

Department of Plant Protection
College of Agricultural Engineering Sciences
University of Salahaddin- Erbil



Course book

Stored product Pests

For year 3 students

Department of Plant Protection

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Stored Product Pests

Food systems in developing countries are not always as well organised and developed as in the industrialised world. The overall increase in human population growth poses great challenges to food system so the demand for enhanced food production is as topical as ever. Grains and legume products are vital food source for humans universally. High proportions of produce may be lost due to agricultural pest, both pre- and post- harvest in stores and, problems of environmental and food hygiene mean that food systems in continue to be stressed.

Stored food products are important economically because it will be available throughout the year for consumption and not restricted to specific time during

the season. In addition to their nutritional values which are rich source of vitamins, minerals, carbohydrates, fats, oils, and protein.

Various pests such as insects, mites, fungus, birds and rodents were considered to be major problems that associated with food availability and their quality. The food quality includes some invisible changes in the nutritive value or visible changes in grains properties such as appearance, colour and texture. It is estimated that around 15% of total food products might be lost during storage processes due to pests especially insects and rodents.

Besides, many species of stored product insects might cause allergies to humans due to transmitting toxins that produced by some fungi, bacteria or other types of toxins such as qinones which also might consider carcinogenic substance.

With the growing need of higher standards of living, the demand for better food quality has increased. Therefore, knowing major sources of grain deterioration in stores is important. Consequently necessary precaution can be taken with different procedures for the prevention and control of stored product pests. The damages of these pests would involve economical grains such as barley, wheat, rice and legume seeds for instance broad beans, chickpea, peas in addition to dry fruits and vegetables.

Crop production in Kurdistan is in continuous decline owing to drought, lack of financial support to famers and thus importing most commodities from abroad rather than encouraging local production. Further, with the current losses due to stored pests, beside other factors, are considered a major constraint in increasing crop production both quantitatively and qualitatively in our country. Our aims are to better understand the sources of infestation and how to minimize the lost by finding suitable solutions.

The ability to identify the different species of pests directly associated with stored products, together with access to information about their biology and pest status, is important to be able to support effective control measures against them.

Communication

- A reminder of general stored product pests and evaluate the students for their levels of knowledge regarding their classification
- Lecture presentations to illustrate the most common stored product pests by showing pictures and samples.
- Visit for silos to inspect samples and identify the most popular control methods.

Marking and evaluation

Students are evaluated during the semester by:

- | | |
|--|-----|
| - Short exams (quizzes): | 5% |
| - Two monthly exams: | 10% |
| ----- | |
| - Subtotal total | 15% |
| - Final exam : | 50% |
| ----- | |
| - Total for the theoretical part: 65% | |

Suggested references

- Storage Pest Management. By Sandeep Sharma & Arun K Choudhary Mahamaya Publishing House, 2008.
- Insects of stored products. By David Rees. CSRIO publishing, 2004.
- Common Insect Pests of Stored Food Products. Trustees of the British Museum (Natural History), 1980.

Course plan

Week	Subjects covered
1	Grains and their importance, factors affecting grain storages and standard properties of stored products.
2	Variation on basic life-cycles and stored product insect characteristics and division
3	Main sources for insect infestation and how we can detect internal infestation
4	Inspection of stored grains for insect pests and estimation of the losses
5	Biology of stored product insects :order Coleoptera

6	1st exam (first hour) + Biology of order Coleoptera (second hour)
7	Biology of stored product insects :order Lepidoptera
8	PCR technique and stored product pests
9	Ecological factors that influence stored product insects
10	Control techniques on stored product insects with safe usage of pesticides in stores
11	Plant Extract and Microwave techniques
12	Storage losses due to mites and fungi
13	2nd exam+ (first hour) + losses by moulds (second hour)
14	Storage losses due to rodents and control methods
15	Seed storage with storage structure and warehouse management
16	Storage losses due to birds
17	Determination of moisture content in grains and seed health low

Exam sample:

- Definitions, such as: Acute poison, Arrhenotoky, ...
- Classification of organism, such as *Tribolium confusum*
- Methods for pest control such as: Biological control
- Mention factors affecting stored product insects, such as: Temperature
- Mention two characteristics of some pests, for instance:

Rattus norvegicus, Corcyra cephalonica

What are grains?

Grains are the products of plants belong to Gramineae family which mainly cultivate for feeding purposes. The word cereal use as indicator for plants in this family while grains as indicator of fruits and seeds.

Food grains: grains used as food for humans such as wheat and rice.
Feed grain: grains used for animal feeds such as barley and oat.

Legume pulses: grains (seeds) which belong to plants of Poaceae family which consider an important source of proteins such as cowpea and lentil.

Table shows different kinds of grains

Scientific name	Common name	
<i>Triticum aestivum</i> L.	Wheat	Cereal seeds
<i>Hordium vulgare</i> L.	Barley	
<i>Oryza sativa</i> L.	Rice	
<i>Zea mays</i> L.	Maize	
<i>Sorghum vulgare</i> Pers	Sorghum	
<i>Avena sativa</i> L.	Oats	
<i>Secale cereale</i> L.	Rye	
<i>Pennisetum typhoideum</i> L.	Millet	Pulses seeds
<i>Vigna sinensis</i> Savi	Cowpea	
<i>Pisum sativum</i> L.	Pea	
<i>Lens asculenta</i> Moench	Lentil	
<i>Cicer arietinum</i> L.	Chickpea	
<i>Phaseolus vulgaris</i> L.	Bean	
<i>Vicia faba</i> L.	Broad bean	
<i>Glycine max</i> Mera	Soya bean	
<i>Phaseolus mungo</i> L.	Green gram	

Factors affecting grain storages

- Storage temperature
- Moisture content of grains
- Properties of grains
- Insects
- Fungi
- Rodents
- Mites
- Birds

Storage temperature

Most of grains stops breathing and consequently die when storage temperature reaches above 50 Celsius which also affects gluten contents in breads ,though some kind of bacteria and fungus continue breeding till 80°C.

Insect's reproduction will increase with the increase of temperature till 40°C. However if continuously exposed to this degree might cause the death. Further, will affect fertility and led to produce sterile individuals. Almost all insect stages might die if either exposed to 66°C for 4 min or 60°C for 10min. While temperature below 15°C can influence insect development stages and eventually causes death when exposed to 10 Celsius for a long period of time.

When grain temperature rises above the average it is an obvious sign of grain deterioration. The increase of grains temperature usually accompanied with the increase of CO₂ production due to: grain respiration, insects, bacteria or fungi activity.

Moisture content of grains

Factors that might influence raising moisture content of grains:

- Harvest before complete maturation of product or after rainy days
- Grains exposure to dew, rain or fogs
- Sea transportation of seeds
- Transferring grains from dry area to damp area
- Lack of homogeneity in grains (e.g. mixing early and late ripening crops)

The Binomial System (classification)

Scientific naming began with the Swedish botanist Carl Linnaeus in the eighteenth century. Linnaeus did two critically important things for the development of taxonomy. He invented an accessible and straightforward way of classifying plants known as the sexual system. He assigned each plant a trivial name with only two parts as apposed to the complex polynomial Latin names that had been used. The binomial system is the same one we use today.

- The first part of the name is called the genus and is always capitalised.
- The second part of the name is called the species and is not capitalised. e.g. *Tribolium confusum*, Confused Flour Beetle

1. Kingdom	Animalia
2. Subkingdom	Invertebrata
3. Phylum	Arthropoda
4. Subphylum	Mandibulata
5. Class	Hexapoda
6. Subclass	Metabola
7. Division	Holometabola
8. Order	Coleoptera
9. Family	Tenebrionidae
10. Genus	<i>Tribolium</i>
11. Species	<i>confusum</i>



Subclass Ametabola

Characteristic of Apterygota



No metamorphosis: the adult form is a progressive development of the young form, Young similar to adult, but smaller and lacks developed genitals and adults and nymph live in the same habitat also mould feeder, scavenger

Class Arachnida (mites)

Unlike insects, they have only two main parts to their bodies on which 4 pairs of legs are found. In some groups, these two body sections may even be fused into one. Arachnids do not have wings or antennae, although some have a pair of special sensory palps near the head (modified, non-walking legs).

Class Crustacea (woodlice)

Body made up of three parts (the head, thorax and abdomen). The head and thorax are generally fused together, and in some, covered by a protective carapace. Varying number of legs, often two pairs of antennae, they lack wings (woodlice) live on land and found in warehouses.



The standard properties of grains and stored products

Stored products used for human consumption should have below properties:

1. No pesticide residual or any other harmful chemical should detect on grains
2. Foreign substances such as (stone, straw, sand, soil, weed, glass, stem and seeds of other plants should be no more than 4%
3. The percentages of damaged seeds by fungus, humidity & temp should not exceed 5%
4. The waste product uric acids that results from insects activity should not be more than 10g /100g seed sample
5. The moisture content should not be more than 13%
6. Living organism such as rodents and insects (different stages) should not be present

Fedral Grain Inspection Service (FGIS) helps with sampling, inspection, process verification, weighing and storage examination services that accurately and consistently describe the quality and quantity of the commodities being bought and sold.