Stored products pests: 3th lecture –Third Stage

Detection of hidden infestationhe stored grain insects cause quantity and quality losses in the stored grains. Overall postharvest losses of grains are about 10–15% of fairly common in many developing countries. For minimizing the stored grain losses, early detection of insects holds paramount importance. Different methods used to detect the storage grain insects. Careful observation is necessary when detecting samples. These observations are imperative, as there are not always larvae, pupa, or adults readily available for examination and identification.

Techniques for the detection of hidden infestation:

1-Staining method: This is rapid method in which various dyes are used to stain the egg plugs in grains made by the weevils.

- **Acid Fuchsine**: The stain is prepared by mixing 0.5 g acid fuchsine in one litre of 5% aqueous glacial acetic acid. Samples of grains are prepared by soaking in warm water for 5 minutes and are immersed in the stain for 2-5 minutes. The excess stain is removed by washing in tap water. The egg plugs of weevil are stained bright cherry-red and feeding punctures including mechanical injuries are stained in light pink.

- **Gentian violet**: Grain samples are immersed for 2 minutes in a solution containing 10 drops of 1% aqueous stock solution of gentian violet in 50 ml of 95% ethanol and the egg plugs are stained to purple colour.
- **Berberine sulphate**: Grain samples are immersed in 20 ppm solution of the aforementioned dye for one minute, rinsed and examined under ultra violet light. The egg plug stains show intense greenish-yellow colour.

2-Floating method: This method involves the use of two solutions of different specific gravity, e.g. sodium silicate in water (Sp gravity 1.16) and methyl chloroform (Sp gravity is 1.30) Sodium silicate remains on the top. The grains are immersed in the fluids and a three layer separation occurs. The healthy kernels sink into the bottom, the infested one float and the light weight kernels including those infested by early stages of insects hang in the line of separation between the two solutions.

3-Gelatinization method: when the grain is boiled for 10 minutes in a 10% solution of sodium hydroxide, the kernels become translucent, thereby, reveal the presence of internal infestation.

4-Acoustical methods: Insects hidden inside kernels of grain can be detected acoustically by amplification and monitoring of their movement and feeding sounds, with the help of the highly sensitive instruments with 40 kh (the low ultrasound region) airborne sensor.

Disadvantages of acoustic methods

1- That they cannot detect dead insects in grain
2- That they cannot detect infestation by early larval stages of insects.

5- Electrical conductance: A single kernel characterization system is commonly used to measure grain kernel weight, moisture content, diameter, and hardness. This system works on the principle of electrical conductance and compression force. The kernel acts as one resistor in a tworesistor and voltage-divider circuit of the single kernel characterization system. Conductance is monitored by measuring the voltage across the kernel.

A low voltage measurement corresponds to low kernel resistance, which is typical of high moisturecontent kernels. If a live insect is present inside a kernel, there is likely to be a large downward slope in the conductance signal.

6-X-Ray radiographic method: Soft X-ray is the only non-destructive, direct method that can detect insect infestations in grain kernels. In the future an automated line-scan X-ray system could inspect 1 kg grain in about 15 min compared to 5-6 hr using a Berlese funnel.

- **Advantages OF X-Ray Method**

1- Soft X-ray imaging is the only non-destructive and timesaving technique.
2- All hidden stages of insects can be observed rapidly.

7-Near-infrared reflectance (NIR) spectroscopy:

The NIR technique provides information based on the reflectance properties of different substances present in a product. The NIR is based on the absorption of electromagnetic wavelengths in the range 780–2500 nm. The concentrations of constituents such as water, protein, fat and carbohydrate can be determined using classical absorption spectroscopy.

Advantages OF Near-infrared reflectance (NIR) spectroscopy;

1- Evolved as a fast, reliable, accurate and economical technique for compositional analysis of grains.
2- This technique can be used for both qualitative and quantitative analysis.

3- **Techniques for the detection of light infestation:**

1-Agitation of bags: this is effective for low population densities of *Sitophilus* spp., which will often walk out of sack after they have been sufficiently disturbed. A long stick may be drawn over surfaces of vertical stack or they can be hit activate small number of moth which are therefore more readily observed.

2-The feel of grain in bulks: walking across the surface of bulk grain with bare feet may prove an excellent guide to its general condition. If it feels cool there is no need for immediate concern. However, if a hot spot exists, this indicative of high dust content and moisture migration with subsequent rise in temperature.

3-Use of traps: various traps have been designed to exploit the activities of many species of insects.

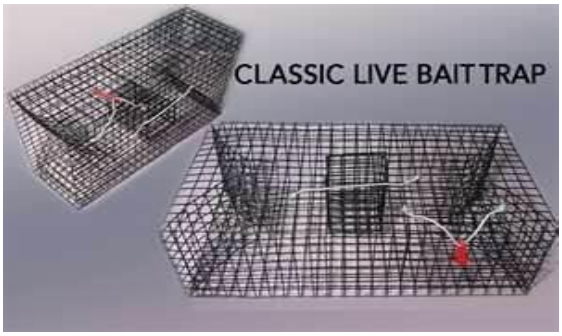
1-Crevice traps: Most pests that attack stored produce prefer to keep their body in contact with as much substrate as possible. Such insects will seek cracks and cervices rather than remain in the open. A trap which contains many attractive crevices will accumulate insects. Once insects enter they may be reluctant to leave even though they can. A simple crevice trap can be made from a piece of corrugated cardboard that are highly effective at detecting *Tribolium*, *Oryzaephilus* and *Cryptolestes* within stored grains

2. Pitfall traps: Designed for monitoring insect pests in bulk grains. It can be used either at the surface of grain or can be buried up to 50cm deep under the surface. The dome is especially designed so that insects cannot walk in a direct line across the surface without falling into one of the trap holes. Thus, rely on the fact that many insects cannot climb out of vertically walled container once they have fallen in it because the inside border is coated to prevent insects from climbing out.

Simple pitfall traps can be made from disposable plastic drinking cups. These can be buried into grains so the top is level with the grain surface. Grains can be prevented from entering the traps by covering the opening with mesh that still allow insects to pass through. The sides are slippery and cannot climb in or alternatively a small quantity of vegetable oil (e.g. cooking oil) may be placed on the bottom to trap insects that fall in like *Oryzaephilus* spp.

These traps allow early detection of pests, often prior to, or replacing visual detection, even with low levels of infestation. In providing information on the distribution and extent of pest problems they can also help to optimise or reduce the use of chemical treatments.

3- Bait traps: Certain foodstuffs are highly attractive to storage insects, especially which contain volatile oils. Examples include dried fruit, ground nuts and brown rice. A simple trap can be made from a mesh bag containing a mix of such materials. Insects attracted can simply be shaken out and examined



4- Light traps: Many insects are attracted to lights like *Lasioderma serricone* in the tobacco industry while the Pyralid moths such as *Ephestia* and *Plodia* are not very attracted to light