GRAINSAFE
STORED GRAIN MANAGEMENT

Stored grain insects - know your enemy

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Insect pests seriously damage feed and grain stocks. They attack the whole grain or selectively eat the germ of seeds.

Insect damage to grain causes:

- **reduced weight;**
- **poorer quality;**
- **lower germination**

Moth webbing, faeces and excretory products, insect bodies and fragments may make grain unfit for human consumption or unpalatable to stock.

Insects increase the heat and moisture levels in grain. This stimulates even greater insect activity and encourages activity by moulds and other micro-organisms, accelerating grain spoilage.

Grain insect control and grain losses from insect damage cost the industry millions of dollars each year.

Effective control of insects is vital - so important that Australian regulations require export grain to be certified as insect free.

Detection of insects in grain by our customers could result in loss of valuable markets. cont'd

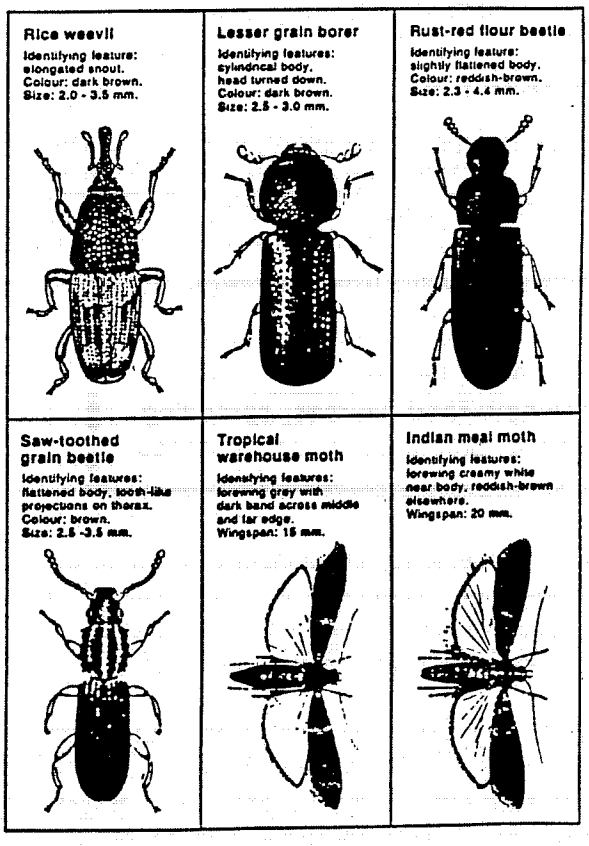

Figure 1

Major pests of stored grain

DPI QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES
GRDC Grains Research & Development Corporation

▸ Major species

Many different types of insect infest grain and related products, but four beetle species and two moths cause most problems in Australia. They fall into two main groups - primary feeders and secondary feeders.

Primary feeders

Primary feeders attack whole grain and breed in it. The **lesser grain borer** (*Rhysopertha dominica*) and the **rice weevil** (*Sitophilus oryzae*) are important primary feeders. Rice weevils lay their eggs inside seeds and lesser grain borers glue them to the outside.

After hatching, both insects feed and develop to adults within individual grains. When adults emerge little is left of the seed. Both insects continue feeding on grain through their adult life.

Secondary feeders

Secondary feeders eat broken and cracked grain, grain dust and fragments, and processed products. They don't burrow into whole grain.

Secondary feeders include the **rust-red flour beetle** (*Tribolium castaneum*), **saw-toothed grain beetle** (*Oryzaephilus surinamensis*), **tropical warehouse moth** (*Ephestia cantella*) and **indianmeal moth** (*Plodia interpunctella*).

▸ Reproduction

Grain insects reproduce rapidly under favourable conditions. At 30°C, lesser grain borers grow to adults in about 4 weeks and lay about 400 eggs in 4 months. Rust-red flour beetles lay 10 to 20 eggs a day, producing over 1000 eggs.

Adult insects fly or crawl to new food sources, spreading insect problems over wide areas

Grain temperature and moisture affect insect reproduction and movement greatly. The grain insects discussed above reproduce fastest at about 30°C and grain moisture contents of about 15%.

Insect population growth slows at grain moisture contents of 12% and virtually stops at 9%. At temperatures below 20°C, most insects reproduce so slowly that little damage occurs. Below 15°C population growth stops for most species. As the temperature rises, insects start breeding again.

Rust-red flour beetles
(Starting population - 100 beetles)

Temperature/ moisture content	No. insects after 3 months
35°C @ 12% mc	1,210,000
30°C @ 12% mc	275,000
25°C @ 12% mc	12,100
25°C @ 10% mc	400

Aerating grain by passing controlled amounts of air through it can reduce insect activity dramatically. Although aeration does not guarantee insect-free grain, it provides effective protection in most areas of Australia.

▸ Control

Keeping grain and grain handling equipment free of insects is an ongoing but important task. A combination of methods is the best way to minimise insects - an approach often referred to as integrated pest management (IPM).

The most suitable insect control method depends on the requirements of your market. Using chemical protectants on grain may limit your marketing options.

▸ IPM checklist

Effective Integrated Pest Management programs for long-term insect control in stored grain should include several of the following:

- clearing all grain residues from sheds and equipment to remove insect breeding areas;
- reducing grain moisture, and cooling with aeration to slow population growth;
- fumigating with phosphine in sealed storages to control infestations;
- applying controlled atmospheres in sealed storages to control insects;
- keeping silos sealed after fumigation to provide longer protection from reinfestation;
- using insecticides only when residual protection is needed or options don't exist. ■