

Hallucinogens, Medicines, and Foods, the Double Lives of Poisonous Plants

*Ellen A. Dean, UC Davis Herbarium, Plant Biology,
One Shields Avenue, University of California, Davis, CA 95616*

Many of our worst weeds are plants that have been used by people for centuries. This is true of poisonous plants as well. An excellent example to start with is St. John's Wort or Klamath Weed (*Hypericum perforatum*). This weed, introduced from Europe, once infested millions of acres of rangeland in northern California; the infestation was brought under control by the release of several beetle species, mostly in the genus *Chrysolina* (the Klamath Weed Beetle); this was one of the most successful bio-control campaigns in history (Harris, 1988).

The infestation of St. John's Wort was considered especially problematic, because after ingestion of this plant, range animals (goats, sheep, horses, and cattle) develop photo-sensitization, lose areas of skin, refuse to eat, develop blindness, and may die due to starvation. The poisonous principle that causes photosensitization is hypericin (Fuller and McClintock, 1986). Yet those interested in medicinal plants know that this species has been used as a medicinal plant for centuries and is now a lucrative off-the-counter drug sold in all drugstores for the treatment of mild depression. The chemical agent thought to be involved in this is hyperforin (Barnes, et al. 2001), rather than hypericin as previously thought.

This particular example brings up several important concepts that should be considered when discussing useful poisonous plants:

- **Species Specificity:** Some poisonous plants are only poisonous to particular animal species. One of the most famous in California is yellow star thistle (*Centaurea solstitialis*) which is particularly toxic to horses (Fuller and McClintock, 1986). In the case of St. John's Wort, most reports of poisonings are in range animals, however significant photosensitive reactions do occur in humans (Brockmoller et al., 1997). Therefore, it is important to find out what species are affected by a plant that is labeled as poisonous.
- **Dosage:** Often the difference between a medicine and a poison is dosage level. In the case of St. John's Wort, probably the reason it so poisonous to livestock is because those animals ingest the plants in such large amounts. There are many examples of poisonous plants that are used medicinally in the correct dosage.
- **Preparation:** In addition, many plants that are thought to be toxic can be rendered harmless or medicinal by correct preparation of the plant for ingestion – which is again a matter of dosage. This is not true of commercial preparations of St. John's Wort, otherwise warnings about photo-sensitization wouldn't be posted on the bottles.

A good example of a very poisonous plant that when used in the correct dosage has been used as an effective medicine in both Europe and North America is Larkspur (*Delphinium* spp.).

Fuller and McClintock (1986) state that this poisonous genus probably causes more loss of cattle than any other, and the genus is also considered poisonous to humans (Hill and Fouand, 1986). The toxic compounds consist of several diterpene alkaloids including delphinine, delphineidine, and ajacine, which are found most concentrated in the seeds but are also found in other plant parts (Hill and Fouand, 1986). In high dosage, these compounds cause digestive and muscular system disruption which can lead to death (Fuller and McClintock, 1986). Used in low dosage, however, these same compounds have been used internally to cure stomach ache and intestinal parasites, as well as externally to treat lice. It must be noted, however, that taken internally, the medicine causes vomiting and diarrhea – ie. it is a bit like taking ipecac (Moerman, 1998).

Another good example of a toxic genus that has been used widely for medicine is Milkweed. The genus *Asclepias* has been known to be toxic to grazing animals, chickens, and humans, with symptoms ranging from weakness, staggering, seizures, breathing difficulty, coma, and death. The toxins, which occur throughout the plant, are not well characterized, but include toxic resinoids, cardioactive glycosides, and alkaloids (Fuller and McClintock, 1986; Hill and Fouand, 1986). However, plants in this genus have been taken internally by Native Americans for a variety of medicinal purposes including backache, stomachache, headache, rheumatism, and cough (Moerman, 1998). Many Websites dealing with medicinal herbs discuss the genus, although they warn of the toxic properties and the need for careful preparation.

Just as there is a fine line between medicine and poison, some plants find themselves walking the fine line between hallucinogen and poison. Top among these are Jimson Weed (*Datura* spp.) and the Peyote cactus (*Lophophora williamsii*). In the case of Peyote, the user becomes quite ill prior to reaching a stage where hallucination is possible. In both cases, the toxic but hallucinogenic compounds are alkaloids: scopolamine in Jimson Weed and mescaline in Peyote. Various species of Jimson Weed has been used for centuries in spiritual ceremonies by shamans on both sides of the Pacific; Peyote is a New World hallucinogen (Lewis and Elvin-Lewis, 1977; Heiser, 1969; Schultes and Hofmann, 1992).

Somewhat different in concept are poisonous plants that are used as a food source, although in many cultures, the boundary between medicine and food is very ambiguous. Here, the importance of good preparation is obviously paramount. There are many examples of food plants that fall into this category – some which are important world food crops. A good example is tapioca or cassava (*Manihot esculenta*) which produces a storage root high in starch, but also high in cyanide (O’Hair, 1995). Another well-known food plant that can be toxic is Rhubarb (*Rheum* spp.), which contains high concentrations of oxalic acid, especially in the leaf blades (Fuller and McClintock, 1986). Interesting California native plants that fall into this category include California Buckeye (*Aesculus californica*) and Elderberry (*Sambucus* spp.).

Buckeye is a multi-purpose plant that was used as both a fish-poison and a food by California Indians. All parts of the plant contain the toxic compound Aesculin, a coumarin glycoside; even the nectar is poisonous to honey bees. Symptoms of poisoning (in humans and cattle) include digestive upset, stupor, dilated pupils, abortion, paralysis, and, rarely, death (Fuller and McClintock, 1986). The poisonous nature of the plant was well-known by California

Indians. The large seeds were ground up and the flour carefully leached so that it could be used as a food source; the unleached seed flour was used as a fish poison (Moerman, 1997).

Elderberry is another multi-purpose plant: an important medicine, a source of fruit, and a source of wood for musical instruments. In Fuller and McClintock (1986) the fruits are not listed as toxic, although they warn that eating too many uncooked berries can cause nausea. All other parts of the plant are poisonous, especially the roots; toxins include alkaloids and cyanogenic glycosides. As well as being used for juice and jams, the cooked berry juice is a popular winter cold remedy in Europe (for boosting immune system function) and plant preparations are now sold in this country in both capsule and liquid form (Dean, personal experience). California Indians used an infusion made from the blossoms as a cold remedy, among other medicinal uses (Moerman, 1997).

Finally, I close by relating the the many uses of the multi-purpose weed Black Nightshade (*Solanum nigrum*), a lowly, underappreciated European weed. Most people consider this plant highly toxic and are warned from an early age not to ingest it. I, of course, have a steadily increasing population growing in my front lawn under a shade tree, and I am watching its growth and reproduction with interest. As reported in Fuller and McClintock (1986), all plants in the genus *Solanum*, including potatoes and eggplants, contain the alkaloids solanine and solanidine. These compounds can cause gastric irritation, vomiting, dizziness, coma and death, which is why people are wary of all nightshades, including green potatoes (Lewis and Elvin-Lewis, 1977).

I first became aware of the many uses of black nightshade and its close relative American nightshade, while taking an edible plants course in the Bay Area. The instructor had us eat the fully ripe berries, and it was at that point that I realized that the black berries are not toxic, perhaps just the unripe green berries (Schilling, 1992); in fact the ripe berries of these species are sought out by children in Asian cultures (Schilling, 1992), and they have been traditionally used to make pies and jams (Hedrick, 1972). However, since then, it has come to my attention that many African and Asian cultures also use this plant as a cooked pot-herb or edible green (Corlette et al., 2003; Hedrick, 1972; Schilling, 1992). In addition, Black and American Nightshades are used medicinally in many cultures – taken internally for cancer, urinary tract infections, and hypertension (Schilling, 1992; Dean, unpublished) and used externally for skin complaints (Esquivel & Zolla, 1986; Badruzzaman et al., 1989).

As you can see from the above examples, the same plant can be considered a poison and a medicine, a poison and a hallucinogen, or a poison and a food. In cultures other than our own, the boundaries between these categories are often hazy and dosage may determine the toxicity of a plant.

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