Unit 1
MODULE
6

DISEASE CYCLE

I. Introduction

In crop protection, studying the different life cycles of pest and diseases is important to be able to develop a pest management plan. Just like in insects that undergo metamorphosis, in every stages of its development, different pest control approach is applied.

Same scenario is applied with plant diseases. Disease cycle helps us determine the level of penetration and development of a pathogen infesting the field. This module covers each stages of disease cycle and aids the students to discern what happens during each stage and determine the level of damage the disease caused in the crops. Depending on the stage, the farmers can adopt a decision of to whether it is still treatable or not.

It is important for agriculturist to know the nature of each disease cycle for it varies depending on the type of pathogen in focus therefore differs in their speed of development and method of reproduction.

II. Learning Objectives

At the end of this module, the students are expected to:

1. Describe what disease cycle is.
2. Identify each stages of disease cycle.
3. Explain the importance of studying disease cycle in crop protection.

III. Pre-Test

Question

What is Disease Cycle?

Answer

Question

What are the different stages of Disease Cycle?

Answer

Question

How can we apply our knowledge about the disease cycle in crop protection?

Answer

IV. Discussion

Disease Cycles

Plant disease cycles represent pathogen biology as a series of interconnected stages of development including dormancy, reproduction, dispersal, and pathogenesis. The progression through these stages is determined by a continuous sequence of interactions among host, pathogen, and environment. The stages of the disease cycle form the basis of many plant disease prediction models. The relationship of temperature and moisture to disease development and pathogen reproduction serve as the basis for most contemporary plant disease prediction systems.

In order for a disease to develop, a pathogen must be present and successfully invade plant host tissues and cells. The chain of events involved in disease development includes inoculation, penetration, infection, incubation, reproduction, and survival. The spreading of the newly produced pathogen reproductive organs to other uninfected crops is called secondary inoculation. Once it is started, a new cycle rotation will occur.

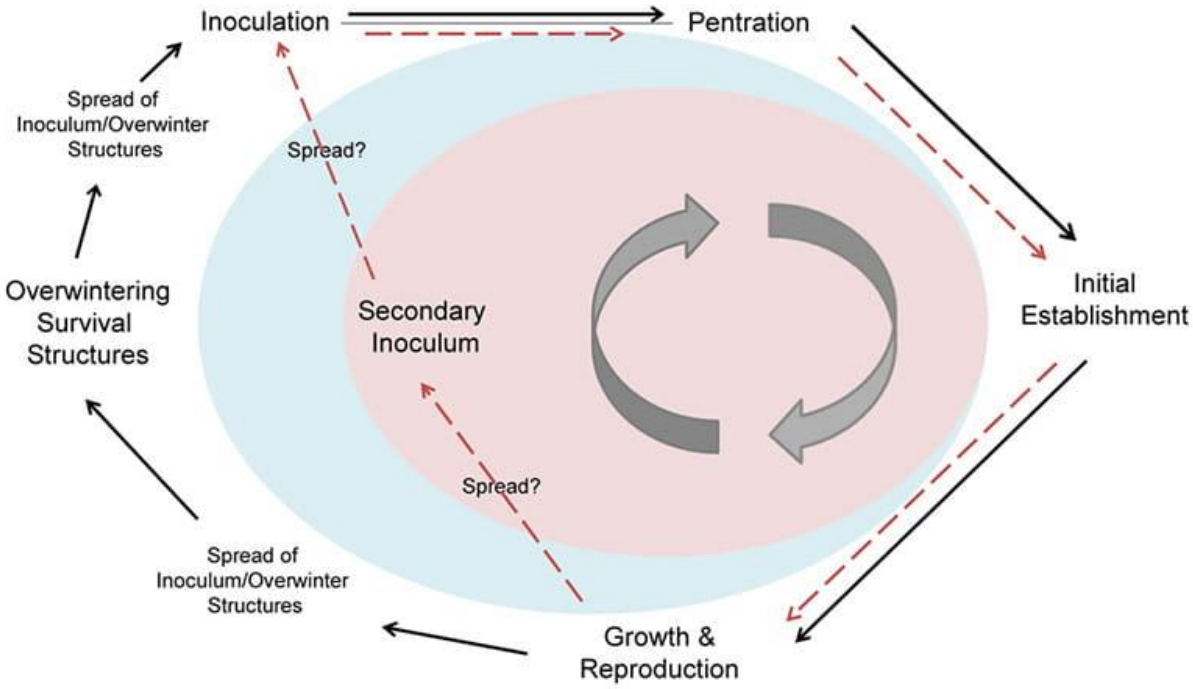
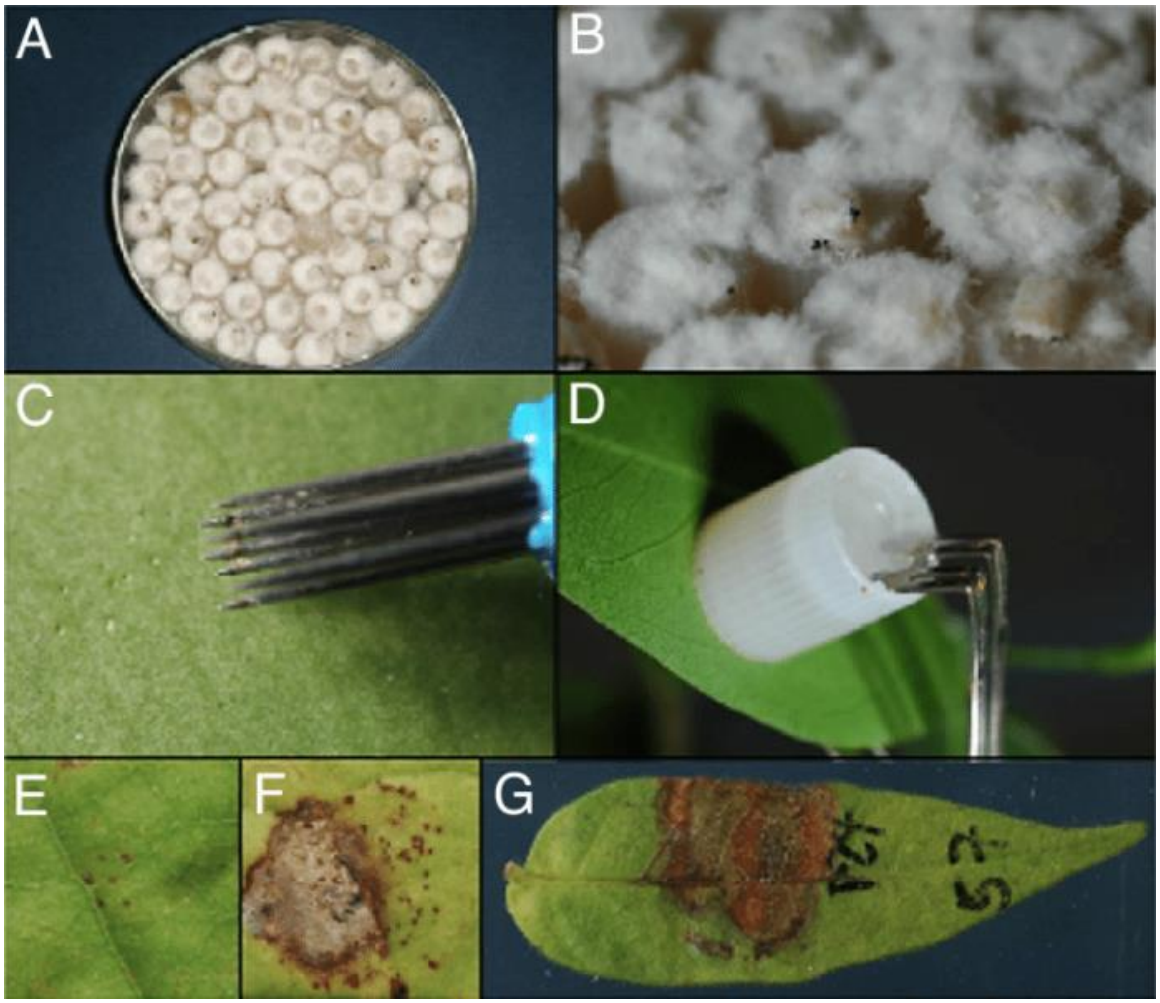


Figure 1. The monocyclic pathogen follows the black arrows to complete its cycle. Polycyclic pathogens follow the red arrows for the majority of the season and the black arrows at the end of the season.

Inoculation

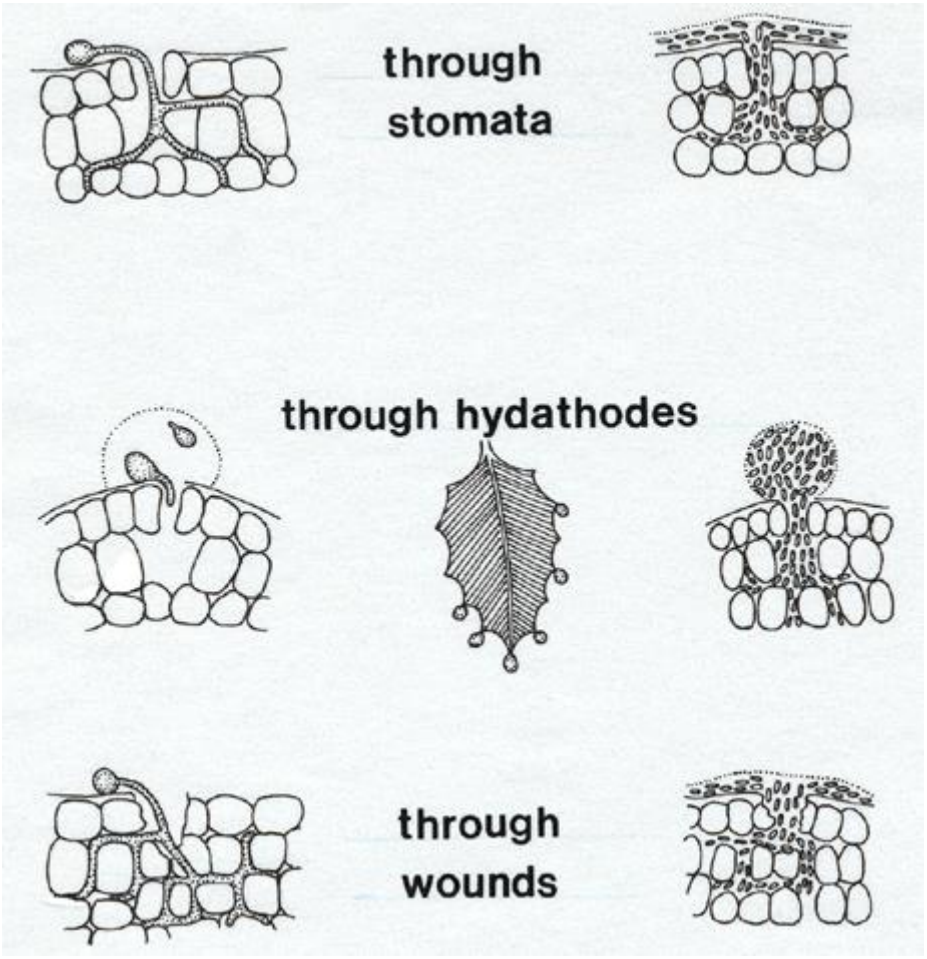
This describes the introduction of the plant pathogen to the host. Different pathogen groups employ different inoculation methods and are equipped with various specialized mechanisms that aid in the inoculation process. For example, some fungal pathogens release spores into the air and the spores are then spread with the aid of air currents.



Inoculation procedure for testing whether fungal pathogens can cause disease on leaves. (A) Pathogen inoculum grown in agar-filled cryovial caps. (B) Closeup of inoculum. (C) Wounding the leaf surface. (D) Clamping the inoculum to the leaf. (E) Wound response (resistant). (F) Necrosis (susceptible). (G) Diseased leaf 7 d after inoculation.

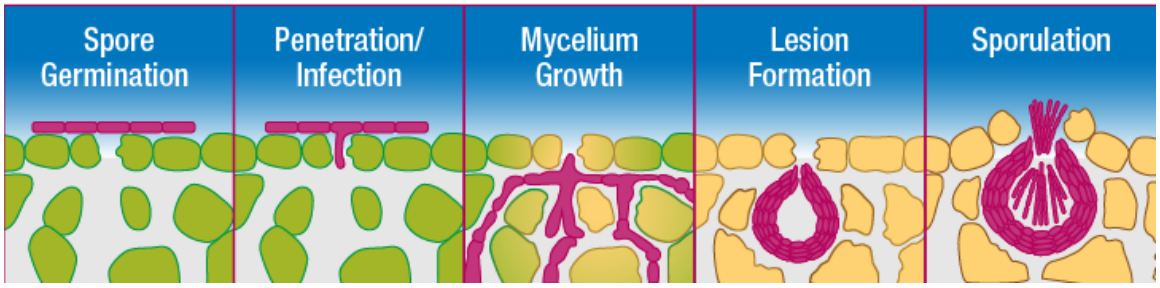
Penetration

Wound sites and natural plant openings, such as stomata and hydathodes, facilitate the entrance of some plant pathogens; others have evolved unique mechanisms for direct penetration. Fungi and nematodes are able to actively penetrate host tissues and cells if environmental conditions, such as moisture and temperature, are favorable for the penetration process.



Infection

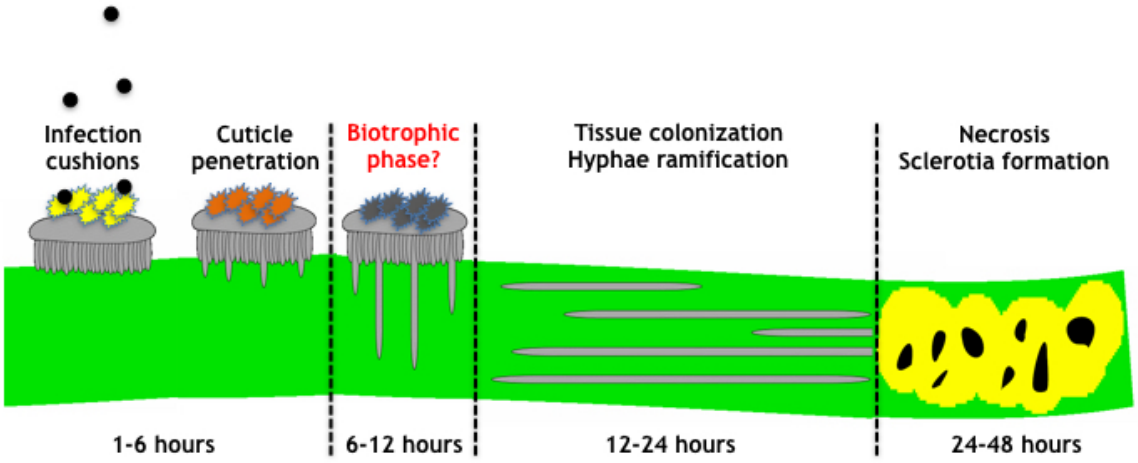
This occurs when the pathogen invades the plant tissue and establishes a parasitic relationship between itself and the plant. Viruses, bacteria, and phytoplasmas are not able to actively penetrate or enter plant host tissues. Therefore they must rely on other methods to infect plant tissues and cells. Associations with insect vectors have been established by these pathogens to aid inoculation and dispersal.



Fungal infection and development

Incubation

Once inside the plant, pathogens may undergo an incubation period and remain latent for a period of time before initiating disease.



Sclerotinia stem rot timeline for incubation

Reproduction

Plant pathogens can reproduce sexually and asexually. It is dependent on the pathogen.

Survival

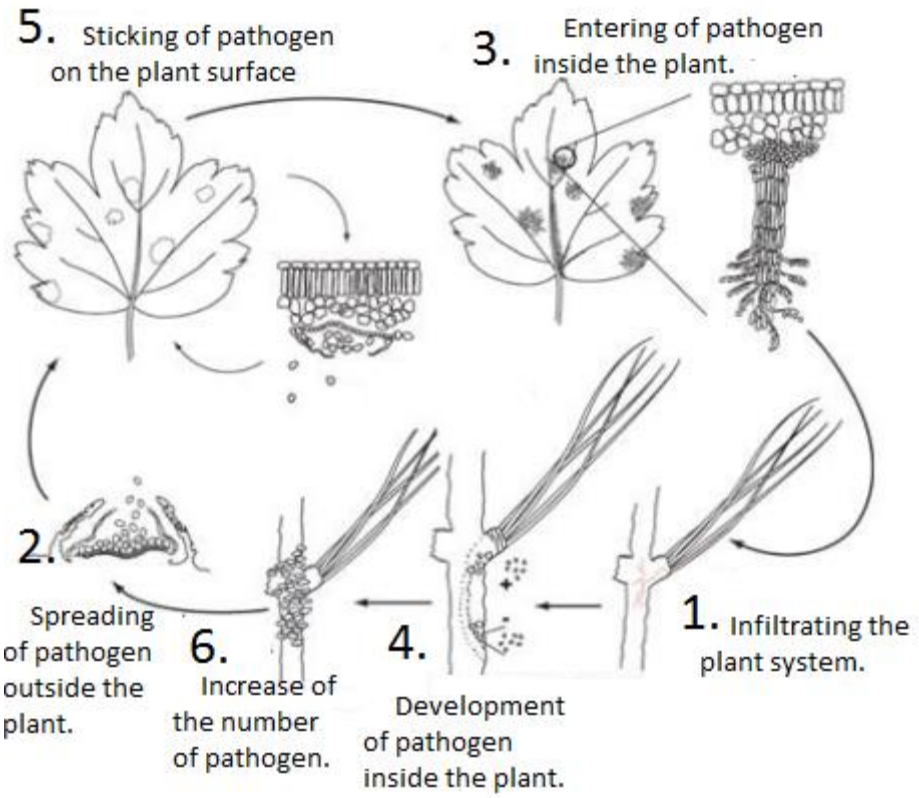
Plant pathogens have evolved so they can survive prolonged periods of unfavorable weather conditions. For example, brown spot is a fungal pathogen that produces spores that are dark in coloration which reduces the amount of UV light penetrating and preventing cell death. In addition, Soybean cyst nematode lays their eggs within a cuticle casing. The cuticle casing is very hard and prevents other microbes and chemicals to penetrate killing the eggs prior to hatching.

If any step is disturbed in the cycle, the disease will be less severe or fail to develop. Knowing and understanding the disease cycle for a particular disease is very helpful in managing the disease. There are two types of disease cycles, monocyclic and polycyclic.

V. Activity

Post-Test

In the picture below, the disease cycle is described in each stage. Identify which stage these disease activities belong to. Choose the anwer provided in the box below.



INCUBATION	INOCULATION
SURVIVAL	PENETRATION
INFECTION	
REPRODUCTION	SECONDARY INOCULATION

VI. Summary

- Plant disease cycle represents the pathogen progression through stages which is determined by a continuous sequence of interactions among host, pathogen, and environment.
- The different stages of disease cycle are inoculation, penetration, infection, incubation, reproduction, and survival.
- The spreading of the newly produced pathogen reproductive organs to other uninfected crops is called secondary inoculation. Once it is started, a new cycle rotation will occur.

VII. References

De Wolf, E. D., & Isard, S. A. (2007). Disease cycle approach to plant disease prediction. *Annu. Rev. Phytopathol.*, *45*, 203-220.

Internet Source

https://cropwatch.unl.edu/soybean-management/plant-disease

https://www.researchgate.net/figure/Inoculation-procedure-for-testing-whether-fungal-pathogens-can-cause-disease-on-leaves_fig3_6447613

https://www.ncforestservice.gov/forest_health/pdf/FHH/FHH_Diseases.pdf