days at the optimum conditions to 167 days during unfavourable conditions. An adult female lays 400 to 600 eggs in her lifetime of about 60 days.

Three larval instars are noted and take about 17 days to complete in maize. The larvae have few hairs and tend to curl into a C-shape.

The adult borer is similar to the lesser grain borer (*Rhizoperthadominica*) but is larger (3 -4 mm long) and shinier. *Prostephanustruncatus* and the bamboo borer (*Dinoderus* spp.) are also similar in appearance.

The adult larger grain borer is cylindrical and dark brown in colour. The antenna has a three-segmented club and the head is not visible from above. The abdomen is distinctly square, viewed from above. Literature indicates that adults may either be good or weak fliers and infestation may start in the field prior to harvest.