Postharvest Pest & Diseases of Selected Commodities

Introduction

- Losses due to postharvest diseases occur at any time during postharvest handling.
- Postharvest diseases cause direct economic losses.
- Disease products produce potential health risks.

Eg. Fungal genera such as *Penicillium*, *Alternaria* and *Fusarium* produce mycotoxins under certain conditions.

Pathogen

- Plant pathogens are organisms such as fungi, bacteria, protists, nematodes, and viruses that cause plant diseases.
- Virtually all postharvest diseases of fruits and vegetables are caused by fungi and bacteria.
- Viruses are not an important cause of postharvest diseases.

Pathogen

- Many of the fungi which cause postharvest diseases belong to the phylum Ascomycota and associated fungi Anamorphici (Fungi Imperfecti).

- In Ascomycota, the asexual stage of fungi (anamorph) is common in postharvest diseases than the sexual stage of fungi (telemorph).

Pathogen

- Important genera of anamorphic postharvest pathogens of phylum Ascomycota include;

Penicillium

Aspergillus

Geotrichum

Botrytis

Fusarium

Altenaria

Colletotrichum

Dothiorella

Lasiodiplodia

Phomopsis

Pathogen

- In the phylum Oomycota, the genera *Phytopthora* and *Pythium* are important postharvest pathogens causing a number of diseases such as;

✓Brown rot in citrus by *Phytopthora citropthora and Phytopthora parasitica.*

✓Cottony leak in cucurbits by *Pythium sp.*

Pathogen

- In the phylum Zygomycota, the genera *Rhizopus* and *Mucor* are important postharvest pathogens causing a number of diseases such as;

✓Watery soft spot of many fruits and vegetables by *Rhizopus stolonifer.*

Pathogen

- Phylum Basidiomycota is not an important causal agents of postharvest diseases.
- *Sclerotium rolfsii* and *Rhizoctonia solani* which have basidiomycete sexual stage can cause significant postharvest losses of vegetables such as tomato and potato.

Pathogen

- The major causal agents of bacterial soft rots are various species of *Erwinia, Pseudomonas, Bacillus, Lactobacillus,* and *Xanthomonas*.
- Bacterial soft rots are important postharvest diseases in many vegetables but are less important in fruits.

Pathogen

- Postharvest diseases are classified into two according to how infection is initiated.

✓Quiescent or latent infections.

✓Infections initiate during and after harvest.

Pathogen - Quiescent or latent infections

- Pathogen initiate infection of the host usually before harvest, then enters a period of inactivity/dormancy until the physiological status of the host tissue changes in such a way that infection can proceed.
- The physiological changes occur during fruit ripening trigger the reactivation of quiescent infections.

Eg. Anthracnose of various tropical fruits by *Colletotrichum* sp.

Grey mold of strawberry by *Botrytis cinerea*.

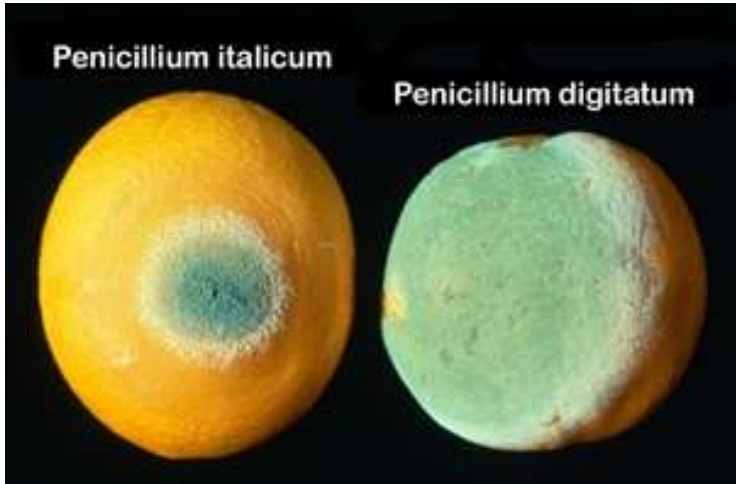
Pathogen - Infections initiate during and after harvest

- These infections occur through surface wounds created by mechanical and insect injury.
- Wound need not be large for infection to take place.

Eg. Blue and green mold by *Penicillium* sp.

Transit rot by *Rhizopus stolonifer*.

soft rot by *Erwinia carotovora*.

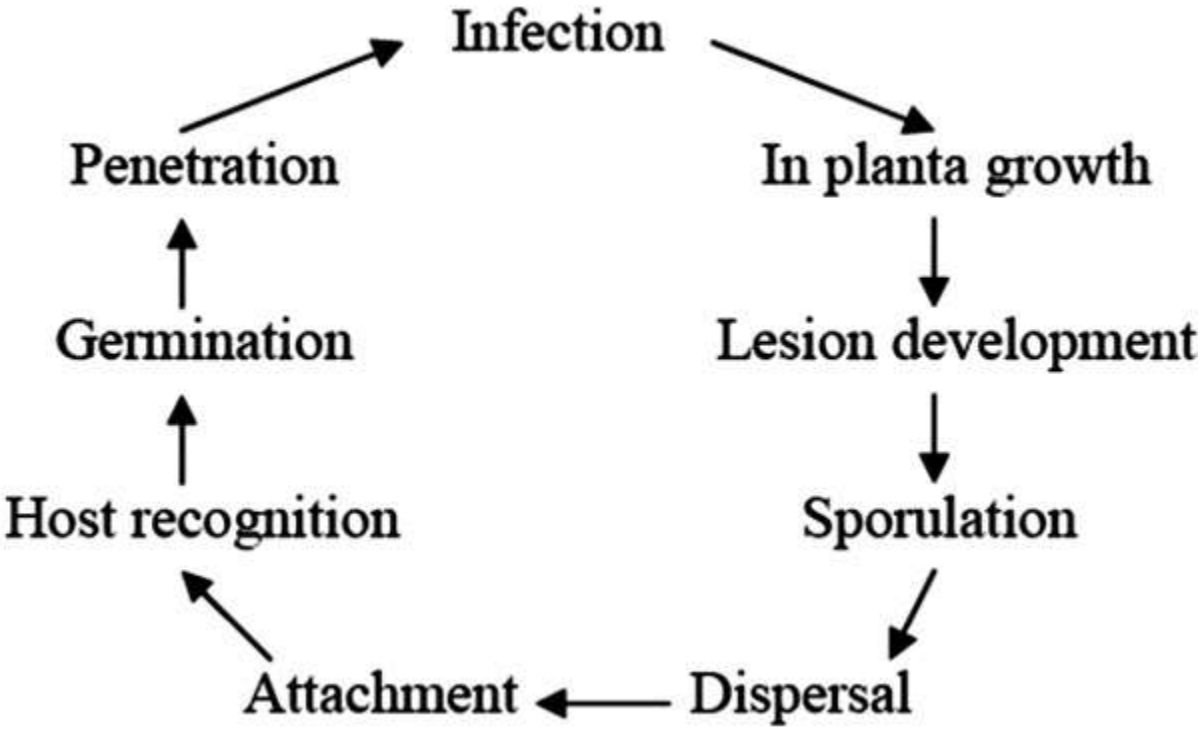


Infection Process

- The pathogenesis by fungi is a complex process.

1. Dispersal and arrival of an infectious particle in the vicinity of the host.
2. Adhesion to the host.
3. Recognition of the host (may occur prior to adhesion).
4. Penetration into the host.
5. Invasive growth within the host.
6. Lesion development in host.
7. Production of additional infectious particles.

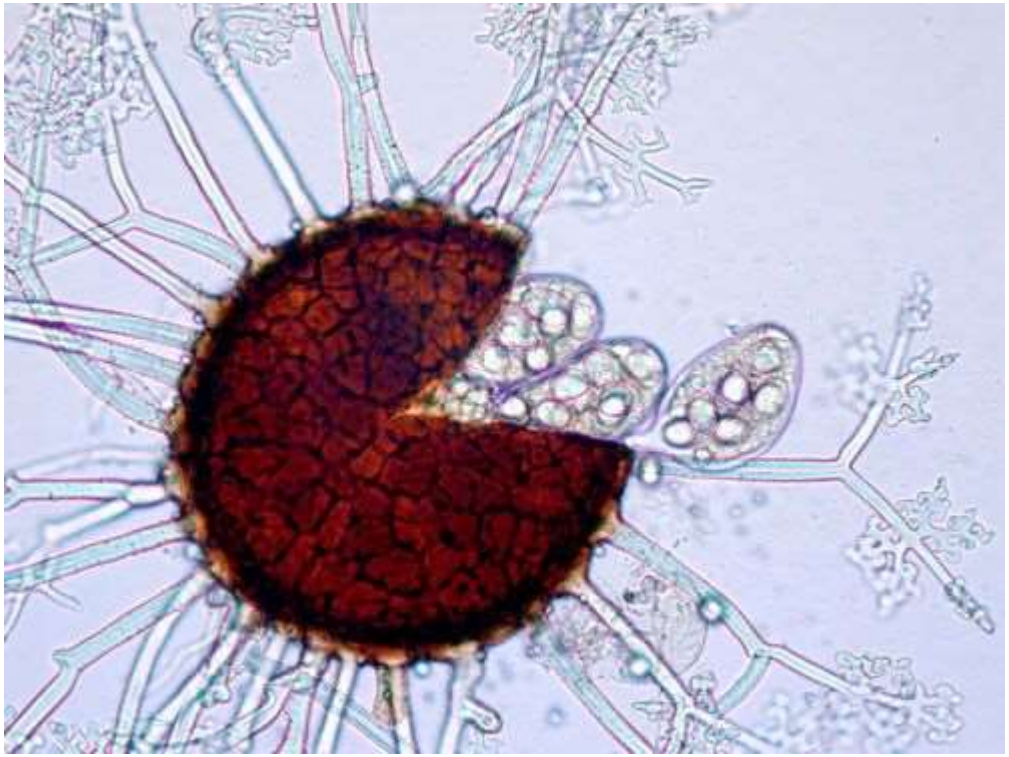
Infection Process



Infection Process – Spore Dispersal

- The most common process to initiate infections.
- Dispersal mechanisms can be either passive or active.

Passive dispersal	Active dispersal
Spore dispersal by wind, water and animals.	Shooting ascospores through the boundary layer of air surrounding the fruiting body by forcible discharge.

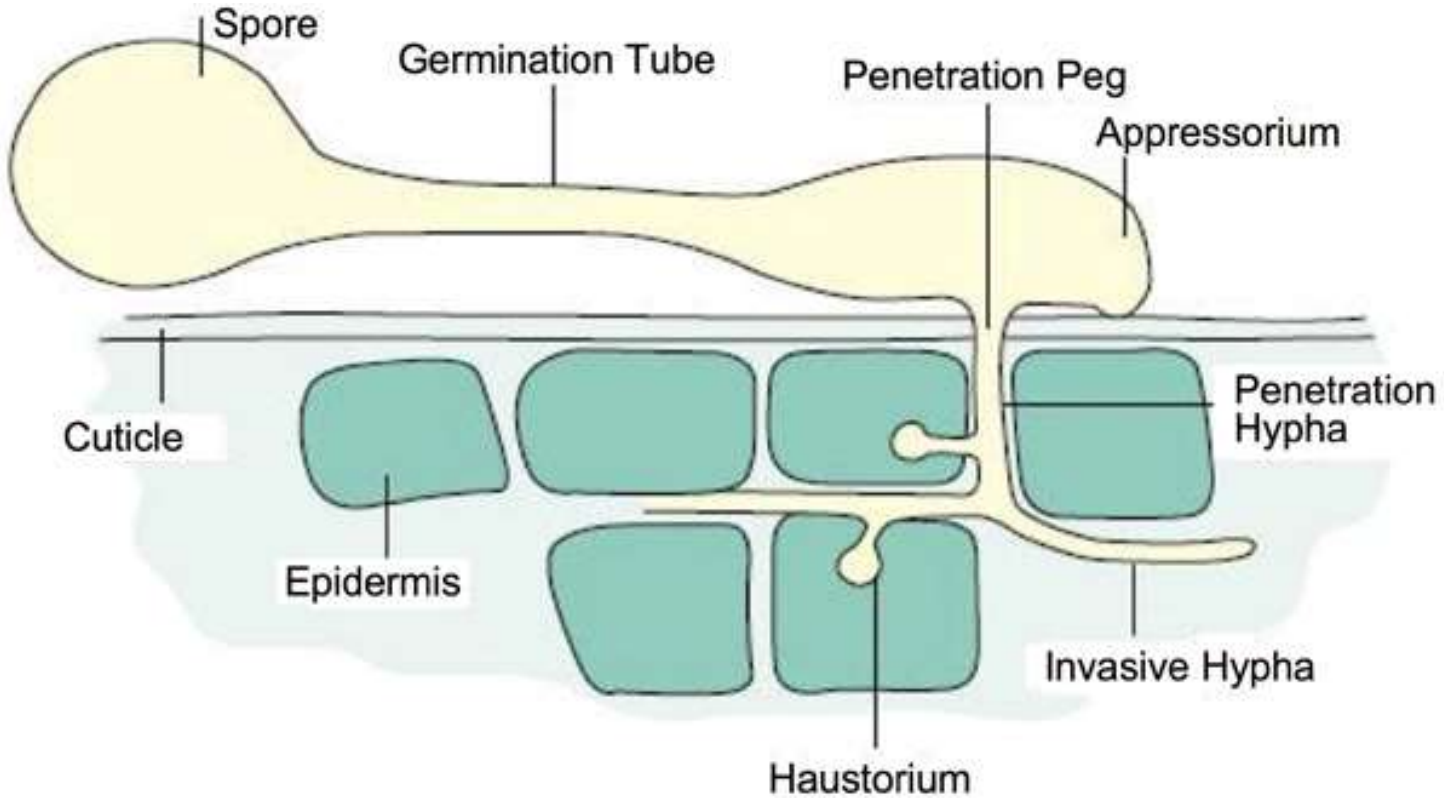


Ascoma of a powdery mildew, broken open to reveal asci with ascospores.

Infection Process – Adhesion to the Host

- Adhesion of spores to the host involves physical and chemical processes.
- Spores attach the host tissue via adhesion molecules.
- A germination tube then emerges from the spore.
- An infection structure called appressorium develops from the germination tube.
- Hyphopodia, haustorium mother cells and infection cushions are other different types of infection structures.
- Facilitate the entry of pathogen into the host tissue.

Infection Process – Adhesion to the Host



Infection Process – Adhesion to the Host – Spore Germination

- Inactive vegetative spores are not dormant.
- If a spore is deposited in a moist fresh wound, it germinates immediately if temperature and atmospheric conditions are favorable.
- Spores swell as moisture is absorbed.
- As swelling becomes noticeable, O_2 consumption and CO_2 evolution increases.

Infection Process – Adhesion to the Host – Spore Germination

- Before germination spores exhibit low metabolic activity.
- Germination is associated with rapid increase in synthesis of DNA, RNA and proteins.
- The amount of ER and mitochondria also increases.
- After swelling, germination tube protrudes through the spore coat.

Infection Process – Adhesion to the Host – Spore Germination

- Protrusion depends on protein synthesis.
- As germ tube lengthens it develops side branches.
- Spore germination is a hazardous event in fungi life cycle as fungi become susceptible to;

✓Lethal effects of ɣ and UV irradiation.

✓Low and high temperatures.

✓Absence of O_2.

✓Exposure to toxic chemicals.

Infection Process – Recognition of the Host

- Signal transduction is an integral component of the host recognition process.

Eg. Protein kinase mediated signal transduction.

Receptor mediated signal transduction.

G-protein coupled receptor protein signal transduction.

- Modification of the physiology of host during symbiotic relationship.
- Symbiosis, encompassing mutualism through parasitism.

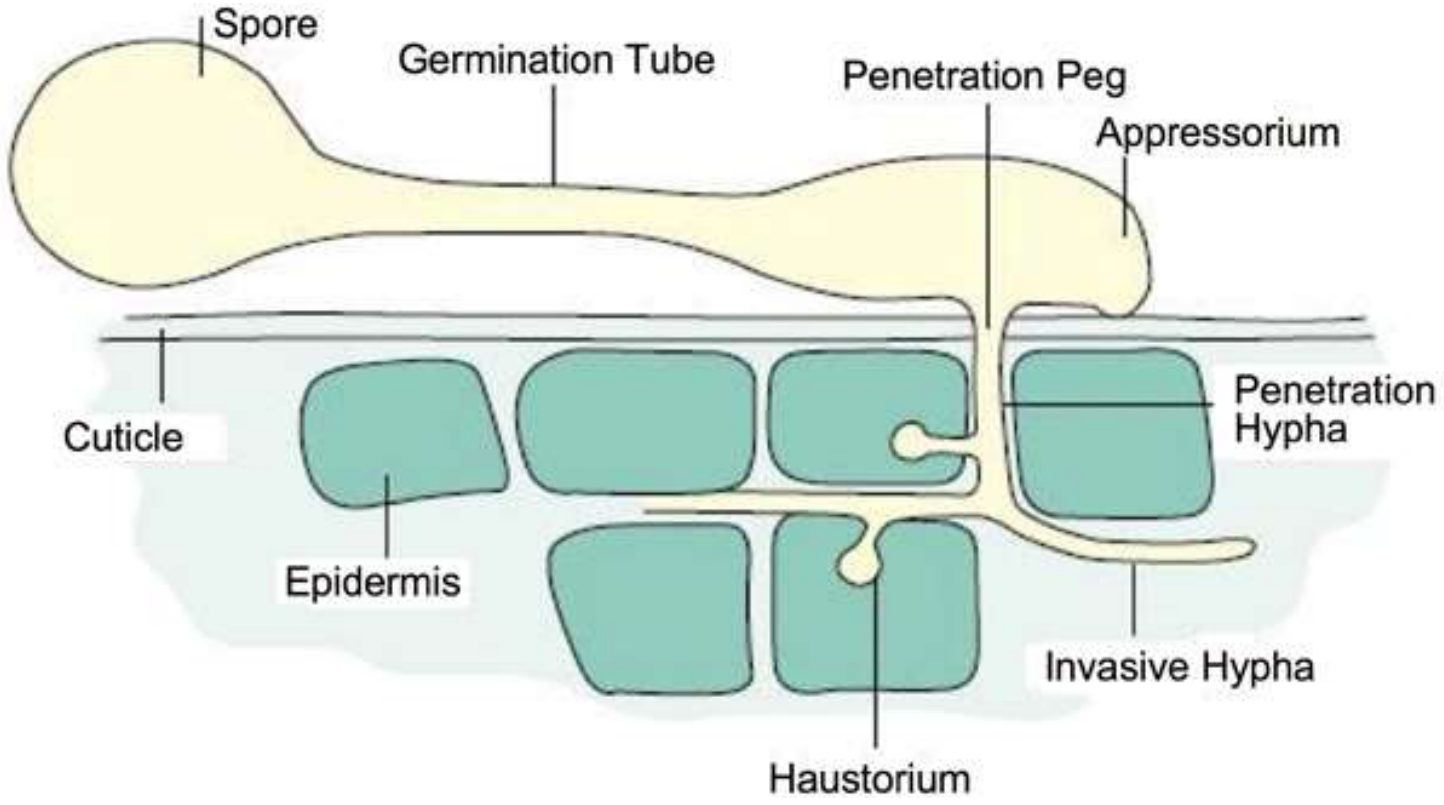
Infection Process – Penetration into the Host

- Pathogens have evolved several mechanisms that include structural and enzymatic components to enter into host tissues.
- Once on the surface of host, spores germinate by producing a germ tube.
- Appressorium develops from the well formed germ tube.
- It is highly specialized, swollen, dome/ cylindrical organ with a thick wall.

Infection Process – Penetration into the Host

- Appressoria are used to penetrate directly into plant tissues.
- Appressoria and germ tube adhere tightly to the surface of the host by mucilaginous materials.
- Appressorium contains a pore on the underside against the host surface which is covered by a thin germ wall.
- Through the pore, a fine protrusion called penetration peg penetrate the cuticle and cell wall.
- Enzymes (cutinase) are excreted through the pore to the surface of the host.

Infection Process – penetration into the Host



Infection Process – Penetration into the Host

- This peg extends and forms penetration hypha into the underlying tissue.
- In some cases, penetration is aided by turgor pressure from the appressorium.
- Appressoria produced by some fungi such as rust fungi do not penetrate directly through the cuticle but gain entry by stomata.

Infection Process – Penetration into the Host

- Latent infections result from an interruption in infection following direct penetration.
- If the penetration peg is unable to overcome host resistance, the infection remain quiescent until the host resistance is reduced.

Eg. Anthracnose in apples, avocado, mango and papaya by *Colletotrichum gloeosporioides*.

Infection Process – Invasive Growth within the Host

- After successful penetration, invasive hyphae are formed branching through the host tissue.
- These excrete toxins that kill the host cells.
- Extracellular enzymes are produced that breakdown complex constituents into simple ones that can enter fungal cells.
- They act as building blocks for the growth and development of fungi.

Infection Process – Lesion Development

- Infection results lesions.
- Lesions are any abnormalities involving any tissue or organ due to any disease or injury.

Infection Process – Sporulation

- Production of spores after completing the vegetative spore cycle.