
Rice weevil
BEETLES/WEEVILS IN
STORED GRAIN

PESTS OF STORED GRAIN

- Grain in storage is subject to depredations of insects, mites, rodents, birds and moulds of which insects account for huge losses.
- In India losses during post harvest handling and storage estimated at 15 % annually.
- FAO estimate of total world losses in storage is 10% annually.
- Out of total storage in India 65 to 70 % being stored at farmers level and 30 to 35 % by traders and Government agencies.

- Pests of stored grain causes different types of losses, namely, weight loss, food loss, quantity loss, monetory loss, loss of good will and seed loss. These losses are caused by

1. External / Physical factors like temperature, light, moisture
2. Internal / biotic factors like insects, mites, rodents, birds *etc.*

Sources of infestation

1. Field infestation: rice weevil, bruchid, grain moth.
2. Migration from infested sources: rice weevil, red flour beetle, grain moth.
3. Wooden or bamboo granaries, floor cracks and crevices.
4. Bins, old gunnies with grains.

5. Nearness to feed rooms and other stock of feed.
6. Seed received from infested sources.
7. Waste grain or seed
8. Temporary storage in villages
9. Grain stored in open or poorly constructed structures.
10. During transport

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. Insects that damage stored grain can broadly be placed in two groups as follows

STORED GRAIN INSECT PESTS

✓ Hard bodied beetles Soft bodied moths

Internal feeders

- Grain weevil
- Grain moth
- Lesser grain borer
- Khapra beetle
- Pulse beetle
- Groundnut bruchid

External feeder

- Rice moth
- Red flour beetle
- Saw toothed beetle
- Cigarette beetle

Rice weevil: *Sitophilus oryzae*
Maize weevil: *S. zeamais*
Granary weevil: *S. granarius*
(Curculionidae: Coleoptea)

DISTRIBUTION

- They are distributed worldwide and throughout India. All the three species are similar in appearance and found together on rice, wheat, maize and jowar.
- Among these *S. oryzae* is commonest and widely distributed and also found in paddy fields

APPEARANCE

- ✓ Beetles are small reddish brown, dark brown or black with long slender snout.
- ✓ Wings have four light reddish or yellowish spots.

- Grubs are small white, apodous with yellow brown head.

LIFE HISTORY

- Female weevil makes a depression with mandibles on grain and lays eggs up to 400.
- The eggs are sealed by a gelatinous secretion.
- Egg period is 6 – 7 days.
- Adults live for 4 – 5 months.
- Pupa is dirty white initially and turns to dark brown.
- Pupal period is 6 – 14 days.
- 3-4 generations in a year are completed

NATURE OF DAMAGE

- Upon hatching from eggs tiny grubs bore into grain and feed internally.
- Grubs are small white, apodous with yellow brown head. Both grubs and adults cause heavy damage in monsoon. Damage symptoms are

SYMPTOMS OF DAMAGE

- Hollowed out grains
- Kernels reduced to powder
- Heating takes place during heavy infestation , which is known as dry heating

LESSER GRAIN BORER

Rhizopertha dominica

Bostrichidae: Coleoptera

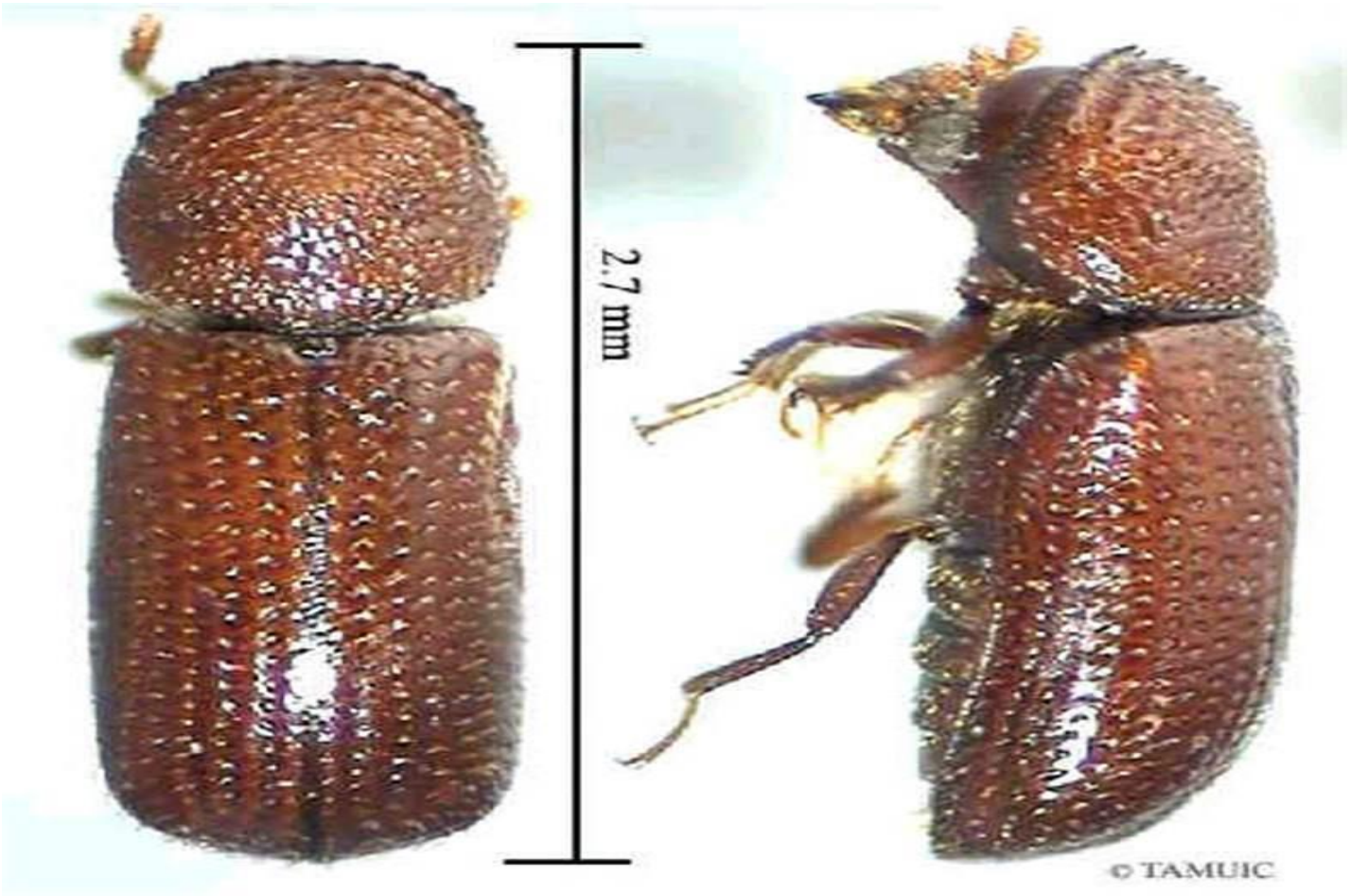
DISTRIBUTION

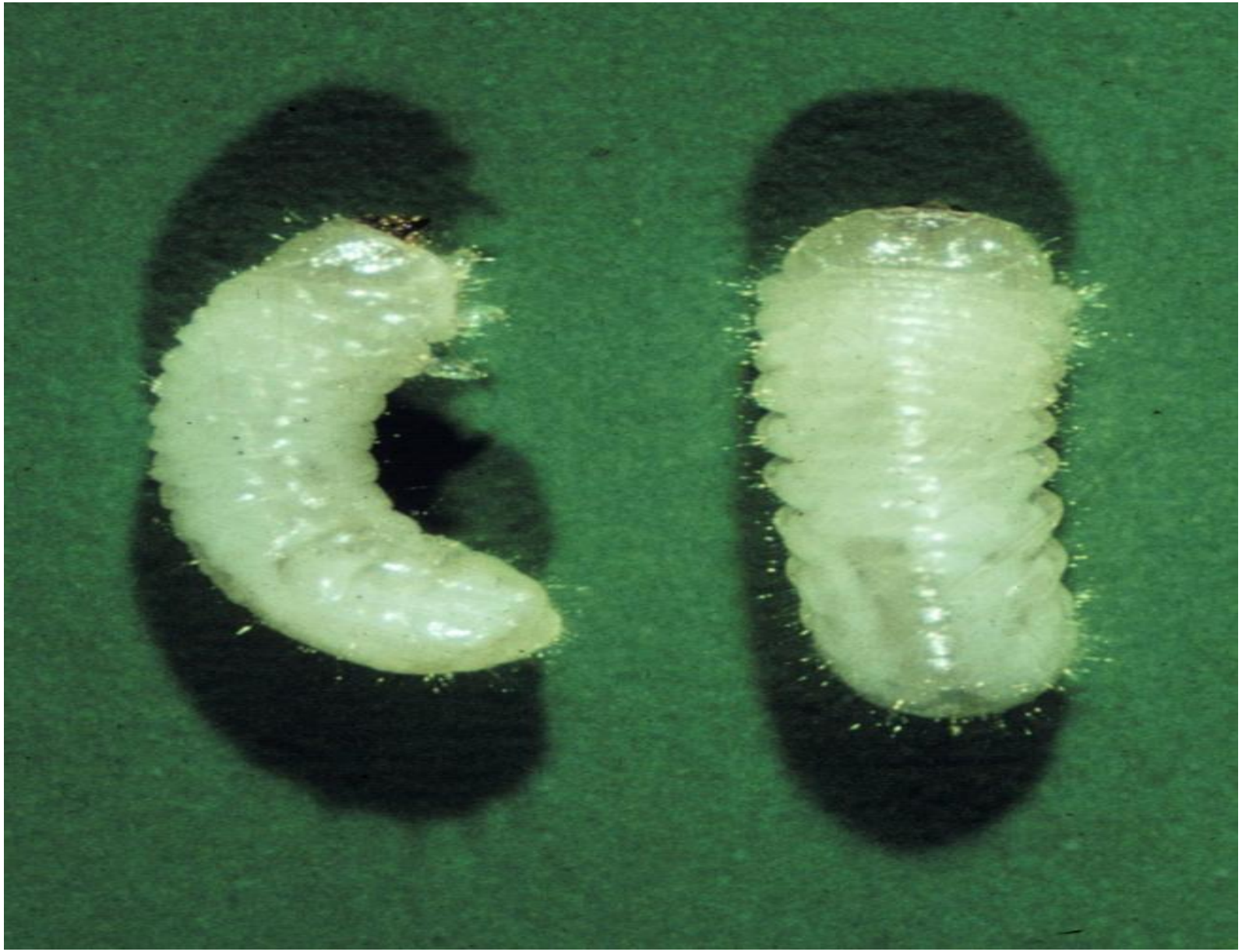
- This pest is original inhabitant of India, now spread to rest of world.
- It is a pest of unhusked paddy. It also causes damage to wheat, maize, sorghum, barley, dried potato, millets, tamarind, pumpkin seed, biscuits as well as broken pulses.

APPEARANCE

- ✓ Brown to blackish beetles.
- ✓ The head is deflexed downwards to such an extent that it is almost hidden in a dorsal view. There is a prominent constriction between prothorax and elytra.

Dorsal and side view of adult Rhyzopertha dominica. Note position of head underneath thorax, a characteristic of the family Bostrichidae.

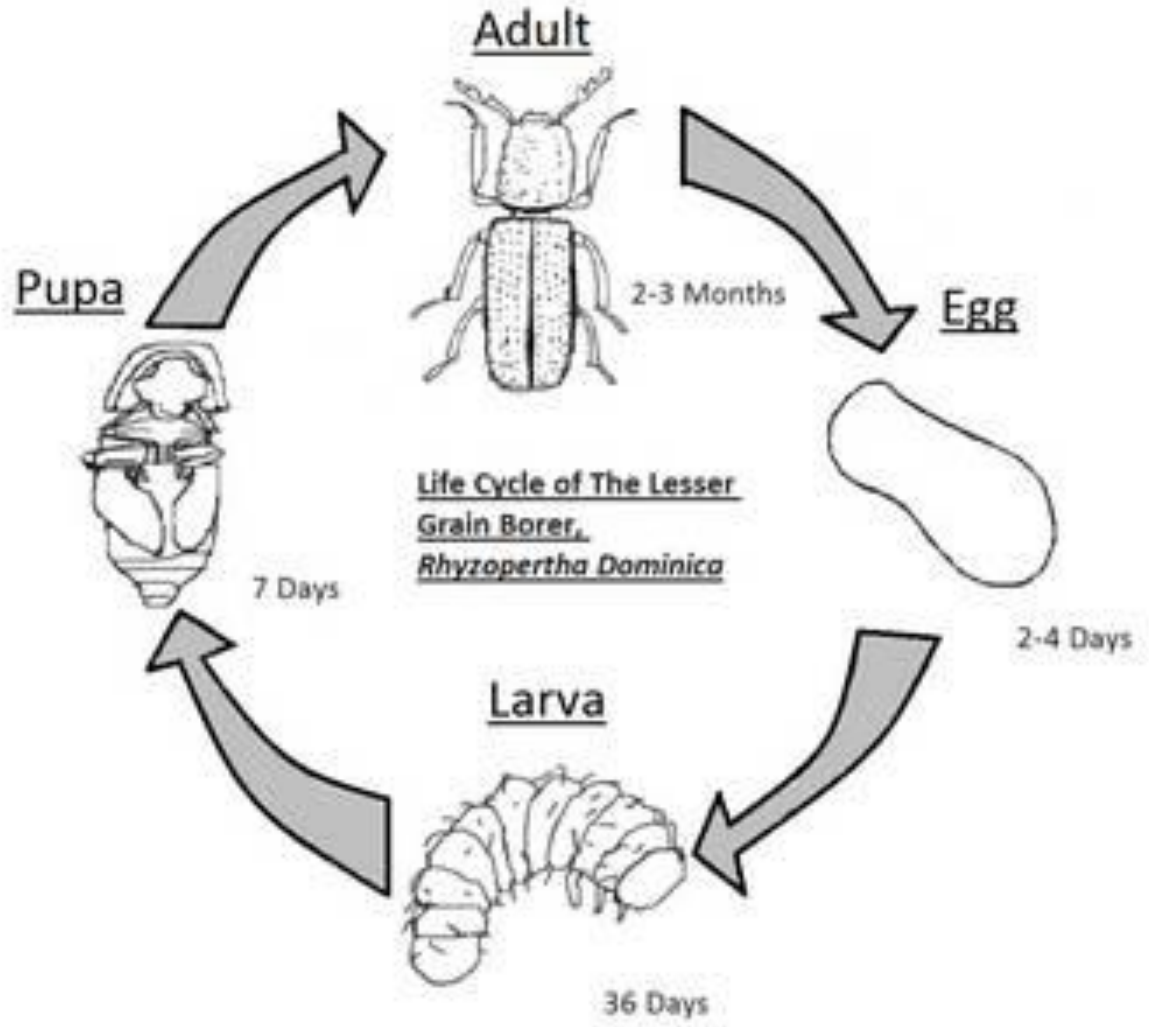




- ✓ Full grown grub is 3 mm long, dirty white with light brown head, constricted elongate body.

LIFE HISTORY

- Eggs are glued on the surface or gaps of cereal grains singly or in clusters.
- Single female lays up to 300 – 400 eggs. Egg period is 5 – 9 days.
- Grub period is 44 days. Pupation is inside the grain. Pupal period is 7 – 8 days.
- Entire life cycle takes 25 days under optimum conditions. 5 – 6 generations per year are completed


Adult
2-3 Months
Egg
2-4 Days
Larva
36 Days
Pupa
7 Days
Life Cycle of The Lesser Grain Borer, Rhyzopertha Dominica

- Males live for longer periods
- Adults come out from the grain after some days leaving irregular hole.
- Antenna has a large loose three segmented club.

NATURE OF DAMAGE

- These are good fliers and migratory, spoiling more than they eat.
- Flour produced serves as feed for young grubs till they enter the grain.
- After hatching, grubs feed on flour produced by the adults.
- Later burrows in to the slightly damaged grain.

- Both grubs and adults are destructive, feeding inside the grains.
- The free living larvae normally enter the grain after 3rd instar for pupation. Infestation is indicated by

SYMPTOMS OF DAMAGE

- Irregular messy waste flour spots in bagged storage
- Heating
- Kernels reduced to mere shells
- The damaged kernels remain engulfed in a film of waste flour.


UGA1233134

KHAPRA BEETLE

Trogoderma granarium

Dermestidae: Coleoptera

DISTRIBUTION

- It is a native of India.
- It is more confined to extreme dry climate as in Punjab, Haryana, U.P., M.P. and Rajasthan. It is less common in coastal areas. It is highly destructive to wheat, also infesting maize, jowar, rice, pulses, dried fruits, oil seeds and their cakes.

APPEARANCE

- Small, dark brown beetles are 2 – 3 mm long. There is distinct division of head, thorax and abdomen.
- Body is convex, oval in shape. Males are smaller, darker and incapable of flying.


© M. Feike - Institut für Schädlingskunde

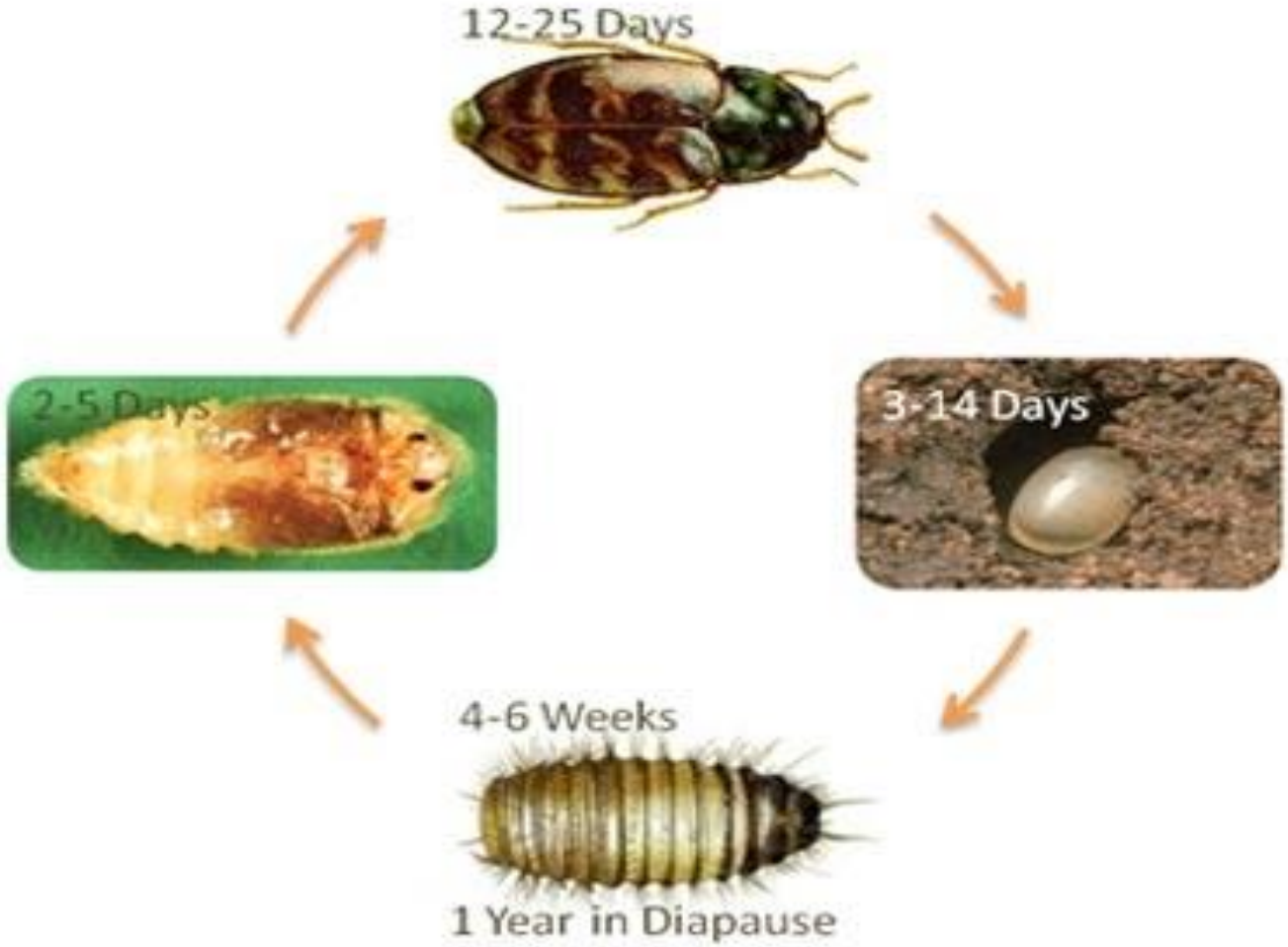

1 mm
USDA APHIS PPQ BALTIMORE
5436039

Adult, larva, and larval skins of the khapra beetle, Trogoderma granarium

- Full grown grub is yellowish brown, with brown head, clothed with long hairs of 40 mm.
- Adults do not cause damage.

LIFE HISTORY

- Fecundity is 13 – 85 per female.
- Egg period is 3 – 5 days.
- Grub period is 20 – 40 days.
- Pupation takes place in last larval skin among the grain.
- Pupal period is 4 – 6 days.
- It completes 4 – 5 generations are observed per year.



Life cycle *Trogoderma granarium*, Khapra Beetle

NATURE OF DAMAGE

- Being a primary pest, grub alone is destructive to grain starting with germ portion, surface scratching and devouring the grain.
- It reduces grain into frass.
- Excessive moulting creates public discrimination, loss of market appeal due to insanitation caused by the cast skins, frass, and hair.
- Crowding of larvae leads to unhygienic conditions in warehouses
- Damage is confined to peripheral layers of bags or 30-45 cm in bulk storage. Infestation is indicated by

SYMPTOMS OF DAMAGE

- Presence of cast skins, frass and hair on bags

A characteristic of warehouse beetle infestations is the accumulation of cast larvae skins.

PULSE BEETLE

Callosobruchus maculatus

Bruchidae: Coleoptera

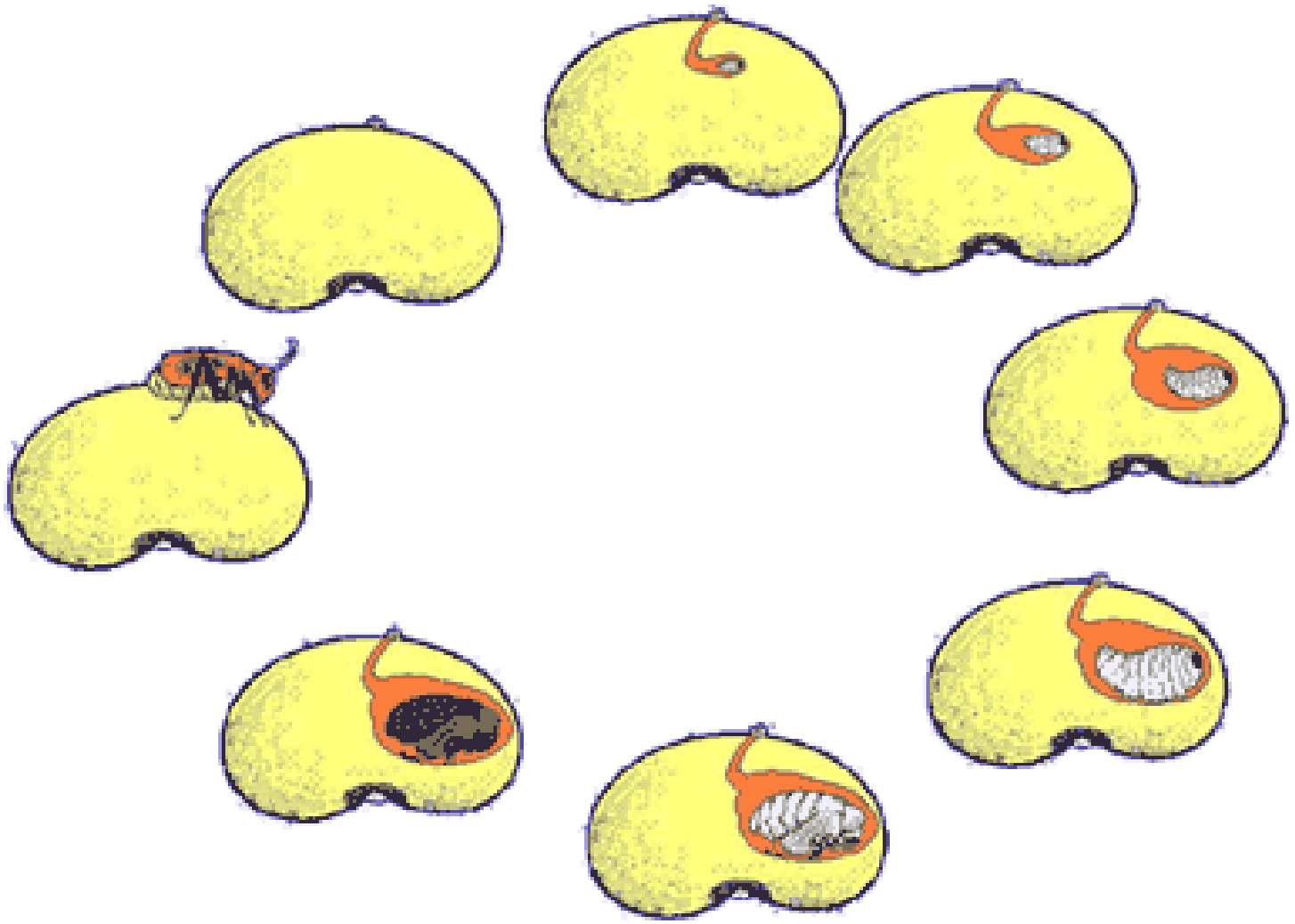
APPEARANCE

- ✓ Brownish grey beetle with characteristic elevated ivory like spots near the middle of the dorsum of the body. Abdomen is conspicuously swollen. Elytra do not cover the abdomen completely.
- ✓ Grub is fleshy, curved, white, creamy in colour, with black mouthparts.

LIFE HISTORY

- Female lays 30 – 100 @ 1 – 37 / day and one egg / grain.
- Egg period is 14 – 1 6 days.


1 mm



- Grub period is 10 – 12 days but hibernation in winter is for 117 – 168 days.
- Full grown grub lies at periphery next to seed coat and pupates.
- Pupa is oval in shape and white in colour.
- Pupal period is 4 – 28 days.
- 7 – 8 overlapping generations are completed per year

NATURE OF DAMAGE

- Young grub bores into the grain eat up the grain kernel and completes the development. Symptoms indicative of its infestation are

SYMPTOMS OF DAMAGE

- Damaged grain unfit for consumption.
- Damaged grain converted to flour by traders give off flavour.


UGA1435014

GROUNDNUT BRUCHID

Caryedon serratus

Bruchidae: Coleoptera

DISTRIBUTION

- It is of Asian origin, but has become distributed to many tropical and subtropical regions of the world.
- It is a large robust bruchid which is associated with groundnut when stored in their shells; it is also a pest of tamarind pods

APPEARANCE

- The beetle has a reddish-brown cuticle densely clothed with grey-brown setae and with dark irregular markings on the elytra.
- The pygidium in the female is fully visible from above.

NATURE OF DAMAGE

- Eggs are glued on to groundnut pods or kernels, and infestation can take place as soon as the groundnut is harvested and left to dry.
- The larvae bore into the groundnut shell and feed on the seed.
- They usually leave the pod to pupate; each larva spins a paper-like pupal cocoon which it usually attaches to the outside of a pod.
- Severe infestations are usually restricted to the outer layer of groundnuts.

- The optimum conditions for development are 30-330C and 70-90% R.H., under which development period is 41-42 days. Infestation of groundnut by the beetle is revealed by

SYMPTOMS OF DAMAGE

- Larval exit holes and presence of cocoons outside the pods
- Damage to the seeds seen when pods are split open.

FLOUR BEETLES

Rust red flour beetle *Tribolium castaneum*

Confused flour beetle *Tribolium confusum*

Tenebrionidae: Coleoptera

APPEARANCE

- ✓ Beetles are small, reddish brown or brick red beetles, smooth and 3.5 mm long.
- ✓ The grub is worm like, white creamy and turns to reddish yellow and hairy. Faint stripes and two spine like appendages are present at the end segment. Length is up to 5 mm.

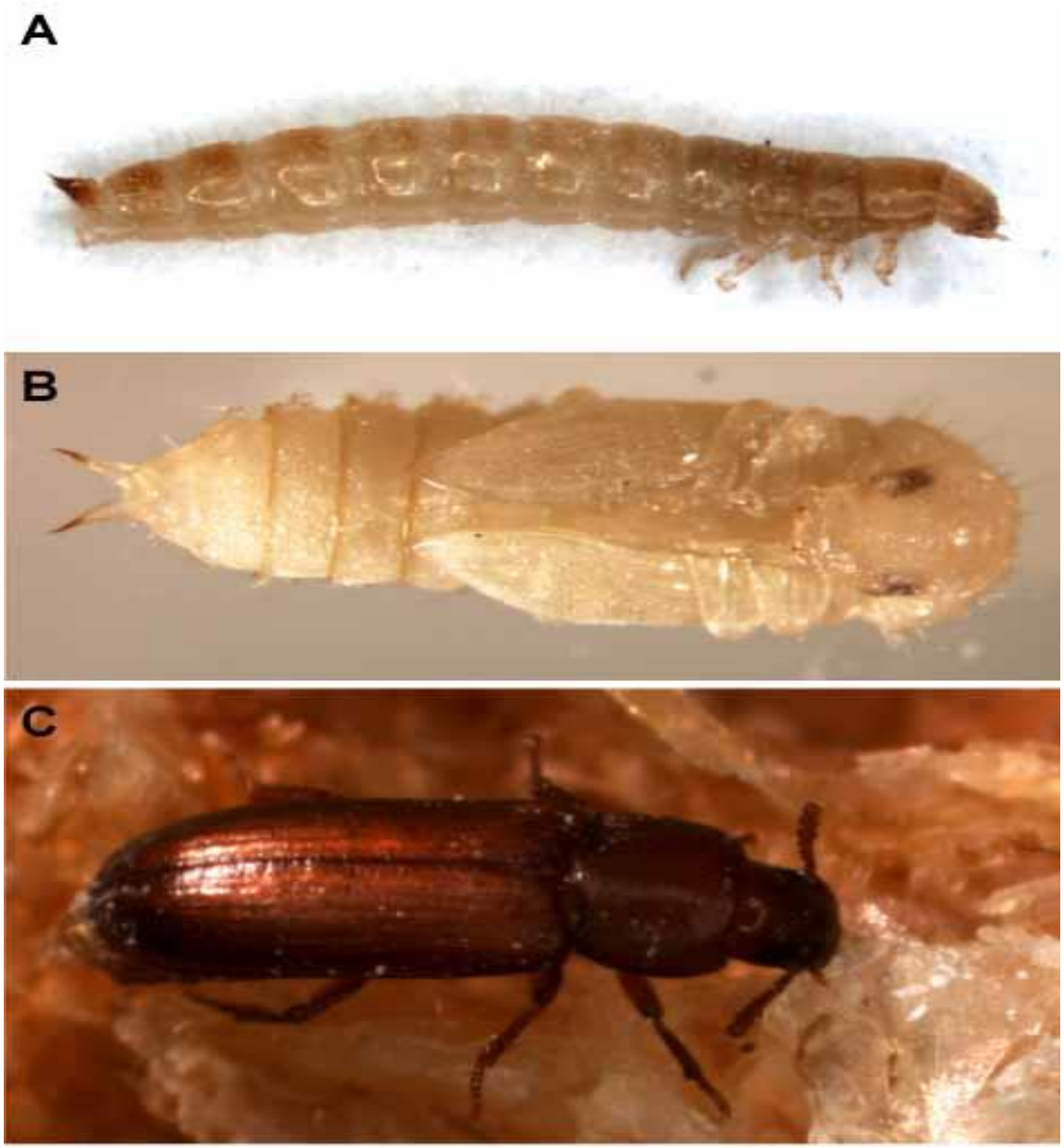
Tribolium castaneum

Tribolium confusum

LIFE HISTORY

White cylindrical sticky eggs are laid loosely in grain or flour.

- Fecundity is 400 – 500/ female.
- Larval period is 3-12 weeks
- Pupation loosely in the grain and pupa is naked.
- Pupal stage lasts 5-9 days.
- Life cycle is completely in 4-5 weeks


A
B
C

NATURE OF DAMAGE

- Both adults and larvae are incapable of feeding on sound grain.
- They damage milled products.
- Flour beetles are secondary pests of all grains and primary pests of flour and other milled products.
- In grains, embryo or germ portion is preferred

SYMPTOMS OF DAMAGE

- Flour greyish and mouldy giving disagreeable odour.


gettyimages
Nigel Cattlin
81781695


RED FLOUR BEETLE

SAW TOOTHED BEETLE

Oryzaephilus surinamensis ,O. mercator

Silvanidae: Coleoptera

APPEARANCE

- ✓ The beetles are narrow, flattened measuring 2.5 to 3.0 mm long with thorax with six teeth like serrations on each side.
- ✓ Grub is slender, pale creamy with two slightly darker patches on each segment.
- It moves freely in grain. Maximum length is 3mm.

LIFE HISTORY

- Eggs are laid loosely in grain / flour/ cracks of receptacle / godown @ 300 per female.
- Grub period is for 14-20 days

Adult

Larvae

Damaged Grain

- Full grown larva makes protective cocoon like covering with sticky secretion.
- Prepupal and pupal period lasts for 7-21 days.
- Multiplication is quick in rainy season and in coastal areas

SYMPTOMS OF DAMAGE

- Roughening of grain surface producing off odour
- Heating of grain with higher percentage of brokens

CIGARETTE BEETLE

Lasioderma serricorne

Anobiidae: Coleoptera

- It is cosmopolitan pest, also feeds on seeds, dried plant products, such as black and red pepper.
- It is a round beetle, light brown in colour.
- Head and prothorax bent down to give humped nature.
- Grubs are yellowish with light brown head.
- Eggs are laid in and about the substance on which it feeds.
- Pupation is in silken cocoon covered with bits of food.
- Both grubs and adults bore holes into tobacco products like cigarettes, (cigars) and chewing tobacco.
- It also damages stuffing furniture.

GRAIN MOTH / ANGOUMOIS GRAIN MOTH

Sitotroga cerealella

Gelechiidae: Lepidoptera

APPEARANCE

- ✓ Adult is buff, brown or straw coloured with narrow pointed wings, fringed with long hairs which are prominent along posterior margin.
- ✓ Caterpillar is 5 mm long, white with yellow brown head.

LIFE HISTORY

- Small, whitish eggs are laid singly or in batches on or near grain which later turn reddish.
- Egg period is 4 – 8 days.
- Larval period is 3 weeks.

- Pupa is reddish brown. Pupation in a silken cocoon in a cavity made during feeding.
- Pupal period is 7 – 13 days.
- It hibernate in winter in pupal stage.
- Adult emerges out through a circular hole with a flop.
- 3 - 4 generations are seen in a year.

NATURE OF DAMAGE

- Larvae are destructive feeding on grain kernels.
- Larva bores into grain, feeds inside up to 30 – 50 percent seed is damaged. Sometimes whole grain is damaged.


UGA1435096

SYMPTOMS OF DAMAGE

- Infestation confined to upper 30 cm depth.
- Damaged grain give out unpleasant smell.

RICE MOTH

Corcyra cephalonica

Galleriidae: Lepidoptera

DISTRIBUTION

- It is distributed in Asia, N. America and Europe, pest on rice, gram, sorghum, maize, groundnut, cotton seed.

APPEARANCE

- Moth is pale buff brown coloured. Wing expanse is 25 mm, forewings with dark veins.
- It is bigger than other grain moths. Adult longevity is one week

LIFE HISTORY

- Eggs are laid singly or in groups of 3 – 5 each on the grain.
- Egg period is 4 -7 days.
- Larval period is 21 – 41 days.
- Pupa is in a silken cocoon.
- Pupal period is 9 – 14 days.
- Six genetrations per year are completed.

NATURE OF DAMAGE

- Caterpillar alone is responsible for damage. It prefers partially damaged grains and feed.
- It pollutes food grains with frass, moults and dense webbing. In case of whole grains, kernels are bound into lumps up to 2 kg with the following

SYMPTOMS OF DAMAGE

- Grain converted to webbed mass
- Damaged grain / flour with bad odour unfit for consumption.

- Disinfestation of stores by treating walls, dunnage, ceilings of empty godown with malathion 50 EC 1: 100 or DDVP 100EC 1: 300 @ 3 litres / 100m2(DDVP is a constant and fumigant)
- Maintenance of good storage conditions by providing dunnage, leaving gangway or alleyway of 0.75 – 1.0 mt all around for aeration, inspection and operations
- Air charging or treating alley ways with malathion 1: 100 or DDVP 1: 300 @ 1 litre of spray fluid per 270 m3
- Stack spraying over the bags with malathion 50 EC 1: 100 @ 3 litres/ 100m2. Do not spray directly on food grains

Prophylactic treatment of seeds or grains for small scale storage

- If for seed purpose, mix 1 Kg of activated Kaoline or Lindane 1.3 D or malathion 5 D for every 100 Kg of seed, store in gunny or polythene lined bags
- If for grain purpose, mix 1 Kg of activated Kaoline for every 100 Kg of grain and store
- To protect pulse grains, activated kaoline or any edible oil @ 1Kg/100 kg of grain.
- Mix neem seed kernel 1 kg for every 100 kg of cereals or pulses and store never mix synthetic insecticides with grains meant for consumption. This is legal offence.

Curative measures

- Most useful and practical curative method is fumigation and fumigants. Process of applying toxins in fumes or gases to infested grains for certain period in reasonably airtight chamber or room is called fumigation. Depending upon the need, fumigation may be
- Shed fumigation
- Cover fumigation
- Fumigation in air tight containers

Choose the fumigant and work out the requirements based on the recommendation.

- Aluminium phosphide:

- For cover fumigation or air tight containers - 3 tablets of 3g each/ tonnes of grain
- In case of cover fumigation, mud plastering and sand snakes to be used for preventing leakage of toxic gas.
- For shed fumigation – 21 tablets each weighing 3g / 28 m3
- Period of fumigation – 5 days
- Other fumigants earlier used are EDB, EDB + EDCT. MBr are now banned and no longer permitted.

Process of fumigation:

- Insert required number of aluminium phosphide tablets in between bags in different layers all around stack and above the stack..
- Cover the bags immediately with fumigation cover.
- Seal it with mud or sand snakes.
- Keep the bags for 5-7 days under fumigation.
- After fumigation period, lift covers in a corner to allow residual gas to escape.
- Aerate the stocks.

- Follow similar steps to ensure leak proof conditions in shed or container fumigation.
- Fumigants have no residual effect on new immigrants, so sample periodically and fumigate stored grain based on need.
- Handle fumigants with utmost care as per specifications.
- 3g aluminium phosphide tablets releases 1g of phosphine (PH3)
- AlP + 3H2O -----> Al(OH)3 +PH3
- Phosphine is a deadly poison. 3g tablets should be supplied through Govt. agencies only under close monitoring of technical personnel. Now 12 g tablets

- (Quickphos) giving same dose of phosphine (1g) as 3g tablet are marketed to facilitate easy and direct availability to farmers. In 12g tablet, safety is incorporated by the size, addition of bitterants to aid vomiting in case of accidental poisoning.

<u>Other curative methods:</u>

- Mechanical methods
- Light traps against *Ephestia*, *Lasioderma* for monitoring and mass trapping
- Use of centrifugal force: subjecting infested commodities at a speed of 2000 – 3000 rpm kills insects.
- A device ENTOLETOR for milled products is effective.

THANK U……..