BACK POCKET GUIDE

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

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STORED GRAIN PESTS IDENTIFICATION

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Contents

Introduction

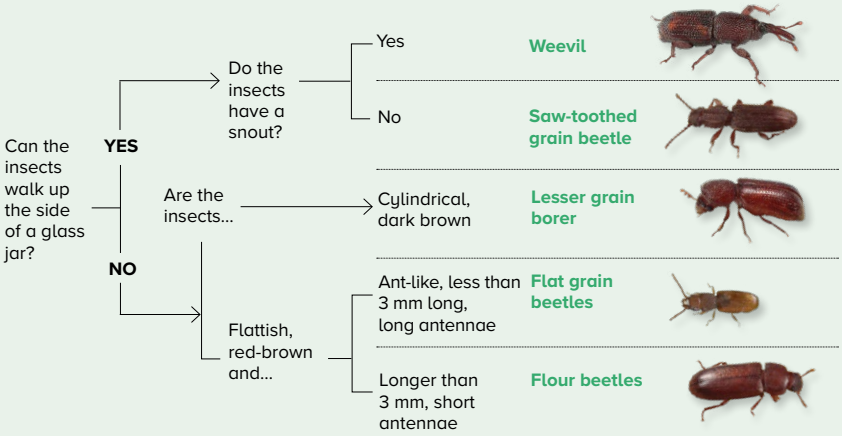
This identification guide provides a snapshot of common pests found in stored grain in Australia. The tolerance for live storage pests in grain sold off-farm either for the domestic, human-consumption market or for the export market is nil.

With more grain being stored on-farm, growers need to identify pests early and monitor – at the very least – monthly.

Regular inspection by sieving grain from the top and bottom of silos will provide an early warning of insects.

Identification of common pests of stored grain

The following flowchart provides a useful guide for grain pest identification.



Source: QDPI

Lesser grain borer (*Rhyzopertha dominica*). Photo: QDPI

Lesser grain borer

A serious pest of most stored grains: the lesser grain borer has developed resistance to a number of grain insecticides.

Key features:

- Dark brown, cylindrical shaped beetle (up to 3 mm long) with club-like antennae.
- Viewed from the side, the beetle's mouth parts and eyes are tucked underneath the thorax (chest).
- Adult beetles are strong flyers.

Life cycle:

- Life cycle completed in 4 weeks at 35° C and 7 weeks at 22° C. Breeding stops below 18° C.
- Females lay between 200 and 400 eggs on grain surface. Young larvae (white with brown heads) initially feed outside of the grain, then bore into the grain.
- Adults live for 2 to 3 months.

Detection:

- Their habit is to remain hidden in grain. Regular sampling and sieving is required for detection.

Rust-red flour beetle (*Tribolium castaneum*). Photo: QDPI

Rust-red flour beetle

Commonly found in stored cereal grain, processed grain products, oilseeds, nuts and dried fruit.

Key features:

- Adult beetles (3 to 4.5 mm long) are bright reddish-brown when young and a darker brown when older.
- Beetle has 3 larger segments on end of antennae.
- Similar species: Confused flour beetle (*Tribolium confusum*), which is more common in cool, temperate regions.

Life cycle:

- Life cycle completed in 4 weeks at 30° C, 11 weeks at 22° C and reproduction stops below 20° C.
- Adults live from 200 days to 2 years and fly in warm conditions.
- Up to 1,000 eggs laid per female, loosely scattered throughout the grain.
- Cream-coloured larvae feed externally on damaged grain.
- Beetles infest whole grain, but breed more successfully on processed products.

Detection:

- Beetles move quickly and are strong flyers. When in low numbers, use sieving and probe traps to detect.
- Preferred habit is around storage areas with poor hygiene, broken grain, gradings or bulk cottonseed.

Rice weevil (*Sitophilus oryzae*).
Photo: QDPI

Rice weevil

Major pest of whole cereal grains.

Key features:

- Adults are dark brownish black (2 to 4 mm long) with a long weevil snout.
- Has 4 small light coloured patches on its rear wing covers.
- Rarely flies, but climbs vertical surfaces (for example, glass jar).
- Similar species: Maize weevil (*Sitophilus zeamais*) and granary weevil (*Sitophilus granarius*).

Life cycle:

- Adults live 2 to 3 months.
- Larvae generally not seen – they feed and develop inside single grains.
- Life cycle completed in 4 weeks at 30° C, 15 weeks at 18° C, breeding stops below 15° C.

Detection:

- Under warm conditions or when grain is moved, rice weevils are often observed climbing out of grain, up vertical surfaces. Sieving and probe traps recommended to detect low numbers.

Flat grain beetle (*Cryptolestes* spp.). Photo: QDPI

Flat grain beetle

Often referred to as rusty grain beetle. Infests most stored grain and feeds on damaged grain. Some populations have high levels of phosphine resistance.

Key features:

- Beetle is smaller than other major stored grain pests (2 mm long), very flat, reddish brown colour with long thin antennae.
- Fast moving, seeking cover under grain or trash.
- Adults fly readily and can live for several months.
- *C. ferrugineus* most common in Australia, but there are several closely related *Cryptolestes* species with similar appearance.

Life cycle:

- Life cycle completed in 4 weeks at 30° C to 35° C with moist conditions, 13 weeks at 20° C, breeding stops at 17.5° C.
- Larvae, with characteristic tail and horns, feed and develop externally on damaged grains.
- Females lay up to 300 eggs loosely in the grain stack.

Detection:

- Sieving and probe traps usually required for detection.
- Some populations of flat grain beetles have developed very high levels of phosphine resistance. Send in insect samples for testing after a fumigation failure.

Saw-toothed grain beetle (*Oryzaephilus surinamensis*). Photo: QDPI

Saw-toothed grain beetle

Infests cereal grains, oilseeds, processed products, peanuts and dried fruits.

Key features:

- A dark brown-black beetle (up to 3 mm long), fast moving.
- Thorax (chest) has saw-toothed pattern on each side and 3 distinct ridge lines on top.
- Adults climb vertical surfaces (glass jar) and fly in warm conditions.

Life cycle:

- Prefers damaged or processed grain to establish in significant numbers.
- Adults can live for several months, females laying 300 to 400 eggs loosely throughout the grain. White larvae feed and develop on the grain.
- Life cycle completed in 3 weeks at 30° C to 33° C, 17 weeks at 20° C, reproduction stops below 17.5° C.

Detection:

- Sieving and probe traps are recommended for detection.
- Saw-toothed grain beetle has developed resistance to a number of grain insecticides.

Psocids: Booklice (*Liposcelis* spp.).
Photo: QDPI

Psocids: Booklice

Infests a wide range of grains, commodities and storage facilities.

Key features:

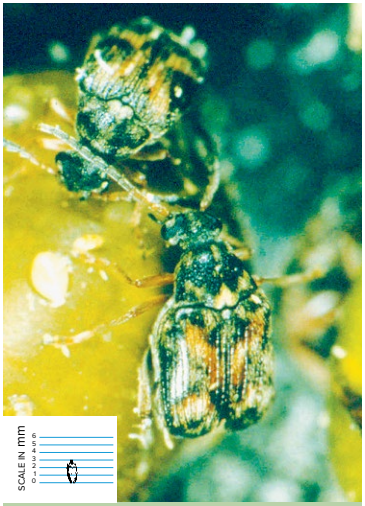
- Booklice are very small, soft-bodied and opaque, pale coloured (up to 1 mm long), often appear as a 'moving carpet of dust' on grain or storage structures.
- A secondary pest, feeding on damaged grain and moulds.
- There are 3 main species of psocids in Australia, often in mixed populations.

Life cycle:

- Thrive under warm, moist conditions: optimum 25° C and 75% relative humidity. Life cycle is 21 days.
- Eggs are laid on grain surface, hatching to nymphs that moult through to adult stage.

Detection:

- Warm, humid conditions increase activity. Usually observed in storage or on grain surfaces. Sample and sieve to detect when in low numbers.



Bruchids: Cowpea weevils (*Callosobruchus* spp.).
Photo: CSIRO

Bruchids: Cowpea weevil

Callosobruchus spp. are pests of most pulse crops, including mungbeans, cowpeas, field peas, chickpeas, soybeans and lentils.

Key features:

- Adults (up to 4 mm long) emerge through perfectly round holes in the seed.
- Globular, tear-shaped body is reddish brown with black and grey markings.
- Wing covers (elytra) do not fully cover the abdomen.
- Adults have long antennae, climb vertical surfaces (glass jar) and are strong flyers.

Life cycle:

- Adults do not feed, but females lay 100 white eggs clearly visible on the outside of seed. Adults have a short lifespan of 10 to 12 days. Unlike most storage pests, adults may also lay eggs on mature seed pods in a standing crop.
- Larvae feed and develop within individual seeds and emerge as adults leaving a neat round hole.

Detection:

- A common problem in warmer months for mungbeans. Fortnightly, thorough sampling and sieving is important to prevent serious losses.

Pea weevil (*Bruchus pisorum*).
Photos: SARDI Entomology

Pea weevil

Both a paddock pest and storage pest (appears in storage after emergence). In WA, it is a major pest of field peas.

Key features:

- Adult globular body length (4 to 5 mm long) with long legs and antennae.
- Wings (elytra) are patterned with white/cream spots.
- Do not breed in stored dry peas, adults lay and glue eggs onto pods in standing pea crops before harvest.
- Adult emerges through a neat round hole in the seed.
- Adults are strong flyers, they reappear in spring to visit flowers to feed on the nectar then seek out new field pea crops to lay eggs.

Life cycle:

- Hatching larvae bore through the seed pod and into a single seed where they feed, grow and pupate.
- Breed one generation per year. Adult is long-lived and overwinters but does not feed on field peas.

Detection:

- Adults migrate into crops from seed sources and trees where they shelter under the bark.
- Field peas should be regularly checked, in and around the crop edges when first pods are forming using a sweep net when temperatures are above 18° C.
- Check pea seed for neat round holes (evidence that adults have emerged).

Angoumois grain moth (*Sitotroga cerealella*). Photo: CSIRO

Angoumois grain moth

A pest of whole cereal grains that only infests surface layers of bulk-stored grains. Infestation of standing maize crops before harvest is quite common, occasionally in other cereal crops.

Key features:

- Silvery grey to grey brown wings that taper to a point.
- Wings have a long fringe of fine hairs along the posterior edge.
- Adults (5 to 7 mm long) are unable to penetrate grain, therefore only infest surface layers of bulk grain.

Life cycle:

- Adult moths do not feed but lay 150 to 300 eggs on or near the grain surface. This pest does not create webbing.
- Larvae burrow into a single grain and feed and develop until the adult moth emerges in 10 to 14 days through a visible hole.
- Life cycle takes approximately 5 to 7 weeks in warm conditions.

Detection:

- Take regular monthly samples and look for moths near grain surface. When adults emerge, pupal cases are often found protruding from grain.

Indian meal moth
(*Plodia interpunctella*).
Photo: CSIRO

Indian meal moth

A pest in flour mills, processing plants, dried fruit and on the surface of all types of grains.

Key features:

- Adults (5 to 7 mm long) have distinctive bicoloured wings – dark reddish brown on rear half of the wing and grey at the front.

Life cycle:

- Female moth lays 200 to 400 eggs on the foodstuff.
- Larvae create webbing as they feed. They then pupate in several grains webbed together in a clump.
- In summer, life cycle takes approximately 4 weeks.

Detection:

- Take regular monthly samples and look for webbing and moths near grain surface.
- Also check in residues on grain harvesting and handling equipment.

Warehouse moth (*Ephestia* supp.).
Photo: CSIRO

Warehouse moth

A pest of flour mills, food processing plants, cereal grains and oilseeds.

Key features:

- Adult moth body length is 8 to 10 mm.
- Moth has grey wings with many fine, dark wavy markings, including lighter stripes extending horizontally across each forewing.
- Extensive webbing created by larvae is visible on the grain surface.

Life cycle:

- Adult moths do not feed and are short-lived. Female lays between 100 and 270 eggs over a 2-week period on or near grain.
- Larvae is coloured light pink with a small black spot at the base of each hair.
- Full life cycle, 30 days under ideal conditions, 30° C and 75% relative humidity.

Detection:

- Take regular monthly samples and look for webbing and moths near grain surface. All moths are typically active at dusk and dawn.

Rusty grain beetle (*Cryptolestes ferrugineus*). Photo: QDPI

Phosphine-resistant insects

- Saw-toothed grain beetle and lesser grain borer have developed some resistance to a number of grain insecticides.
- Flat grain beetle: some populations (rusty grain beetle) have developed a high level of phosphine resistance.
- A range of stored grain insects are becoming harder to kill with phosphine fumigations.
- This threatens exports, as phosphine may become ineffective against some pests.
- Poor fumigation practices increase resistance (for example, repeated fumigations in unsealed or poorly sealed storages).
- Strong phosphine resistance is also found in other countries.
- Live insects detected following fumigation should be tested for resistance.
- Resistant insects can fly between stores or be transported in machinery.

Exotic pests: not present in Australia

Be on the lookout

The following pests have serious potential impact on the value of grain if detected in Australia.

If you see anything unusual, report it to your local state department of primary industries or phone the Exotic Plant Pest Hotline, **1800 084 881**

Karnal bunt

(*Tilletia indica*)

- Can infect wheat, durum and triticale.
- Usually only part of each grain is affected. Infected stored grain will have a sooty appearance and will crush easily, leaving a black powder.
- Infected grain often has a rotten fish smell, flour quality is seriously reduced.
- Symptoms are similar to common bunt.

Khapra beetle

(*Trogoderma granarium*)

- Attacks most stored grains.
- Larvae are covered in fine hairs.
- Looks identical to the warehouse beetle to the naked eye.
- Causes grain loss in storage.
- Larvae skins contaminate grain and cause allergies on consumption.
- Phosphine fumigation is not reliably effective.

Use a 2 mm mesh sieve to separate insects from grain.
Photo: Kondinin Group

How to monitor and identify grain pests

- Identify pests early by regular fortnightly/monthly sampling.
- Sieve (with 2 mm mesh) grain samples taken from the top and bottom of stores onto a white tray. Hold tray out in sunlight to warm for 10 to 20 seconds to encourage insect movement to identify them.
- Also use grain probes or pitfall traps to monitor for insects. These are pushed into the grain surface and then pulled up for fortnightly/monthly inspection. Place 1 or 2 traps in the top of a silo or several traps in a grain shed.
- If live insects are found, identify them and select the appropriate treatment for the grain type and insect. Always check product labels. Ensure potential grain buyers and end-users also accept treatments selected.

A probe can often more easily detect pest species in a grain sample than a sieve.
Photos: Chris Warrick, Kondinin Group

Control measures

Hygiene:
Insects thrive in sheltered, warm sites with a food source. Promptly clean out grain residues from empty silos, equipment and harvesters.

Aeration:
Using aeration reduces grain temperatures and creates uniform, cool conditions in the grain bulk. This maintains grain quality and slows or stops grain pests breeding. Aim for grain temperatures of 20° C in summer and under 15° C in winter. Automatic controllers run fans when the ambient temperature and relative humidity are lowest.

Fumigation:
Storages must be gas-tight sealable to control all stages of the insect life cycle (eggs, larvae, pupae and adult). A 5-minute, half-life pressure-test to Australian Standard 2628 or monitoring gas concentrations during fumigation provides confidence of a complete control. Repeat fumigations in non gas-tight storages leads to resistance.

To check insects for resistance, send samples for testing

Follow these basic steps:

- Use a small, strong plastic container that is well sealed. DO NOT provide air holes as insects will escape
- Place 20 to 100 insects with clean untreated grain into container
- Do not overfill the container – leave some air space
- Label container with the date, your name and the silo/storage identification
- Provide all your contact details (address, phone and email) and a brief explanation of why you are seeking a resistance test, the storage type and details of any grain treatments
- If possible, post early in the week so the insects are not left in the mail over the weekend.

Send samples for phosphine testing to your relevant regional Australian laboratory:

Northern region (QLD, northern NSW and NT):
Dr Manoj Nayak
QDPI/Crop and Food Science
Ecosciences Precinct
41 Boggo Road
Dutton Park Qld 4102
GPO Box 267
Brisbane Qld 4001
E: manoj.nayak@dpi.qld.gov.au

Southern region (southern NSW, VIC, SA and TAS):
Dr Jess Hoskins
NSW DPIRD, Yanco Agricultural Institute
Private Mail Bag
Yanco NSW 2703
E: jessica.hoskins@dpird.nsw.gov.au

Western region (WA):
For biosecurity, send WA insects only to:
Mike Jones
WA DPIRD Plant Biosecurity
20 Gregory St
Geraldton WA 6530
or
Ben Clarke/Sam Manning
DPIRD C/- ECU School of Science
Building 19, Rm 38
270 Joondalup Drive
Joondalup WA 6027
E: phosphinemanagement@dpird.wa.gov.au

For instructions on how to send samples for testing, visit the GRDC Stored Grain information hub website or scan the QR code.

Useful resources

Grain Trade Australia: graintrade.org.au

Exotic Plant Pest Hotline: 1800 084 881

GRDC Grain Storage Extension team specialists:
storedgrain.com.au
National hotline: 1800 WEEVIL (1800 933 845)
info@storedgrain.com.au

Grains Farm Biosecurity Program: 02 6215 7735
biosecurity@phau.com.au, grainsbiosecurity.com.au

GRDC GrowNotes™
– Grain storage

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