

# Plant Defenses

Naturalist Outreach Speakers Bureau

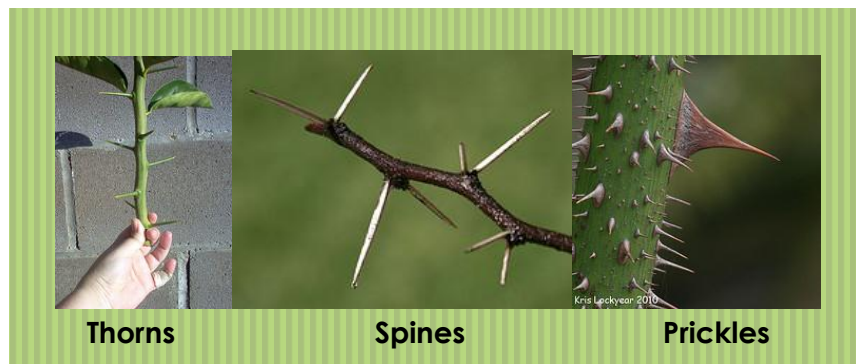
Presented by Ellie Taylor

## *Plants have evolved to oppose pests.*

One thing that greatly differentiates plants from animals is their lack of motility. This leads plants to adapt different ways of defending themselves from the same pressures animals face.

### Plant Defenses against Herbivory

If you were a plant, how would you defend yourself against predation by animals, otherwise known as **herbivory**? Plants have many ways to cope with this pressure. Many plants develop prickly structures, especially on their stems. If these structures are



modified from a branch, then they are **thorns**. If they're modified from a leaf, it's a **spine**, or if it's an extension of the epidermis, it's a **prickle**. You can tell which is which by its placement on the stem of the plant. No matter which it is, they usually prevent herbivores and especially large animals from eating the plant or fruit of the plant.

Plants also often have hairs on their stems, leaves, and petioles called **trichomes** that generally don't bother us handling them, but irritate the mouths of bugs and animals trying to eat them.

## *Odd Defenses*

One odd plant and relatively rare plant defense is **thigmonasty**. Thigmonasty is the non-directional response of a plant to touch. The *Mimosa pudica* (known as the sensitive plant) has the ability to rapidly close its leaflets upon touch, possibly because herbivores won't want to eat a quickly moving plant, or to look more twig-like.



Some plants, like *Lithops* even utilize **camouflage**. These particular plants look like rocks, so they are unappetizing to herbivores.

However, plants can also make themselves simply inconvenient to eat. The most common way they do this is by producing **waxes** or **lignin**. Wax is the shiny substance seen on many plant leaves (people even utilize this wax sometimes in products such as carnauba wax). Waxes not only help prevent animals from eating a plant, they also help with evaporation and temperature control in many plants. Lignin is the substance that makes many plants woody. Animals don't eat wood because they often can't chew or digest the complex molecules that make up lignin.



**Poison Ivy, a toxic plant.**

Plants in many cases synthesize toxins that harm or kill animals that try and eat them. Once an animal has eaten a toxic plant and gotten sick once, they rarely go back. Animals quickly learn what they can and cannot eat. Most houseplants are toxic to most animals, but some animals have adapted to eat some plants that other animals cannot.

### *Plant Defenses against Disease*

Plants have diseases just like people and animals, but cope with them in many different ways.

Though plants use **waxes**, **tree bark** and **lignin**, and **trichomes** as defense against herbivory, they are also especially useful when preventing against diseases. Diseases can vary from bacteria, fungi, or viruses. Waxes, lignin, and trichomes all act as a physical barrier to either living plant cells touching and transferring the disease, or toughening the cells and creating an impenetrable surface even minute diseases can't break through.



**Bark**



**Trichomes**

Some plants will produce chemicals that are toxic to biotic diseases. Many antibacterial and fungicidal chemicals were either found in plants or synthesized from plant compounds.



**Hypersensitive Cell Death**

Another very common plant defense against disease is **hypersensitive cell death**. Though a dramatic name, it simply means the plant will kill any cells immediately that contain the pathogen. This causes spotting seen on many diseased leaves. The plant shuts down the cell that contains the pathogen and the cells around it so the pathogen cannot spread and infect the entire plant.

## Plant Defenses against Other Plants

Many times, plants compete with each other for resources, and so have adapted ways in communities to defend themselves.

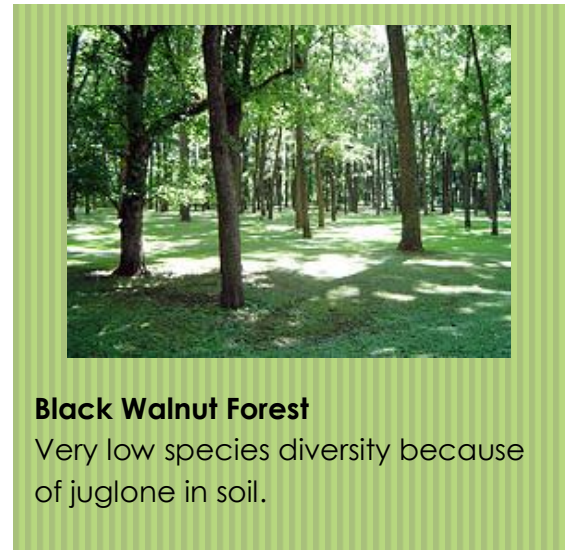
Some plants have evolved ways to defend themselves from other approaching plants. One of these ways is **allelopathy**. A famous example of this is the *Juglans nigra* (Black Walnut tree), whose mature roots emit the toxin juglone, which kills many plants in the vicinity, and can even irritate animals. This reduces the *J. nigra*'s competition for light and water from other plants in the vicinity. Many plants are juglone-resistant.

Vining plants, and some others, have **thigmotropism**. Like thigmonasty, thigmotropic plants move in response to touch, but they move according to the direction of the touch. Vining plants have this ability to wrap themselves around other, more stable plants, for example. On the other hand, most roots have a negative touch response, so they grow away from obstructing objects. This is a type of defense from roots and other structures.

## Plant Defenses from the Environment

Plants cannot get up and move if there is a huge natural disaster occurring, so many have developed environmental defenses.

Many plant in desert environments, called **succulents**, store large amounts of water in their cells so that they can survive until the next rare time that the plant receives water.



### Black Walnut Forest

Very low species diversity because of juglone in soil.



### Succulent, Drought-resistant Plants

Again, wax comes to the rescue! Plants will often produce wax that can either defend plants from flooding or drought, by shedding water from the leaf or by preventing water loss by creating a boundary layer between the plant and the environment.

Environmental defenses are as varied as the environment in which the plant lives. Plants that live deserts employ different defenses than plants that live in tropical environments. Plants that are dealing with drought stress will often close their stomata at least during the day, when plants are losing the most water. This halts photosynthesis, but preserves water in the short term, ultimately killing the plant if drought continues long enough. Trees and bushes will sometimes drop their leaves in times of drought as a method of preserving water through reducing photosynthesis and amount of plant matter that needs nourishment.

### *Plants employ many strategies to protect themselves*

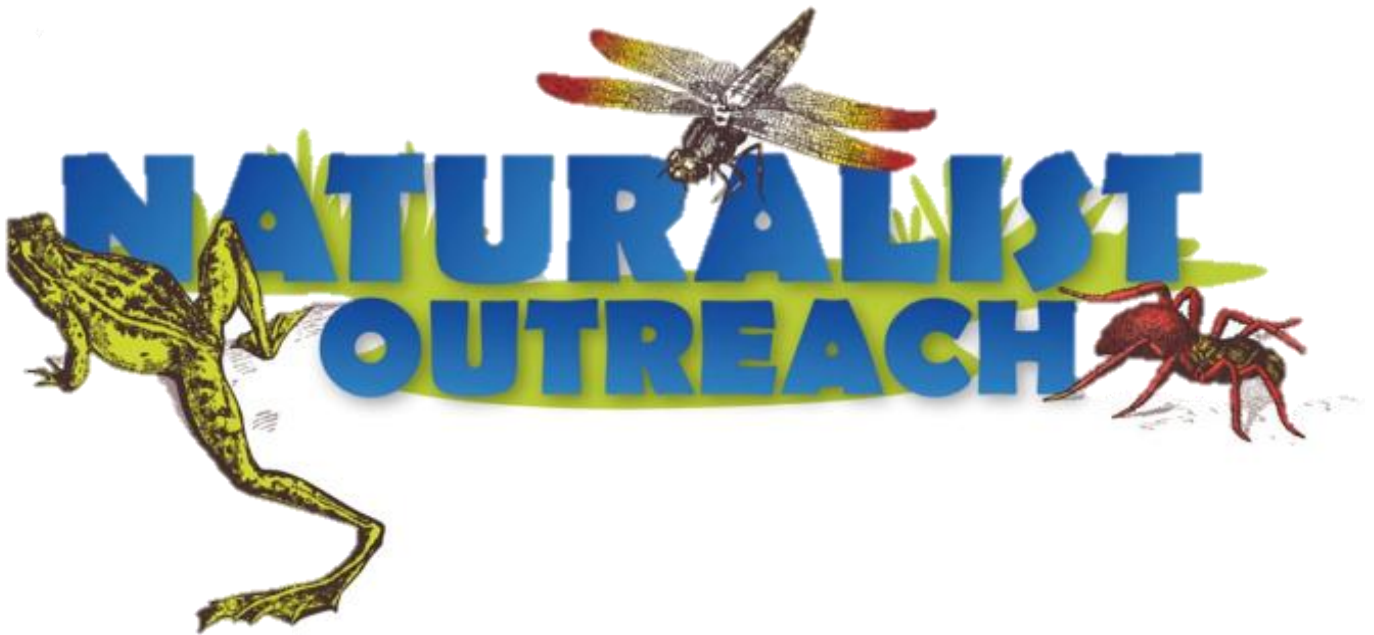
Some defense mechanisms protect the plant from many different factors, biotic and abiotic. Some plant defenses are structural, as in they are always present, like thorns, and some are induced, like the thigmonastic defense and hypersensitive cell death. Some defenses are specific to a particular disease, and some are broad, like the development of wax or lignin, which protect the plant in many ways. So even though plants can't move, it doesn't mean they are helpless! Plants employ many defenses because they can't move, and this is one of the things that make plants unique and remarkable.

#### *Further Reading*

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