11-Saw toothed grain beetle *Oryzaephilus surinamensis* –

Family :Silvanidae

Saw-toothed grain beetle is one of the best-known cosmopolitan species. It is a slender, flat brown beetle. The thorax part has six sawtooth-like projections, hence the name given. These insects were recently placed in Silvanidae, and earlier are under Cucujidae. These insects are typically secondary pests mainly feed on damaged grains primarily damaged by other insects or mechanical damage. Larva can attack the germ in whole cereal grains. They reduce the nutritional content of the grains and reduce germination. In addition, damaged grains produce an odor upon severe infestation. Though the insects are winged but rarely fly. They always wander in search of food and rest in crevices, ducts, and roofing spaces, as they are difficult to eradicate

Life cycle

Egg: Eggs are white in color, laid loosely in cracks of storage receptacles, and go down. The hatching Period is 3-17 days.

Larvae: Slender with two darker patches on each segment. Larval period is 14-20 days.

Pupae: Full-grown larvae form the cocoon-like covering with sticky secretion and pupate inside. The pupal period is 7-21 days**.**

Adult: Adult insects are narrow, flattened having six teeth like serrations on each side. Females can lay up to 300 eggs.

Distribution and status: Cosmopolitan and common in worldwide pest of grain and grain products

Host range: Feed on food of vegetable origin, grains, and grain products such as chocolate, drugs, and tobacco.

Damaging stage: Both adults and grubs

Damage symptoms: Adults can be seen upon careful observation if the number is more. However, insects can climb on glass surface also; they can be seen on container walls. Using pitfall traps for the detection of these insects is an unsuitable idea. Since these are secondary pests, generally they are found in the damaged grains. It feeds on grains, dried fruits, etc by scarving of grain surfaces or burrowing holes in them.

12- Merchant saw toothed grain beetle *Oryzaephilus mercator*

The biology of *O. mercator* is nearly identical to *Oryzaephilus surinamensis* (the sawtooth grain beetle). It can be differentiated from *O. surinamensis* by its larger eyes and by the shape of the head, the area just behind the eyes of *O. mercator* is narrower than that of *O. surinamensis*, which has a more triangular shaped head. Unlike *O. surinamensis*, adults are capable of flight

Oryzaephilus surinamensis

Oryzaephilus mercator

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Mandibulata

Class: Insecta (Hexapoda)

Order: - Lepidoptera

. **1-Angoumois grain moth: *Sitotroga cerealella***

Family: Gelechiidae

The insect's names come after its first notice in 1736 in the Angoumois province of France. It is one of the most internal feeding destructors. Infestation starts from the field itself during the ripening milking stage. However, in storage infestation is restricted to the surface. Infestation produces abundant heat and moisture that may encourage mold growth and attract secondary pests.

Egg: The female lays up to 150 eggs on the outside of kernels and in cracks. Egg period is 4-8 days.

Larvae: A full-grown larva is about 5 mm long, with a white body and yellow-brown head. Larvae capable of tunneling sound grains. Adult

Pupae: Larvae spin a silken cocoon inside the grain and change into a reddish brown pupa. Before pupation, larvae cut a circular opening on

the husk which is covered by a silken cover to come out. The pupal period is 9 -12 days.

Adults: The adult is a buff, grey-yellow, brown, or straw-colored moth, about 10-12 mm in wing expanse. Adults live for about 4 - 10 days.

Distribution and status: Cosmopolitan, more abundant in warmer regions. However, in Indian conditions, the pest is abundant in milder conditions.

Host range: Regarded as most destructive internal feeder mainly attacking paddy, maize, sorghum etc. before harvest also.

Damaging stage: Larvae, only whole cereals are attacked, greatest damage occurs in the upper layer grains in storage

Detection: Early infestation is difficult to detect because the hole made by young insects is so small that it cannot be seen. Larva enters and it's way in the grain, then turns about and spins silken wet over the opening by which it entered that it is difficult to locate it. The appearance of moths in the stores and round holes in grains/heating of grains is the first indication.

2-Indian meal moth *Plodia interpunctella*

Family: Pyralidae

Life cycle:

Egg: Eggs are laid singly or in clusters and stick to various foods by a sticky secretion, hatch in 4-20 day.

Larvae: Larvae having 5-7 instars. Newly hatched larvae feed on grain while mature larvae feed on grain germ. White color larvae having polychrome in pink, brown and greenish. Fully grown larvae able to spin webs and leave silk threads in their path of travel.

Pupae: The fully grown larvae make threaded cocoons and pupate inside. Sometimes pupa is often seen on grain surface and on wall of bins. Pupal period is 4-10 days

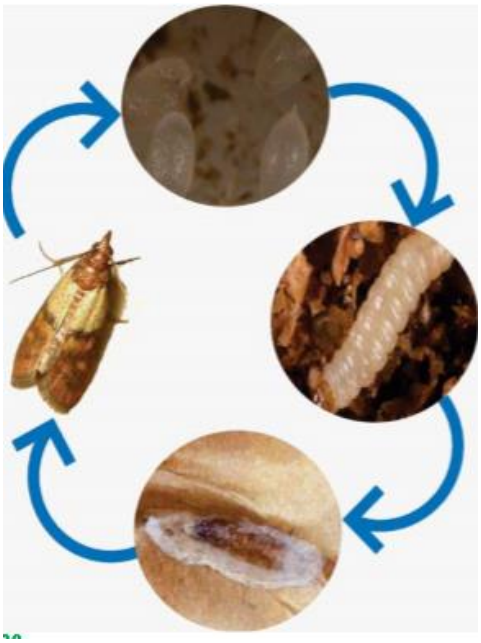
Adult: Adults mate immediately after emergence and start the life cycle. Female moth can lay 30-350 eggs in a minute. Adults generally do not feed.

Distribution and status: A native to America, but now a cosmopolitan species. Adapted to wide range of climates around the world.

Host rang: Wider host range includes stored grains and pulses, dried fruits and nuts, dried vegetables and processed foods. , dead insects, et

Damaging stage: Larva

Damage symptoms: Only the larva causes damage. Larvae creates more severe problem by feeding and contaminating produce through faeces. Larvae feed by webbing. The webbing may also cause condensation which leads to damaging molds. Crawling caterpillars completely web over the surface of heap of grains with silken threads. The adults fly from one bin to another and spread the infestation.



3-Rice moth: *Corcyra cephalonca* (Stainton)

Family: Pyralidae

Rice moth is one of the key pests of rice, cocoa, confectionary, cereal grains etc. Adult insects do not feed and live for only 1 or 2 weeks. These are external feeders, which feed on grains by webbing them together. Rice moth is widely used for rearing of natural enemies in the laboratory use in field against crop pests as it is easier and cheaper to produce natural enemies on different stages of *Corcyra trichogramma* spp. is used for mass-breeding.

Life cycle

Egg: Eggs are whitish, oval in shape, 0.5 mm long, and have an incubation period of 4-5 days.

Pupae: The pupal period is about 10 days but may extend to 40-50 days to tide over winter.

Larvae: Full-grown larva is pale whitish,15 mm long with short scattered hairs and no markings on the body.

Adult: light greyish-brown in color, 12 mm long. The wing span of about 15mm

Distribution and status: The rice moth is distributed in Asia, Africa, North America, and Europe. In the larval stage, it is an important stored-grain pest in both India and Pakistan. Distributed well in all rice-growing areas.

Host range: Paddy, rice, wheat, maize, sorghum, millet, dried stored product.

Damaging stage: Larva

Detection: Larvae cause damage by webbing together grains forming lumps and feeding from inside. Larvae leave webbing in the grains before pupation, causing excessive lumping, which reduces the marketing quality of the grains. *C. cephalonica* adults can be seen resting on store surfaces and have a peak of flight activity at dusk. The larvae crawl over the stored food and in the last instar construct cocoons that may be found within the stored food, on sack surfaces and store structures. Infestations cause a bad smell.

4-Almond Moth / Fig moth: *Ephestia cautella*

Family: Pyralidae

Life cycle:

Egg: The female lays whitish eggs indiscriminately in cracks and crevices of the receptacles or on the foodstuff.

Larvae: While feeding, the larvae spin tubes in the food material and are full-grown in 40-50 days. The full-grown larva is white with a pinkish tinge and measures 1.5 cm.

Pupae: The larvae pupate inside the cocoons and the pupal stage lasts about 12 days.

Adult: greyish wings with transverse stripes on the outer region and the wing expanse is about 12 mm. The life cycle is completed in about two months and there are 5-6 generations in a year.

Distribution and status: Worldwide

Host range: It is a serious pest of dried fruits such as currants, raisins, dried apples, dates, berries, figs, almonds, walnuts, tamarind seeds, etc. It has also been recorded on malted milk, dried mango garlic bulbs, various cereal grains, and grain products.

Damage symptoms: The caterpillars make tunnels in the food materials. The number of silken tubes is sometimes extremely high and these clog the mill machinery where the infested grains have been sent for milling.

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Mandibulata

Class: Insecta (Hexapoda)

Order: - Psocoptera

Grain lice: *Liposcelis divinitorius*

Bionomics: Pale grey or yellowish-white colored, small, pin-head-sized louse with a filiform antenna. It lays about 7-60 eggs. The metamorphosis is incomplete.

Damage symptoms: They are scavengers affecting only the germ portion in heavy infestation. It feeds on insect fragments and broken grains. It attacks all starchy material.