

INSECT PESTS OF FOOD STORAGE (ACCORDING TO THE FAO GUIDELINES)

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INSECT PESTS OF FOOD AID



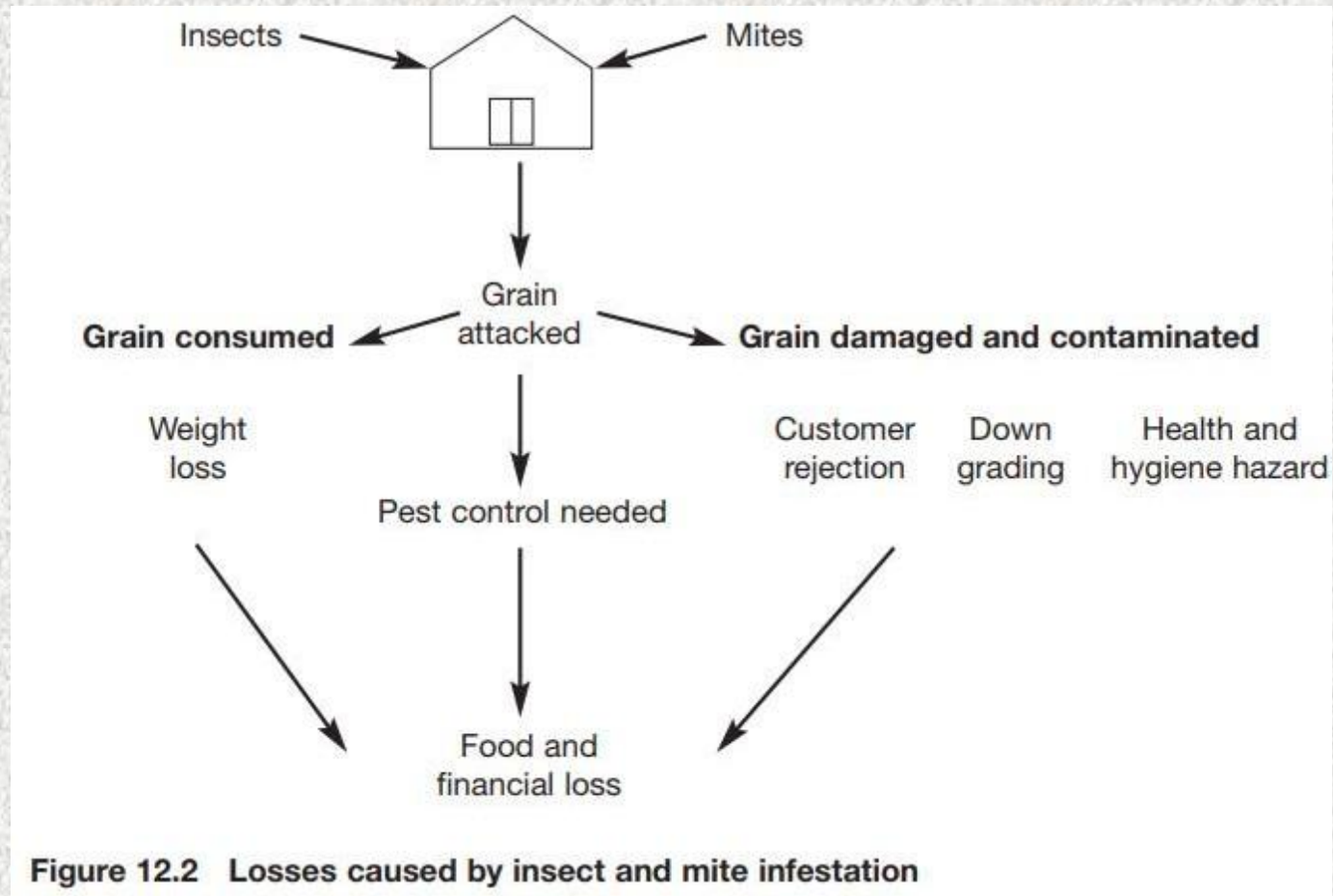
INSECT PESTS OF FOOD AID

- About **30 species of insect** commonly infest food aid grain and grain products,
- Although there are **200–300 species** that may occur from time to time.
- Most insect pests are either beetles or moths although there are some other types.
- In addition to insects, the only other invertebrates that are commonly found in stored food are mites.

BEETLES VS MOTHS



LOSSES CAUSED BY INSECT AND MITE INFESTATION



LIFE STAGES OF INSECTS IN STORED FOOD

- During the course of their lives, insects pass through a **number of stages**.
- The adult stage is responsible for reproduction.
- **After mating**, females lay eggs in selected places.
- Immature insects hatch from the eggs and then **feed and grow** to become adults.
- For many insects, the immature stage differs in form greatly from the adult, and is called a larva (Figure 12.3).
- When the larva hatches from an egg it is very small, typically 1–2 mm long. It begins to feed and grow immediately, but the larval skin is unable to stretch so the larva must shed its outer skin, **a process called moulting**, to allow growth.
- **Moulting occurs several times**, and when a larva is fully grown the final moult produces an immobile stage known as a pupa (Figure 12.3).
- Although the **pupa is unable to move about**, it is physiologically very active with the tissues becoming reorganized in such a manner that the larva changes (or metamorphoses) into the adult.
- At the **end of the pupation period** (typically 5–6 days), the fully formed adult emerges from the pupal skin (Figure 12.3).

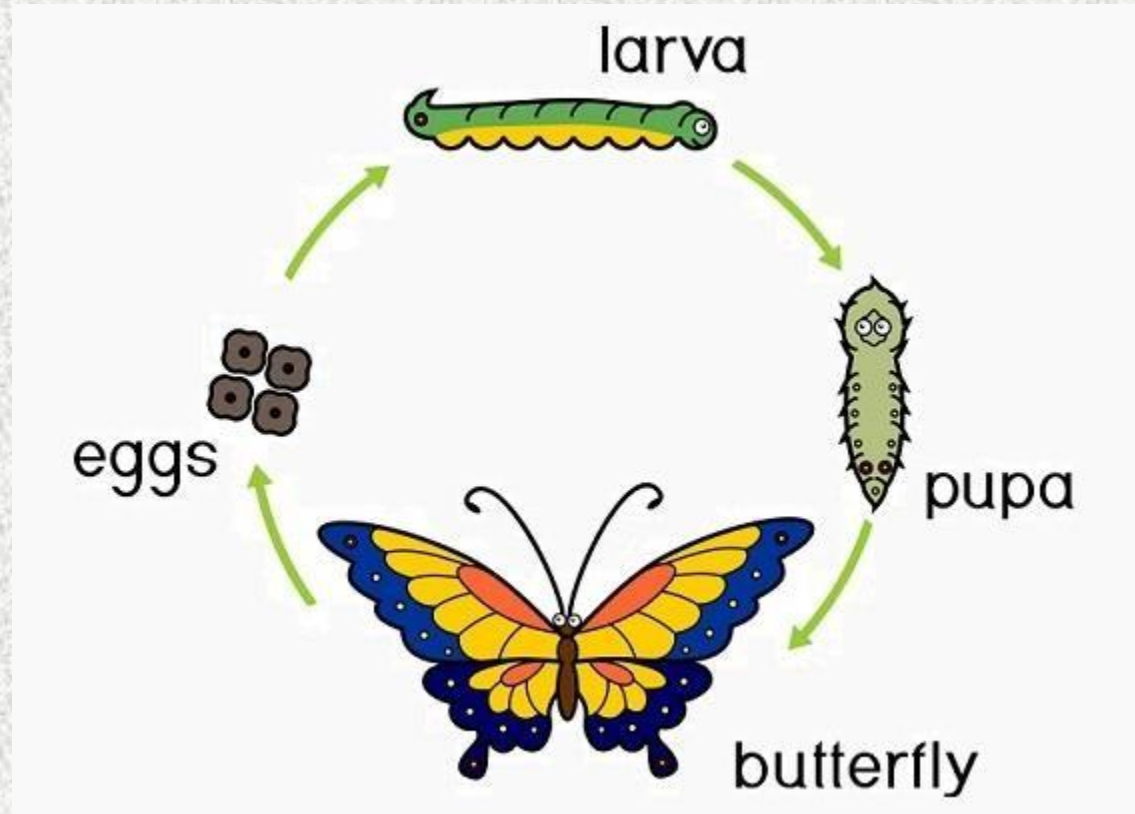
DEFINE LARVA

- the active immature form of an insect, especially **one that differs greatly from the adult** and forms the stage between egg and pupa.
- **Pupa** = an insect in its inactive immature form between larva and adult.

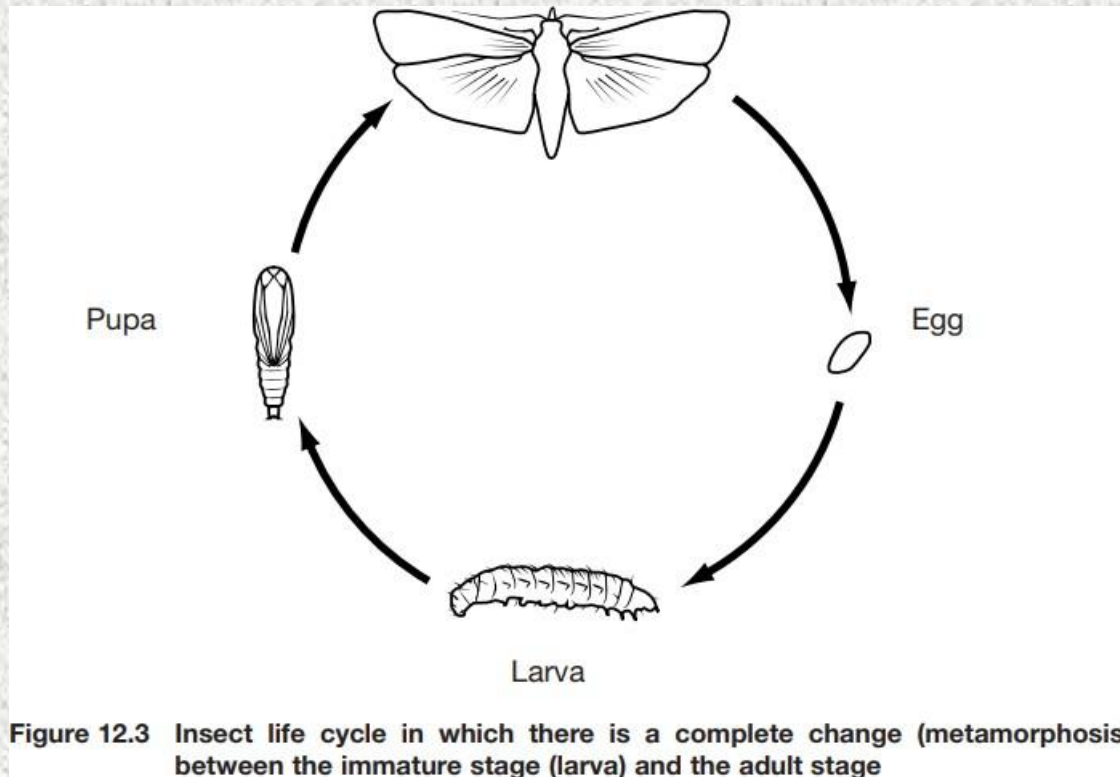
MOULTING



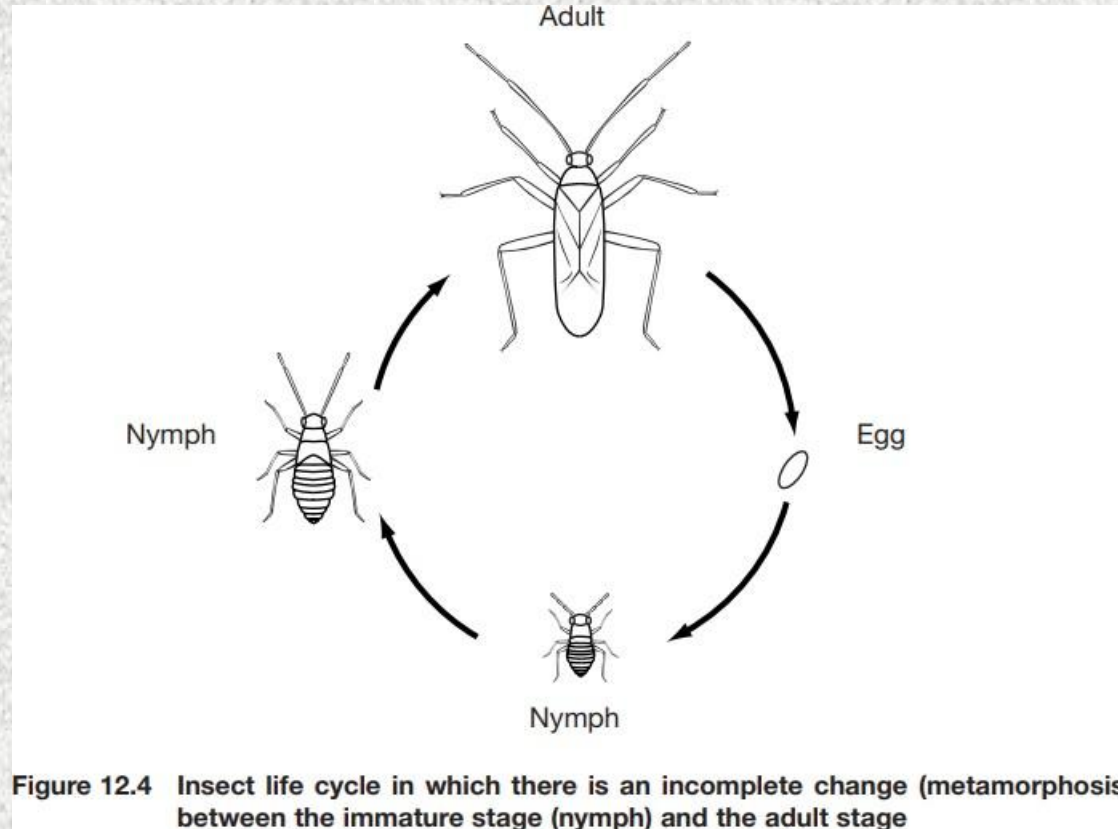
LARVA AND PUPA



COMPLETE METAMORPHOSIS



INCOMPLETE METAMORPHOSIS



- Another mode of development, ‘incomplete metamorphosis’, is shown by certain other insects and mites.
- In this case the **immature stages resemble the adult** (Figure 12.4) and are known as nymphs.
- Although **they are similar to the adults**, nymphs lack certain adult features such as sexual organs and wings.
- Nymphs grow through a **series of moults**, and gradually adult features begin to develop.
- The most obvious of these features is the development of wing ‘buds’ that eventually develop into complete wings.
- The **adult features become mature and functioning** only after the final moult.

CATEGORIES OF PESTS

- Insects that attack cereals and grain pulses are usually divided into two groups:
 - primary pests and
 - secondary pests.
- **primary pests are usually more destructive** than secondary pests, especially in shortterm storage.

FIND OUT THE DIFFERENCES BETWEEN PRIMARY PESTS AND SECONDARY PESTS.



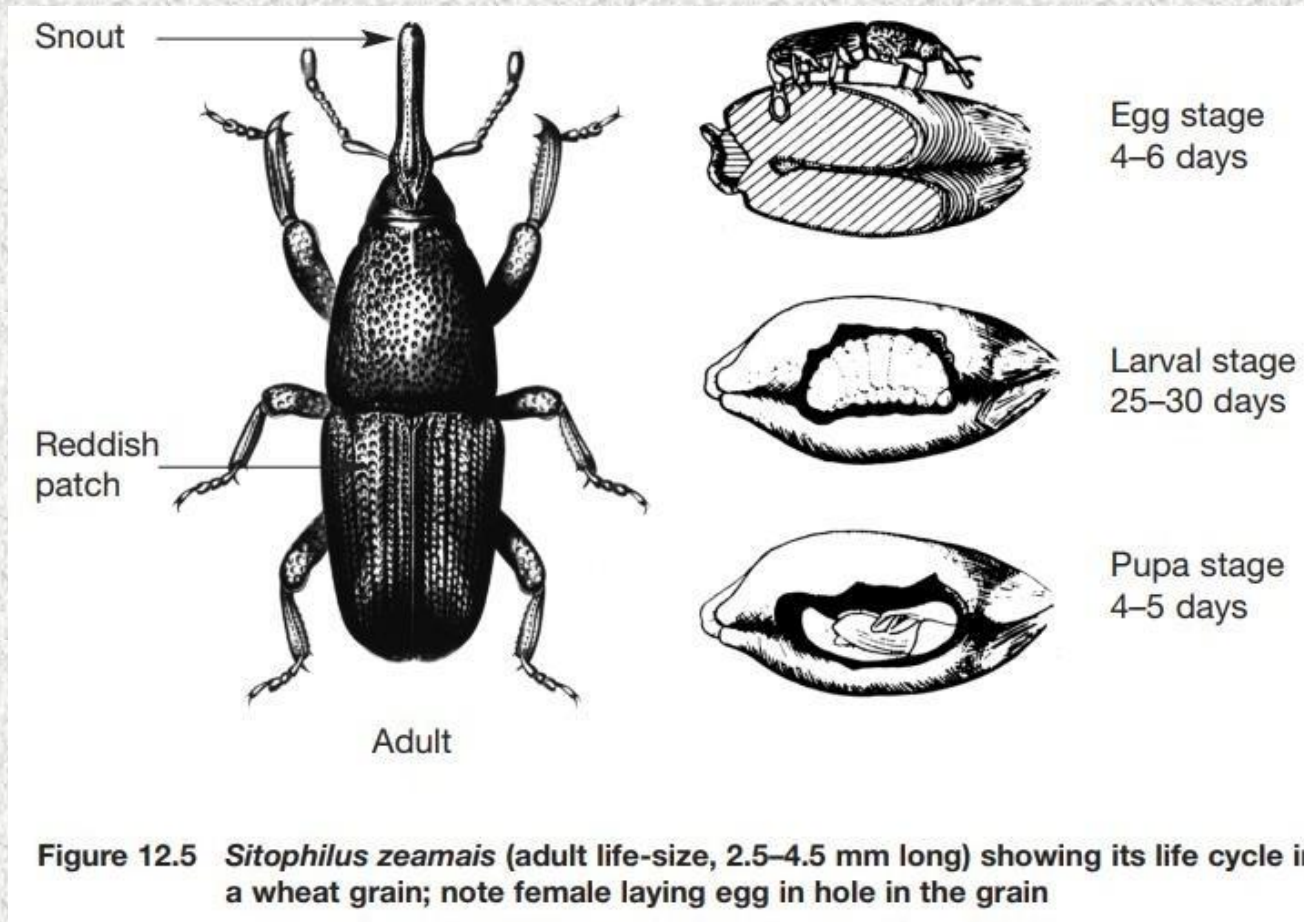
PRIMARY PESTS OF CEREALS (*SITOPHILUS* SPP.)

- Beetles of the genus *Sitophilus* are important **primary pests** of whole cereal grains and are called weevils.
- **Three species** are pests of stored grain:
 - *Sitophilus zeamais* (maize weevil),
 - *Sitophilus oryzae* (rice weevil) and
 - *Sitophilus granarius* (granary weevil).
- The common names are misleading because they suggest the pest is restricted to particular grains, which is not the case.
- The adults of all three species are small, active insects with a **narrow snout** that carries the mouthparts.
- The **body colour ranges from light to dark brown**, and both *S. zeamais* and *S. oryzae* often have four large, reddish-orange spots on their wing cases (Figure 12.5).

***SITOPHILUS ORYZAE* (RICE WEEVIL)**



PRIMARY PESTS OF CEREALS (*SITOPHILUS* SPP.)



PRIMARY PESTS OF CEREALS

(*SITOPHILUS* SPP.)

- *Sitophilus granarius* is essentially a **temperate pest** and is not found in tropical countries, except occasionally in cooler, upland areas.
- *Sitophilus zeamais* and *S. oryzae* are commonly found throughout the world in **tropical and subtropical** regions, especially where ambient humidities are fairly high.
- Under favourable conditions, such as **27 °C and 70% RH**, development from egg to adult in all three species is completed in about 35 days.

SITOTROGA CEREALELLA

- *Sitotroga cerealella* is an important **primary pest** of cereals.
- In *S. cerealella* the forewings of newly emerged adults are covered with **yellowish-golden scales**,
- but in **older adults** the body is **entirely grey**.
- The hind wings carry a fringe of very long hairs (Figure 12.8)

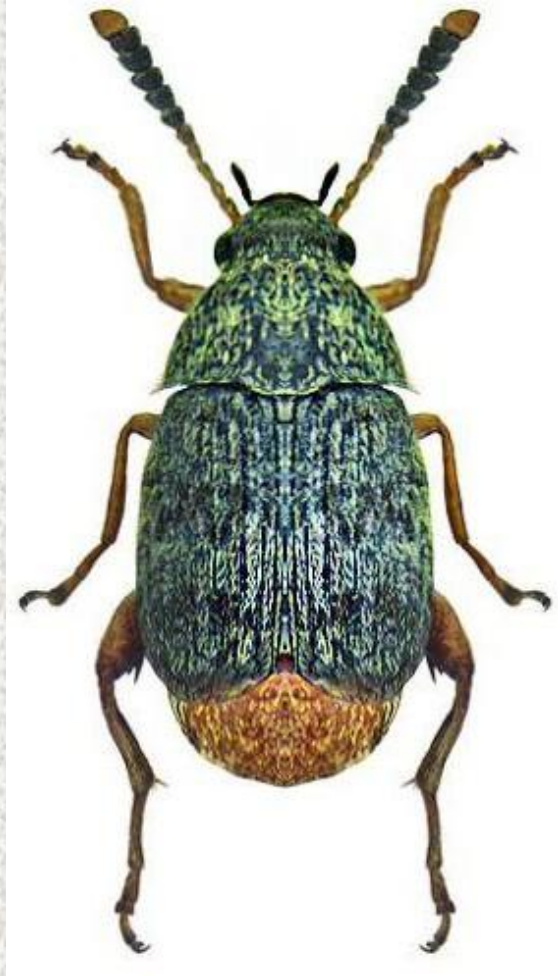
SITOTROGA CEREALELLA



ACANTHOSCELIDES OBTECTUS

- *Acanthoscelides obtectus* is a common pest of *Phaseolus* beans.
- It sometimes attacks other legumes, but it is seldom a serious pest on these.
- The adult is a robust, active beetle, the **body colours of which are greys, browns and reddish-browns** forming vague and indistinct patterns.
- The wing cases **do not completely cover the abdomen** (Figure 12.9).
- Adult beetles are able to infest beans **before or after harvest**.
- Adult beetles are short-lived (**typically 7–14 days**) and do not feed in store.
- In the field, however, **they may feed on the pollen** of many plant species.
- The beetles are capable of **tolerating quite low temperatures**, which has resulted in their spread to cool, highland regions of the world and into some temperate areas.

ACANTHOSCELIDES OBTECTUS



***CALLOSOBRUCHUS* SPP.**

- Species of *Callosobruchus* are important **primary pests** of a number of legumes including cowpeas, pigeonpeas, chickpeas, adzuki beans, peas, grams and (occasionally) soyabeans.
- They **do not** usually attack **kidney beans or butter beans** (*Phaseolus* spp.)
- The life cycle of *Callosobruchus* spp. is **similar to that of *A. obtectus***,
- There are several species, including ***C. chinensis***, a common Asian pest.



SECONDARY PESTS

- A large number of unrelated pests can be conveniently classified as secondary pests.
- They are predominantly associated with commodities **that have suffered previous physical damage caused by a primary infestation** or a milling process.
- Many are pests of cereal products, but others are associated with oilseeds, spices and other commodities.

TROGODERMA GRANARIUM



TROGODERMA GRANARIUM

- *Trogoderma granarium* is a very serious pest of cereal grains and oilseeds, and many countries have specific quarantine regulations against possible importation.
- Massive populations may develop, and grain stocks can be almost completely destroyed.
- Attacks occur in large-scale stores. The presence of *T. granarium* on grain exported to some countries will result in an order to carry out expensive pest control measures or a rejection of the shipment.
- The females are larger than the males.
- The wing cases are lightly clothed with fine hairs and are mid-brown in colour or irregularly mottled.
- Although the adults have wings, they are not known to fly and appear to rely on transport in old bags, etc., to move from one store to another.
- *Trogoderma granarium* is very tolerant of high temperatures (up to 40 °C) and low humidities (down to 2% RH). It is, therefore, a pest in hot, dry regions where other storage pests cannot survive.

TRIBOLIUM CASTANEUM

- *Tribolium castaneum* feeds on a range of commodities, especially cereals, but also groundnuts, nuts, spices, coffee, cocoa, dried fruit and occasionally pulses. ○
- It will also feed on animal tissues, including the bodies of dead insects, and
- It will attack and eat small or immobile stages of living insects, especially eggs and pupae.
- Under optimum conditions (33–35 °C at about 70% RH) adults live for many months



TRIBOLIUM CASTANEUM

- Heavy infestations by *T. castaneum* and other tenebrionidae can produce **disagreeable odours and flavours** in commodities due to the production of **quinones** from the abdominal and thoracic defence glands of the adults.
- **Flour exposed to *T. confusum*, at 100 adults/kg for 3 weeks**, showed a distinct change in viscosity and extensibility when made into dough.
- **Tumours have been observed in mice** that had been fed flour on which an initial population of *T. castaneum* at 20 adults/kg had been allowed to develop for 1 year.

CRYPTOLESTES

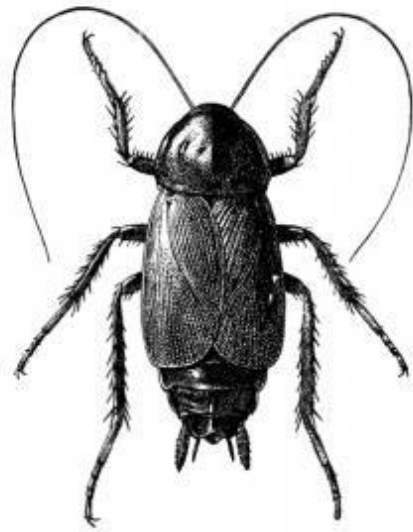
- Several species of *Cryptolestes* are common in mills and stores where they are **secondary pests of cereals, nuts, oilcakes, dried fruit** and other commodities.
- The adults are small (2.0–2.5 mm long), elongate, very flat, **light-coloured beetles**. They have long, thin antennae (Figure 12.14).
- The **embryo of cereals** is often attacked preferentially.
- *Cryptolestes* spp. prefer food with a **high moisture content**, and the presence of large numbers may **indicate moisture problems**.



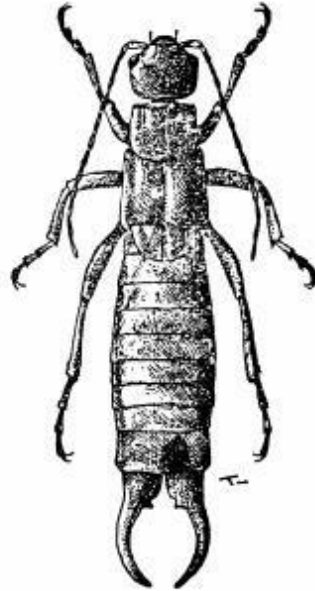
OTHER SPECIES

- Mould-feeding beetles are frequently found in food warehouses.
- While they do little direct damage, they **act as vectors to spread fungal spores** and help to spread mould quickly through a commodity.
- **The presence of large numbers of these insects** may indicate **poor physical condition** of all or part of the consignment.
- Examples of such beetles are *Carpophilus* spp. and *Typhaea stercorea*.
- Various **wood-boring beetles and termites attack storage structures**. They can also damage the commodity or its **packaging by boring**.
- Several insects that occur in stores **do not attack the grain directly**, but feed on dust and residues or on the dead bodies of insects and other animals.
- These are referred to as **scavengers**, and their numbers are high when conditions in store are unhygienic.
- **Typical scavengers are cockroaches**, earwigs and silverfish (Figure 12.22), as well as flies and ants. Cockroaches are often highly visible and associated with rubbish in unhygienic store.

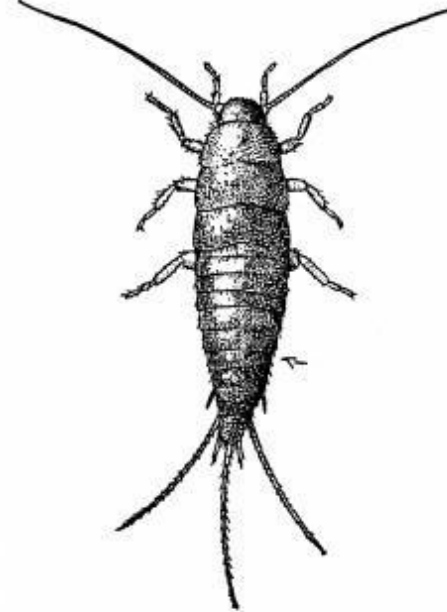
TYPICAL SCAVENGERS



(a)



(b)



(c)

Figure 12.22 Typical scavengers (a) cockroach, (b) earwig and (c) silverfish

‘BENEFICIAL’.

- Several species consume the pests found in stores and so are described as ‘beneficial’.
- These include predatory beetles such as *Tenebroides mauritanicus*.
- although, besides eating storage pests, this species also attacks the stored commodity; and *Xylocoris* bugs which are common and effective predators of insect eggs and small, soft-bodied insects.
- Some species of mites prey on the eggs of moth pests.

QUESTION

