HOST-PARASITE RELATIONSHIP

MODULE 14
Module objectives

• To enable the students to know the relationship that exist between the plant and the pathogen prior to infection.
• For students to understand the conditions necessary for relationship to occur between the host and parasite.
• To help them know the various ways by which the host plant resist the pathogen/infection.
Introduction

• This phenomenon in plant pathology is basically nutritional.
• The pathogen derives most of its essential nutrients from the host without conferring any benefit in return.
• Such relationship may be **obligatory** or **facultative**.
• Where the pathogen grows within the host and serves outside only in dormant form e.g. spore, the parasite is said to be an obligate one.
• Most of these type of pathogen then do not normally grow on artificial culture.
• The facultative parasite lives on the remains of dead plants and is therefore essentially a saprophyte. However, given the right conditions it can act as a parasite.
• Some other parasites behave in such a way to make it difficult to classify them as being either obligatory or facultative.
Introduction

• In order to establish a host-parasite relationship, the pathogen must first arrive at or land on the surface of the host.
• Then follows the penetration of the tissue through the development of a penetrating organ like the germ tube of a germinating spore.
• Usually during this stage, there are visible symptoms and the period may be regarded as incubation stage.
• This stage may in turn lead to the outward recognition of first symptom as the plant get infected.
• However, the relationship may not reach or pass beyond the incubation stage if the host plant is able to mount an effective resistance.
• The pathogen develops a penetrating organ into the host.
• Despite this the host still survives. It has some forms of resistance.
Resistance to infection

• A plant can put up an effective resistance to an infection either one or two methods; by protection or defence.

• The growth of a parasite inside its host usually results in some changes that are detrimental to the plant.

• However, the plant has some defensive mechanisms which may either prevent the parasite from establishing itself on the host or strangulate the developing pathogen.

• Such a plant is therefore said to develop some resistance to the parasite.

• The ability of a plant to offer some resistance to a pathogen makes infection an exception rather than the role.

• Such a resistance may be either in-built and therefore called PROTECTION of induced and therefore called DEFENCE.
Resistance to infection (contd)

Resistance by protection:

• The plant possess some in-built, structural or chemical features that prevent the entry of a pathogen.

• The surface layer of the host provides the physical barriers to penetration by pathogen, while some toxic chemicals which may be present on the surface or inside the host cell make it difficult for the pathogen to establish itself.

• Resistance by protection can be achieved at least by 3 methods;
  i) Structural
  ii) Chemical
  iii) By the absence of certain nutrients.
Resistance to infection (contd)

- **In structural protection**, the natural structure of the host prevents the penetration, germination or spread of the pathogen. Such structures are many. Examples are waxy cuticle, thick epidermal wall, narrow stomatal pore or possession of hairs.

- The **cuticle** is known to be hydrophobic therefore prevents water drops collecting on its surface thereby denying the pathogen the much needed water to germinate on the surface of the host. Also, a **thick epidermal wall** will make direct penetration difficult. Infection by the pathogen may also depend on the structure of the stomata.

- If the stomatal pore is too narrow, penetration becomes more difficult. The presence of the hairs on the surface of the host may help to ward off the pathogens.
Resistance to infection (contd)

• **Chemical protection**: may be conferred on the host through the production of waxes and cutin on epidermal surface or through the production of exudates from leaves and rats or from production of some toxic materials like phenolic substances.

• **Absence of certain nutrients**: Plants that lack some essential nutrients which the pathogen may need/ requires for growth will not be easily attacked by that pathogen.

2. RESISTANCE BY DEFENCE

• If the resistance by protection fails and the pathogen succeeds in entering the plant tissue, defense-resistance may then develop whereby a dynamic mechanism sets in to defend the plant. Those may happen in one of 3 ways;

  i) **By histological defense**: This is the type of defence whereby the injury caused to the host by the pathogen, triggers off in rapid cell division such that the host “walls off” the pathogens by developing cork layer, abscission cells, tyloses or gums.
Resistance to infection (cont'd)
Resistance to infection (contd)

• In addition to the cork layer formation, a tylose may develop. A **tylose** is a ballon-like enlargement of the membrane of a pit in the wall of xylem parenchyma cell and a vessel or tracheids protruding into the cavity of the vessel/ tracheids blocking the lumen. Tyloses occur in many wooden plants but may also be induced by infection or wounding.

• **Accumulation of toxic substances**: Plants may react to infection or mechanical injury by the accumulation of toxic chemicals which are mostly phenolics.

• **Increased levels of auxins in the host tissues**: The auxin level of an infected tissue normally increases, and these auxins generally impedes or inhibit fungal growth, and therefore, increased levels of auxins may provide a defense against fungal attack.

• However, fungi can in-turn produce the enzyme IAA (Indoly1 Acetic Acid-) oxidase which can inactivate auxins but the host cells can also inhibit the enzymes through the production of polyphenols by converting trytophan to IAA.