



Major Stored Grain Insect Pests in India

(*Methuku Anil Kumar)

Plant Biosecurity Division, National Institute of Plant Health Management,
Rajendranagar, Hyderabad, 500030, India

*Corresponding Author's email: anilmethuku70320@gmail.com

About one thousand species of insects have been found in stored products around the world. Some of these pests can cause significant damage to grains in storage. This article provides an overview of the damage symptoms and biology of some of the main pests found in stored grains, such as *Sitophilus oryzae*, *Rhyzopertha dominaca*, *Trogoderma granarium*, *Tribolium castaneum* and *Sitotroga cerealella*. These pests can be classified based on their feeding behavior as internal or external feeders, or as major or minor pests depending on the extent of damage they cause. These classifications help in making decisions for managing insect infestations in stored grains.

Introduction

In India, around 10% of food grains produced are lost after harvest due to improper storage, insects, rodents and microorganisms. The economic impact of grain-infesting insects is not just the physical material they consume, but also the contamination they leave behind, making the food unsafe for consumption. Insects can infest grain storage at different stages of processing, such as during development, threshing, transit, or storage. Some pests start damaging crops during ripening and continue to cause harm during storage. Common sources of infestations include old bags, storage structures, containers and cross-contamination. There are approximately one thousand insect species worldwide associated with stored products, which can destroy grains and leave them with unpleasant odors and flavors. The majority of insect pests are classified under the orders Coleoptera and Lepidoptera.

Types of infestation

Hidden infestation (Field infestation): Insects like Bruchids, *Sitotroga* fly from stores to field and lay eggs on maturing grains or pods which hatch out in favourable condition when grain reaches stores. This is termed as hidden infestation.

Cross infestation: Insects from old stocks / grain lying in cracks and crevices in emptied godowns and containers crawl or fly to fresh stocks, and infest them. This is termed as cross infestation.

Classification

The stored grain insect pests can be classified on the basis of their feeding behaviour, these can be grouped as external and internal feeders.

Primary insect pest: Capable to damage and breed in undamaged solid grains.

Internal feeders: Larvae feed entirely within the kernels or stored material e.g. Grain weevil, Lesser grain borer, Pulse beetle, Groundnut bruchid and Grain moth

External feeders: Larvae and adults feed on the grain from outside e.g. Red flour beetle, Saw toothed beetle, Khapra beetle, Cigarette beetle and Rice moth.

Secondary feeders: These include insects which develop after the infestation of other pests as they feed on cut and broken seeds e.g., saw toothed grain beetle *etc.*

Important Stored Product Pests

1. **Rice weevil - *Sitophilus oryzae* (Coleoptera: Curculionidae):** This is one of the serious pests of paddy, wheat, millet, barley, maize, sorghum and other cereals causing considerable qualitative and quantitative loss during the storage (Fig. 1). Full grown larva is 5 mm in length and plumpy, fleshy, legless creature. Reddish brown adult is 3 mm in length, with a cylindrical body and a long, slender, curved rostrum. Its elytra bear four light reddish or yellowish spots. 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, females lay about 400 eggs on the grain by making a depression and the hole is sealed with a gelatinous secretion. 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 pupal stage lasts 6-14 days. On emergence, adult weevil cuts its way out of the grain and lives for about 4-5 months. Both the adults and the grubs cause damage. The developing larva lives and feeds inside the grain causing irregular holes of 1.5 mm diameter on grains of rice, sorghum, wheat, barley, maize before harvest and in storage.



Damage symptoms: Hollowed out grains, kernels reduced to powder and heating of the grains.

2. **Lesser grain borer - *Rhyzopertha dominaca* (Coleoptera: Bostrychidae):** Lesser grain borer is regarded as second in importance to rice weevil as destroyer of the stored grains. It is mostly found in warmer regions of the world and damages wheat, barley, maize, paddy, sorghum and other products (Fig. 2). The larva is about 3mm long, dirty white, with light-brown head and a constricted elongated body. The adult is a small cylindrical beetle measuring about 3 mm in length and less than 1 mm in width. It is shining dark brown with a deflexed head, covered by a crenulated hood-shaped pronotum. The pest breeds from March to November while in December enters hibernation as an adult or as a larva. A single female can lay 300-400 eggs in 23-60 days at the rate of 4-23 eggs per day. The incubation period is about 5-9 days. Larva cuts a circular hole in the pedicel end of the eggs and comes out of it. Larval period is of 23 - 50 days while pupal period is of 4 - 6 days. Adult lives for about 40 - 80 days. There are 5 -6 generations in a year. Both the adults and the grubs cause damage.



Damage symptoms: Irregular messy waste flour spots in bagged storage, heating and kernels reduced to mere shells.

3. **Khapra beetle, *Trogoderma granarium* (Coleoptera: Dermestidae):** Its habit of congregation in cracks and crevices of bricks, masonry and wood storage has given it, the name 'khapra'. It is an external feeder and none of the stage lives in the grain. It is a serious pest of wheat but can also damage jowar, rice, maize, sorghum, oilseeds and pulses (Fig. 3). The insect breeds from April to October and hibernates in the larval stage from November to March in cracks and crevices. Female begins to lay white translucent eggs on the grains, singly or sometimes in clusters of 2 -5. A female may lay 13 - 35 eggs in 1 - 7 days at the rate of 1 - 26 eggs per day. The egg period varies from 3 -10 days. Larval period is 20 - 40 days and pupal period is 4 - 6 days. Pupation takes place in the

last larval skin among the grains. The adults are incapable of flying. There are 4-5 generations in a year. Fresh yellowish white larva grows 4 mm long and turns brown. 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 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. They can reduce 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.



Damage symptoms: Infestation is indicated by presence of cast skins, frass and hair on bags.

4. **Red flour beetle *Tribolium castaneum* (Coleoptera: Tenebrionidae):** Cosmopolitan in distribution, it is the worst pest of flour mills. It feeds on cereals, flour, starchy material, fruit nuts, millets and prepared cereal foods (Fig. 4). It usually feed on broken grains and results in dust formation. Infested flour emits sour and pungent smell, which is due to some secretions of beetles. The young larva is yellowish white and measures 1 mm in length. As it matures, it turns reddish yellow. Pupation takes place in the flour. The pupa is yellowish and hairy. The pupal stage lasts 5-9 days. The development period from egg to the adult is 26-30 days in summer. Both the larvae and adults cause damage. The greatest damage is during the hot and humid monsoon season. The larvae are always found hidden in the food. The adults, however, are active creatures, but mostly found concealed in flour. Adult construct tunnels as they move through flour and other granular food products.



Damage symptoms: In severe infestation, the flour turns greyish and mouldy, and has a pungent, disagreeable odour making it unfit for human consumption.

5. **Angoumois grain moth *Sitotroga cerealella* (Lepidoptera: Gelechiidae):** It is distributed worldwide as a pest of paddy, maize, jowar, barley, wheat (Fig. 5). It does not attack milled rice and other cereal products. Adult is buff, brown or straw coloured with narrow pointed wings, fringed with long hairs which are prominent along posterior margin. Small, whitish eggs are laid singly or in batches on or near grain which later turn reddish. Egg period is 4 - 8 days. Caterpillar is 5 mm long, white with yellow brown head. Larval period is 3 weeks. Larvae are destructive feeding on grain kernels. Larva bores into grain, feeds inside up to 30-50 % seed is damaged. Sometimes whole grain is damaged. Pupa is reddish brown. Pupation in a silken cocoon in a cavity made during feeding. Pupal period is 7 - 13 days. It hibernates in winter in pupal stage. Adult emerges out through a circular hole with a flop. 3 - 4 generations are seen in a year.



Damage symptoms: Infestation confined to upper 30 cm depth, damaged grain give out unpleasant smell.

Conclusion

External feeders are easily noticeable due to their presence, while internal feeders are often only detectable once significant damage has occurred. It is important to understand the symptoms of damage, as well as the life cycle and biology of major stored product insect

pests, in order to effectively monitor and assess their impact. This knowledge will enable the development of appropriate strategies for controlling these pests.

References

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