

# PLANT DEFENSES

by John Schwegman

**P**lants are nature's producers. They use sunlight, air, and water to produce sugar, starches, and cellulose; food for the rest of us. Just about everything alive except plants consumes plants or something else that has consumed plants. With so many creatures just waiting to eat them, plants would not last long if they were defenseless. Given the handicap of being rooted and immobile, plants do a remarkable job of defending themselves. A wide variety of plant defenses are found in Illinois.

Thorns and spines are obvious physical defenses on many of our plants. They make it very hard on a grazing or browsing animal seeking an easy meal. While we don't often think of it in these terms, trees and shrubs are naturally protected against being eaten. Their tough woody tissue is coarse and hard to digest. Wood also lets many plants raise their leaves beyond the reach of earth-bound grazers.

Another physical protection plants use in Illinois is latex. By having large quantities of rubber in their abundant sap, plants like the Milkweeds [*Asclepias*] and Spurges [*Euphorbia*] "gum up" the mouth parts of many of the caterpillars that might eat them.

Several native Illinois plants of the pea family [Legume] defend themselves by their behavior! The Leafy Prairie Clover [*Petalostemum foliosum*] has compound leaves with numerous leaflets that it folds up at night. It is a very palatable species, especially relished by rabbits. Just as the rabbits come out in the evening, the plant folds up its leaves and becomes much

less visible. Other peas such as the Partridge Pea [*Cassia fasciculata*] also fold their leaves after several bumps or pulls as would happen if an animal was eating on them.

Chemical protections are the most widespread defense. They take the form of poisons, taste-altering compounds, numbing chemicals, stinging compounds, and skin and eye irritants. Dr. David Siegler of the *University of Illinois*, an expert on plant defensive chemicals, considers tannin to be one of the most ancient and widespread plant protectors. Tannin in the form of tannic acid makes leaves and other plant parts bitter to the taste. "The reasons for its effectiveness, other than its bitter taste, continue to elude us", he says. Theories that tannin inhibits digestion and utilization of plants by animals have recently been proven false. The fact that squirrels love bitter acorns that are packed with tannins points up one common fact about plant defenses. In virtually every case, there are some animals that develop a tolerance for them.

Terpenes in pine trees serve several functions. Volatile terpenes such as turpentine protect against feeding animals while the thick terpene we call rosin also seals wounds against fungal spores and diseases. Terpenes are not confined to pines. Rhododendrons and other plants also have powerful terpenes in their tissues.

The root of Jack in the Pulpit or Indian Turnip [*Arisaema*] is so hot to the taste that it is rarely eaten by anything. The "heat" in hot peppers is also a repellent to would-be eaters (Mexican

food fans excepted).

Our common little tree called Prickly Ash [*Xanthoxylum americanum*] has a second name of "toothache" tree because of the natural novocaine in its bark. Any deer or other animal that browses it gets a numb mouth and does not taste much for awhile. Early settlers used its bark, as well as roots of Purple Coneflowers [*Echinacea*] which contain similar chemicals, to numb the pain of toothache. [TWG Editor: The Prickly Ash is also home to the nasty-smelling "orange dog"—the caterpillar that later turns into the Giant Swallowtail Butterfly].

Some chemical repellents do not require eating to be effective. Hairs filled with irritating chemicals protect the Stinging Nettle [*Urtica dioica*] plant. The hairs inject their poison into animals that brush up against them, causing severe irritation. The repellent effect of Poison Ivy [*Rhus radicans*] is well known, as is the strong odor and eye irritation of Wild Onion [*Allium canadense*].

The most widespread of our native plant poisons is probably cyanide. It is effective in prohibiting feeding on plants by a wide range of animals. Dr. John Ebinger of *Eastern Illinois University* has screened many Illinois plants for this chemical. He thinks that at least 300 kinds of our plants, and probably many more, use this poison to protect their leaves from being eaten.

Our wild Black Cherry [*Prunus serotina*] is a common native tree with high levels of cyanide in its leaves. Many of us have noticed Black Cherry trees with nearly all their leaves eaten off by tent

caterpillars. These caterpillars are yet another example of how animals can develop a tolerance for even the strongest of poisons when there is a meal to be gained.

Many toxic alkaloid chemicals are produced by wild flowering plants such as the Lobelia we call Indian Tobacco [*Lobelia inflata*]. Alkaloids are probably the largest and most diverse group of defensive chemicals, but remain the least well known.

One plant defensive chemical many of us ingest in our coffee, tea, or cola is caffeine. Dr. Siegler says that plants apparently use this chemical as a defense to their territory against other plants. Caffeine leaches into the soil from the plant or its leaves which have fallen to the ground. Once in the soil, it inhibits the growth of other plants which could compete with the defending plant for space, nutrients, and moisture. An example is *Ilex cassine*, a Holly native to the Southeast.

The next time you hear about the vast array of chemicals and potential medicines in the plants of the tropical rainforest, just remember that Illinois plants have a rich chemical heritage of their own.



**John Schwegman** retired from the *Illinois Department of Natural Resources* in 1996, and is thoroughly enjoying life in Metropolis, IL. He spends his time on the Ohio River searching for the endangered “Fat Pocketbook” and other fresh water mussels; being an archeologist; studying botany; and watching for Caspian Terns and other great birds. He takes a video camera and notebook everywhere. He can be reached via [botany@midwest.net](mailto:botany@midwest.net).