Poisonous Plants of the Midwest

The common poisonous plants examined here fall into two families, the Anacardiaceae (Cashew Family) and the Apiaceae (Carrot Family). In our region, poisonous members of Anacardiaceae are represented by poison ivy and poison sumac, and toxicity manifests as contact dermatitis (an itchy, weepy rash) with varying levels of severity. There are many poisonous members of Apiaceae, including poison hemlock, wild parsnip, water hemlock, and giant hogweed. Toxicity in this group manifests in several ways, from contact phytophotodermatitis (weepy rash/burn) to respiratory failure and death. These poisonous plants vary in distribution and abundance, but many are extremely common within the human environment, such as roadsides and agricultural edges.

Toxicity in humans is derived from a reaction to organic compounds produced by plants called secondary metabolites. These compounds are synthesized as byproducts of primary metabolic pathways in plants (i.e. respiration and photosynthesis – processes involved in growth, development, and reproduction) and are used by plants in ways that enable them to cope with their environment as evolutionary adaptations, such as deterring herbivory, allowing ripe fruits to be found by seed-dispersers, and reducing competition for resources (allelopathy, a chemical exclusion mechanism). These compounds may also have functions in plant metabolism not yet understood - recent studies indicate that they may have important functions in chemical signaling in primary metabolic processes (Crozier et al. 2009).

Secondary metabolites are generally classified by their biosynthetic origin as 1) phenolics; 2) terpenoids; and 3) nitrogen-containing compounds including alkaloids and glucosinolates (http://www.biologyreference.com); each group includes compounds that are both useful and toxic to humans. For example, phenolics include the nutritional supplement lycopene, taken as an antioxidant, and urushiol and furocoumarins, some of the toxic constituents of the poisonous plants examined here (http://www.biologyreference.com).

Human uses of plant metabolites are nutritional, medicinal, and daily, in products - from soaps to our favorite flavors and vices. We consume plants based on their flavors, which are created by the compounds they contain, and influence their nutritional quality and value. Alkaloids serve many purposes in our society, and give us many vices: chocolate, nicotine, and caffeine. We use furanocoumarins found in the leaves and seeds of Apiaceae for many familiar spices and flavors: celery, parsley, dill, and cumin, among many others (van Wyk and Wink 2004). In personal care products, we use essential oils from Lamiaceae and Rutaceae, and other plant compounds for their scents, and effects on metabolism, tissues, and mood.

As a caveat, compounds have different effects on humans as a matter or dosage or mode of exposure. For example, compounds used in medicine can also be extremely toxic, depending on dosage, interactions with other compounds and as is the case with furanocoumarins, give us familiar flavors when ingested, or may give us phytophotodermatitis when it contacts skin exposed to sunlight.

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Toxicodendron radicans, Anacardiaceae (Cashew Family)
poison ivy, eastern poison ivy

Photo by M. Hacker. poison ivy and jewelweed.

This common plant grows as an herbaceous ground cover or as a vine climbing up trees. Older vines can be distinguished by their ample rootlets growing off the main vining stem, giving the vine a shaggy or hairy appearance. Most people have a reaction to this plant (allergic contact dermatitis), some more severe than others. Contact with skin may result in an itchy rash; severe reactions include swelling and puss-filled welts.

Poison ivy contains urushiol (a phenolic compound), which is responsible for this reaction. Humans and a few other primates are the only animals that get a rash from poison ivy. Some animals even use poison ivy as a food source (Gladman 2006).

With even slightly elevated levels of carbon dioxide, this plant responds by increasing urushiol levels, and growing and spreading more aggressively – with an imbalance of carbon dioxide driving global climate change, we can expect this plant to become a greater public health concern (Ziska et al. 2007).

"Leaves of three, let it be" is a common saying that helps one to identify poison ivy, but poison ivy isn't the only plant with leaves of three. Often, poison ivy co-occurs and is confused with Virginia creeper (*Parthenocissus quinquefolia*). Both species are "creepers" with similar coloration, deep greens with tinges of reds about the stems and petiole (leaf stalk), but Virginia creeper has five leaflets, not three.

Photo by S. Namestnik

Poison ivy also commonly occurs with jewelweed (*Impatiens capensis*) as pictured above. Recent studies have validated the efficacy of jewelweed in preventing allergic contact dermatitis due to a saponin, a class of compounds, produced by the plant (Motz et al. 2015). This soapy constituent of jewelweed is not only effective as a pre-treatment, but may also reduce severity of contact dermatitis if applied immediately after exposure.

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Poisonous Plants of the Midwest

Toxicodendron vernix, Anacardiaceae (Cashew Family)
poison sumac

You are not likely to run into poison sumac unless you are in a high-quality wetland. This beautiful plant grows as a small tree or shrub and is less common than its cousin, poison ivy, due to its strict habitat requirements. In our region (Chicagoland), poison sumac can be found in sphagnum bogs, forested seeps, fens and interdunal sloughs (Wilhelm and Rericha 2017). Like poison ivy, poison sumac's toxicity is derived from urushiol, but reactions to poison sumac can be more severe than poison ivy and longer lasting. I do not wish urushiol-induced contact dermatitis upon anyone, but I do hope you get to see this plant – it is quite attractive, and I hope you appreciate its habitat – usually really cool systems of high quality and biodiversity. Poison sumac can be distinguished from other shrub sumacs by its white berries (vs. red), and drooping flower clusters (vs. upright).


Photo by S. Namestnik


Photo by S. Namestnik

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Poisonous Plants of the Midwest

Conium maculatum, Apiaceae (Carrot Family)

cigue maculee, cigue tachetee, deadly hemlock, poison parsley, poison-hemlock, poison hemlock

This species is an herbaceous biennial plant that grows to heights of 5-8 feet tall. Its alternate leaves are divided 2 to 4 times into narrow leaflets, giving the leaves a “lacy” or “ferny” appearance. Small, white flowers are in clusters called umbels (an arrangement of flowers in the shape of an umbrella that is characteristic to the family). It’s important to note that this species is poisonous if ingested, whereas the previous two cause contact dermatitis.

Photo by R. Duddleson

In ancient Greece, this plant was commonly used to put criminals to death, in fact, the famous philosopher Socrates was sentenced to die by drinking a hemlock “tea”. This plant is a neurotoxin for which no antidote exists, even small amounts can be fatal. Ironically, this plant is everywhere. It is common in nutrient rich soils, including roadsides, waste grounds, on agricultural edges and it tolerates wet soils (Wilhelm and Rericha 2017). This sinister plant’s mode of action starts with a compound called coniine and γ-coniceine (alkaloids), which causes paralysis of respiratory muscles and ultimately results in death by lack of oxygen (Reynolds 2005). Below, Plato describes poison hemlock toxicity (Phaedo 117e–118a) as witness to his mentor’s execution, from *Phaedo*:

> *The man who had administered the poison laid his hands on him and after a while examined his feet and legs, then pinched his foot hard and asked if he felt it. He said “No”; then after that, his thighs; and passing upwards in this way he showed us that he was growing cold and rigid. And again he touched him and said that when it reached his heart, he would be gone. The chill had now reached the region about the groin, and uncovering his face, which had been covered, he said—and these were his last words—“Crito, we owe a cock to Aesculapius. Pay it and do not neglect it.” “That,” said Crito, “shall be done; but see if you have anything else to say.” To this question he made no reply, but after a little while he moved; the attendant uncovered him; his eyes were fixed. And Crito when he saw it, closed his mouth and eyes.*

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Poisonous Plants of the Midwest

Pastinaca sativa, Apiaceae (Carrot Family)
wild parsnip

This is a tricky one, in that the roots are edible (cultivated varieties are subspecies of this wild species) but the vegetative parts of the plant are phototoxic, meaning contact with the plant upon exposure to UV rays will result in skin irritation (phytophotodermatitis). The skin irritation of phototoxicity has been described as being similar to a severe sunburn – sore, red patches and blistering. Wild parsnip (*Pastinaca sativa)* produces furanocoumarins within the foliage, an anti-herbivory mechanism which causes phytophotodermatitis in humans (Averill and Di'Tommaso 2007).

The flower clusters (inflorescences) are composed of small yellow flowers in an arrangement typical of the family (an umbel). Leaves are alternately arranged and compound (divided into leaflets), and leaflet blade margins are toothed and usually lobed.

Photo by M. Hacker

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Cicuta maculata, Apiaceae (Carrot Family)

water hemlock, common water hemlock, poison parsnip, spotted cowbane, spotted parsley, spotted water-hemlock, spotted water hemlock, spotted water hemlock

Cicuta bulbifera

bulb water hemlock, bulblet-bearing water-hemlock, bulblet-bearing water hemlock

Water hemlock (*Cicuta maculata*) is an attractive perennial herbaceous wetland plant and native to the region; it is also one of the most poisonous plants in North America. The toxicity of this plant is attributed to the compound cicutoxin, which has severe effects on the central nervous system. When ingested, this plant causes nausea, vomiting, cramps, and seizures, but any amount can result in death or permanent damage to the central nervous system (Schep et al. 2009.)

Cicuta maculata, Photo by S. Namestnik

Water hemlock typically grows 3 – 6 feet in height on a pale green to pinkish-purple-green stem. Its flowering heads are like other members of the Apiaceae – a cluster of small white flowers in an umbel; the leaves are alternate and divided; each twice or thrice compound leaf has 3 – 7 leaflets with toothed (serrate) margins. Bulb water hemlock (*Cicuta bulbifera)* is less common and can be distinguished by its smaller, fragile stature and linear leaflets (up to 5mm wide) with few slender teeth versus wider (larger leaflets greater than 5mm) and regularly toothed leaflets of water hemlock. To distinguish these species from other similar looking members of the Apiaceae, look at the veins in a leaflet blade; species of the genus *Cicuta* have veins that terminate in the sinuses (notches in between teeth) of the toothed leaf margins whereas all other species of Apiaceae have veins that terminate in the teeth.

C. maculata

C. bulbifera

C. maculata

Photos S. Namestnik

C. bulbifera

C. maculatata

Poisonous Plants of the Midwest

Heracleum mantegazzianum, Apiaceae (Carrot Family)
giant hogweed

A non-native species new to the region, this biennial/short-lived perennial herbaceous species has the potential to cause serious problems. First, it is highly phototoxic. Like *Pastinaca sativa*, it produces furanocoumarins, but reactions (sunburn-like rash and blistering) may be more severe. The phytophotodermatitic reaction is reported to leave dark scarring. Some sources claim that this plant may cause blindness if it gets in the eyes – but these claims have not been substantiated with research. Second, it is highly invasive and currently listed as a Federal Noxious Weed. Interestingly, the English rock band, Genesis, captures the history, ecology, toxicity and recommendations in treating this species in a truly epic (also incredibly progressive and exquisitely produced) piece, The Return Of The Giant Hogweed:

Photos by S. Namestnik

Long ago in the Russian hills,
A Victorian explorer found the regal Hogweed by a marsh,
He captured it and brought it home.
Botanical creature stirs, seeking revenge.
Royal beast did not forget.
He came home to London,
And made a present of the Hogweed to the Royal Gardens at Kew.

Waste no time!
They are approaching.
Hurry now, we must protect ourselves and find some shelter
Strike by night!
They are defenceless.

This plant grows up to 15 feet on thick bright green to greenish-pink stems often dotted with dark red spots, and a cluster of small white flowers (umbel inflorescence). Leaves are also huge, with widths of over 3 feet, are ternate-compound (divided into three sections) and deeply incised. In our region, giant hogweed (*Heracleum mantegazzianum*) can be confused with common cowparsnip (*Heracleum maximum*) and great Angelica (*Angelica atropurpurea*) of the Apiaceae, and native to the region. Common cowparsnip can be distinguished from giant hogweed by its shorter stature (less than ~8 feet tall), green sheaths (vs. red-spotted sheaths), up to 45 flowers per umbel (vs. 50-150), the downy hairy lower leaf surface, and shorter fruit stalks (less than 2 cm long). Great Angelica, a native wetland plant, can be distinguished from giant hogweed by its leaf shape, which is 2-3 times divided into leaflets and its spherical flower cluster, versus the deeply incised ternate-compound leaf structure and flat to slightly hemispherical flower cluster of giant hogweed.

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