

Pests of Stored Grains and Products

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Stored-grain pests

- Freshly harvested grains are free from insect infestation.
- Insects reach the grains either through
 - Infested gunny bags
 - Receptacles
 - Storage of fresh grains in godowns already having infested grains
 - Insects hidden in cracks and crevices.
- Grains of all kinds are liable to serious damage by insect pests during storage.
- Primary pests: capable of damaging all kinds of stored food grains
- Secondary pests: others attack only the broken or milled grains.

- High rate of multiplication.
- Factors affecting rate of growth and multiplication
 - Temperature,
 - Humidity
 - Nature of their food,
 - Conditions of storage (light, darkness, dampness, ventilation)
 - Population of insects.
- The attacking insects are beetles and moths.
- Beetle: both the larvae and the adults cause damage
 - hollow out and feed inside the grains,
 - breaking them in bits and
 - reduce them to frass or powder.
- Moths: caterpillars cause damage
- Four well marked stages in both: namely: egg, larva, pupa and adult.

Major Pests

1. Grain Moth: *Sitotroga cerealella* (Olivier)
2. Rice Moth: *Corcyra cephalonica* (Stainton)
3. Pulse Beetle: *Callosobruchus chinensis* (Linnaeus)
4. Khapra Beetle: *Trogoderma granarium*
5. Rice Weevil: *Sitophilus oryzae*

Grain Moth: *Sitotroga cerealella*

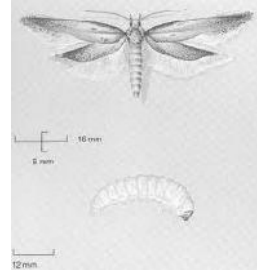
- Lesser grain borer: *Rhizopertha dominica*
- Red flour beetle: *Tribolium castaneum* & *T. confusum*
- Indian meal moth: *Plodia interpunctella*
- Almond moth: *Ephestia (Cadra) cantella*

Distribution

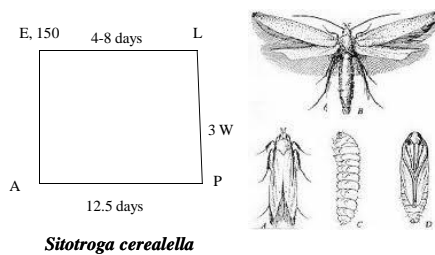
- Lepidoptera : Gelechidae
- World-wide distribution
- Indian sub-continent: more abundance in mountainous areas or where climate is rather mild
- Important pest of stored grain
 - Wheat,
 - Maize,
 - Sorghum,
 - Barley,
 - Oats, etc.

Appearance

- Larvae cause damage by feeding on the grain kernels.
- Full-grown larva:
 - 5 mm long,
 - white body and
 - yellow-brown head.
- Adult: buff, grey-yellow, brown or straw coloured moth, measuring about 10-12 mm in wing expanse.
- Characteristic feature: presence of narrow pointed wings with long hairy fringe, most prominent along the posterior margin.



Life-Cycle



Life-cycle

- Breeding in April to October.
- Insect overwinters as a hibernating larva and as the season warms up, it pupates in early spring.
- After emergence, moths mate within 24 hours and the females start laying eggs singly or in batches on or near the grain.
- Eggs: small and white, when freshly laid, turning reddish later on.
- A single female may lay (on an average, 150 eggs) usually within a week after mating.
- The incubation period is about 4-8 days in summer. Experimentally, the eggs hatch in 8.5, 6.0, 4.1 and 4.6 days at 20, 25, 30, and 35 C, respectively.

- The newly emerged larva soon bores into the grain and feeds on its contents.
- The larval stage may last about 3 weeks.
- Before pupation, the larva constructs a silken cocoon in a cavity made during feeding and then turns into reddish-brown pupa.
- Later, the adult 25, 30 and 35 C, the duration of the larval and pupal stages is 23.5, 20.2, 19.4, and 22.2 days, and 12.5, 9.1, 6.5 and 12.2 days, respectively.
- The female adults have a longer life-span than the males, the duration being 10.3, 7.5, 6.6 and 4.3 days at 20, 25, 30 and 35 C, respectively.
- During the active season, the life-cycle is completed in about 50.6 days. Several generations are completed in a year.

Damage

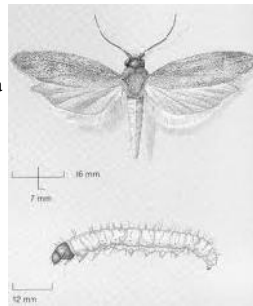
- Damage maximum during monsoon.
- Larva bores into grain and feeds on its contents.
- It extends the hole which partly gets filled with pellets of excreta.
- About 30-50 per cent of the contents are consumed, Sometimes the larva finishes off the entire grain.
- With infestation the grains give out an unpleasant smell and present a unhealthy appearance, each grain being covered with scales shed from the moths.
- In a heap of grain, it is the upper layers that are most severely affected.

Control Measures

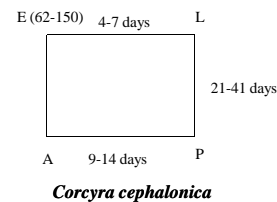
Rice Moth: *Corcyra cephalonica*

Distribution

- Distributed in Asia, Africa, North America and Europe.
- Larval stage is an important stored-grain pest in both India and Pakistan.
- Also infests
 - gram,
 - sorghum,
 - maize,
 - groundnut
 - cotton seed.



Life-Cycle



Life-cycle

- Pest is active from March to November when all stages are noticed.
- It passes winter in the larval stage and the overwintered larvae pupate sometimes during February.
- The moths emerge in March. They are active at night and lay eggs singly or in groups of 3-5 each on the grains, bags and on other objects in the godowns.
- A single female may lay 62-150 eggs during its life-span of 2-4 days. The eggs hatch in 4-7 days and the larvae feed under silken web-like shelters, preferring the partially damaged grains.
- They grow in five stages and are full fed in 21-41 days, after which they make silken cocoons among the infested grains for pupation.
- The pupal stage lasts 9-14 days and the adults live for over one week.
- They complete their life-cycle in 33-52 days and the pest completes approximately 6 generations in a year.

Damage

- Larvae damage the grains of rice and maize by feeding under silken webs.
- When infestation is high, the entire stock of grains may be converted into a webbed mass.
- Ultimately, a characteristic foul odour develops and the grains are rendered unfit for human consumption.

Pulse Beetle: *Callosobruchus chinensis*

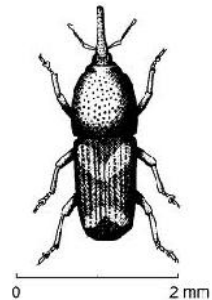
Distribution

- The pest has been reported from the
 - USA,
 - Mauritius,
 - Formosa,
 - Africa,
 - China,
 - Philippines,
 - Japan,
 - Indonasia,
 - Sri Lanka,
 - Myanmar
 - India.

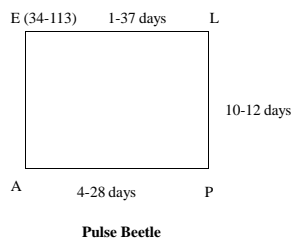
- Notorious pest of
 - gram,
 - mung,
 - moth,
 - peas,
 - cowpeas,
 - lentil and
 - arhar
- Also been reported on
 - cotton seed,
 - sorghum and
 - maize.

Appearance

- Damaging stage: larva.
- Larva: whitish with a light-brown head and later on it acquires a creamy hue.
- Mature larva is 6-7 mm long.
- Adult beetle: measuring 3-4 mm in length, is oval, chocolate or reddish brow and has long serrated antennae.
- There is a pair of white elongate prominences in the middle of the hind margin of the thorax, a spine on each of the inner and outer edges of the end of the hind femur, and truncate elytra, not covering the patagium.



Life-Cycle



Life-cycle

- The pest breeds actively from March to the end of November.
- It hibernates in winter in the larval stage.
- At the end of March, the adults appear and copulate immediately after emergence.
- A day later, the female starts laying small, oval, scale-like eggs which are glued to the grain.
- In this species, more than one egg may be laid on the grain.
- Thus, two or three (up to 8 have been reported on a single grain) larvae may develop in separate chambers.
- A single female may lay 34-113 eggs at the rate of 1-37 per day.
- The highest egg production is in May and October and the least in April, June, July and December.
- The eggs hatch in 7-14 days in April, 4-6 days in September and 8-16 days in November.
- The viability of the eggs varies from 3.6 per cent in May to 76.9 per cent in August and September.

- The young larva bores into the grain and completes its development inside.
- The larval stage is completed in 10-12 days in August and September, and 26-38 days in November.
- The hibernating larvae take 117-168 days to complete their development.
- The full grown larva migrates towards the periphery and comes to lie next to the seed coat where it turns into an oval white pupa.
- The pupal stage lasts 4-28 days, depending upon the season.
- The adult escapes by cutting a circular hole in the seedcoat and such grains can be spotted easily.
- The average life span of an adult is 5-20 days.
- A preponderance of males occurs throughout the active season.
- The insect passes through 7-8 overlapping generations in a year.

Damage

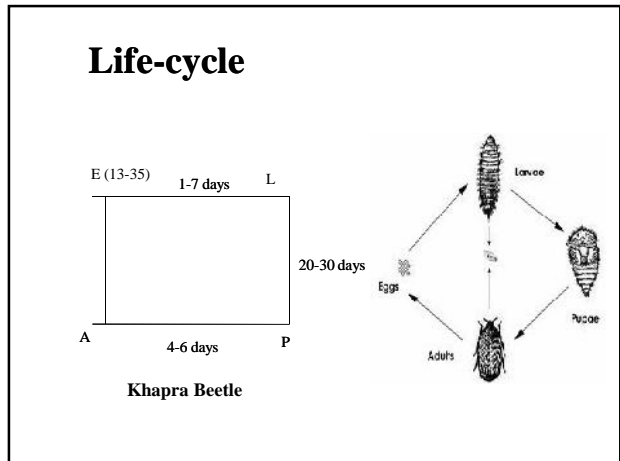
- Damage: peak from April to September and is considerably reduced in October-November.
- Damage to the pulses infested with this insect is very high and quite often each and every grain in infested so that the pulses become unfit for human consumption.
- Infested gram is often converted by the traders into flour which has a characteristic off-flavour and should not be marketed.

Khapra Beetle: *Trogoderma granarium*

- ### Distribution
- Native to India
 - Spread to many countries like England, Germany, Israel, USA.
 - In the Indian sub-continent, it is a very destructive pest of wheat and other grains, particularly in the north-western dry regions of Pakistan, Rajasthan, Haryana and Punjab.
 - Apart from wheat, the insect has also been recorded on sorghum, rice, barley, gram, maize, poppy, pulses, pistachio, walnut and other dried fruits.

Appearance

- Only the larvae cause damage.
- A newly emerged yellowish-white larva is about 1.5 mm long and has a brownish head.
- When full grown, it is about 4 mm in length and is brownish, with yellow-brown transverse bands across the body which has long hairy bristles.
- The integument between the segments and the ventral surface of the body is pale yellow.
- The adult is a small dark-brown beetle, 2-3 mm long, with a retractile head and clubbed antennae.
- The entire body is clothed in fine hairs.
- The males are distinguished from females by being smaller and darker, with more elongated terminal points of the antennae.



Life-cycle

- The insect breeds from April to October and hibernates in the larval stage from November to March in cracks and crevices of walls and floors or in other sheltered places.
- Copulation takes place 2-3 days after emergence, a male being capable of fertilizing more than one female.
- One to three days after copulation, the female begins to lay white translucent eggs on the grains, singly or sometimes in clusters of 2-5.
- the eggs are rather cylindrical, rounded at one end and narrow at the other.
- A female may lay 13-35 eggs in 1-7 days at the rate of 1-26 eggs per day, the largest number being laid on the first day.
- The incubation period varies from 3-5 days in June to 6-10 days in October.
- The male larva is full fed in 20-30 days and the female larva in 24-40 days.
- Pupation takes place in the last larval skin among the grains.
- This stage lasts 4-6 days. The adults are incapable of flying. There are 4-5 generations in a year.

Damage

- The greatest damage is done in summer from July to October. The grubs eat the grain near the embryo or at any other weak point and from there proceed inwards. They usually confine themselves to the upper 50 cm layer of grains in a heap or to the periphery in a sack of grains. If the infestation is severe, the devastation is complete, reducing the grain to a mere frass. Since the larvae are positively thigmotactic, they can be collected by merely placing gunny bags on a heap of grain.

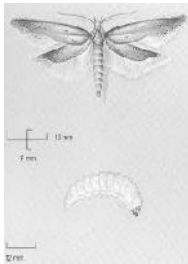
Rice Weevil: *Sitophilus oryzae*

Distribution

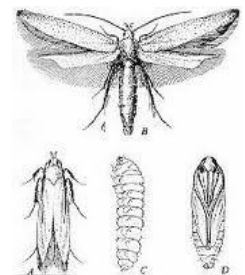
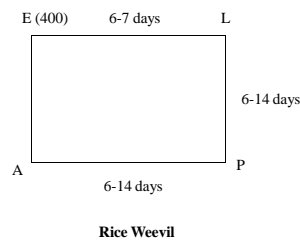
- The pest is world-wide and is found practically throughout India.
- It is commonest and, perhaps, the most destructive pest of stored grain throughout the world.
- Both the species are similar in size and appearance and are found together feeding upon rice, wheat, maize and other grains.
- The rice weevil may, however, be found in the paddy fields as well.

Appearance

- Both the adults and the grubs cause damage.
- The full-grown larva is 5 mm in length and is plump, fleshy legless creature, having a white body and a yellow-brown head.
- The adult is a small reddish-brown beetle, about 3 mm in length, with a cylindrical body and a long, slender, curved rostrum.
- Its elytra bears four light reddish or yellowish spots and thorax is fitted with round depressions.



Life-Cycle



Life-Cycle

- The rice weevil breeds from April to October and hibernates in winter as an adult inside cracks and crevices or under wheat bags in the godowns.
- During the active season, the females lay eggs on the grain by making a depression with the help of their mandibles.
- After an egg has been laid, the hole is sealed with a gelatinous secretion.
- A single female may lay as many as 400 eggs.
- The eggs hatch in 6-7 days and the young larvae bore directly into grain, where they feed and grow to maturity.
- Then, they pupate inside the grain. The pupa, at first, is dirty white, but later on becomes dark brown.
- The pupal stage lasts 6-14 days.
- On emergence, the adult weevil cuts its way out of the grain and lives for about 4-5 months.
- At least 3-4 generations are completed in a year.

Damage

- Heavy damage may be caused by this pest to wheat, rice, maize and sorghum grains, particularly in the monsoon. It has also been reported feeding on oats, barley, cotton-seed, linseed and cocoa. The weevils destroy more than what they eat.

