

Development of Plant Diseases

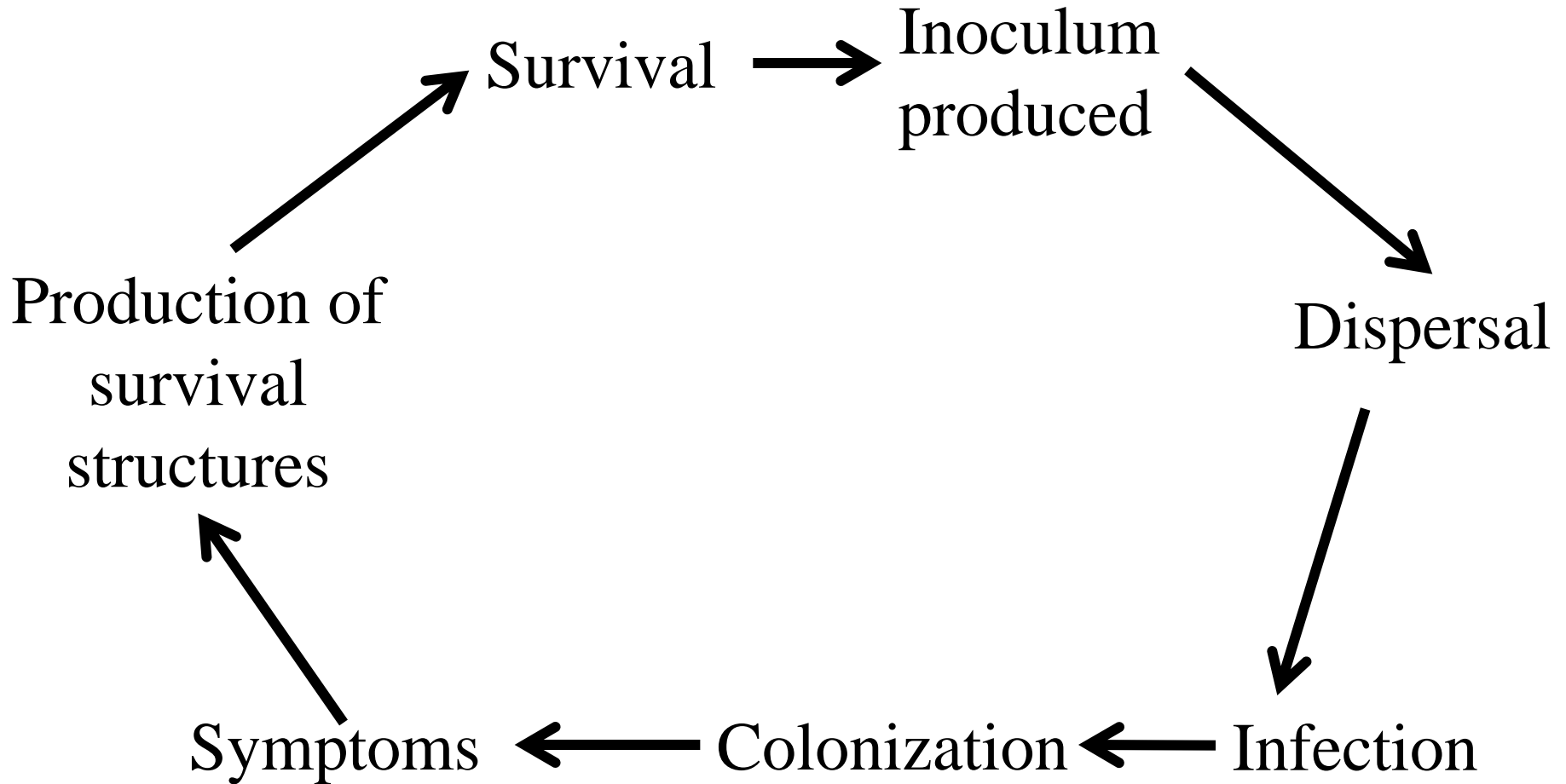
Disease of a plant could simply be defined as any alteration of one or more of the ordered series of physiological processes resulting in a loss of co-ordination of the energy utilization as a result of continuous irritation by the presence or absence of

some factors or agents.

The stages in plant disease development are referred to as plant disease cycle. In every infectious disease, a series of events occur in successions which could lead to development and continuation of the disease as well as the

pathogen. The chain of event is called **DISEASE CYCLE**. A disease cycle sometimes correspond fairly or closely to the life cycle of the pathogen it is primarily referred to as the apparent development of the disease.

Disease cycle



Comparison of disease cycles

	Fungi	Bacteria	Viruses	Nematodes
Survival	Crop residue Soil Alt. hosts -	Crop residue Soil Alt. hosts Insect vectors	- - Alt. hosts Insect vectors	Crop residue Soil - -
Dispersal	Wind Rain Insects	Wind Rain Insects	- - Insects	Tillage Equipment Water run-off
Infection	Directly Wounds Insect feeding	- Wounds Insect feeding	- - Insect feeding	Directly - -

Inoculum

Source of inoculum varies for each disease

- May be produced on residues left in the field
- Present in the soil
- Present in weeds or other crops in the area
- Present in or on the seed
- Present in soil sticking to equipment or tools
- Carried by wind or water
- Carried by insect vectors
- Carried in by animals, birds, and people

Spread of inoculum

Two ways

1. Plant placed in soil that contains a pathogen
2. Inoculum moves from its source to host plant



Penetration of inoculum and infection

- Infection occurs when a pathogen successfully enters a plant and develops, grows, reproduces, and spreads within the plant
- Pathogens enter a host through natural openings, wounds on plant surfaces, or by penetrating directly into the plant

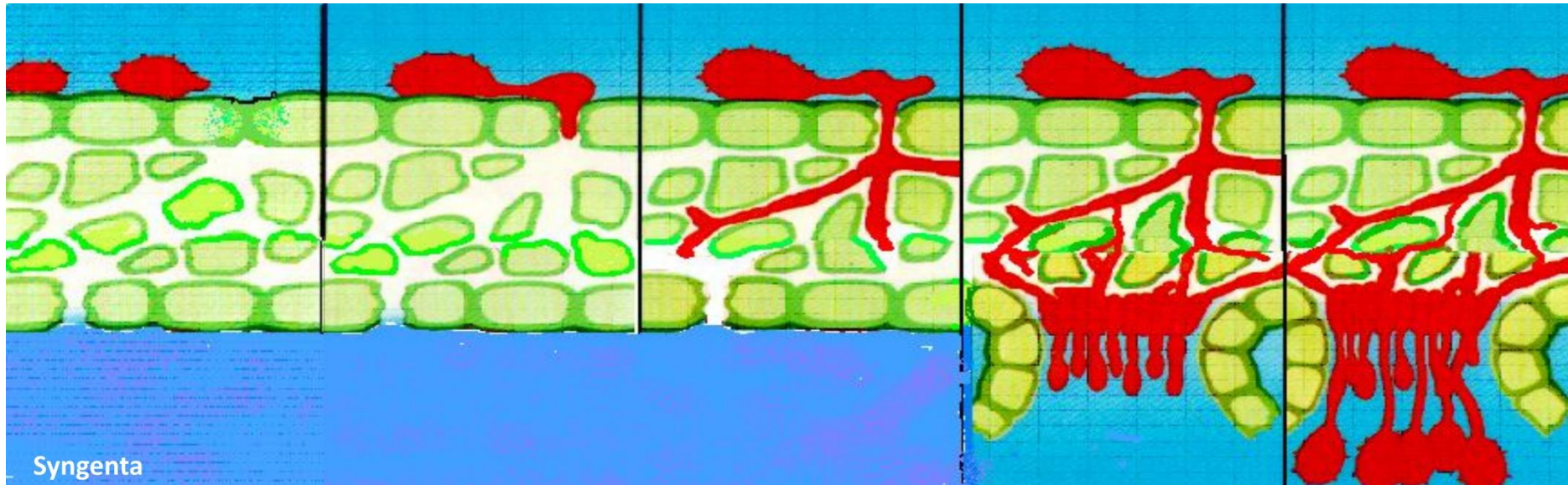
Spore
germination

Penetration

Mycelial
growth

Pustule
formation

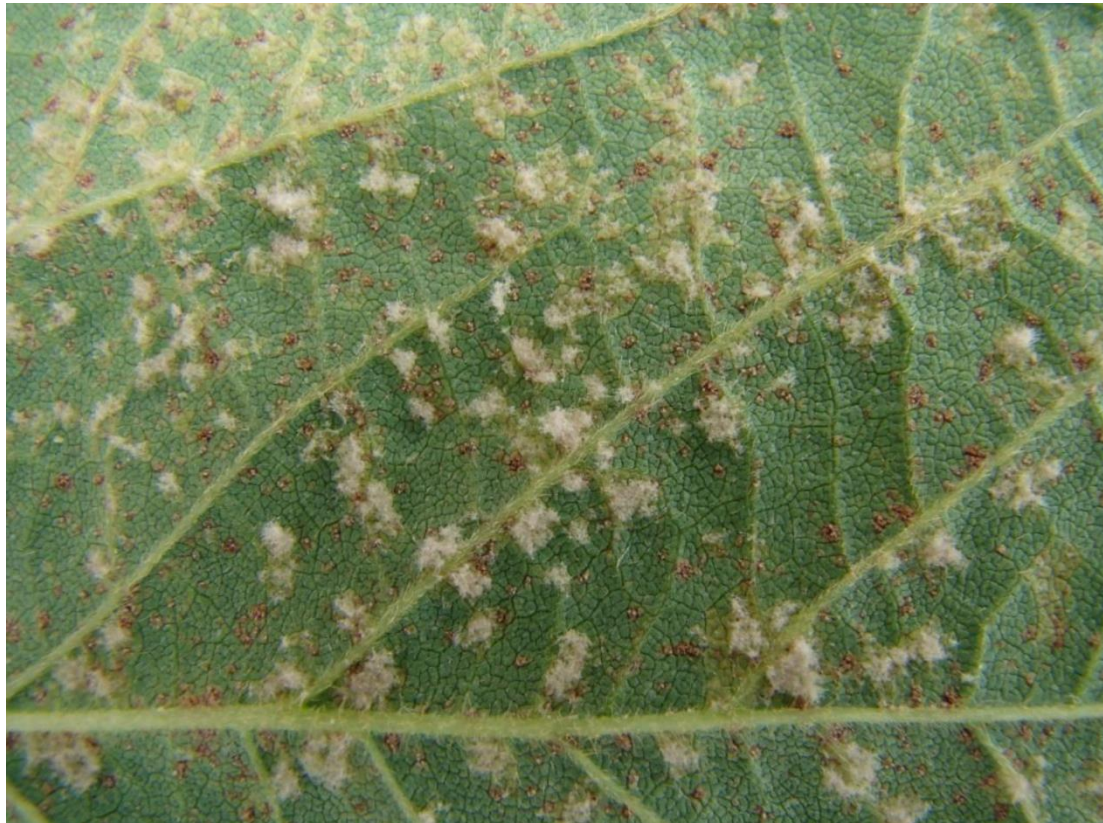
Sporulation



Secondary cycles

- Some diseases have only one cycle during the growing season (often root rots)
- Some diseases develop secondary or repeating cycles during the growing season (often foliar diseases)

- Number of cycles depends on the pathogen, susceptibility of the host, and environmental conditions



Invasion

Various pathogens invade plant host in a different ways an varying extent. Some fungi such as those causing apple scab of potato and black pod of coca produces mycelium, which grows powdery mildew which is common in

sorghum, produce mycelium only on the surface of the plant which later sends its haustoria into the epidermal cell. Most fungi spread into all tissues of the host organs. The effect either by growing directly through the cells, which is called **INTER-CELLULAR MYCELLIUM** or

within the cells which is called
INTERACELLULAR MYCELIUM.

SUMMARY OF TYPES OF PLANT PATHOGENIC INVASION

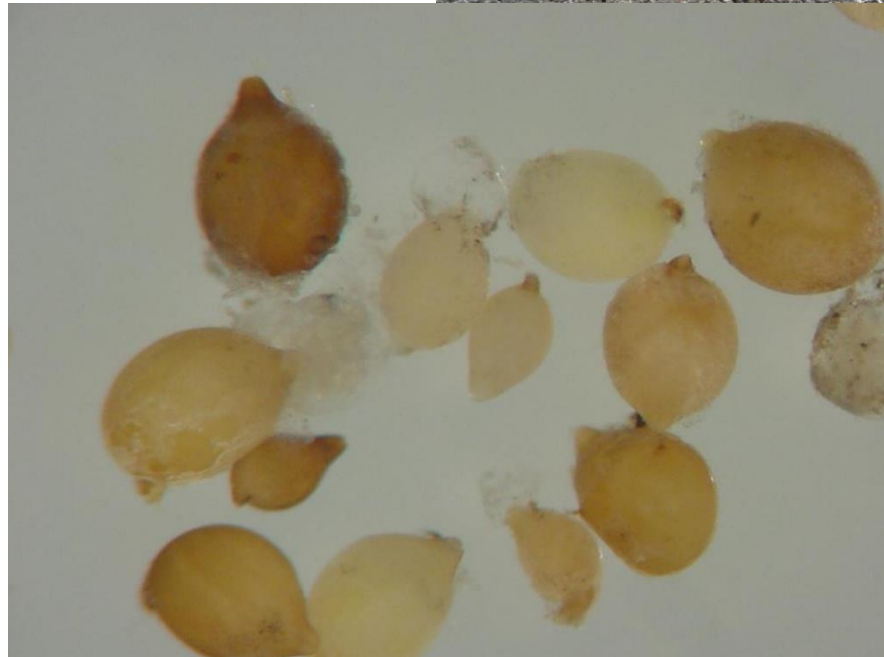
CLASS OF PATHOGEN	TYPES OF PATHOGENIC INVASION
Fungi	Both inter and intercellularly
Bacteria	Both inter and intercellularly
Fastidious Bacteria	Either of inter and intercellularly as well as systematically.

Virus	Intracellularly and systemically
Viroids	Intracellularly and systemically
Mycoplasma	Intracellularly and systemically
Nematodes	Both inter and intercellularly

Pathogen survival

Pathogens survive season to season in:

- Soil
- Crop residue
- Weed or non-crop hosts
- Seed or vegetative plant parts
- Insects
- Mild climates



Relationship between Disease Cycle and Epidemics

Some pathogen (mycoplasma, viroids and viruses) complete only one or even part of one disease cycle in one year.

Those set of pathogens are referred to as **MONOCYCLE** or **SINGLE CYCLING**

PATHOGEN. Disease that associate with monocyclic pathogen, primary inoculum is the only inoculum available for the entire season since here is no secondary inoculum produced at the end of disease cycle is however greater than those that is present at the beginning of the season and

so in monocyclic disease the amount of inoculum increased steadily from year to year.

In some other disease the causal agent has more than one generation per growth as well as season, and such pathogen is called POLYCYCLIC

PATHOGEN. Polycyclic pathogen can complete many disease cycle per year. The amount of inoculum is multiplied by air or airborne vectors and is responsible for the kind of disease that caused most of the explosive epidemics on most crops, for example mildew. In polycyclic

viruses, the fungi that lack sexual stages and on the other hand such as sclerotia and mycelium of infected plant tissues. The number of sexual spores that survives across infection is usually very small, but only primary infection takes place in some of the disease like fungi vascular wilt,

mycoplasma yellow as well as viral infections. The infective pathogen may not complete a disease cycle within one year, but instead, they take several years before inoculum is produced enough to be disseminated and then initiate few infection. Such pathogen is called

POLYETIC PATHOGEN. Although, polyetic pathogen may not cause a new infection over a given area within a year and the amount of inoculum does not increase greatly within a year because they survive in perennial crops. They have advantage that at the start of each year,

they have almost as much innoculum as they had at the end of previous year therefore, the innoculum may increase steadily (exponential increase) from year to year, they may cause severe epidemic when considered over several years.

These three relationships has a great

consequence of epidemiological significance because it affects the amount of inoculum that resulted into the initiation of the disease spread as well as amount of disease over time, which invariably determines the amount of yield loss caused by pathogenic infection,

which on a global may result into famine, hunger and starvation. The rate of inoculation on disease increase (R) has been calculated for any disease and varies from 0.1 – 0.5 per day for a polycyclic pathogen such as corn leaf blight, tomato leaf blight, grain rust as well as tobacco

mosaic virus, while for polyetic, it varies from 0.02- 2.3 per year. Examples of this includes the Dutch elm disease, chestnut blight and peach mosaic virus, the value of rate of inoculum (R) signifies that as the inoculum increases, the rate of disease spread as well as amount of

disease increase. It is highly important to understand the relationship between disease cycle and epidemic because of its importance in describing the rate of disease increase.

Summary

- Understanding the difference between a sign and a symptom is key in identifying a plant disease
- A plant disease cannot develop if a susceptible host, pathogen, and favorable environment do not occur simultaneously

- The major plant pathogens responsible for disease development in plants are fungi, bacteria, viruses, and nematodes
- The disease cycle describes the interaction of the pathogen with the host