

Poison Hemlock

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The toxicity of poison hemlock has been known throughout history. In ancient Greece it was used to poison political prisoners. Perhaps the most renowned prisoner to die from the plant was Socrates in Athens in 329 B.C. Condemned to die, he drank the poisonous juice to commit suicide. Hemlock is also thought to be given to Christ along with vinegar and myrrh when he was crucified. Native Americans once used hemlock toxins a component of the poison in the tips of their arrows. The most recent human deaths have resulted from mistaking poison hemlock with edible species of the carrot family. Originally imported from Europe as an ornamental plant, poison hemlock has spread rampantly throughout North America.

Identification

Poison hemlock (*Conium maculatum*), also called poison parsley, is a member of the parsley family, Apiaceae (Figure 1). It is a biennial, or sometimes perennial, growing 3 to 8 feet tall and occasionally reaching 10 feet. During the first year of growth, poison hemlock forms a large rosette and usually remains in the vegetative stage. During the second year, it produces tall stems and then flowers. The dried stems can persist after aging and are found throughout the winter.

Identifying characteristics of poison



Figure 1: Poison Hemlock (*Conium maculatum*)

hemlock are its stout, extensively branched, erect stem with distinct ridges. Its stems are hollow, except at the nodes, (the points at which the leaves attach). The lower portions of the stems have purple spots.

Poison hemlock leaves are shiny green, triangular, and highly dissected. The leaves have long clasps on the stalk of the stem, and the length of the

stalk clasps decreases upward on the plant. The leaves are large, up to 12 inches long and 4 inches wide. They are alternately arranged on the stem, dividing three to four times. Poison hemlock leaves are pinnately compound, meaning that each leaf is made up of several pairs of leaflets that sprout from opposite sides of a main leaf stalk (figure 2). The leaflets are

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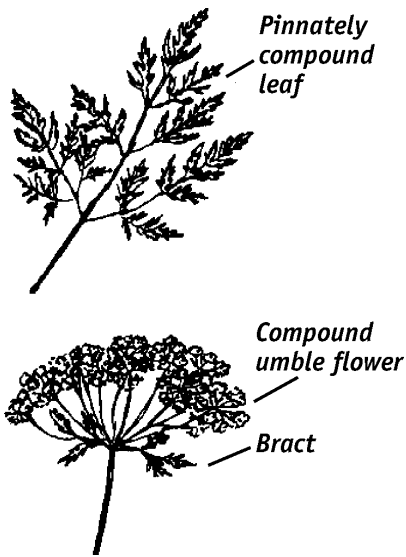


Figure 2: Poison hemlock leaves and flowers

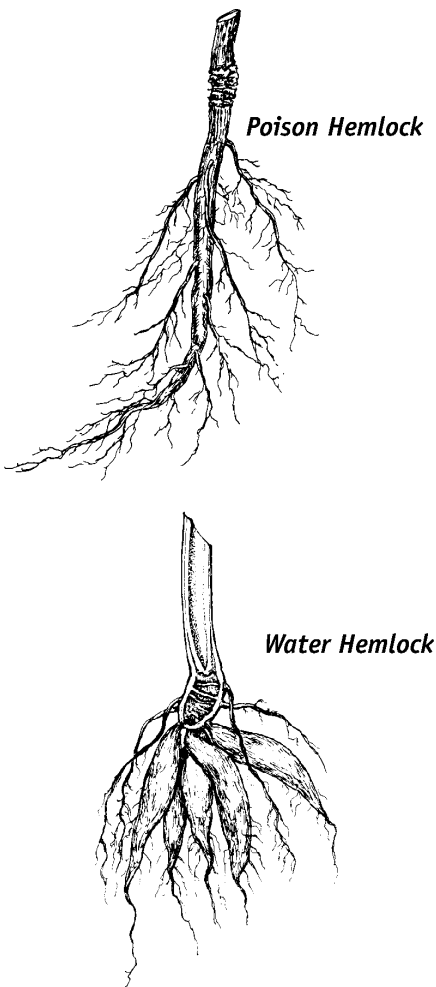


Figure 3: Poison hemlock and water hemlock roots compared

segmented and 1/8 to 1/4 inch long. The leaf veins terminate at the tips of the teeth of the leaf.

Flowering occurs in July and August. The flowers are white, lack sepals (green leaf-like petals at the flower base), and are arranged in a broad (about 2 inches wide) compound umbel: an umbrella-shaped bunch composed of small flowerets on individual stems that extend from a common terminal stalk (Figure 2). The bracts at the base of the umbel are 1/4 inch long with a green center and whitish edges.

Seeds are paired, 1/8 inch long, light brown, barrel-shaped capsules with conspicuous longitudinal ribs. The fleshy, white taproots may be up to 3/4 inch in diameter. The roots have an odor similar to carrots or parsnips and the foliage has a strong musty odor.

Misidentification of poison hemlock with other members of the carrot family is common and can be deadly. One distinguishing characteristic between poison hemlock and wild carrot is the lack of hairs on the leaves and stems of poison hemlock.

Cow parsnip differs from poison hemlock by its palmately compound leaves. Unlike pinnately compound leaves, which are arranged in rows along the stalk, palmately compound leaves radiate at the end of the stalk in a semicircle. Water hemlock can be distinguished from poison hemlock by the main taproot and stem. In water hemlock, the root stalk is branching and tuberous, similar to that of a dahlia plant. (Figure 3.) The lower part of the stem of water hemlock is divided into chambers which contain its toxicant.

Origin

Poison hemlock originated in Europe and was introduced to North America in the 1800's as an ornamental. Since then, it has been extremely successful distributing itself throughout most of North America. It now occurs in nearly every state in the United States and southern Canada, including the majority of the counties of the western United States (Figure 4).

Impacts

Poison hemlock can invade perennial crops like alfalfa, but it is only a significant problem in the first cutting, because subsequent regrowth of the alfalfa can suppress poison hemlock. In grain fields, poison hemlock can contaminate harvested grain seed. However, it is more common for poison hemlock to invade grazing areas than crops. It tends to grow in moist pastures and meadows where it has the potential to out-compete more desirable native species. Perhaps the largest impact of a poison hemlock invasion is its toxicity to livestock. Serious livestock losses can occur when animals graze on fresh forage, harvested silage, or hay contaminated with poison hemlock.

Detrimental / Toxicity

All parts of the plant are extremely poisonous. The lower portions of the stem and root are particularly deadly. Environmental factors can alter the alkaloid composition and concentration. Of the eight known alkaloids in poison hemlock, the principle toxins are the piperidine alkaloids coniine and coniceine. Coniine is more common in the seed and in mature plants, but coniceine makes up 98% of the total alkaloids in the early vegetative stage. Coniceine is eight times as toxic as coniine. These two principle alkaloids affect the reproductive system and the central nervous system of animals.

All classes of livestock and wildlife are affected by the toxins of poison hemlock. Cattle, goats, and horses are the most susceptible domesticated animals because they are least able to metabolize the toxic agents. Symptoms of poisoning can occur within 30 minutes to 2 hours, depending on the animal, and include nervousness, trembling, muscular weakness, knuckling at the fetlock joints, loss of coordination, dilation of pupils, a weak and slow heartbeat, coma, and eventually death from respiratory paralysis. Poison hemlock can cause fetal deformation if a pregnant animal eats the plant. Toxins can pass into the milk of an animal, affecting the offspring, and

in the case of dairy cattle can affect the safety of milk that humans consume. To reduce livestock exposure to poison hemlock's toxins, prevent grazing when the plant is the only available green forage, such as in early spring.

Habitat and Associated Plants

Poison hemlock grows at low elevations bordering pastures and cropland and gradually invades perennial crops. It occurs where moisture is adequate and disturbance is relatively frequent—for example, stream and ditch banks, riparian woodlands and flood plains. Poison hemlock tends to be more competitive in wet soil conditions but it can survive in dry sites. It is common for the weed to first spread downstream and then move to dryer upland sites.

Seed Germination, Productivity, Longevity, and Dispersal

Poison hemlock reproduces solely by seeds. Seeds often drop next to the parent plant and regenerate, forming dense stands of the invasive plant. The seeds are not well developed for long range dispersal so the plant relies on seed spread primarily by water, birds and rodents.

Since the plant stalk persists through winter, seeds have the potential to disperse from September to late February. This long dispersal period increases the plant's potential for long-term survival. Dispersal over a period of months also allows the seedlings to establish at various times of the year. For example, seeds dispersed in the late fall will establish seedlings in the late winter and seeds dispersed in the late winter will germinate in the spring, the fall or in the following year.

Up to 85 percent of the dispersed seeds germinate as soon as environmental conditions allow. The remaining seeds enter a dormant period. Their dormancy can be broken as soon as light, temperature, and moisture conditions are favorable. Poison hem-

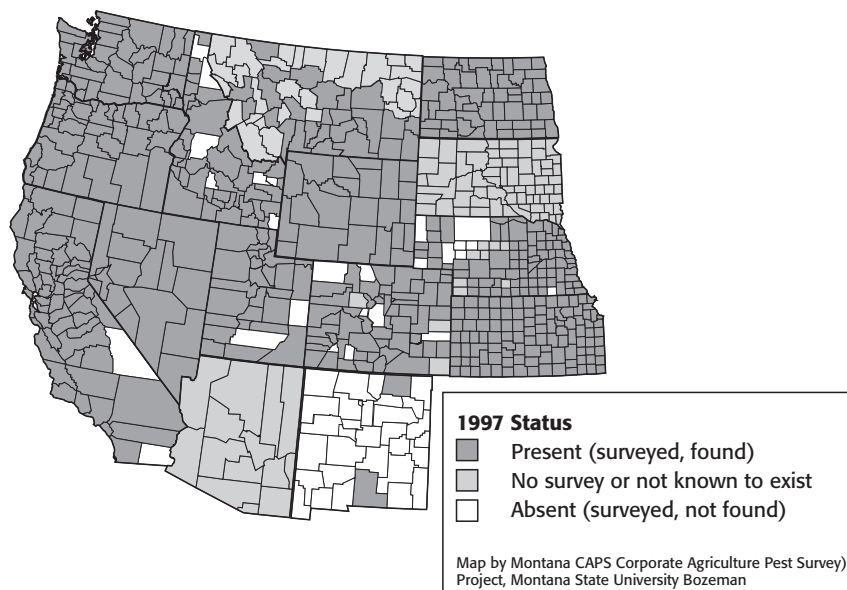


Figure 4: The distribution of poison hemlock by county in the western United States.

lock seeds are relatively short-lived (three years) and a long delay in seed dispersal increases their chance of survival. Seeds can germinate from late summer to early spring when the moisture and temperature conditions are suitable, generally in the cooler periods of the year.

Managing Poison Hemlock

Early Detection, Prevention, Containment and Small-scale Eradication

It is important to prevent the expansion of poison hemlock from small-scale to large-scale infestations. If you discover poison hemlock on your property you should map and monitor areas of current populations and continually scout for newly established plants. To prevent seeds from spreading along the waterway, minimize soil disturbance: Refrain from driving vehicles and machinery through the infested area and limit livestock use in the area. Containment of the weed infestation is an important part of the management. The best way to contain populations of poison hemlock is to spray the borders of the infested area with a herbicide. Containment is a long-term management commitment because it does not eliminate or reduce the infestation level, it simply limits the weed spread. Eradi-

cate new infestations of one to a few plants immediately (preferably before the plant sets seed) by hoeing or spot-applying herbicide.

Biological Control

The European palearctic moth, or hemlock moth (*Agonopterix alstroemeriana* (Clerck)), may offer possibilities for biological control of poison hemlock. Although it is not known how the insect was introduced to the United States, the hemlock moth has become widely disbursed. Its only known host plant in Europe and the United States is poison hemlock.

The hemlock moth larva is light green with a blackish-brown head and adults are grayish-brown. The larvae feed on the poison hemlock foliage, buds, immature seeds, stem tissues and flowers in the spring and early summer. When several hundred larvae attack one plant it may be completely defoliated. The larvae are also thought to prevent seed production. Adult moths emerge in summer and consume some foliage but the larvae are most effective. Collection and redistribution of the adult or larval stage is relatively easy and accomplished by clipping heavily infested foliage and distributing the material among uninfested poison hemlock. The success of hemlock moth in controlling poison hemlock populations varies.

Chemical Control

Several herbicides can be used to control the emergence of poison hemlock sprouts. Tebuthiuron (Spike*20P®) and the sulfonyleurea herbicides, chlorsulfuron (Glean FC®) and a combination of chlorsulfuron and metsulfuron (Escort®), all provide excellent preemergence control. Photosynthetic inhibitors such as hexazinone (Velpar®) (1.5 lb ai/acre), metribuzin (Lexone DF® or Senor 4®) (1.0 lb ai/acre), and terbacil (Sinbar®) (1.0 lb ai/acre) also give excellent preemergence control. If you are spraying these herbicides in crops to control the emergence of hemlock sprouts from seeds, spray when the crop is dormant.

To chemically control poison hemlock after the sprouts have emerged, you can use phenoxy herbicides or glyphosate (Roundup® or Rodeo®). Phenoxy herbicides such as 2,4-D (amine and ester formulations); 2,4-DB and MCPA (all at 1.0 to 2.0 lb ai/acre) are the most effective if sprayed in the early spring after emergence. Combine 2,4-D with a wetting agent for application. In the amine form it can be applied up to the water's edge (without direct contact to the water). The Rodeo formulation of glyphosate can be applied with direct contact to water.

When the plants are in the rosette phase, an application of glyphosate (1.0 lb ai/acre) can provide good control, but cooler temperature can reduce its effectiveness. Escort® with a surfactant at 3/4 oz/acre, sprayed in the early spring or late fall, is also effective, but it is not appropriate within 20 feet of the water

table. Glyphosate (a non-selective herbicide) could also be used if there are no desirable plants growing beneath the weeds, or in a reseeding project, or in spot or non-selective spraying.

Chemical treatment of poison hemlock may require repeated applications to deplete the seed bank. The length between applications depends on the herbicide. Glyphosate and 2,4-D usually require yearly applications. Escort should be applied every 2-4 years. Once poison hemlock is depleted, it is important to implement proper grazing, fertilization, and irrigation management to promote the growth of desired species and to reduce the risk of reinfestation.

Mechanical Control

In croplands, plowing or repeated cultivation will prevent poison hemlock establishment. In other areas, repeated mowings can be used to remove the bolting plant material, reduce its competitive ability, deplete carbohydrate energy reserves in the taproot, and prevent seed production. Burning has not been tried as a method to manage poison hemlock because there is not adequate dry fuel in the spring to burn the plant before it sets seed.

Integrated Weed Management

The effectiveness of integrated management techniques is largely unknown because few integrated programs have been used to manage poison hemlock. However, as is the case in managing most weed infested areas,

integration of techniques such as biological control and herbicide could be beneficial because they attack the plant in more than one site. You may also want to integrate revegetation through broadcast seeding or a no-till drill to increase competitive pressure on poison hemlock and promote desired species. Follow-up monitoring and management should always follow weed management application.

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