

# Introduction to Plant Pathology



# What is a plant disease?

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- A plant **disease** is any abnormal condition that alters the appearance or function of a plant. It is a physiological process that affects some or all plant functions. Disease may also reduce yield and quality of harvested product.
- Disease is a process or a change that occurs over time. It does not occur instantly like injury.



# What is a plant disease?

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- Visible effects of disease on plants are called **symptoms**. Any detectable changes in color, shape, and/or functions of the plant in response to a pathogen or disease-causing agent is a symptom.
- **Signs** of plant disease are physical evidence of the pathogen, for example, fungal fruiting bodies, bacterial ooze, or nematode cysts. Signs also can help with plant disease identification.

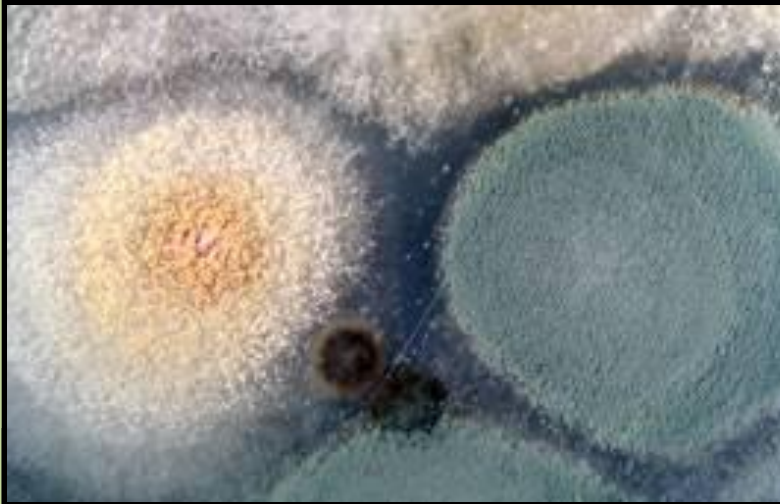
# What causes plant disease?

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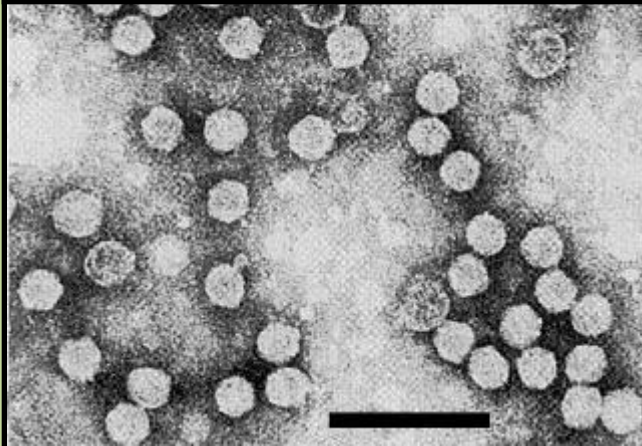
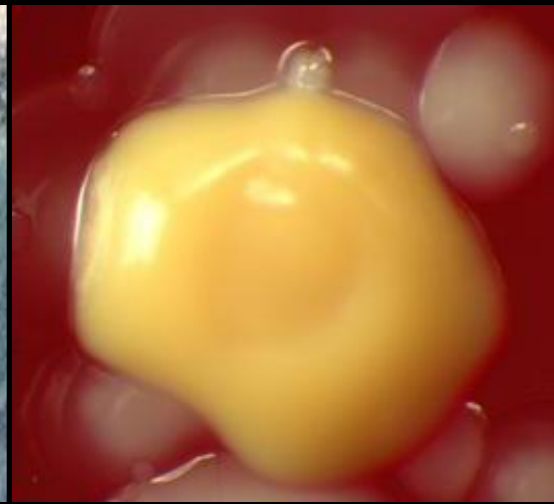
- Infectious plant diseases are caused by living organisms that attack and obtain their nutrition from the plant they infect. The parasitic organism that causes a disease is a **pathogen**. Numerous fungi, bacteria, viruses, and nematodes are pathogens of corn and soybean in Iowa.
- The plant invaded by the pathogen and serving as its food source is referred to as a **host**.

# Types of pathogens

Fungi



Bacteria



Viruses



Nematodes

# Role of the environment

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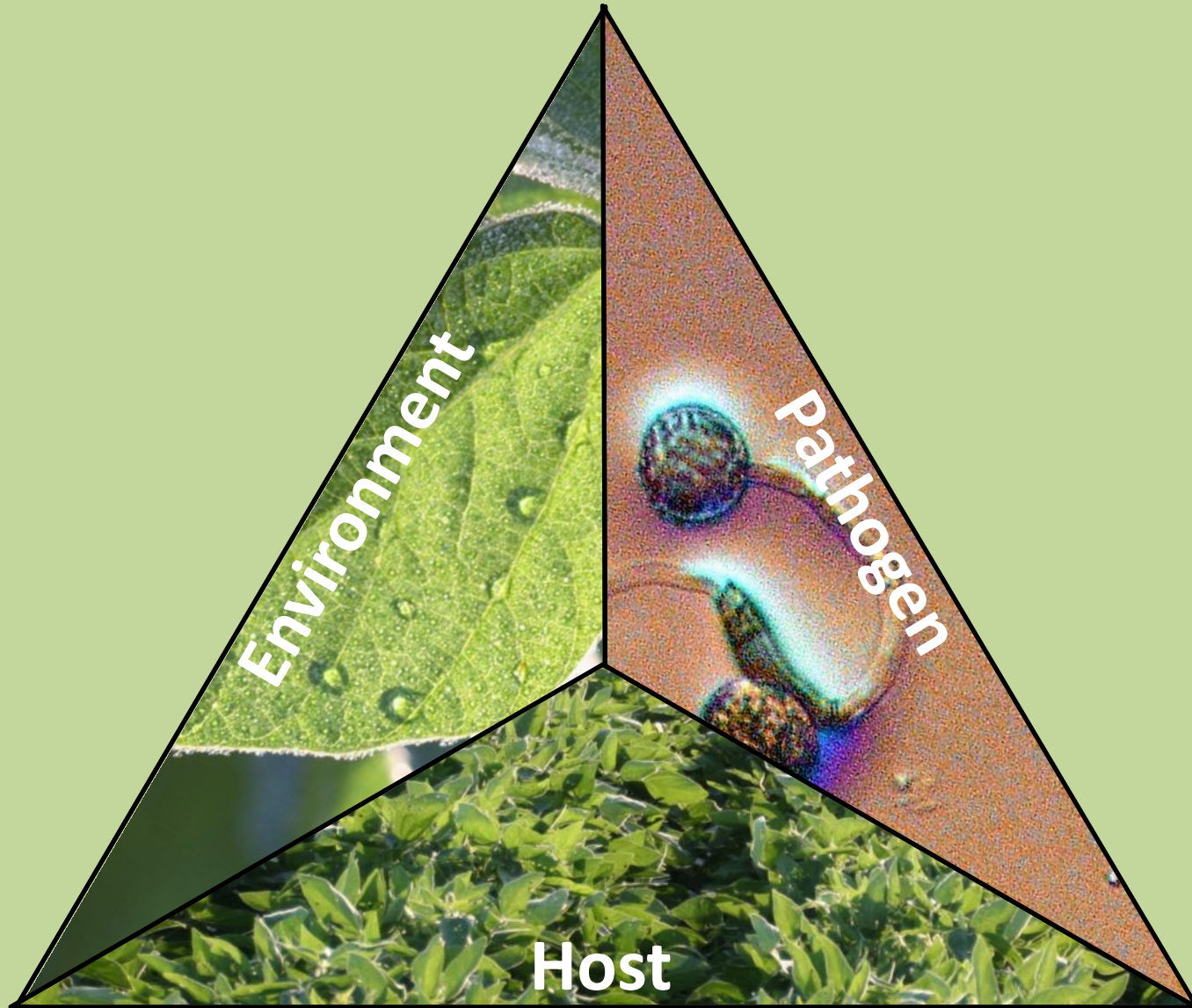
- A favorable environment is critically important for disease development – even the most susceptible plants exposed to huge amounts of a pathogen will not develop disease unless environmental conditions are favorable.





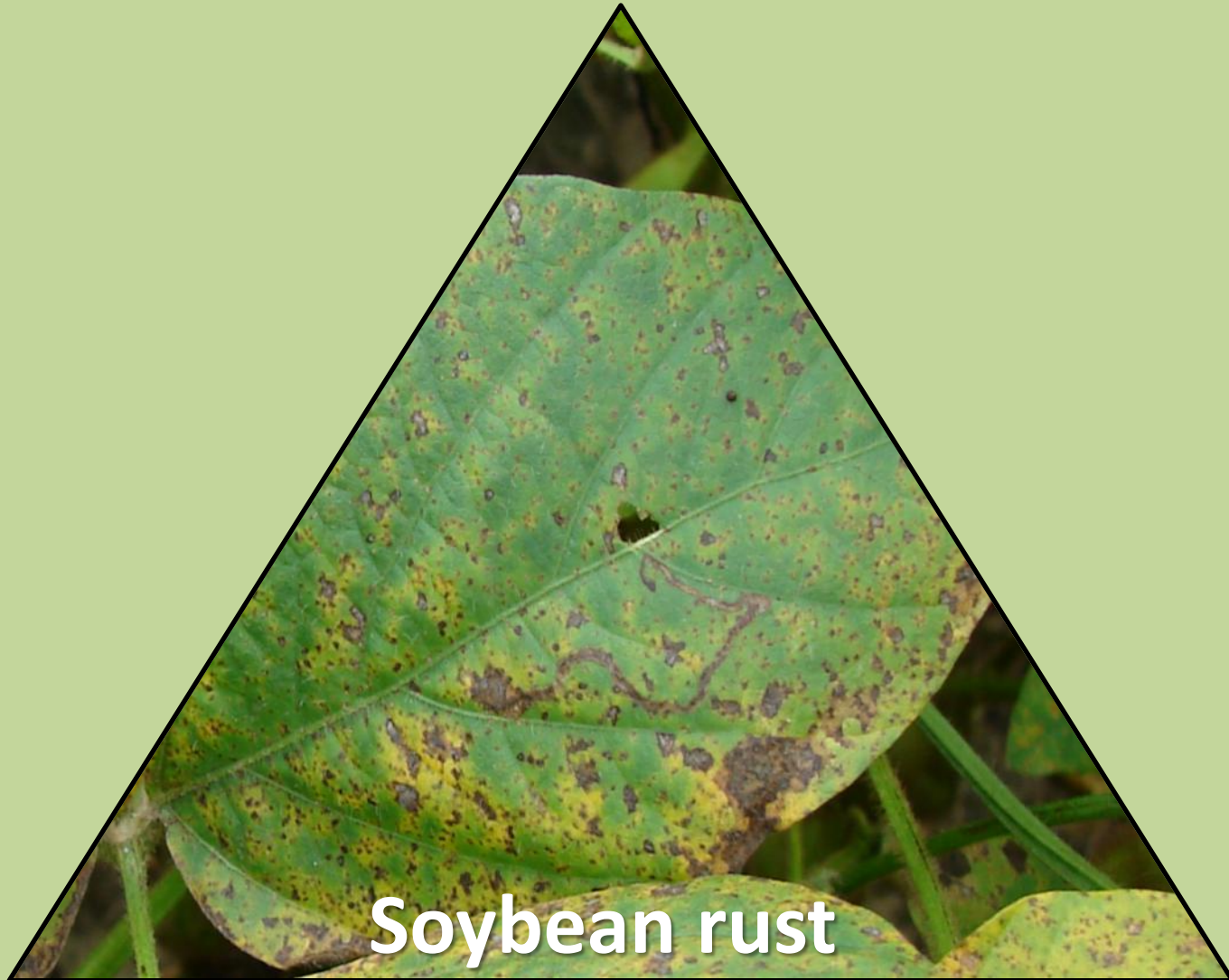
# The Disease Triangle

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# The Disease Triangle

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Soybean rust



# Groups of plant pathogens - fungi

- Vast majority are beneficial
- Can cause plant, human, and livestock diseases
- Most cannot be seen without a microscope
- Lack chlorophyll
- Composed of growing structure of delicate, threadlike filaments called hyphae
- Reproduce by forming spores



# Groups of plant pathogens - bacteria

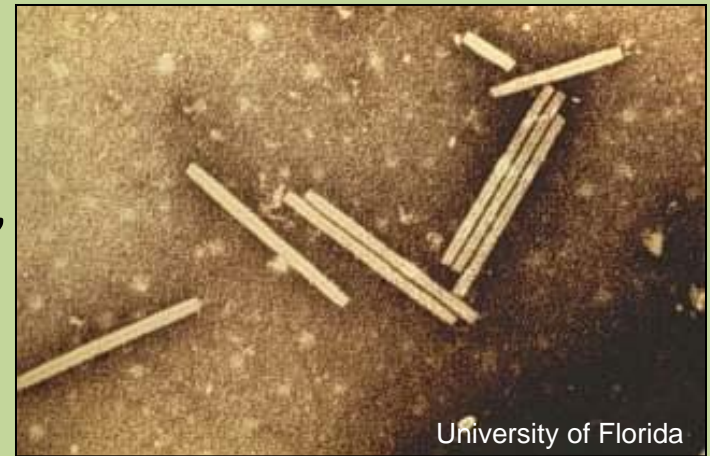
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- Extremely small organism requiring microscope to be seen
- Bacteria population can increase in number in short time period
- Cells clump together in masses called colonies
- Obtain food from dead or decaying organic matter or living tissue
- Spread plant to plant by wind-driven rain
- Gain entrance through natural plant openings or injuries



# Groups of plant pathogens - viruses

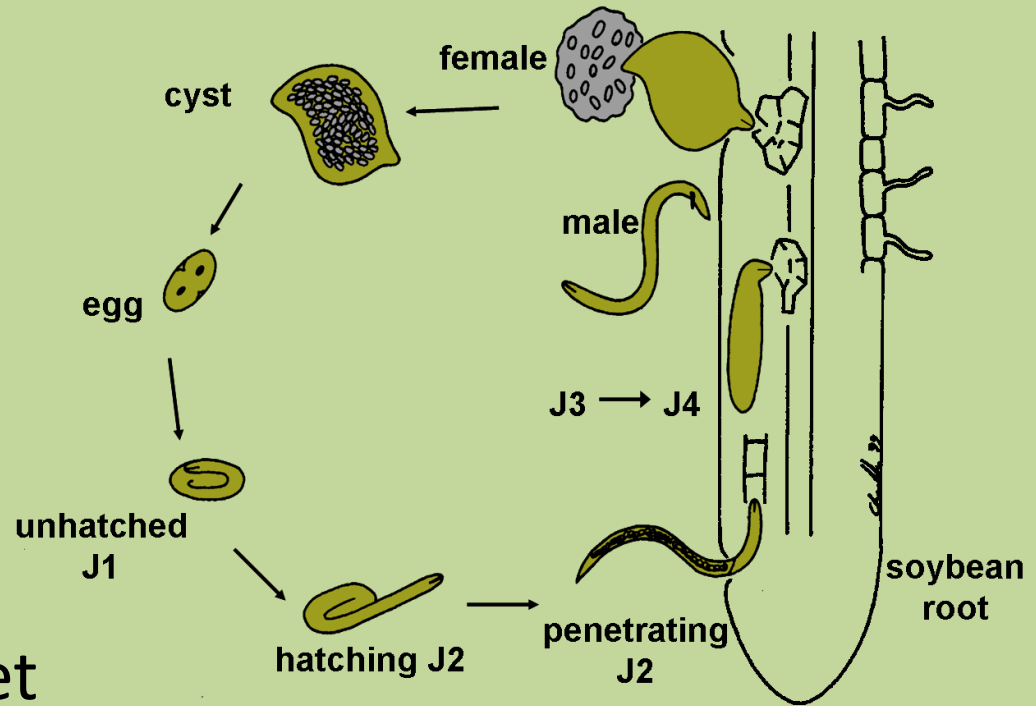
- Most familiar because they cause human and animal diseases such as influenza, polio, rabies, smallpox, and warts
- Cause some destructive plant diseases
- Measure only about one-millionth of an inch in size
- Are not complete living systems
- Survive only in living cells
- Transmitted by insects which are called vectors





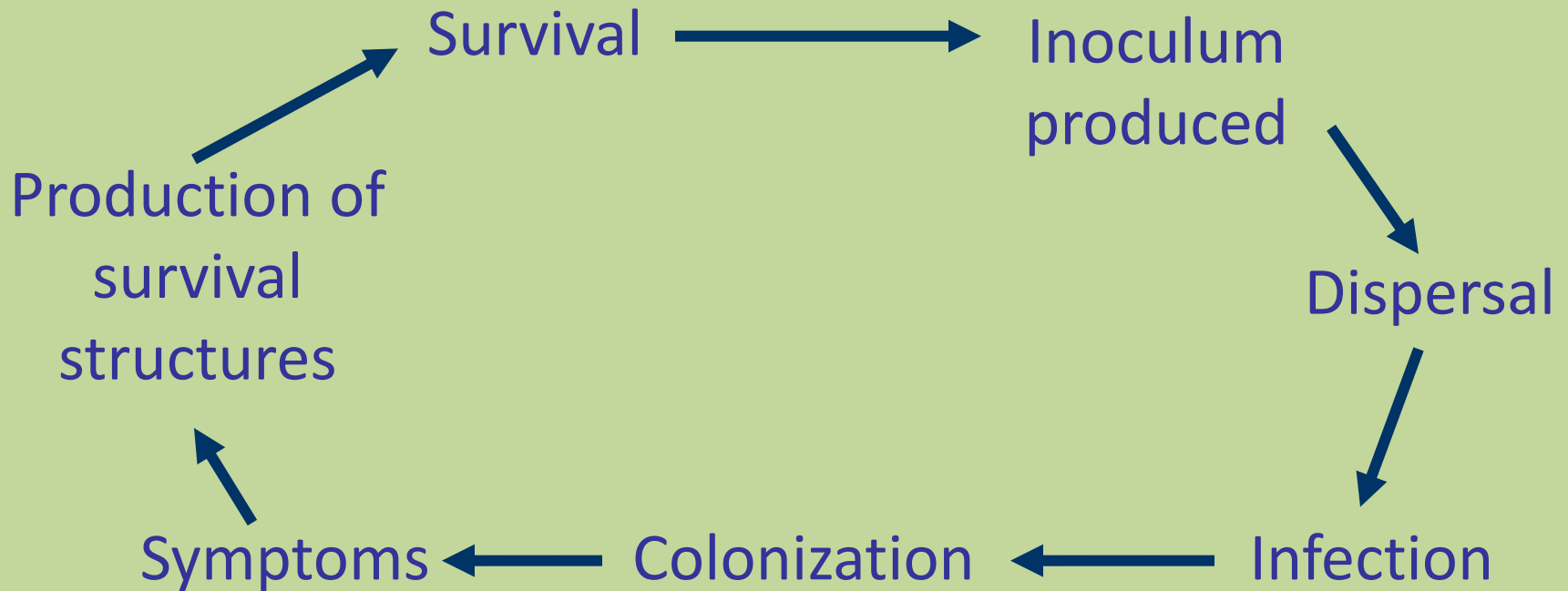
# Groups of plant pathogens - nematodes

- Round, slender, threadlike worms
- Some are parasites on animals, insects, fungi, other nematodes, and plants
- Plant-parasitic nematodes have a stylet
- Most live in the soil and feed in or on plant roots



# Disease cycle

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# Comparison of disease cycles

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



# Inoculum

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## 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

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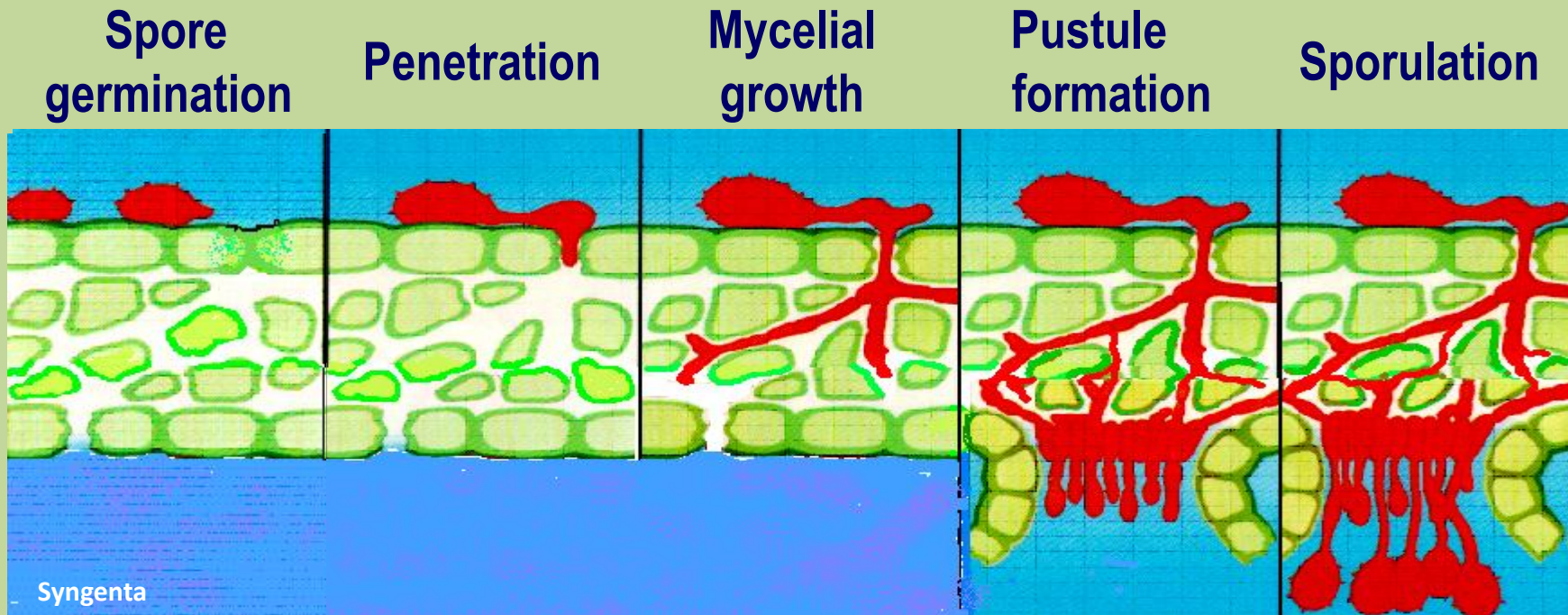
## Two ways

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 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





# Secondary cycles

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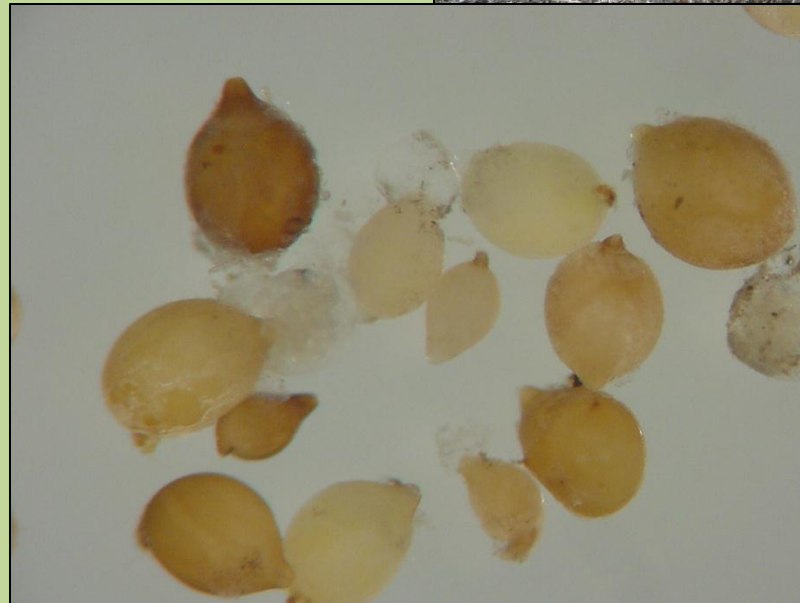
- Some diseases have only one cycle during the growing season (often root rots)
- Some diseases develop secondary or repeating cycles during the growing season (often foliar diseases)
- Number of cycles depends on the pathogen, susceptibility of the host, and environmental conditions



# Pathogen survival

## Pathogens survive season to season in:

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



# Summary

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- 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