Deterioration of crude natural products

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The factors which must be considered in relation to drug deterioration are :

Moisture content

Temperature

Light

Presence of oxygen

when these conditions are suitable , living organisms such as :

Bacteria

Moulds

Insects

Mites

will rapidly multiply, using the drug as a source of nutrient.

Primary Factors

1. Air-dried medicinal products contain approximately **10–12% moisture**, which in some cases may be enough to activate enzymes in the leaves and cause glycolysis, as occurs in **Digitals** plant. Other medicinal products, such as **Squill** powder, which contains a **mucilage** substance, absorb moisture rapidly and become a sticky mass.

2. Shipping medicinal products in containers can lead to **damage** due to condensation on the inner metal walls. This is a particular problem with shipments from humid to temperate climates.

3. High temperatures may speed up enzyme activity , and increase in temperature will lead to the loss of volatile oils from dried plant material.

4. Direct sunlight can cause the breakdown of some components , such as vitamins in cod liver oil , as well as the bleaching of leaves and flowers.

5. Oxygen contributes to the conversion of volatile oils into resin , Oxygen also contributes to the rancidity of fixed oils.

Mould and Bacterial attack

- The moulds found in deteriorating drugs are usually the same as those associated with poorly stored food products. Species of **Rhizopus** , **Mucor** , **Penicillium** and **Eurotium** , are common. Their presence is indicated by a mass of hyphae which bind the particles of drug and by a characteristic smell.

Bacterial attack of crude drugs is less obvious, because it is not a direct cause of damage. Some pathogenic bacteria such as : **salmonellae** and ***Escherichia coli*** are Found in crude drugs such : **digitalis** , **sterculia** , **tragacanth** , **gelatin**.

Also, as plant materials which have been dried under normal conditions contain viable **bacteria** and **mould** spores in variable amounts, the **pharmacopoeias** set limits for the total viable aerobic count per gram of drug.









Arthropod animal pests that attack crude drugs

1. Beetles attack

Beetles are insects belongs to the order of **Coleoptera** , (the largest order of the animal kingdom) , comprising some **250 000 species**, of which about **600** have been found associated with stored food products or drugs.

Not all of these insects use the same stored product, but they can be found in the wood of packing crates. The beetle's body consists of a head, thorax, and abdomen. Attached to the underside of the thorax are three pairs of legs, while the upper surface typically bears two membranous hindwings folded beneath horny forewings.

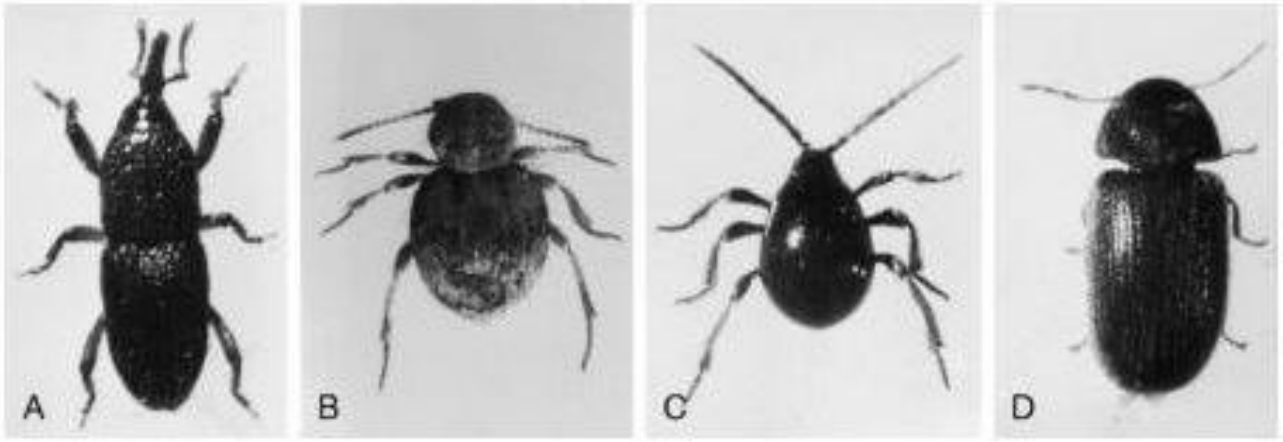
These insects transform during storage from **egg** to **larva**, then to **pupa**, and finally to **adult**. **Both** the **larva** and the **adult** can **damage** stored products. Among the characteristics that distinguish the larvae of most species that attack food and herbal medicines are well-developed mouthparts capable of biting, and a head that is darker than the rest of the body. The most important types of insects (beetles) that attack stored crude drugs are :

A. *Calandra granaria*

B. *Ptinus* spp.

C. *Gibbium* spp.

D. *Stegobium paniceum*


A
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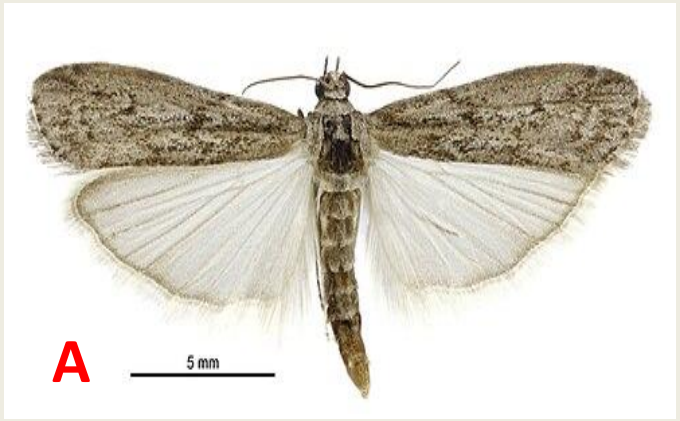
2. Moths and butterflies

Moths and butterflies are belong to the order of **Lepidoptera.** If clothing is infested, the damage is caused by the **larvae**, **not the adults**. Because moths are highly mobile and lay large quantities of eggs, infestations spread rapidly.

Moths that attack of stored drugs include :

Moth	products attacked
A- *Ephestia kuehniella*	almond , capsicum , cocoa , cotton seed , ground-nut
B- *E. cautella*	tonco bean , cocoa
C- *E. Elutella*	Cocoa , tobacco , pomegranate , root bark
D- *Plodia interpunctella*	cinnamon bark , yeast cake
E- *Tinea pellionella*	mustard seed , Almonds , Ginger , Capsicums , linseed , tobacco , saffron


A
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B


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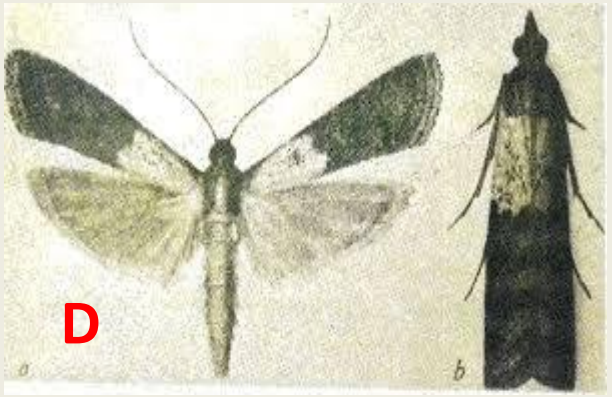
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Arachnida

The **arachnids** or **mites** differ from the true insects in that the mature forms have **8 legs** and it does **not have antennae**. The members of the family **Tyroglyphidae** such as ***Tyroglyphus dimidiatus*** (the cheese-mite), are much smaller than the insects, and individuals can only be seen with a lens. ***Tyroglyphus farinae*** (the flour-mite), is **0.4–0.7**mm long , and the body shape is oval. Mites is attack cereal products , oil-seed cakes , ergot, quince , linseed , and feeds on stored medicinal herbs and dry pharmaceutical products.



Cheese mite



Flour mite

Control of infestation

The detection, prevention and removal of mite and insect infestation is an important hygienic and economic consideration for all who have cause to store and use crude drugs.

Effective preventive measures involve :

1. Good hygiene in the store , include :

- removal of spills of chemical and hazardous materials .
- removal old debris and packaging materials.
- elimination of sources of infections such as floor cracks.

2. Effective stock control , include :

- regular check-up.
- rotation of stock.
- early detection of infestation.

3. Optimum storage conditions , include :

- maintenance of cool.
- dry environment.

4. Good packaging , include :

- woven sacks and bags.
- multi- paper sacks .
- Paper
- Polyethylene film.

If material becomes infested it may be wiser to sacrifice a small consignment rather than to risk contamination of other materials.

After a contaminated drug has been removed, pallets, shelves, walls and floors should be thoroughly cleaned and sprayed with a contact insecticide.

Fumigation is the only practical means of killing insects and mites in large cargo. Methyl bromide and ethylene oxide have been commonly used and the treatment needs to be applied under gas-proof sheets or in suitable chambers.

Studies have been conducted on the effect of **ionizing radiation** on mites and various types of beetles, where it was found that **small doses** inhibit reproductive ability, while **large doses** destroy both mites and eggs.

Storing at low temperatures reduces insect infestations and gradually eliminates insects, larvae, and eggs if a sufficiently low temperature is used.

The eggs of ***Ephestia elutella*** and ***E. kuehniella*** are rapidly destroyed at **−15°C** and more slowly at rather higher temperatures.

The eggs of the flour mite can resist exposure to **−10°C** for up to **12 days** or **0°C** for several months , development is possible within the range **2.5–30°C** , depending on humidity.

Spoilage by rodents :

Rodents cause significant spoilage of drugs , pharmaceutical raw materials , and stored products by chewing packaging , contaminating items with feces , urine , hair , and introducing pathogens like ***Salmonella***.

Rodent feces usually contain the animal's hairs, so that drugs which on microscopical examination show the presence of these hairs should be rejected.

Thanks for your listening

