30.8B: Plant Defenses Against Pathogens

Plants defend against pathogens with barriers, secondary metabolites, and antimicrobial compounds.

Learning Objectives

- Identify plant defense responses to pathogens

Key Points

- Many plants have impenetrable barriers, such as bark and waxy cuticles, or adaptations, such as thorns and spines, to protect them from pathogens.
- If pathogens breach a plant’s barriers, the plant can respond with secondary metabolites, which are often toxic compounds, such as glycol cyanide, that may harm the pathogen.
- Plants produce antimicrobial chemicals, antimicrobial proteins, and antimicrobial enzymes that are able to fight the pathogens.

Defense Responses Against Pathogens

Pathogens are agents of disease. These infectious microorganisms, such as fungi, bacteria, and nematodes, live off of the plant and damage its tissues. Plants have developed a variety of strategies to discourage or kill attackers.

The first line of defense in plants is an intact and impenetrable barrier composed of bark and a waxy cuticle. Both protect plants against pathogens.
A plant’s exterior protection can be compromised by mechanical damage, which may provide an entry point for pathogens. If the first line of defense is breached, the plant must resort to a different set of defense mechanisms, such as toxins and enzymes. Secondary metabolites are compounds that are not directly derived from photosynthesis and are not necessary for respiration or plant growth and development. Many metabolites are toxic and can even be lethal to animals that ingest them.

Additionally, plants have a variety of inducible defenses in the presence of pathogens. In addition to secondary metabolites, plants produce antimicrobial chemicals, antimicrobial proteins, and antimicrobial enzymes that are able to fight the pathogens. Plants can close stomata to prevent the pathogen from entering the plant. A hypersensitive response, in which the plant experiences rapid cell death to fight off the infection, can be initiated by the plant; or it may use endophyte assistance: the roots release chemicals that attract other beneficial bacteria to fight the infection.

Mechanical wounding and predator attacks activate defense and protective mechanisms in the damaged tissue and elicit long-distancing signaling or activation of defense and protective mechanisms at sites farther from the injury location. Some defense reactions occur within minutes, while others may take several hours.

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