

STORED GRAIN PESTS IDENTIFICATION



GRDC[™]

GRAINS RESEARCH
& DEVELOPMENT
CORPORATION

NATIONAL

THE BACK POCKET GUIDE

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 present.

IDENTIFICATION OF COMMON PESTS OF STORED GRAIN

The following flow chart provides a useful guide for grain pest identification.

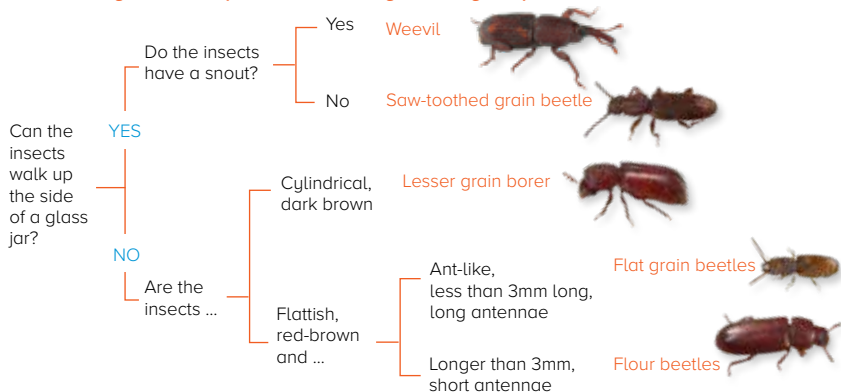




PHOTO: DAF, QLD

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 3mm 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 four weeks at 35°C and seven weeks at 22°C. Breeding stops below 18°C
- Females lay between 200 – 400 eggs on grain surface. Young larvae (white with brown heads) initially feed outside then bore into the grain
- Adults live for 2 – 3 months.

DETECTION:

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

Lesser Grain Borer (*Rhyzopertha dominica*)



Rust-Red Flour Beetle (*Tribolium castaneum*)

PHOTO: DAF, QLD

Rust-Red Flour Beetle

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

KEY FEATURES:

- Adult beetles (3 – 4.5mm long) bright reddish-brown in colour when young and a darker brown when older
- Three larger segments on end of end of antennae
- Similar species: *Tribolium confusum* – confused flour beetle, 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 1000 eggs per female, loosely scattered throughout the commodity
- Cream-coloured larvae feed externally on damaged grain
- Beetles infest whole grain, but breed more successfully on processed products (i.e. flour).

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: DAF, QLD

Rice Weevil

Major pest of whole cereal grains.

KEY FEATURES:

- Adults are dark brownish black (2 – 4mm long) with a long weevil 'snout'
- Have four small light coloured patches on its rear wing covers
- Rarely flies, but climbs vertical surfaces (e.g. glass jar)
- Similar species: *Sitophilus zeamais* – maize weevil, and *Sitophilus granarius* – granary weevil.

LIFE CYCLE:

- Adults live 2-3 months
- Larvae generally not seen – they feed and develop inside single grains
- Life cycle completed in four 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 & probe traps recommended to detect low numbers.



PHOTO: DAF, QLD

Flat Grain Beetle

Infests most stored grain and feeds on damaged grain. Some populations have high levels of phosphine resistance.

KEY FEATURES:

- Smaller than other major stored grain pests (2mm 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 – 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.



PHOTO: DAF, QLD

Saw-Toothed Grain Beetle

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

KEY FEATURES:

- Dark brown-black beetle (up to 3mm long), fast moving
- Thorax (chest) has saw-toothed pattern on each side and three 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 – 400 eggs loosely throughout the grain. White larvae feed and develop externally
- Life cycle completed in 3 weeks at 30 – 33°C, 17 weeks at 20°C, reproduction stops below 17.5°C.

DETECTION:

- Sieving and probe traps are recommended for detection
- Has developed resistance to a number of grain insecticides.

Saw-Toothed Grain Beetle (*Oryzaephilus surinamensis*)



PHOTO: DAF, QLD

Psocids – Booklice

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

KEY FEATURES:

- Very small, soft-bodied and opaque, pale coloured (up to 1mm 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 three 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 21 days
- Eggs are laid on grain surface, hatching to nymphs that moult through to adult stage.

DETECTION:

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

Psocids – Booklice (*Liposcelis* spp.)



PHOTO: CSIRO

BRUCHIDS: Cowpea weevils

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

KEY FEATURES:

- Adults (up to 4mm 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 lay 100 white eggs clearly visible on the outside of seed. Adult short lifespan 10 –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.

Bruchids: Cowpea weevils (*Callosobruchus species*)



Pea Weevil

Both a field 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 – 5mm 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 peas 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 nearby 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).

PHOTOS: SARDI ENTOMOLOGY

Pea Weevil (*Bruchus pisorum*)



PHOTO: CSIRO

MOTHS: Angoumois Grain Moth

A pest of whole cereal grains which 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 which taper to a point
- Wings have a long fringe of fine hairs along the posterior edge
- Adults (5 – 7mm long) are unable to penetrate grain, therefore only infest surface layers of bulk grain.

LIFE CYCLE:

- Adult moths do not feed but lay 150 – 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 – 14 days through a visible hole
- Life cycle takes around 5 – 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.



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 – 7mm long), distinctive bicoloured wings – dark reddish brown on rear half of the wing and grey at the front.

LIFE CYCLE:

- Female moth lay 200 – 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 about 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.



PHOTO: CSIRO

Warehouse Moths larva (*Ephestia species*)

Warehouse Moths

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

KEY FEATURES:

- Adult moth body length is 8 – 10mm
- 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 – 270 eggs over a two week period on or near grain
- Caterpillar 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.



PHOTO: DAF

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 high level of phosphine resistance.
- A range of stored grain insects are becoming harder to kill with phosphine fumigations.
- Threatens exports, as phosphine may become ineffective against some pests.
- Poor fumigation practices increase resistance (e.g. repeated fumigations in unsealed or poorly sealed storages).
- Strong phosphine resistance is also found in overseas 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.

PHOTO: PADIL



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.

PHOTO: USDA





PHOTO: KONDININ GROUP

How to monitor and identify grain pests

- Identify pests early by regular fortnightly/monthly sampling.
- Sieve (with 2mm 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 & end-users also accept treatments selected.

Use a 2mm mesh sieve to separate insects from grain.

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. Best aeration results are achieved by using a good quality automatic controller that selects optimum temperature and relative humidity times to run fans.



PHOTO: CHRIS NEWMAN, DAFWA



PHOTO: KONDININ GROUP

FUMIGATION:

Ensure a storage is 'well sealed - gas tight' to achieve effective control of all stages of the insect life cycle (eggs, larvae, pupae and adult). Pressure test sealable silos to check for leaks.

Insect resistance is often developed due to repeated fumigations in poorly sealed storages.

To check insects for resistance, send samples for testing

FOLLOW THESE BASIC STEPS:

- Use a small, strong plastic container which is well sealed.
DO NOT provide air holes - 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 details
- If possible post early in the week so the insects are not left in the mail over the weekend.



SEND SAMPLES TO YOUR RELEVANT REGIONAL AUSTRALIAN LABORATORY:

NORTHERN REGION (QLD AND NORTHERN NSW):

Dr Manoj Nayak
DAF
Ecosciences Precinct
GPO Box 267
Brisbane Qld 4001
E: manoj.nayak@daf.qld.gov.au

SOUTHERN REGION (SOUTHERN NSW, VIC, SA AND TAS):

Please phone 02 6938 1605 before sending sample
Dr Joanne Holloway
NSW DPI / Wagga Wagga Agricultural Institute
Pine Gully Rd
Wagga Wagga NSW 2650
E: joanne.holloway@dpi.nsw.gov.au

WESTERN REGION (WA):

David Cousins
DPIRD Entomology
3 Baron-Hay Court
South Perth WA 6151
E: David.Cousins@dpiird.wa.gov.au

FOR WA
BIOSECURITY ONLY
WA INSECTS TO BE
SENT TO THIS LAB!

Useful resources

GRDC GRAIN STORAGE EXTENSION PROJECT
WEBSITE: www.storedgrain.com.au

GRAIN TRADE AUSTRALIA:
www.graintrade.org.au

EXOTIC PLANT PEST HOTLINE: 1800 084 881

FREE Grain pest identification guides

CROP INSECTS: the Ute Guide –
Southern grainbelt edition
(GRDC Order Code: GRDC008)

CROP INSECTS: the Ute Guide –
Northern grainbelt edition
(GRDC Order Code: GRDC009)

CROP INSECTS: the Ute Guide –
Western grainbelt edition
(GRDC Order Code: GRDC209)

All ute guides are available from
Ground Cover Direct, 1800 110 044



GRAIN STORAGE SPECIALISTS: QUEENSLAND AND NORTHERN NSW

National Hotline 1800 weevil
(1800 933 845)
Philip Burrill, 0427 696 500
philip.burrill@daf.qld.gov.au

SOUTHERN NSW, VICTORIA, SA AND TASMANIA

Chris Warrick, 0427 247 476
chris@primarybusiness.com.au

WESTERN AUSTRALIA

Ben White, 0407 941 923
ben@storedgrain.com.au

GRAIN BIOSECURITY CONTACTS: SOUTH AUSTRALIA

Judy Bellati, 0412 218 228
judy.bellati@sa.gov.au

VICTORIA AND TASMANIA

Jim Moran, 0418 377 930
jim.moran@ecodev.vic.gov.au

WESTERN AUSTRALIA

Jeff Russell, 0447 851 801
jeff.russell@dpird.wa.gov.au

NEW SOUTH WALES

Bill Gordon, 0428 133 944
billy.gordon@dpi.nsw.gov.au

QUEENSLAND

Kym McIntyre, 0429 727 690
kym.mcintyre@daf.qld.gov.au
Plant Health Australia
www.planthealthaustralia.com.au

OTHER GUIDES:

Insects of stored grain: a pocket reference, (www.publish.csiro.au)

Stored grain pest control guide, (www.storedgrain.com.au)

DISCLAIMER: Any recommendations, suggestions or opinions contained in this publication do not necessarily represent the policy or views of the Grains Research and Development Corporation (GRDC). No person should act on the basis of the contents of this publication without first obtaining specific, independent or professional advice. The Corporation and contributors to this *Back Pocket Guide* may identify products by proprietary or trade names to help readers identify particular types of products. We do not endorse or recommend the products of any manufacturer referred to. Other products may perform as well or better than those specifically referred to. GRDC will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information in this publication.

COPYRIGHT: © All material published in *The Back Pocket Guide* is copyright protected and may not be reproduced in any form without written permission from GRDC. Reprinted July 2019



**Maureen Cribb, Manager Integrated Publications
Grower Business Group
T: 02 6166 4500 E: maureen.cribb@grdc.com.au**



**Queensland and northern NSW:
Philip Burrill
philip.burrill@daff.qld.gov.au**

**Southern NSW, Vic, SA and TAS:
Chris Warrick
chris@primarybusiness.com.au**

**Western Australia:
Ben White
ben@storegrain.com.au**

**Project coordinator:
Chris Warrick
info@storegrain.com.au**

The Stored Grain Pests Identification Back Pocket Guide is part of a series of Back Pocket Guides published by GRDC.

Photos courtesy Queensland Department of Agriculture and Fisheries unless otherwise specified.

GROUND COVER DIRECT How to order
FREE PHONE 1800 11 00 44 FREE FAX 1800 00 99 88
EMAIL ground-cover-direct@canprint.com.au
POST Ground Cover Direct, PO Box 7456, Canberra MC ACT 2610
FOR A COMPLETE LISTING OF ALL GRDC PUBLICATIONS, GO TO www.grdc.com.au/bookshop

P Level 4 | 4 National Circuit, Barton ACT 2600 | PO Box 5367, Kingston ACT 2604
T +61 2 6166 4500 **F** +61 2 6166 4599 **E** grdc@grdc.com.au

Produced by www.coretext.com.au