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Purposeful Use Of Poisonous Plants

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Words like “poisonous” and “toxic” tend to conjure up negative images of illness, pain, and death. In humans the encounters with poisonous plants often involve mistaken identity or lack of knowledge about the plant’s capability. But a more comprehensive look at our interaction with poisonous plants must take into account that we have knowingly used them as instruments of punishment, torture, murder, and suicide. We have also used our knowledge of plant toxins to make arrow poisons and to kill fish, insects, and rodents. Probably the least known and most mysterious is our use of these plants by various societies in ordeal rituals that determine guilt. All of these are the subject of this paper.

On the much more positive side of the ledger, many of our best known medicines come from plants where we take advantage of their toxic effects to achieve the desired effects in controlled situations. Many people are alive today because of the glycosides in the foxglove plant and their effect on the contraction of the heart.

ARROW & DART POISONS

"We did not escape without damage because [the Indians] killed another companion of ours ... and in truth, the arrow did not penetrate half a finger, but as it had poison on it, he gave up his soul to our Lord."(Francisco de Orellana, 1541)

Peoples of both the Old World and the New World have used many different plants in the preparation of these poisons. Native Americans on this continent used relatively few arrow poisons from plant sources, relying instead on rattlesnake venom and the juices of the black widow spider. The Indians of South America and the tribesmen of Africa used arrow poisons both to hunt wild game and in wars against their enemies.

CURARE. This is probably the most famous arrow poison. The name is a phonetic rendering of an Indian phrase meaning, "He, to whom it comes, falls." Other spellings used in the literature are urari, woorari, woorali, and wourali. Curare is the name for a whole group of arrow poisons used in South America. The fact that the ingredients and their relative proportions vary from one location to the next hindered any real understanding of the botanical and chemical nature of the poison.

The Baron Alexander von Humboldt was probably the first European to witness the preparation of curare. He wrote that the Indians shredded bark of certain trees and made an infusion from it. This was further concentrated by boiling it. Several other plant materials were added to the mixture.

The Indians have several different ways of assaying the strength of curare. One is to wound a frog with a poisoned arrow or dart. If it can jump more than eight times without the curare taking effect, then the potion is deemed too weak. Another test involves a monkey jumping from tree to tree. When the curare is at its proper strength, an animal should not be able to jump to more than one tree before the toxin takes effect. And, a final test is that since the honor of preparing curare often falls to the old women of the tribe, if they are not half intoxicated by the fumes of the boiling mixture, the brew is not yet ready.

The exact botanical nature of curare is still in some doubt. The two principal toxic ingredients are *Strychnos* spp. (often *S. toxifera*) of *Loganiaceae* and *Chondrodendron tomentosum* of the moonseed family (*Menispermaceae*).

Three basic groups or kinds of curare are often recognized, based upon the physical form in which they are prepared. **Tubocurare,** also known as tube curare or bamboo curare, is cylindrical, having been packed in hollow bamboo stems. The two other kinds are **gourd** or calabash curare and **pot** curare. *Chondrodendron* is the principal ingredient in tube curare; it is also used in pot curare. *Strychnos* is used in both calabash and pot curare.

The active ingredient is d-tubocurarine chloride or tubocurarine chloride, a whitish, odorless powder. Poisoning manifests itself in muscular relaxation by blocking of impulses between the nerve and the muscle fiber activated by it. Symptoms include impaired vision; bilateral drooping of lips; heaviness of face; relaxation of

jaw; weakness of head muscles; inability to raise head; paralysis of spinal muscles, legs, & arms; slowed respiration; and death. Curare is rapidly destroyed and excreted. Its action usually lasts for about 15-20 minutes, during which the victim dies. The flesh of animals killed by curare may be eaten.

There are also medicinal uses for curare. Because it is a muscle relaxant, it may be used in the treatment of convulsive mental patients and in certain types of surgery. Curare is also used to diagnose myasthenia gravis, a muscular disorder characterized by an overall deterioration of muscle tone.

KOMBI. The action of this African arrow poison was first described in detail by Dr. David Livingstone, the missionary to Africa of "Dr. Livingstone, I presume" fame. He observed people preparing a poison from the fruits of *Strophanthus*, a member of Apocynaceae, the dogbane family. The action of kombi is much like that of curare. The wounded animal rarely runs more than about a hundred yards before it falls. Kombi contains strophanthin, a glycoside with digitalis-like effects. It must get into the blood stream, which means that the flesh of kombi victims is edible.

Strophanthin also finds limited uses in medicine. It is used on heart attack victims when time is of the utmost importance. It takes effect much faster than digitalis, but it is such a violent poison that the dosages must be carefully controlled.

UPAS. This is an arrow poison used by the natives of Java. The chief ingredient is *Antiaris toxicaria* of Moraceae, the mulberry family.

OUABAIN. The natives of tropical Africa prepare an arrow poison from *Strophanthus gratus*. A somewhat inferior brand can be made from *Acokanthera schimperi* and *A. deflexa*. Ouabain is the most rapidly acting heart-glycoside known.

NEW WORLD ARROW & DART POISONS

Scientific Name (Family)	Area of Use
Aconitum spp. • Buttercup	North America
Anemone spp. • Buttercup	North America
Anomospermum spp. Moonseed	South America
Capsicum annuum • Nightshade	South America
Cocculus spp. • Moonseed	South America
Colliguaja odorifera • Spurge	South America
Chondrodendron spp. • Moonseed	South America
Conium maculatum • Parsley	North America
Cynanchum macrophyllum • Milkweed	North America
Delphinium elatum • Buttercup	North America
Dieffenbachia seguine • Philodendron	Cuba
Dioscorea spp. • Yam	West Indies
Ficus atrox • Mulberry	South America
Gautteria venificiorum • Annona	South America
Hippomane mancinella • Spurge	West Indies
Hura crepitans • Spurge	Central & South America
Jacquinia spp. • Theophrasta	Central & South America
Nicotiana spp. • Nightshade	Central & South America
Papaver nudicaule • Poppy	North America
Pedilanthus tithymaloides • Spurge	West Indies
Piper geniculatum • Pepper	South America
Piscidia piscipula • Bean	North America
Ranunculus spp. • Buttercup	North America
Sapium biloculare • Spurge	Mexico
Sebastiana palmeri • Spurge	Mexico
Serjania spp. • Soapberry	West Indies
Spigelia fruticulosa • Logania	South America
Strychnos spp. • Logania	South America
Tabernaemontana spp. • Dogbane	South America
Yucca glauca • Lily	North America

FISH POISONS

Many different plants have been used to poison, or more precisely, to stupefy fish. The technique is reasonable straightforward. It typically involves putting the required part of a particular plant in a still body of water. The plant toxin is released into the water, numbing the fish so that it comes floating to the surface, where they can be gathered up.

The California buckeye (*Aesculus californica*) was used by several tribes of Native Americans. Seeds,

sometimes leaves or young stems, were crushed and made into a mash that was floated on the surface of the water. The stupefied fish were then gathered by hand or in nets.

The fish poison tree (*Piscidia piscipula*) of the bean family occurs in Texas, Florida, Mexico, the West Indies, and South America. Its leaves, stems, and root bark are macerated with a rum distillation residue or lime water. The material is then placed in baskets and floated in the water until the stupefied fish surface. The plant contains piscidin, a mixture of two toxic glycosides.

Scientific Name • Common Name	Where Used
Aesculus californica • California buckeye	California
Chlorogalum pomeridianum • soaproot	California
Clibadium spp. • Cunambi	Amazon
Conium maculatum • wasia	Mexico
Croton setigerus • turkey mullein	California
Derris elliptica • tuba-root	Asia
Echinocystis fabacea • manroot	California
Erythrina piscipula	South America
Hura crepitans • oassucú	South America
Lomatium dissectum	California
Lonchocarpus spp. • barbasco	Tropical America
Lycopus spp. • horehound	California
Manihot esculenta • cassava	Guiana
Patinoa sphaerocarpa	Amazon
Paullinia spp. • timbó	South America
Phyllanthus spp.	South America
Sapindus saponarius • amolli	Mexico
Serjania spp. • timbó	South America
Smilacina sessilifolia • Solomon seal	California
Tephrosia piscatoria	South America
Thevetia peruviana • jorro-jorro	Brazil
Trichstema lanceolatum • blue curls	California
Umbellularia californica • pepperwood	California
Wikstroemia spp.	Hawai'i

INSECTICIDES

In addition to the more exotic arrow and ordeal poisons, the plant kingdom yields useful poisons for the control of insects. About 1200 different species have been used in this context, although only rotenone, pyrethrum, and nicotine are of any real commercial value. One of these, rotenone, was used for centuries as a fish poison in South America before its use as an insecticide.

Rotenone is a very popular insecticide derived from the roots of *Derris* and *Lonchocarpus*, both members of the bean family. The former is native to the Old World tropics, while the latter is New World in its distribution. Rotenone was first isolated from *Derris* in 1902. It is a colorless, crystalline compound extracted from the dried roots. Rotenone is insoluble in water, but soluble in oil. It is about fifteen times more toxic than nicotine. The toxic principle has no effect on warm blooded animals. Rotenone was isolated from the roots of *Lonchocarpus* in 1926. Its roots are richer in the toxin than those of *Derris*.

Pyrethrum is the name given to the dried flower heads of three species of *Chrysanthemum*. They yield volatile oils that paralyze insects. This came as no surprise to horticulturists who knew that these plants were rarely attacked by insects. Depending upon the species, the pyrethrum is often called "Dalmatian insect powder," "Caucasian insect powder," or "Persian insect powder." Pyrethrum has been used successfully in the control of flies, fleas, malarial mosquitos, and body lice.

Scientific Name • Common Name	Comment
Anabasis ioaphylla	Used in Near East
Annona cherimola • cherimoya	Used against lice
Chrysanthemum cinerariifolium	Pyrethrum
Croton texensis • croton	Used in New Mexico
Cymbopogon nardus • lemon grass	Citronella oil
Delphinium spp. • larkspur	Seeds used
Derris spp. • tuba-root	Root source of rotenone
Dolichos pseudopachyrrhizus • hyacinth bean	Tropical Africa
Duboisia hopwoodii	Leaves contain nornicotine
Eupatorium spp. • boneset	Eastern N. America
Gardenia lucida	Used in Asia to ward off flies
Ipomoea quamoclit • morning glory	Seeds used
Liquidambar styraciflua • sweet gum	Fumigant
Lonchocarpus spp. • barbasco	Source of rotenone

Macuna spp. • velvet bean	Seeds contain L-dopa
Melia azedarach • China berry	Used against flies
Nicotiana spp. • tobacco	Leaf dustings used
Pinus palustris • long-leaved pine	Pine oil used
Ruta graveolens • rue	Leaves contain volatile oil
Schoenocaulon officinale • sabadilla	Seeds used
Sesamum indicum • sesame	Used with pyrethrum
Tanacetum vulgare • tansy	Used on fleas and lice
Xanthoxylum clava-herculis • prickly-ash	Bark

RODENTICIDES

These plant toxins are used in poison baits, primarily to kill rats. Therefore, they are sometimes called **raticides**. They are effective in small quantities, and appear to taste just fine.

Squill or **sea-onion** • *Drimia maritima* is a Mediterranean member of the lily family. Since ancient times, its bulbs and extracts of the bulbs have been used to kill rodents. If you or I eat this material, it will make us sick and we will vomit, thereby ridding the system of the toxin. Rodents, on the other hand, have no "vomit control center" in their brains so that any plant parts consumed will remain in the stomach and be absorbed. The sea-onion contains a series of toxins that affect the heart. They are called cardiac glycosides and they are chemically similar to those found in the foxglove plants. The sea-onion toxins, given by injection in moderation, have medicinal uses as diuretics, emetics, and expectorants.

Sweet clover. One of the most pleasant smells of rural areas is freshly mown pastures. Part of that nice aroma comes from sweet clovers • *Melilotus* spp., herbs of the legume family. These plants also produce a form of **coumarin**, which inhibits blood clotting. Given in controlled quantities, coumarins are effective as blood thinners. Some years ago, the Wisconsin Alumni Research Foundation discovered that a modified form of coumarin made a very effective rat poison. They named it **warfarin** – after themselves. The poor little rats go off someplace and die from internal hemorrhaging.

Scientific Name (Common Name)	**Comment**
Coriaria thymifolia (shanshi)	Americas & Pacific Islands; psychoactive
Dieffenbachia seguine (dumb cane)	Also a popular, but toxic ornamental
Drimia maritima (red squiii, sea-onion)	native to Old World
Gliricidia sepium (quick stick)	Shade crop for coffee; also insecticide
Helleborus niger (black-hellebore, Christmas-rose)	Also a powerful purgative
Persea americana (avocado, alligator-pear)	Also toxic to house pets
Spondianthus preussii	Also a fish poison and in executions
Veratrum album (white-hellebore)	Native to Europe & Asia

ORDEAL POISONS

The lives of many peoples through the ages have been dominated by a complex pantheon of deities, both good and evil. In many societies, one very important obligation was to placate friendly gods and not to encourage the evil ones. These were not societies that were protected by a single omnipotent god who rewarded good deeds and punished the wicked. In many tribes, the people developed procedures for determining guilt and innocence. This was a trial or an ordeal to which suspects were subjected. If innocent, the person would be able to pass the ordeal; but, if guilty, he or she would fail.

We have used similar devices in the United States and Europe. Consider the witch trials of the 17th century. A woman suspected of being a witch was bound, placed in a bag, and tossed in a lake. If she floated, it was concluded that she was indeed a witch and she was dispatched in some novel fashion. If the woman sank to the bottom of the lake and drowned, her survivors had the consolation of knowing that she was innocent.

Many of the African tribes employed plant poisons in their own version of the ordeal. No one really knows how the use of ordeal poisons began. One plausible explanation is that food gatherers mistakenly picked a toxic plant, assuming it to be edible. The people of the village ate it; some were poisoned and died, while others lived. Given the philosophical and religious climate, a possible explanation that would come to mind is that those who ate the plant and died were somehow connected with witchcraft or were guilty of some evil and were being punished.

There are several different ways in which the ordeal poisons were employed. One of the most straightforward involves a plant called the **tanghin of Madagascar** • *Cerbera* spp. All parts of this tree are toxic, the fruits especially so. The toxin is a cardiac glycoside. The person undergoing the ordeal is given a drink of rice water or rice soup. He or she is then given three pieces of chicken skin to swallow without chewing, followed by the crushed tanghin fruits mixed with banana juice and a preparation of cardamom leaves or juice. Incantations are performed. The concoction acts as an emetic, a substance that will cause vomiting. Failure to do so is an immediate sign of guilt. The vomitus is carefully examined by tribal officials to see if all three pieces of chicken

skin are present. They must be if the suspect is to be judged innocent. If not, the other members of the tribe kill the person, knowing now that he or she is guilty. The significance of the chicken skin lies in the belief that an evil spirit inhabits the body of a guilty person and that it would devour any flesh presented to it, including chicken skin. Before considering this to be a quaint custom, consider that in 1830 a series of natural disasters and diseases swept Madagascar. This prompted mass ordeal trials to determine who was causing these calamities. As many as 6000 people died in one trial!

Probably the most famous of the ordeal poisons involves the **Calabar bean** • *Physostigma venenosum*, a vine of the legume family named after a town in Nigeria. It has a long history of use in Africa as a means of identifying and killing witches. The trial consisted of the accused drinking water that contained eight smashed Calabar beans. If the person regurgitated the beans or raised his right arm and survived, then he was judged innocent. The fast-acting toxin, **physostigmine**, rarely produced that result.

In recent years this plant has been the object of medical research. This same toxin is now used to treat glaucoma, chronic constipation, and aspects of Alzheimer's disease.

The "**Mauvi tree**" of East Africa is used by the natives of the Lake Nyassa region. The bark is mixed with other substances and given to the suspects. If you are guilty, you will vomit and die. There is a certain simplicity to it. The body of the guilty party is spirited away by relatives who will cremate the remains, grind up the bones, and put the powder on their faces.

In some instances, the suspects at an ordeal will be asked to perform some task. Inability to do so is taken as a sign of guilt. In one tribe, the medicine man draws a line on the ground about ten feet in front of the suspects. If you can walk across the line, you are innocent. In another tribe, the suspect is asked to jump over a stick held about 50 cm above the ground. One tribe that occupied what used to be called the Ivory Coast in Africa used the white latex from a member of the spurge family. A latex-soaked piece of cotton was placed under the eyelid and allowed to remain there for a required period. Damage to the cornea was taken as evidence of guilt.

Many of the ordeal poisons were simple preparations involving a toxic plant and one or two other ingredients. Some were complex preparation of a plant poison, lizards, crushed snakes, toads, hearts from previous victims, miscellaneous human organs, blood, and bile. The various ingredients were then fermented for one year to bring them up to proper strength.

The belief in the accuracy of the ordeal poisons was so powerful that perfectly innocent people who were subjected to the ritual would confess to the most horrible crimes if they felt the toxin taking effect. As with so many useful social institutions, corruption soon tainted the ordeal rituals. The priests and witch doctors found that they could guarantee the outcome of an ordeal by careful preparation of the poisons. Their friends received weak doses; their enemies seldom survived. The witch doctor would make a conspicuous display of drinking a weak dose of the ordeal poison before a large crowd to strengthen his position in the community and to show that the innocent had nothing to fear.

PLANTS USED IN ORDEAL RITUALS

Common/scientific Name	**Where Used?**
African pearwood • *Mimusops djave*	Africa
Bushman's poison • *Akokanthera venetata*	Africa
Calabar bean • *Physostigma venenosum*	Africa
Combretum confertum	Africa
Desert-rose • *Adenium obesum*	Africa/Arabia
Sassy bark • *Erythrophleum suaveolens*	Old World tropics
Strychnos icaja	Africa
Strychnos kipapa	Africa
Tallow tree • *Detarium senegalense*	Africa
Tanghin of Madagascar • *Cerbera vinenifera*	Indian/Pacific coasts
Violet-tree • *Securidaca longipedunculata*	Tropical Africa

PLANTS USED IN EXECUTIONS

Common/scientific Name	**Where Used?**
Allspice jasmine • *Gelsemium elegans*	Indomalaysia
Bejuco de agua • *Rourea glabra*	C. & S. America
Hemlock water-dropwort • *Oenanthe crocata*	Europe
Mexican shrubby-spurge • *Euphorbia cotinifolia*	C. & S. America
Monk's hood • *Aconitum napellus*	Europe
Muavi tree • *Parkia bussei*	Africa
Oleander • *Nerium oleander*	Mediterranean
Pink root • *Spigelia anthelmia*	Old World tropics
Poison hemlock • *Conium maculatum*	Greece

Rat's bane • *Dichapetalum toxicaria*	Africa
Sago palm • *Metroxylon sagu*	Malaysia
Timbo • *Paullinia pinnata*	Mexico & C. America
Yellow heads • *Gnidia krausiana*	Africa

PLANTS USED TO COMMIT SUICIDE

Common/scientific Name	**Where Used?**
Kaffir-onion • *Boöphane disticha*	Africa
Tanghin of Madagascar • *Cerbera manghas*	Indian/Pacific coasts
Allspice jasmine • *Gelsemium elegans*	Indomalaysia
Glory-lily • *Gloriosa superba*	India
Jequirity or rosary bean • *Abrus precatorius*	
Mountain-laurel • *Kalmia latifolia*	E. North America
Phyllanthus engleri	Africa
Catchbird tree • *Pisonia brunoniana*	Tropical Asia/Oceania

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ORDEAL POISONS

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