

# PHARMACOGNOSY

## Hallucinogens, Narcotics and Common Poisonous Plants

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## **Hallucinogens**

**Introduction:** Hallucinogens are natural and synthetic (synthesized) substances that, when ingested (taken into the body), significantly alter one's state of consciousness. Hallucinogenic compounds often cause people to see (or think they see) random colors, patterns, events, and objects that do not exist. People sometimes have a different perception of time and space, hold imaginary conversations, believe they hear music and experience smells, tastes, and other sensations that are not real. The other names of hallucinogens are Cartoon acid, Microdot, California sunshine, Psilocybin, Magic mushrooms.

Many types of substances are classified as hallucinogens, solely because of their capacity to produce such hallucinations. These substances are sometimes called "psychedelic," or "mind-expanding" drugs. They are generally illegal to use in the United States, but are sometimes sold on the street by drug dealers. A few hallucinogens have been used in medicine to treat certain disorders, but they must be given under controlled circumstances. Hallucinogens found in plants and mushrooms were used by humans for many centuries in spiritual practice worldwide. Unlike such drugs as barbiturates and amphetamines (which depress or speed up the central nervous system, respectively) hallucinogens are not physically addictive (habit-forming). The real danger of hallucinogens is not their toxicity (poison level), but their unpredictability. The actual causes of such hallucinations are chemical substances in the plants. These substances are true narcotics. Contrary to popular opinion, not all narcotics are dangerous and addictive. A narcotic is any substance that has a depressive effect, whether slight or great, on the central nervous system. People have had such varied reactions to these substances, especially to LSD (lysergic acid diethylamide), that it is virtually impossible to predict the effect of a hallucinogen will have on any given individual. Effects depend upon the person's mood, surroundings, personality, and expectations while taking the drug.

Natural hallucinogens are formed in dozens of psychoactive plants, including the peyote cactus, various species of mushrooms, and the bark and seeds of several trees and plants. Marijuana and hashish, two substances derived from the hemp plant (*Cannabis sativa*), are also considered natural hallucinogens, although their potency (power) is very low when compared to others. Marijuana (also called grass, pot, tea, weed, or reefer), a green herb from the flower of the hemp plant, is considered a mild hallucinogen. Hashish is marijuana in a more potent, concentrated form. Both drugs are usually smoked. Their effects include a feeling of relaxation, faster heart rate, the sensation that time is passing more slowly, and a greater sense of hearing, taste, touch, and smell.

A form of LSD was first produced in 1938, when Albert Hoffman, a Swiss research chemist at Sandoz Laboratories, synthesized many important ergot alkaloids (organic plant bases), including Hydergine, LSD-25, and psilocybin. The physical effects of hallucinogens are considered small compared to their effects on the mind. Death from an overdose of hallucinogens is highly unlikely, but deaths have resulted from accidents or suicides involving people under the influence of LSD. LSD is so powerful that a tiny amount can have a hallucinogenic effect.

**Medical Uses of Hallucinogens:** Hallucinogens have been studied for possible medical uses, including the treatment of some forms of mental illness, alcoholism, and addiction to the drug opium. They have also been given to dying patients. Most of these uses have been abandoned, however. A synthetic form of the active chemical in marijuana, Tetra Hydro cannabinol (THC), has been approved for prescription use by cancer patients who suffer from severe nausea after receiving chemotherapy (treating cancer with drugs). THC is also used to reduce eye pressure in treating severe cases of glaucoma. PCP is occasionally used by veterinarians as an anaesthetic and sedative for animals.

Hallucinogenic plants have played an important role in many developing cultures of the world, including our own. They have been used in healing, as entheogens, and as religious sacraments, as well as having recreational utility. It is only a recent development that use of all hallucinogens has become frowned upon. A vast amount of resources has been put into controlling common psychoactive substances (Marijuana, LSD, PCP, etc.), which may be turning curious experimenters back towards the use of plants and other unregulated substances as a means of getting "high". There are many different species of hallucinogenic plants. Much information is available on many of them, yet some are less studied than others. This is a brief overview of several plant hallucinogens. They are as follows: Belladonna (*Atropa belladonna*), Betel Nut (*Areca catechu*), The Brooms (misc. sp.), Cabeza de Angel (*Calliandra anomala*), Calamus (*Acorus calamus*), California Poppy (*Eschscholzia californica*), Catnip (*Nepeta cataria*), Chicalote; Prickly Poppy (*Argemone mexicana*), Coleus (*Coleus* sp.), Colorines (*Erythrina flabelliformis*), Damiana (*Turnera diffusa*), Daturas (*Datura* sp.), Doñana (*Coryphantha macromeris*), Fennel (*Foeniculum vulgare*), Hawaiian Baby Woodrose (*Argyrea nervosa*), Hawaiian Woodrose (*Merremia tuberosa*), Heliotrope (*Valeriana officinalis*), Henbane (*Hyoscyamus niger*), Hops (*Humulus lupulus*), Hydrangea (*Hydrangea paniculata*), Iochroma (*Iochroma* sp.), Kava Kava (*Piper methysticum*), Khat (*Catha edulis*), Lion's Tail (*Leonotis leonurus*), Lobelia (*Lobelia inflata*), Madagascar Periwinkle (*Catharanthus rosea*), Mandrake (*Mandragora officinarum*), Maraba (*Kaempferia galanga*), Maté (*Ilex paraguayensis*), Mescal Beans (*Sophora secundiflora*), Mormon Tea (*Ephedra nevadensis*), Morning Glory (*Ipomoea* sp.), Nutmeg (*Myristica fragrans*), Ololuique (*Rivea corymbosa*), Passionflower (*Passiflora incarnata*), Pipiltzintzintli (*Salvia divinorum*), Psilocybe Mushrooms (misc. sp.), Rhynchosia (*Rhynchosia phaseoloides*), San Pedro (*Trichocereus pachanoi*), Sassafras (*Sassafras albidum*), Shansi (*Coriaria thymifolia*), Silvervine (*Actinidia polygama*), Sinicuichi (*Heimia* sp.), So'ksi (*Mirabilis multiflora*), Syrian Rue (*Peganum harmala*), Tobacco (*Nicotiana tobaccum*), Wild Lettuce (*Lactuca virosa*), Wormwood (*Artemisia absinthium*).

### **Examples of Plant Hallucinogens**

#### **1. Belladonna:** *Atropa belladonna* L.; Nightshade family (Solanaceae)

A perennial branching herb growing to 5 feet tall, with 8 inch long ovate leaves. The leaves in first-year plants are larger than those of older plants. The flowers are bell-shaped, blue-purple or dull red, followed by a shiny, black or purple 0.5 inch berry. The plant is native of Europe and Asia.

**Constituents:** Atropine, Hyoscyamine, Atropamine, Belladonnine, Hyoscine.

**Medicinal Uses:** Belladonna can be fatal to most carnivorous animals and humans, but the same doses have very little effect upon most birds and plant eating animals. Children are often poisoned by the berries, mistaking them for cherries or other sweet fruit.

In large doses, belladonna acts upon the cerebrospinal system, as showing such symptoms as dilatation of the pupils (mydriasis), presbyopia, obscurity of vision, blindness (amaurosis), visual illusions (phantasms), suffused eyes, occasionally disturbance of hearing (as ringing in the ears, etc.), numbness of the face, confusion of head, giddiness, and delirium. Belladonna has been, and is being used as a recreational drug, diuretic, sedative, antispasmodic, and mydriatic. It is used very successfully to treat eye diseases, because of its effect of dilating the pupil. Atropine, an extract of belladonna is what an eye doctor uses when they put liquid in your eye before testing you for glasses. Atropine has also been used as an antidote to opium, calabar bean, and chloroform poisoning.

### **2. Betel Nut:** *Areca catechu* L.; Palm family (Palmaceae)

A very slender, graceful palm growing up to 100 feet tall but with a trunk only 6 inches in diameter. This is topped by a crown of three 6-foot-long leaves that are divided into many leaflets. The fruits are the size and shape of a hen's egg and are yellowish to scarlet with a fibrous covering. It is native to Malaysia.

**Constituents:** Betel nut contains **arecaine** and **arecoline alkaloids** which are comparable to **nicotine** in its stimulating, mildly intoxicating and appetite-suppressing effects on the mind. It also contains the alkaloids **arecaidine**, **arecolidine**, **guracine** (guacine) and **guvacoline**.

**Medicinal Uses:** Stimulant, Stroke recovery, Schizophrenia, Anemia, Dental cavities, Ulcerative colitis, Saliva stimulant. It also use as Alcoholism, Aphrodisiac, Appetite stimulant, Asthma, Cough, Digestive aid, Diphtheria and as Diuretic.

The findings of a prior study indicating a therapeutic relationship between consumption of betel nut and symptoms of schizophrenia were tested. These findings have clinical significance in betel-chewing regions and broader implications for theory of muscarnic neurophysiology in schizophrenia.

### **3. Brooms:** Bean family (Leguminosae)

There is some confusion as to which is the most potent of the three species of brooms used for their psychotropic effects. According to the paper first reporting the discovery of the effects of these plants, the blossoms of Canary Island broom were the "most pleasant and effective" of the three. This is also the species used by Yaqui shamans. Canary Island Broom is native to the Canary Islands, Scotch Broom is native to central and southern Europe and Spanish Broom is native to the Mediterranean region.

**Constituents:** Quinolizidine alkaloids (particularly sparteine and lupanine), phenethylamines, isoflavones, flavonoids, a volatile oil, caffeic acid, p-coumaric acids, tannins and pigments.

**Medicinal Uses:** They can be used fresh or dried and are cardiotoxic, cathartic, diuretic, emetic and purgative.

Two strains named ESC1 (T) and ESC5 were isolated from nodules of *Cytisus scoparius* growing in a Spanish soil. Phylogenetic analysis of the 16S rRNA gene showed that these strains belong to the genus *Ochrobactrum*, their closest relatives being *Ochrobactrum anthropi* and *Ochrobactrum lupini*, with 100 and 99.9 % similarity to the respective type strains. The study was aimed to investigate the antioxidant activity of *Cytisus scoparius* on CCl<sub>4</sub> treated oxidative stress in Wistar albino rats. It was observed that *Cytisus scoparius* extract protects liver from

oxidative stress induced by CCl<sub>4</sub> in rats and thus helps in evaluation of the traditional claim on this plant.

**4. Cabeza De Angel:** *Calliandra anomala* (Kunth) Macbride; Bean family (Leguminosae)

This plant is tall and evergreen shrub. Leaves are bipinnate, rachis covered with dense brown hairs. Pinnae 15 pairs or more; leaflets 30-60 pairs, densely crowded and oblong. Pods are 7.5-10 cm long and 1.2-1.8 cm wide, densely villous with red hairs.

**Constituents:** Mainly contains triterpenoidal saponins. Three triterpenoidal saponins were identified by FAB-MS spectrum viz. calliandra saponin M, N and O. Six triterpenoids like calliandra saponins G(1), H(2), I (3), J(4), K(5) and L(6), were isolated from the branches of *Calliandra anomala*.

**Medicinal Uses:** Formerly it was used by Aztecs. Cut the bark and collect resin for several days, dry, pulverize, mix with ash and used as snuff. It acts as Hypnotic, often induces sleep.

**5. Calamus:** *Acorus calamus* L.; Arum family (Araceae)

A vigorous perennial herb growing up to 6 feet tall composed of much long, slender, grass like leaves up to 0.75 inch wide rising from a horizontal rootstock. The flowers are minute and greenish-yellow in color, occurring on a 4 inch long spike resembling a finger. The fruit is berrylike. It is native to eastern North America, Europe and Asia.

**Constituents:** Both triploid and tetraploid calamus contain asarone. Monoterpene hydrocarbons, sequestrene, ketones, (trans- or Alpha) Asarone (2,4,5-trimethoxy-1-propenylbenzene), and Beta-asarone (cis- isomer) contained in the roots essential oils.

**Medicinal Uses:** It is use as an analgesic for the relief of toothache or headache, for oral hygiene to cleanse and disinfect the teeth, to fight the effects of exhaustion or fatigue, and to help cure/prevent a hangover. Also uses as it to treat a cough, made a decoction as a carminative and as an infusion for cholera.

The ethyl acetate fraction of the *Acorus calamus* extract (ACE) was found to enhance adipocyte differentiation as did rosiglitazone. The results of further fractionation of ACE indicated that the active fraction does not consist of beta-asarone, which is a toxic component of this plant. This finding suggests that ACE has potential insulin-sensitizing activity like rosiglitazone, and may improve type 2 diabetes. The *In vitro* acetylcholinesterase (AChE) inhibitory potential of the hydroalcoholic extract and of the essential oil from *Acorus calamus* (AC) rhizomes and that of its major constituents were evaluated based on the Ellman's method.

**6. Catnip:** *Nepeta cataria* L.; Mint family (Labiatae)

A hardy, upright, perennial herb with sturdy stems bearing hairy, heart-shaped, grayish-green leaves. The flowers are white or lilac, 0.25 inch long, and occur in several clusters toward the tips of the branches. Native of Eurasia, naturalized in North America.

**Constituents:** Daucosterol (beta-sitosterol 3-O-beta-D-glucoside) was isolated from the plant, in addition to small amounts of beta-sitosterol, campesterol, alpha-amyrin and beta-amyrin was also isolated.

**Medicinal Uses:** It is use as a household herbal remedy, being employed especially in treating disorders of the digestive system and, as it stimulates sweating, it is useful in reducing fevers. The herbs pleasant taste and gentle action makes it suitable for treating colds, flu and fevers in children. It is more effective when used in conjunction with elder flower (*Sambucus nigra*). The

leaves and flowering tops are strongly antispasmodic, antitussive, astringent, carminative, diaphoretic, slightly emmenagogue, refrigerant, sedative, slightly stimulant, stomachic and tonic.

#### **7. Chicalote; Prickly Poppy:** *Argemone mexicana* L.; Poppy family (Papaveraceae)

An annual herb 1 to 3 feet high with prickly stems, leaves and capsules. The flowers are yellow or orange, up to 2.5 inches across, and followed by an oblong seed capsule. The leaves are white-veined and 4 to 6 inches long. It is native to tropical America.

**Constituents:** The plant contains alkaloids as berberine, protopine, sarguinarine, optisine, chelerytherine etc. The seed oil contains myristic, palmitic, oleic, linoleic acids etc.

**Medicinal Uses:** The whole plant is analgesic, antispasmodic, possibly hallucinogenic and sedative. The fresh yellow, milky, acrid sap contains protein-dissolving substances and has been used in the treatment of warts, cold sores, cutaneous affections, skin diseases, itches etc. It has also been used to treat cataracts.

The sensitivity of two Gram positive (*Staphylococcus aureus* and *Bacillus subtilis*) and two Gram negative (*Escherichia coli* and *Pseudomonas aeruginosa*) pathogenic multi-drug resistant bacteria was tested against the crude extracts (cold aqueous, hot aqueous, and methanol extracts) of leaves and seeds of *Argemone mexicana* L. (Papaveraceae) by agar well diffusion method. Though all the extracts were found effective, yet the methanol extract showed maximum inhibition against the test microorganisms followed by hot aqueous extract and cold aqueous extract.

#### **8. Coleus:** Mint family (Labiatae)

Two species of *Coleus* are used as hallucinogens; both are cultivated in the U. S. They are: *Coleus blumei* Benth. This is the common cultivated coleus. It is a tender perennial herb usually not exceeding 3 feet in height. The leaves are ovate, pointed, 4 inches or more long, edged with rounded teeth. They are mottled with red, green, yellow and purple. The flowers are dark blue or whitish, in a terminal spike. It is native to Java.

*C. pumilus*. It is a low herb with lax stems which lie on the ground and root at the lower joints, or hang over the sides of the pot. The leaves are smaller than those of *C. blumei*, usually not exceeding 2 inches long. The flowers are in long racemes. This plant is native to the Philippines.

**Constituents:** Forskolin, a chemical found in coleus, activates the enzyme adenylate cyclase.

**Medicinal uses:** It is used in Ayurvedic medicine to treat heart and lung diseases, intestinal spasms, insomnia and convulsions. Forskolin is used to dilate the blood vessels and decrease the lung spasms in asthmatics.

#### **9. Colorines:** *Erythrina flabelliformis* Kearny; Bean family (Leguminosae)

A shrub or small tree growing up to 10 feet high with spiny branches and leaves composed of fan-shaped leaflets. The flowers are bright scarlet, in short crowded racemes. The pods are up to 1 foot long, containing bright scarlet oval seeds. It is native to southern Arizona, New Mexico, and Mexico.

**Constituents:** The first compounds isolated from *Erythrina* were alkaloids i.e. b –Erythroidine. Homoerythrina alkaloids were also isolated.

**Medicinal Uses:** *Erythrina* has been used in folk medicine for treatment of insomnia, malaria fever, venereal disease, asthma and toothache. South American Indians used *Erythrina* as a fish

poison. In addition, there are reports of its use as a narcotic and antihelminthic, anti cancer and relaxant in Mesoamerica.

**10. Damiana:** *Turnera diffusa*; Turnera family (Turneraceae)

A small shrub with smooth inch long, pale green leaves which have dense hairs on the underside. The flowers are yellow, rising from the leaf axils, followed by a one-celled capsule, which splits into three pieces. This plant is native to the Southwest and Mexico.

**Constituents:** It contains Arbutin, Volatile Oil, Tetraphyllin B, Resins, Gums, Starch and Tannins.

**Medicinal Uses:** It is used as Stimulant, Mild diuretic, Mild Laxative, Testosteromimetic action, Nervous restorative, Anti-depressant, urinary antiseptic Anxiety, depression. It also uses as sexual inadequacies with a strong psychological or emotional element and to establish normal menstruation at puberty.

A phytochemical investigation of *Turnera diffusa* afforded 35 compounds, comprised of flavonoids, terpenoids, saccharides, phenolics, and cyanogenic derivatives, including five new compounds (1-5) and a new natural product (6).

**11. Daturas:** Nightshade family (Solanaceae)

This genus has 15 to 20 species ranging from annual and perennial herbs to shrubs and trees, with trumpet-shaped flowers. All of these are hallucinogenic.

*Datura fastuosa* L., formerly known as *D. metel*: It is an annual herb, 4 to 5 feet tall, with ovate 7- to 8 inch leaves. The flower is 7 inches long, white inside, violet and yellowish outside, with a purple calyx. The fruit is a 1.25 inch diameter spiny capsule. There are also double-flowered and blue-, red-, and yellow-flowered varieties. It is native to India and naturalized in the tropics of both hemispheres.

*D. inoxia* Mill: It is a low-growing, spreading perennial with hairy 2- to 4 inch leaves. The flowers are white, 6 to 7 inches long, ten-lobed. The fruit is spiny, 2 inches or more in diameter. It is native to Mexico and the Southwest.

*D. meteloides* DC: It is an erect perennial herb with 2- to 5 inch leaves. The flowers are white, 8 inches long, often tinged with rose or violet, fragrant. The capsule is intensely spiny, 2 inches in diameter. It is native to the Southwest and Mexico.

*D. stramonium* L. "Jimson weed.": It is a green-stemmed, hairless annual, 2 to 4 feet tall, with few branches and two 8 inch long ovate leaves. The flowers are white, 4 inches long. The capsule is egg-shaped, to 2 inches long, filled with many black seeds. In *D. Stramonium* var. *tatula* the flower is violet-purple or lavender; the stems are purple. They are easily grown from seeds, which sprout quickly even without bottom heat. It does well in rich soil in a dry, sunny location. Thin out all but the healthiest plant after sprouting.

*D. chlorantha* Hook: It is a hairless, perennial shrub, occasionally reaching 10 feet tall, with almost triangular, wavy-margined leaves. The flowers are yellow, drooping, followed by a prickly capsule. This is not a true tree datura although it occasionally reaches similar heights.

**Constituents:** One steroidal constituent, daturasterol and a tricyclic diterpene, daturabietariene, have been isolated for the first time from the stem bark of *Datura metel* Linn. along with beta-sitosterol and atropine. The structures of the new compounds have been elucidated as 24beta-methylcholest-4-ene-22-one-3alfa-ol and 15,18-dihydroxyabietatriene, respectively, on the basis of the spectral data analyses and chemical reactions.

**Medicinal uses:** The whole plant, but especially the leaves and seed, is anaesthetic, anodyne, antiasthmatic, antispasmodic, antitussive, bronchodilator, hallucinogenic, hypnotic and mydriatic.

**12. Donana:** *Coryphantha macromeris* (Engl.) Lem.; Cactus family (Cactaceae)

A low cylindrical cactus to 8 inches tall, branching at the base, covered with several inch long, soft, spine-tipped tubercles. The flowers are purple, 5 inches across. It is native to Mexico and West Texas.

**Constituents:** Mainly it contains Macromerine, normacromerine. It also contains phenethylamines, normacromerine (N-methyl-3,4-dimethoxy-beta-hydroxyphenethylamine) abundantly.

**Medicinal uses:** It is a strong narcotic or hallucinogenic drug.

**13. Fennel:** *Foeniculum vulgare* Mill; Carrot family (Umbelliferae)

It is a perennial herb growing to 5 feet high, with blue-green stems and leaves. The leaves are finely divided into threadlike leaflets. The flower cluster is a large umbel, composed of fifteen to twenty yellow flowers. This plant is native of southern Europe; naturalized in western U.S.

**Constituents:** The major biologically active constituent of *Foeniculum* fruit oil was characterized as (+)-fenchone and (*E*)-9-octadecenoic acid. It also contains anethole, methyl chavicol, d-apenine, camphene etc.

**Medicinal uses:** The plant is analgesic, anti-inflammatory, antispasmodic, aromatic, carminative, diuretic, emmenagogue, expectorant, galactagogue, hallucinogenic, laxative, stimulant and stomachic. The essential oil is bactericidal, carminative and stimulant.

Pectin's from *Foeniculum vulgare* were extracted under acidic conditions. The obtained pectin's were mainly composed of uronic acid but also contained traces of rhamnose, galactose, and arabinose. Extracted pectin's were used as a carbohydrate source to prepare biopolymer films in the absence and in the presence of phaseolin protein. The anti-ulcerogenic and antioxidant effects of aqueous extracts of *Foeniculum vulgare* (FVE) was studied on ethanol-induced gastric lesions in rats. It was found that pretreatment with FVE significantly reduced ethanol-induced gastric damage.

**14. Hawaiian Baby Woodrose:** *Argyreia nevosa* Bojer; Morning Glory family (Convolvulaceae)

A large perennial climbing vine with heart-shaped leaves up to 1 foot across backed with silvery hairs. The flowers are 2 to 3 inches long, rose-colored, on 6 inch stalks. Pods dry to a smooth, dark brown, filbert-sized capsule containing one to four furry brown seeds. The capsule is surrounded by a dry calyx divided into five petal-like sections. It is native to Asia.

**Constituents:** It contains argyroside, a new steroidal glycoside, (24R)-ergost-5-en-11-oxo-3beta-ol-alpha-D-glucopyranoside. It also contains ergoline alkaloids and D-lysergic acid amide.

**Medicinal uses:** Used as Psychotropic agent, in India it is an Ayurvedic medicinal plant.

**15. Heliotrope:** *Valeriana officinalis* L.; Valerian family (Valerianaceae)

It is a Perennial herb 2 to 5 feet high with pinnately divided leaves and clusters of small, whitish, pinkish, or lavender flowers. This plant is native of Europe and N. Asia.



**Constituents:** It is of complex composition, containing valerianic, formic and acetic acids. The alcohol is known as borneol and pinene. The root also contains two alkaloids - Chatarine and Valerianine.

**Medicinal Uses:** Valerian is a powerful nervine, stimulant, carminative and antispasmodic. It has a remarkable influence on the cerebro-spinal system, and is used as a sedative to the higher nerve centres in conditions of nervous unrest.

The effect of valerian extract preparation (BIM) containing valerian extract, golden root (*Rhodiola rosea* L.) extract and L-theanine (gamma-glutamylethylamide) on the sleep-wake cycle using sleep-disturbed model rats in comparison with that of valerian extract. A significant shortening in sleep latency was observed with valerian extract and the BIM at a dose of 1000 mg/kg.

**16. Henbane:** *Hyoscyamus niger* L.; Nightshade family (Solanaceae)

An annual or biennial herb, to 2.5 feet high, with hairy, 3- to 8 inch long leaves. The flowers are 1 inch across, greenish-yellow with purple veins; they grow in spikes from June to September. The seed capsule is filled with many pitted seeds.

**Constituents:** The main constituents are hyoscyamine, hyoscyne, scopolamine and hyoscipicrin.

**Medicinal uses:** It causes deranged vision, headache, giddiness, dilated pupils, dry throat, hoarseness, weakness of the lower limbs, spasms, cramps, paralysis, loss of speech, or loquacious delirium with hallucinations, followed by a dreamy sleep, according to the dosage.

The cDNA from *Nicotiana tabacum* encoding Putrescine N-methyltransferase (PMT), which catalyzes the first committed step in the biosynthesis of tropane alkaloids, has been introduced into the genome of a scopolamine-producing *Hyoscyamus niger* mediated by the disarmed *Agrobacterium tumefaciens* strain C58C1, which also carries *Agrobacterium rhizogenes* Ri plasmid pRiA4, and expressed under the control of the CaMV 35S promoter.

**17. Hops:** *Humulus lupulus* L.; Hemp family (Cannabinaceae)

A perennial twining vine growing from 15 to 30 feet long with oval 3 to five-lobed leaves having coarsely-toothed edges. Male and female flowers occur on separate plants. It is native to Eurasia.

**Constituents:** It contains Up to 1% volatile oil (humulene, myrcene, caryophylline, farnescene); 15-25% resinous bitter principles and phloroglucinol derivatives known as alpha acids (humulone, cohumulone, adhumulone, valerianic acid) and beta acids (lupulone, colupulone, adlupulone); condensed tannins and phenolic acids, flavonoid glycosides (astralagin, quercitin, rutin), fats, amino acids, unidentified oestrogenic substances, choline, asparagine. The oil and bitter resins together are known as lupulin.

**Medicinal Uses:** Hops are an aromatic bitter and hence may be useful in atonic dyspepsia. By many they are believed to have a sedative effect on the nervous system and are used in hysteria, restlessness, insomnia. It also used as sedative, soporific, visceral spasmolytic, aromatic bitter, digestive tonic, hypnotic, astringent, diuretic.

The in vivo and in vitro effect of hop beta-acids on central nervous system function was investigated. Oral administration of beta-acids (5-10mg/kg) in rats produced an increased exploratory activity in the open field, a reduction in the pentobarbital hypnotic activity and a worsening of picrotoxin-induced seizures.

Xanthohumol (XN) is a prenylated chalcone with antimutagenic and anticancer activity from hops. A nonaqueous reverse polarity capillary electrophoretic method for the determination of XN in hop extract was developed and validated.

**18. Hydrangea:** *Hydrangea paniculata* Sieb. var. *grandiflora*; Saxifrage Family (Saxifragaceae)  
This is the commonest hardy hydrangea in cultivation. It is a treelike shrub 8 to 30 feet high, with 3- to 5 inch long oval leaves. The flowers are whitish, in dense clusters 8 to 15 inches long. The flowers sometimes change to pink and purple with age. It is native to China and Japan.

**Constituents:** It contains flavonoids, a cyanogenic glycoside (hydrangein), saponins, and a volatile oil.

**Medicinal uses:** It is helpful in the treatment of kidney and bladder stones. It is also used in genitourinary system, including cystitis, urethritis, enlarged prostate, and prostatitis.

**19. Iochroma:** Nightshade family (Solanaceae)

Iochroma is a genus of tropical shrubs or small trees with tubular flowers, several species of which are cultivated in the U.S.

*Iochroma coccineum* Schow: It is a shrub with hairy branches and oblong leaves. The flowers are 2 inches long, scarlet, and in drooping clusters. This plant is native to Central America.

*I. fuchsioides* Miers: It is a shrub with narrow, almost hairless leaves, and 1.5 inch long orange-scarlet flowers in drooping clusters. It is native to Peru.

*I. lanceolatum* Miers.: It is a shrub growing to 8 feet tall with hairy, ovate to narrow leaves. The flowers are 2 inches long, purple-blue. It is native to Ecuador.

*I. tubulosum* Benth.: This plant is a hairy shrub, 6 to 8 feet high, with ovate leaves and deep blue 1.5 inch long flowers in drooping clusters. It is native to Colombia.

**Constituents:** Two aglycones (kaempferol and quercetin) and three glycosides (isoquercitrin, kaempferol 3-sophoroside and quercetin 3-sophoroside) were isolated from Iochroma species.

**Medicinal uses:** It is a narcotic drug mainly used traditionally as Hallucinogens.

**20. Kava Kava:** *Piper methysticum* Forst.; Pepper family (Piperaceae)

It is a perennial, soft-wooded shrub growing 8 to 10 feet tall, with 8 inch ovate to heart-shaped leaves. The flower spikes are opposite to the leaves; male and female flowers occur on separate plants. This plant is native to the Pacific Islands.

**Constituents:** Kava pyrones (including kavalactones kawahin, yangonin, methysticin) and Mucilage. It also contains pipermethystine, a kava alkaloids obtained from leaves.

**Medicinal Uses:** It is Used as Diuretic, Urinary antiseptic, Circulatory stimulant Antispasmodic, Analgesic, Anaesthetic (topically), Anaesthetic effect in the gastric mucosa & bladder mucosa, Mental stimulant in small doses depressant in large, Reubefacient (topically) and as Antifungal .

Serial plasma concentration-time profiles of the P-gp substrate, digoxin, were used to determine whether supplementation with goldenseal or kava kava modified P-gp activity in vivo. The current study compared short-term toxic effects of pipermethystine in F-344 rats to acetone-water extracts of kava rhizome (KRE).

## Narcotics

**Introduction:** In 1914 the Harrison Narcotic Act forbade sale of substantial doses of opiates or cocaine except by licensed doctors and pharmacies. Drugs and *Narcotics laws* have tried to keep up with the changing perceptions and real dangers of substance abuse. By 1970 over 55 federal drug laws and countless state laws specified a variety of punitive measures, including life imprisonment and even the death penalty. To clarify the situation, the Comprehensive Drug Abuse Prevention and Control Act of 1970 repealed, replaced, or updated all previous federal laws concerned with narcotics and all other dangerous drugs.

Narcotic refers to opium, opium derivatives, and their semi-synthetic or fully synthetic substitutes "as well as cocaine and coca leaves," which although classified as "narcotics" in the U.S. Narcotics can be administered in a variety of ways. In a medical context, they are taken orally, transdermally (skin patches), injected, or administered as suppositories. As recreational drugs, they may be used orally, but are also commonly smoked, snorted, or self-administered by the more direct routes of subcutaneous ("skin popping") and intravenous ("mainlining") injection, depending on the precise substance in question. The United Nations Office on Drugs and Crime (UNODC) was delegated the Board's day-to-day work of monitoring the situation in each country and working with national authorities to ensure compliance with the Single Convention. This treaty has since been supplemented by the Convention on Psychotropic Substances, which controls LSD, Ecstasy, and other psychoactive pharmaceuticals, and the United Nations Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, which strengthens provisions against money laundering and other drug-related offenses.

Drug effects depend heavily on the dose, route of administration, previous exposure to the drug, and the expectation of the user. Aside from their clinical use in the treatment of pain, cough suppression and acute diarrhea, narcotics produce a general sense of well-being, known as *euphoria*, by reducing tension, anxiety, and aggression. These effects are helpful in a therapeutic setting and contribute to their popularity as recreational drugs, as well as helping to produce dependency. Narcotic use is associated with a variety of side effects, including drowsiness, itching, sleeplessness, inability to concentrate, apathy, lessened physical activity, constriction of the pupils, dilation of the blood vessels causing flushing of the face and neck, constipation, nausea, vomiting and, most significantly, respiratory depression. As the dose is increased, the subjective and toxic effects become more pronounced.

Many law enforcement officials in the United States inaccurately use the word "narcotic" to refer to any illegal drug or any unlawfully possessed drug. An example is referring to cannabis as a narcotic. Because the term is often used broadly, inaccurately or pejoratively outside medical contexts, most medical professionals prefer the more precise term [opioid](#), which refers to natural, semi-synthetic and synthetic substances that behave pharmacologically like morphine, the primary active constituent of natural opium poppy.

**Policy:** The Narcotic and Dangerous Drug Section (NDDS) provides advice and support on a broad range of counter narcotics matters to the Attorney General and other Department policy makers, represents the Department and provides expert guidance on counter narcotics matters in the interagency, intelligence and international communities.

**Litigation:** Federal narcotics prosecutors face sophisticated international organized crime syndicates from Colombia and Mexico, as well as other countries. These organizations produce high volumes of illegal drugs and use foreign countries as platforms from which to control their empires. These traffickers maintain control of their workers through highly compartmentalized cell structures that separate production, shipment, distribution, money laundering, communications and security.

**Signs and symptoms** of narcotic/opioid: **overdose** include euphoria, arousable somnolence ("nodding"), nausea, pinpoint pupils, hypoxia, or in combination with other types of drugs, coma, and seizures.

**Official Forms of Opium:** I. Opium II. Opium Pulvis, *Powdered opium*. III. Opium deodoratum, *Opium denarcotisatum, Deodorized opium, Denarcotized opium*.

**History, Commercial Sources, and Description**—Opium was known to the ancient Greeks, being mentioned in the writings of Theophrastus (about 370 to 286 B. C.), and by the writers of the first century, *e.g.*, Dioscorides and Pliny. Its most probable geographical source was then Asia Minor. Egyptian (Thebaic) opium is recorded as early as the sixth century. The knowledge of the drug was spread eastward by the Arabs. During the middle ages it was used in Europe only as a medicine, and entered into most of the narcotic preparations known as *theriac*. In eastern Asia, however, its use as a stimulant gradually increased and received a powerful impetus since about 1770, by the exportations of opium from India into China. This trade has fallen off considerably, owing to extensive production of the drug by the Chinese themselves. The most notable event in the chemical history of the drug was the discovery of the first alkaloid known, morphine, by Sertürner, in 1811.

The opium met with in commerce is principally that from Asia Minor, which was the kind expressly demanded by the U. S. P., 1880, and the *Br. Pharm.*, 1885, and which is still required by the *Ger. Pharm.*, 1890. The present U. S. P. and *British Pharmacopoeia* do not specify the origin of opium; still, most of the opium entering this country comes from Asia Minor. Other opium-producing countries are Persia, India, Egypt, China, Australia, and some parts of Europe.

**Asia Minor Opium, Turkey opium, Smyrna opium, Constantinople opium:** this is obtained from *Papaver somniferum*. The poppy requires a naturally moist and rich soil, much manure, and diligent hoeing and weeding. A crop of 5 to 8 1/3 pounds of opium, and 200 pounds of poppy-seed, from 1 *toloom* of land (1600 square yards), is considered a good yield; in some years only a little over 1/2 pound has been obtained. After the opium is collected, the seeds are shaken out, expressed in hand presses, and the oil thus obtained is used for burning and for eating purposes. The opium, before it is marketed, is wrapped in poppy leaves, and dried in the shade, and then put into thin cotton bags which are sealed and placed into round baskets. The bags send to Smyrna and are examined by a government official, and the lowest grades (*chicantee, chikinti*) are rejected and sold at cheaper rates to manufacturers of morphine. The Smyrna opium cakes vary in weight from about 300 to 700 grammes, or about 1/2 to 2 pounds; in rare cases, they weigh as much as 3 kilogrammes, or over 6 pounds.

**Persian Opium**—this variety first appeared on the market in the later fifties. It is chiefly grown in the provinces of Kermanshah and Ispahan, from the variety *Papaver somniferum*, Linn, var. *album* (*Papaver officinale*, Gmelin), and is said to contain, when pure, from 13 to 16 % of morphine, while the Smyrna opium contains, at best, little over 13.5%. Persian opium, however, has greatly lost in favor, owing to its being frequently adulterated. It is mixed, for example, with evaporated grape must, or linseed oil (8 to 10 %), probably in order to facilitate its being rolled into small balls or cylinders. It was reported the best variety to contain about 12 % of morphine. It occurs in commerce in the form of cones, weighing about 180 to 300 grammes, or in brick shape, or in circular, flat cakes of 600 grammes weight, or in the form of small cylinders wrapped in glazed paper, and weighing about 15 grammes.

**East India Opium**— About 1770 the Calcutta authorities embarked upon the cultivation of opium and its exportation into China, in order to raise revenue for the benefit of the government officials. The astonishing financial success of this measure, however, induced the East Indian Company to assume entire control of this trade, and to exercise strict supervision over the production and disposition of opium. The principal varieties are the *Bengal* and *Malwah opiums*. The *Bengal opium* is raised in the Central Ganges territory between Patna and Benares, and is fully controlled by the government. The opium growers must obtain a license, and must sell their product, which must possess a specified consistency (70 per cent of dry substance), to the government. The balls formed weigh about 2 kilogrammes each; they are then rolled in "poppy-trash," *i. e.*, broken leaves, capsules, and stalks, then dried by exposure to the air and in drying rooms, and finally put in chests, each holding 40 balls. It contains only from 3 to 4 per cent of morphine, and about as much narcotine. *Malwah opium* is made in Central India; its cultivation is free, only the product has to pay a tax upon delivery at Bombay, from once it is shipped. It is formed in balls of about 300 grammes each. Malwah opium has been most esteemed by the Chinese. The opium intended for export to China, is called in India *provision opium*; that grown for local consumption is called *excise opium* (*Benares Akbari*). In recent years the latter yielded to the Indian government an annual revenue of about £1,000,000. During 1893 the value of the total exports of opium from India was about £8,000,000.

**Chinese Opium.**—Opium was hardly known in China until the importations from India began, about 1780, notwithstanding the protests of the Chinese government. The drug being admitted into China since 1858, the Chinese production has been greatly stimulated by the high import duties placed upon the foreign drug. The chief provinces where opium is now grown are Ssuchuan and Yünnan, and in recent years the import into Shanghai from the western provinces seems to correspond with the decrease in the imports of the English drug<sup>15</sup>. The Chinese opium was at one time inferior to the English opium, while also much cheaper, 20 to 50 per cent; but its quality has since improved.

**Egyptian Opium**— this is now used only by the natives, and is produced at Akmim, and at Assiout, both on the river Nile. It was reported that the former to contain 7.24 %, the latter only 0.6 % of morphine.

**Australian Opium.**—Poppy was first grown in Australia in 1871, and is sown and cultivated in the same manner as Smyrna opium, except that, on account of the antipodal seasons, sowing is done at three different times in the months of June and July, instead of from November to

February, as practiced in Asia Minor. An analysis of Bacchus Marsh opium showed 10.65 % morphine, and 6.48 % narcotine.

**European Opium**—Poppy has been planted in various parts of Germany; but while it yields a high percentage of morphine (8.7, 14.8, and 22 % in Würtemberg opium, E. Dieterich, 1888), the culture of opium is not promising on account of the great value of ground, and the large cost of labor. French opium has high percentage in morphine (from 12 to 22.8 %).

**American Opium.**—Attempts have been made to cultivate poppy in Mississippi, Louisiana, Virginia, Tennessee, Illinois, California, and other states; but while an opium rich in morphine may be obtained from the capsules, the labor it requires would make the cultivation unprofitable. Poppy grown in New Ulm, Minn., yielded 15.23 per cent of morphine, 0.325 per cent narcotine, 0.416 per cent codeine, and 3.5 per cent meconic acid.

**Pharmaceutical Preparations of Opium.**—As per U. S. P., *Powdered opium*: "Opium dried at a temperature not exceeding 85° C. (185° F.), and reduced to a very fine (No. 80) powder. Powdered opium, for pharmaceutical or medicinal purposes, when assayed by the process given under opium, should yield not less than 13 and not more than 15 per cent of crystallized morphine. Any powdered opium of a higher percentage may be brought within these limits by admixture with powdered opium of a lower percentage, in proper proportions".

**Adulterations and Tests.**—In addition to the adulterants before enumerated, opium may be falsified with stones, sand, clay, gypsum, litharge, starch, gum Arabic, ashes, fragments of poppy capsules, resins, wax, licorice juice, etc. Some of these additions may be recognized by closer ocular or microscopic examination; others may be more difficult to detect. Inorganic matter will be indicated by the increase in ash, of which good opium yields not more than 5 or 6 per cent. Gum would be indicated by a gelatinous consistency of a hot aqueous infusion of opium; starch by the iodine test; licorice extract by a dark coloration of the moderately diluted aqueous infusion.

The presence of morphine alone in a vegetable extract does not suffice to prove the extract to contain opium; it must also give the tests for *meconic acid*. This is done in the following manner: Filter the aqueous infusion of the supposed opium, treat it with excess of solution of acetate of lead, and set aside in a tall vessel for the precipitate of meconate of lead to subside; the clear liquor holds in solution acetate of morphine. Pour off the supernatant fluid, and collect the precipitate on a filter. Test the clear filtrate for morphine by evaporating to dryness with potassium carbonate, abstracting the morphine with alcohol, and applying to it the tests. Test the precipitate for meconic acid by suspending it in water and decomposing the lead salt by a current of hydrogen sulphide gas or with diluted sulphuric acid; filter, and in the first case, expel the excess of gas by warming on the water-bath, and apply to the solution the tests for meconic acid .

In recent years, the quality of given opium is judged mainly by its morphine contents, ascertained by reliable assay methods of U.S.P.

As stated above, the U.S. P. demands good opium to contain, in its natural, moist condition, not less than 9 % of morphine.

The U.S.P. assay process lacks directions for testing the purity of the morphine obtained. The degree of its purity may be judged by several methods: (1) Titration with volumetric acid solutions; (2) incinerating the assay morphine, calculating the weight of the ash as calcium meconate, and deducting this value from the weight of morphine employed; (3) treating the assay-morphine with 100 parts of lime-water and weighing the non-morphine residue; (4) separating the morphine from inorganic salts by means of alcohol.

**Chemical Composition.**—the characteristic constituents of opium are its alkaloids, of which about 20 have been discovered. They occur mostly combined with sulphuric acid and with *meconic acid*; narcotine, being a weak base, seems to occur in the free state. Some opiums do not contain all these alkaloids. Eleven *crystallizable* alkaloids found in opium, viz.: morphine, codeine, narceine, narcotine, papaverine, thebaine. Indifferent substances in opium are *meconin* ( $C_{10}H_{10}O_4$ ), and *meconoiosin* ( $C_8H_{10}O_2$ ). Opium contains also small amounts of caoutchouc, wax, and sugar; mucilage, not identical with gum Arabic, albumen, pectin, coloring matter, and inorganic matter (3 to 5 per cent of ash). Starch, fat, and tannin, seem to be absent.

I. **Narcotine** ( $C_{22}H_{23}NO_7$ ): It may be obtained by extracting opium, first with cold ether, which removes wax and fatty matter, then with warm ether, and recrystallizing the narcotine from alcohol. It crystallizes in rhombic prisms, is tasteless and odorless, little soluble in boiling water, soluble in 100 parts of cold, in 20 parts of boiling 85 % alcohol, in 166 parts of cold, in 48 parts of warm ether, and in 2.69 parts of chloroform, in 60 parts of acetic ether, in 22 parts of benzol, and 300 parts of amyl alcohol; insoluble in cold, but soluble in hot solution of caustic potash or lime.

Narcotine is a weak base, forming with acids uncrystallizable, bitter, and soluble salts of acid reaction, decomposable by excess of water, or by evaporation if combined with a volatile acid. Concentrated sulphuric acid dissolves narcotine first colorless and then yellow, and later reddish-yellow; the colorless solution, gradually heated, turns orange-red and exhibits beautiful blue-violet streaks, finally a red-violet color. Neutral narcotine solutions, *e. g.*, in chloroform, are optically laevo-rotatory; in acid solution the rotation is reversed to the right. *Narcotine*, when oxidized with sulphuric acid and manganese dioxide, yields needles of *cotarnine* ( $C_{12}H_{31}NO_3 + H_2O$ ) and upon reduction with nascent hydrogen it gives *meconin* ( $C_{10}H_{10}O_4$ ). The effects of *narcotine* upon the system are but imperfectly known. Narcotine is a powerful antiperiodic, acting without occasioning constipation, uneasiness, and cephalalgia, but frequently causing copious diaphoresis.

II. **Morphine** ( $C_{17}H_{19}NO_3$ ) and *Apomorphine* ( $C_{17}H_{17}NO_2$ ) is the name given to an artificial base derived from morphine by Matthiessen and Wright. It is white or grayish-white, non-crystalline, but soon turns green when exposed to the air, is partly soluble in water, soluble in alcohol, ether and chloroform, yielding different colored solutions with each menstruum, and in very small doses is a powerful, non-irritant emetic and contrastimulant.

III. **Codeine** ( $C_{18}H_{21}NO_3 \cdot H_2O$ ).

IV. **Narceine** ( $C_{23}H_{29}NO_9$ ).—It is obtained from the mother liquors remaining from the preparation of morphine. It crystallizes in rhombic prisms or needles, is first bitter, afterward

styptic, and without odor. Very divergent melting points have been found. The crystals contain some water which it is difficult to expel at 100° C. (212° F.). They are soluble in boiling water and boiling alcohol, insoluble in ether, benzol, petroleum ether, slightly soluble in amyl alcohol and chloroform. Narceine is more soluble in diluted alkalies and ammonia water than in cold water. Narceine is a weak base, but forms with diluted acids crystallizable and soluble salts. When exposed to heat, a smell resembling that of herring-brine (*trimethylamine*) is evolved. Concentrated sulphuric acid colors pure narceine brown, but the solution is light-yellow, and changes to deep red. If rheadine, thebaine, or papaverine are present, a blood-red or blue color will result. Narceine dissolves in concentrated nitric acid with blood-red color. Diluted solution of iodine colors it blue. If narceine is treated with a little concentrated sulphuric acid, and a small amount of sodium nitrite is added, a brown-green coloration is formed, turning blue at the edges; upon heating, a blue-violet color arises.

V. **Thebaine** (C<sub>19</sub>H<sub>21</sub>NO<sub>3</sub>): It was discovered by Thibouméry, in 1832, in Pelletier's chemical establishment. It may occur in rectangular scales or needles, or crystalline granules. It has an acrid, styptic taste, and is of a strong alkaline reaction, forming water-soluble salts with acids, crystallizable from alcohol and ether. Thebaine melts at 193° C. (379.4° F.), and becomes negatively electric upon friction. It is insoluble in water and diluted alkalies; soluble in boiling alcohol, and ether, in about 19 parts of benzol and 60 parts of amyl alcohol; little soluble in chloroform, insoluble in petroleum ether. Boiling with diluted hydrochloric acid converts thebaine into the amorphous bases *thebenine* and *thebaïcine*. Both turn blue with concentrated sulphuric acid. Thebaïne is dissolved by concentrated sulphuric acid with blood-red color.

VI. **Papaverine**: (C<sub>21</sub>H<sub>21</sub>NO<sub>4</sub>).—Pure papaverine crystallizes from alcohol in the form of a network of acicular, white crystals, insoluble in water, but readily soluble in boiling alcohol or ether, in 37 parts of benzol and 76 parts of amyl alcohol; also soluble in warm petroleum ether. Chloroform abstracts it both from acid and alkaline solutions (Dragendorff). It melts at 147° C. (291.4° F.).

VII. **Meconic Acid** (C<sub>7</sub>H<sub>4</sub>O<sub>7</sub>.3H<sub>2</sub>O).—This acid may be obtained from an aqueous infusion of opium by precipitating it with calcium or barium chloride, as calcium or barium meconate, and decomposing these salts by means of sulphuric or oxalic acids (compare *Morphina*). Meconic acid crystallizes from water in the form of micaceous scales or rhombic prisms, which lose their water of crystallization at 100° C. (212° F.). Meconic acid tastes sour, and reddens blue litmus paper. It is little soluble in cold water, easily soluble in 4 parts of boiling water, also in alcohol; insoluble in chloroform, not easily soluble in ether. Meconic acid is dibasic, and accordingly forms two series of salts with bases; only the neutral alkali and ammonium meconates are soluble in water; the salts of other metals are insoluble. When exposed to about 120° C. (248° F.), meconic acid is decomposed into carbonic dioxide and crystallizable *comenic acid* (C<sub>6</sub>H<sub>4</sub>O<sub>5</sub>), upon further heating, sublimable *pyromeconic acid* (C<sub>5</sub>H<sub>4</sub>O<sub>3</sub>) is formed, with additional loss of carbon dioxide, water, acetic acid, and benzol. Meconic acid partly undergoes the first-named decomposition even when heated in aqueous solution.

**Action and Toxicology.**—Opium is narcotic and stimulant, acting under various circumstances as a sedative, antispasmodic, febrifuge, diaphoretic, and an impuissant of the mucous secretions. Topically, it is a direct stimulant and indirect sedative of the nervous, muscular, and vascular



systems. A medium dose, taken while in health, augments the volume and velocity of the pulse, increases the heat of the surface, gives energy to the muscles, renders the mind more acute, and produces a general excitement of the whole system: the brain is especially acted upon, the faculties becoming more clear, the ideas more brilliant, precise, and under control, the power of application more intense, the conversational energies augmented, and frequently a state of frenzy or hallucination is induced. The unpleasant symptoms following the sleep caused by opium may be removed by lemon-juice, strong coffee, or a cathartic.

In some persons the smallest dose will cause nausea, emesis, and gastro-intestinal spasm; in others it will produce occasionally feverishness, headache, watchfulness, restlessness, startling, disagreeable visions, delirium, anxiety, and afterward, an aggravated degree of the more familiar subsequent effects of this drug; these phenomena constitute what is called the *idiosyncratic action of opium*. Occasionally, the rash resembles that produced by scarlatina, and desquamation follows. It acts most energetically when it is promptly absorbed. When opium, or any of its preparations, is applied freely to a blistered, excoriated, or inflamed surface, its effects should be attentively watched, for dangerous accidents which are occasionally happened in this way. In large doses, opium is a poison, producing death if the proper remedies are not promptly and unremittingly resorted to. The state of stimulation and vivacity, if caused at all, is of short duration, being speedily followed by depression of the circulation, and of the functions of the brain, as manifested by diminution of the frequency of the pulse, but not of force, prostration of muscular power, slow, stertorous, and afterward soft or almost imperceptible respiration, flaccidity of the extremities, languor, drowsiness, torpor, or coma, first livid or turgid, afterward pale features, livid lips, excessively contracted pupils, coldness of the limbs, generally retention of the urine, and frequently profuse, cold perspiration, together with an almost entire apathy to external agencies. When a toxic dose of morphine is injected, narcotism ensues very speedily. Opium may kill within 2 hours, though from 6 to 18 hours usually lapse before death ensues. The majority dies in 6 to 12 hours. The remedies are emetics of mustard and lobelia seed, zinc or copper sulphate, ipecac, or apomorphine subcutaneously, with strong coffee, stomach-pump, external counter-irritation, cold applications to the head and spine, forced exercise, galvanism, and artificial respiration. Alcoholic stimulants should be given in small amounts, lest they increase the narcosis. The importance of keeping the patient in motion must not be overlooked. Indeed, atropine is regarded as the best antagonist to poison by opium and morphine. Repeated small doses, 1/70 to 1/40 grain of atropine should be subcutaneously injected at intervals until the pupils begin to dilate. This method is preferable to give a large dose at once, and is attended with results not otherwise obtainable. Stramonium may be used; also gelsemium, giving it short of sedation. Strychnine and cocaine have also been advised, and nitrate of amyl has some advocates. Permanganate of potassium is said to destroy the activity of morphine, and thus prevents its toxic effects. Physiologically, opium and its chief alkaloid affect mainly the functions of the cerebro-spinal tract. In man, the cerebral functions are most impressed; in animals, the spinal axis. The motor and sensory, as well as the higher nerve-centers, are affected, and the terminal nerve-organs respond to its action. It, at first, stimulates and then paralyzes the cardiac motor ganglia and the end-organs of the vagus. The action of the heart and arteries are, at first, increased, and, secondarily, lowered by these drugs. The over stimulation of the spinal cord observed in the lower animals is not generally observed in the human species, and, when occurring, children being generally the individuals so affected. Opium depresses the sexual

functions, and impotence in the male and cessation of the menses are not uncommon in opium habitués.

**Medical Uses and Dosage:** The special uses of opium are so numerous that it is impossible to do more here than mention the most important of them. In all *febrile* and *inflammatory diseases*, it was formerly given either alone, or in combination with ipecacuanha to produce diaphoresis. While, in some instances, it will prove useful, as a rule it is now seldom used in *fevers*, as we possess better agents to accomplish the results formerly sought from the use of opium. In cases of *painful inflammatory affections*, however, it is of considerable value. But to prescribe opium and its derivatives intelligently, it is necessary to understand the conditions which are benefited by them, and those in which they produce harmful effects. The patient with the *hard*, small pulse, the dry tongue, dry, contracted skin, the flushed face, bright eye, and contracted pupil, is always injured by the administration of opium. When, in *typhoid* and other *low fevers*, an exhausted state of the nervous system supervenes, then opium, in stimulant doses only, may be employed. As an anodyne-diaphoretic opium, with ipecac, is likewise beneficial in *rheumatic, neuralgic, and gouty diseases*, in *nervous irritability, morbid vigilance, restlessness, diarrhoea, and dysentery*. Opium, as a pain-reliever, is of inestimable value when properly used, while, when improperly administered, it still relieves the pain, but may mask conditions of disease so that the physician may be unable to properly watch the progress of the case, the amount of pain often being his best guide to the seriousness and extent of the trouble. When opium, in stimulant doses, relieves pain, no untoward results need be expected, for, in these cases, it does not relieve the pain unless indicated. The danger lies in its employment as a sedative and narcotic.

As an antispasmodic, opium is valuable in *asthma, colic, cholera, hysteria, tetanus*, some forms of *dyspepsia, spasmodic and convulsive affections*, especially in spasms accompanying the passage of *biliary* and other *calculi*, or which are present during an attack of *nephritis* or *gout*. Not only does opium relieve the pain, but it also relaxes the spasm attending the passage of the concretions. Morphine is generally employed in place of opium where pain and spasm are very severe. Hypodermatic injections of full doses of morphine form the best known treatment of *puerperal eclampsia*; its action may be assisted by the inhalation of chloroform and other internal treatment as indicated. Morphine with bismuth subnitrate is frequently demanded in *gastralgia*. In *diarrhoea*, opium is frequently indicated, and its tincture injected into the rectum, with starch-water, is the only agent, sometimes, that will give relief from tenesmus in *acute dysentery*. At the same time, the proper internal treatment must be pursued. An injection of morphine is the promptest agent for the relief of *cholera morbus*.

Opium should not be used internally in cases of excessive inflammatory action, without having first allayed this action considerably by other means; or, if opium be administered, it should be combined with ipecacuanha, as in the compound powder of ipecac and opium, for the purpose of modifying its influence and promoting a determination to the surface. Externally, opium is employed chiefly to subdue *pain*, and arrest *local inflammatory action*; it is applied in the form of lotion, liniment, or plaster, and is of service in *neuralgia, rheumatism*, some forms of *cutaneous diseases, irritable blistered surfaces, diseased mucous surfaces*, and in *erysipelatous inflammations*. It is likewise added to topical preparations for *inflammation of the eye*, and to *gonorrhoeal injections*. Dose of opium in pill or powder is from 1/4 to 3 grains, according to its

influence upon the patient, the character of the disease and the object to be accomplished. The dose of the tincture is from 10 to 50 drops.

**Specific Indications and Uses**—To give rest from pain and spasm, and to stimulate the vegetative functions and restrain secretions when the pulse is soft and open, or with short waves, the skin soft and moist, and the tongue moist and sometimes dirty.

**Some Opium Preparations**—Poppy capsules are much weaker in their action than opium; they are occasionally used in the form of syrup or decoction among children, but are in every way inferior to opium itself prepared similarly.

**Syrup Of Poppies**—A *syrup of poppies* may be made by depriving of their seeds, poppy-heads, 9 ounces; reduce them to a coarse powder, moisten them thoroughly with diluted alcohol and digest for 48 hours; then transfer the whole to a percolator, and gradually pour upon it diluted alcohol until 2 pints of the filtered liquor are obtained; then evaporate by means of a water-bath to 8 fluid ounces, filter, add sugar, 15 ounces; proceed in the manner directed for simple syrup.

**Sydenham's Laudanum.**—*Sydenham's laudanum* is a vinous tincture of opium, made according to the *Parisian Codex*, by macerating for 2 weeks in 1 pint of sherry wine, 2 ounces of opium, 1 ounce of saffron, and 1 drachm each of bruised cinnamon and cloves; then filter.

**Rousseau's Laudanum.**—*Rousseau's laudanum* is made by exposing a vessel, in which 6 ounces of honey have been dissolved in 1½ pounds of hot water, to a temperature of about 26.6° C (80° F.), until fermentation commences; then add 2 ounces of good *opium* previously diffused in 1 pound of water, and again expose to a temperature of 26.6° C (80° F.), for a month; express, filter, and evaporate to 5 ounces, to which 1 ounce of alcohol should be added. Six drops of this preparation are equivalent to 1 grain of opium.

The objective of this study was to determine the frequency and nature of poppy seed tea (PST) use by opiate-dependent patients in the form of a written questionnaire. The study took place at the Community Alcohol and Drug Clinic, Wellington, New Zealand, and comprised 24 opiate-dependent patients attending the clinic. A total of 11 of 24 (46%) patients reported having used PST. In five patients currently using PST it represented the major source of opiates, and two had managed to withdraw from use of other opiates with regular PST use. Patients reported a median onset of action of 15 minutes and an effect lasting a median of 24 hours. The major limitation of PST use was the foul taste. PST is used commonly by opiate-dependent patients attending an alcohol and drug clinic in New Zealand.

Opium poppy was transformed with constitutively expressed cDNA of codeinone reductase (PsCor1.1), the penultimate step in morphine synthesis. Most transgenic lines showed significant increases in capsule alkaloid content in replicated glasshouse and field trials over 4 years. The morphinan alkaloid contents on a dry weight basis were between 15% and 30% greater than those in control high-yielding genotypes and control non-transgenic segregants. Transgenic leaves had approximately 10-fold greater levels of Cor transcript compared with non-transgenic controls. Two cycles of crossing of the best transgenic line into an elite high-morphine genotype

resulted in significant increases in morphine and total alkaloids relative to the elite recurrent parent.

The cytochrome P-450-dependent monooxygenase (S)-N-methylcoclaurine 3'-hydroxylase (CYP80B3) lies on the pathway to the benzyloquinoline alkaloid branch point intermediate (S)-reticuline. Overexpression of *cyp80b3* cDNA resulted in an up to 450% increase in the amount of total alkaloid in latex. This increase occurred either without changing the ratio of the individual alkaloids, or together with an overall increase in the ratio of morphine. Correspondingly, antisense-*cyp80b3* cDNA expressed in opium poppy caused a reduction of total alkaloid in latex up to 84%, suggesting that the observed phenotypes were dependent on the presence of the transgene. This study found compelling evidence, that *cyp80b3* is a key regulation step in morphine biosynthesis and provides practical means to genetically engineer valuable secondary metabolites in this important medicinal plant.

### Poisonous Plants

**Introduction:** The World Health Organization (WHO) estimated that 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs. Also, modern pharmacopoeia still contains at least 25% drugs derived from plants and many others which are synthetic analogues built on prototype compounds isolated from plants. It is important to have an awareness regarding the poisonous plants which when used in the proper, prescribed dose, acts as potent therapeutic agents.

Toxins are molecules that are harmful to living organisms. It is a fact that virtually any substance can be harmful at high enough concentrations - as Paracelsus (1493-1541) said in the sixteenth century, "the dose makes the poison." Poisons include both naturally produced compounds and chemicals manufactured by humans. Natural poisons are produced by species of bacteria, fungi, protists, plants, and animals.

Literally thousands of plants contain varying amounts of poisonous substances. In many instances, the poisons are not present in sufficient quantities to cause adverse effects in humans when only moderate contact or consumption is involved, and cooking may destroy or desipate the substance. Some plants have substances that produce toxic effects in some organisms but not in others.

Thousands of plants are available under the poisonous category likely, *Datura suaveolens* All parts, especially seeds and leaves; Baneberry *Actaea* spp. berries and roots; Belladonna *Atropa belladonna* all parts, especially fruits and roots; Black cherry *Prunus serotina* Bark, seeds, leaves. (**Caution:** Seeds of most cherries, plums, and peaches contain a poisonous principle.) Black locust *Robinia pseudo-acacia* seeds, leaves, inner bark Black snakeroot *Zigadenus* spp. Bulbs Buckeye *Aesculus* spp. Seeds, shoots, flowers, leaves, roots. (**Note:** Even the honey bees make from buckeye flowers is poisonous.), Caladium *Caladium* spp. All parts, Carolina jessamine *Gelsemium sempervirens* All parts, Castor bean *Ricinus communis* Seeds, Chinaberry *Melia azedarach* Fruits and leaves, Daphne *Daphne mezereum* All parts, Death angel (fly agaric) *Amanita muscaria* All parts (as little as one bite can be fatal), Death camas (**see** Black

snakeroot), Destroying angel *Amanita verna* All parts (as little as one bite can be fatal), Dieffenbachia *Dieffenbachia* spp. All parts (Dumb cane), *Duranta repens* Berries Dutchman's breeches *Dicentra cucullaria* All parts, English ivy *Hedera helix* Berries and leaves, False hellebore *Veratrum* spp. All parts, Foxglove *Digitalis purpurea* All parts, Gloriosa lily *Gloriosa superba* and other All parts, especially tubers, *Gloriosa* spp., Golden chain *Laburnum anagyroides* Seeds and flowers, Jequirity bean *Abrus precatorius* Seeds, Jimson weed *Datura stramonium* and other All parts, especially seeds, Lantana *Lantana camara* Unripe fruits, Lily of the valley *Convallaria majalis* All parts, Lobelia *Lobelia* spp. All parts, Mistletoe *Phoradendron* spp. Berries, Monkshood *Aconitum* spp. All parts, Moonseed *Menispermum canadense* Fruits, Mountain laurel *Kalmia latifolia* Leaves, shoots, flowers, Mushrooms Many genera and species, especially All parts, *Amanita* spp., Nightshade *Solanum* spp. Unripened fruits. (**Caution:** A poisonous principle is produced in common potato, *Solanum tuberosum*, tubers exposed to light long enough for skins to turn green or greenish.), Oleander *Nerium oleander* All parts, Poison hemlock *Conium maculatum* All parts, Poke *Phytolacca americana* Roots and mature stems, Rhododendron (see Azalea), Rhubarb *Rheum rhaponticum* Leaf blades. (**Caution:** Although young petioles are widely eaten, dangerous accumulations of a poisonous substance can occur in leaf blades.), Rubber vine *Cryptostegia grandiflora* All parts, Sandbox tree *Hura crepitans* Milky sap and seeds, Tansy *Tanacetum vulgare* Leaves, flowers Tung tree *Aleurites fordii* All parts, especially seeds, Water hemlock *Cicuta* spp. Roots, White snakeroot *Eupatorium rugosum* All parts, Yellow oleander *Thevetia peruviana* All parts, especially fruits, Yew *Taxus* spp. All parts except "berry" pulp.

#### **Other Plants Producing Significant Quantities of Poisonous Substances (*Plant Scientific Name along with Poisonous Parts*)**

Amaryllis *Amaryllis* spp. Bulbs, Autumn crocus *Colchicum autumnale* all parts, Bittersweet *Celastrus scandens* Seeds, Bleeding hearts *Dicentra* spp. All parts, Bloodroot *Sanguinaria canadensis* All parts, Blue cohosh *Caulophyllum thalictroides* Fruits, leaves, Boxwood *Buxus sempervirens* Leaves, Buckthorn *Rhamnus* spp. Fruits, Bushman's poison *Acokanthera* spp. All parts, Buttercup *Ranunculus* spp. All parts; toxicity varies from species to species; mostly cause blistering, Buttonbush *Cephalanthus occidentalis* Leaves, Caladium *Caladium* spp. All parts, Carolina jessamine *Gelsemium sempervirens* All parts (even visiting honey bees can be poisoned), Chinchinchee *Ornithogalum thyrsoides* All parts, Crown of thorns *Euphorbia milii* Milky latex, Culver's root *Veronicastrum virginicum* Root, Daffodil *Narcissus* spp. Bulbs, Desert marigold *Baileya radiata* All parts, Fly poison *Amianthemum muscaetoxicum* Leaves, roots, Four-o'clock *Mirabilis jalapa* Seeds, roots, Goldenseal *Hydrastis canadensis* Rhizomes, leaves, Holly *Ilex aquifolium* Berries, Horse chestnut *Aesculus hippocastanum* Seeds, flowers, leaves, Hyacinth *Hyacinthus* spp. Bulbs, Hydrangea *Hydrangea* spp. Buds, leaves, Jack-in-the-pulpit *Arisaema triphyllum* Roots, leaves, Jessamine *Cestrum* spp. Leaves, young stems, Karaka nut *Corynocarpus laevigata* Seeds, Kentucky coffee tree *Gymnocladus dioica* Fruits, Larkspur *Delphinium* spp. Young plants, seeds, Lignum vitae *Guaiacum officinale* Fruits, Locoweed *Astragalus* spp. Location of poisonous principles varies from species to species; plants more of a problem for livestock than for humans. Lupine *Lupinus* spp. Location of poisonous principles varies from species to species; primarily in pods and seeds Marijuana *Cannabis sativa* Resins secreted by glandular hairs among flowers Mayapple *Podophyllum peltatum* All parts except ripe fruits Mescal bean *Sophora secundiflora* Seeds Narcissus (see Daffodil) Ngaio *Myoporum laetum* Leaves. Philodendron *Philodendron* spp. Leaves, stems, Pittosporum *Pittosporum* spp.

Fruits, leaves, stems, Poinsettia *Euphorbia pulcherrima* Milky latex, Poison hemlock *Conium maculatum* All parts, Poison ivy *Toxicodendron radicans* Leaves, Poison oak *Toxicodendron diversilobum* Leaves, Poison sumac *Toxicodendron vernix* Leaves, Poke *Phytolacca americana* Roots, leaves, stems (uncooked fruits may be slightly poisonous) Prickly poppy *Argemone* spp. Seeds, leaves, Privet *Ligustrum vulgare* Fruits, Rhododendron *Rhododendron* spp. All parts, Sneezeweed *Helenium* spp. All parts, Snow-on-the-mountain *Euphorbia marginata* Milky latex, Squirrel corn *Dicentra canadensis* All parts, Star-of-Bethlehem *Ornithogalum umbellatum* All parts, Sweet pea *Lathyrus* spp. Seeds, Tobacco *Nicotiana tabacum* Leaves (when eaten), Water hemlock *Cicuta* spp. All parts

The Water Hemlock or Cowbane (*Cicuta maculata*, L.), a perennial of marshy grounds and stream borders from the Atlantic coast westward to the confines of the Rocky Mountains. A peculiarity of the foliage is the venation pattern -the veins apparently ending within the notches instead of extending to the tips of the teeth. The small white flowers, appearing in summer, are borne at the branch end in compound, long-stalked umbels, after the manner of parsley blossoms. All parts of the plant are poisonous if eaten, producing nausea and convulsions, the fleshy, tuberous roots being especially harmful. The famous Poison Hemlock of Greek history and Macbeth's witches (*Conium maculatum*, L.)- the basis of the death option of Socrates-is also a member of the Parsley family, native to Europe and Asia but now extensively naturalized in the United States in waste grounds on both sides of the continent. It is a smooth, hollow-stemmed, much branched, bluishgreen biennial, sometimes as high as a tall man, but usually much lower, with large, coarsely dissected leaves, the leaf-stalks dilated at the base and sheathing. The stems are often spotted with dark purple. The small white flowers appear in June in compound, many-rayed umbels. The poisonous principle-an alkaloid called conia or conine-is permanently resident in the seeds and only temporarily in other parts of the plant. Death Camas, and also as White Camas and Lobelia- it haunts damp meadows and streamsides, and is in botanical parlance *Zygadenus venenosus*, Wats. The white flowers serve to distinguish it from the blue Camas, which otherwise it strongly simulates. The effect of eating the *Zygadenus* bulb is a profound nausea accompanied by vomiting. It belongs to Pea family, and is a very large one, widely distributed. There are nearly two hundred American species, mostly western-herbaceous plants with oddpinnate leaves, spikes or racemes of usually small, narrow flowers generally produced from the leafaxils, the seed pods mostly bladderly or swollen. These, when dry, have a habit of rustling noticeably in a passing breeze, whence another common name, a dangerously poisonous weed is the Jimson or Thorn-apple (*Datura Stramonium*, L.), whose large funnel-shaped, white or violet flowers and thorny seed-vessels. The whole plant and particularly the seeds are highly poisonous.

This chapter presents the basic details of some important plants. They are as follows: *Abrus Precatorius*, *Aconitum ferrox*, *Anamirta cocculus* , *Papaver somniferum*, *Datura alba*, *Nerium oleander*, *Strychnos nux vomica*, *Cleistanthus collinus*, *Cannabis sativa*, *Gloriosa superba*, *Citrulus colocynthis*, *Semecarpus anacardium*, *Excoecaria agallocha*, *Digitalis purpurea* , *Croton tiglium* and *Plumbago zeylanica* ,

## Examples of Poisonous Plants

### 1. Abrus Precatorius

**Common names:** Abrus seed, Aivoeiro, Arraccu-mitim, Buddhist rosary bead, Carolina muida, Crabs eye, Deadly crab's eye, Indian bead, Indian liquorice, Jequirite, Jequirity Bean, Jumble beads, Juquiriti, Lucky bean, Prayer beads, Precatory bean, Rosary beads, Rosary Pea, Ruti, Tentos da America, Tentos dos mundos, Weather plant, Wild liquorice.



**Description:** *Abrus precatorius* belongs to the family leguminosae, is a slender, perennial climber trees, shrubs, and hedges. Leaves are glabrous with long internodes. It has a slender branch and a cylindrical wrinkled stem with a smooth-textured brown bark. Leaves alternate compound peripinnate with stipules. Each leaf has a midrib from 5 to 10 cm long. It is blunt at both ends, glabrous on top and slightly hairy below. Flowers are small and pale violet in colour with a short stalk, arranged in clusters. The fruit, which is a pod, is flat, oblong and truncate-shaped with a sharp deflexed beak is about 3 to 4.5 cm long and silky-textured. The pod curls back when opened to reveal pendulous seeds. Each fruit contains from 3 to 5 oval-shaped seeds. They are usually bright scarlet in colour with a smooth, glossy texture, and a black patch on top.

**Habitat:** *Abrus precatorius* is a wild plant that grows best in fairly dry regions at low elevations.

**Distribution:** It grows in tropical climates such as India, Sri Lanka, Thailand, the Philippine Islands, South China, tropical Africa and the West Indies. It also grows in all tropical or subtropical areas.

**Poisonous parts:** The most poisonous parts of the plant involved in poisoning are the small, scarlet seeds, that have a black eye at the hilum.

**Main toxins:** The main toxin is abrin, which is concentrated in the seeds.

**Mode of action:** Abrin exerts its toxic action by attaching itself to the cell membranes. Abrin's toxic effect is due to its direct action on the parenchymal cells (e.g., liver and kidney cells) and red blood cells. The larger subunit, the B chain (haptomere) binds to the galactosyl-terminated receptors on the cell membrane, which is a prerequisite for the entry of the other subunit, the A chain (effectomere). This inactivates the ribosomes, arrests protein synthesis, and causes cell death. The A-chain attacks the 60S subunit of the ribosomes and by cutting out elongation factor EF<sub>2</sub>, stops protein synthesis. Abrus agglutinin agglutinates the red blood cells by combining with the cell stroma.

**Symptoms:** After delay of hours or days, then nausea, vomiting, severe abdominal pain and diarrhea, burning in throat; later ulcerative lesions of mouth and esophagus; can be fatal.

**Uses:** Children are attracted by the brightly-coloured seeds. In some countries they play with them and in school use them in their handiwork and to count. Necklaces and other ornaments made from the seeds are worn by both children and adults. The seeds are used to treat diabetes, contraceptive, and chronic nephritis. The plant is also used in some traditional medicine to treat scratches and sores, and a wound caused by dogs, cats, and mice, and is also used with other ingredients to treat leucoderma. The leaves are used for their anti-suppurative properties. They

are ground with lime and applied on acne sores, boils, and abscesses. The plant is also traditionally used to treat tetanus, and to prevent rabies. Boiled seeds of *Abrus precatorius* are eaten in certain parts of India. The root is used to induce abortion against abdominal discomfort, gonorrhoea, jaundice and haemoglobinuric bile. Also traditionally used to treat tetanus and to prevent rabies.

## 2. *Aconitum ferox*

**Common Name:** Indian aconite, monkshood, or wolfsbane.

**Description:** The *Aconitum* genus belongs to the Ranunculaceae family of flowering plants. There are over 250 species of *Aconitum*. Different *Aconitum* species (and their varieties) can be found in most parts of globe. All *Aconitum* plants contain poisonous alkaloids that can, in sufficient quantity, be deadly. These herbaceous perennials are chiefly natives of the mountainous parts of the northern hemisphere, growing in damp soils on mountain meadows. Their dark green leaves lack stipules. They are palmate or deeply palmately lobed with 5–7 segments. Each segment again is 3-lobed with coarse sharp teeth. The leaves have a spiral or alternate arrangement. The lower leaves have long petioles. The 3–5 carpels are partially fused at the base. The fruit is a follicle.



**Habitat:** Shrubberies and forest clearings, 2100 - 3600 metres from C. Nepal to Bhutan.

**Distribution:** *Aconitum* L. (Ranunculaceae) is a diverse genus with nearly 300 species worldwide, mostly in temperate and alpine regions of northern hemisphere. It was suggested that 26 species and 2 varieties in India amounting to 28 taxa while the rest are distributed in Japan, central Europe, East Asia, and Eastern and North-western America. In India, the genus is restricted only to the Himalayan region, and interestingly the species found in eastern Himalayas are not known from western Himalayas and vice-versa.

**Poisonous Parts:** Dried tuberous root.

**Main Toxin:** Aconitine, picroaconitine and napelline; further hydrolysis gives aconine.

Pseudoaconitine.

**Mode of Action:** Aconite first stimulates and later paralyses the nerves of pain, touch, and temperature if applied to the skin, broken or unbroken, or to a mucous membrane; the initial tingling therefore gives place to a long-continued anaesthetic action. When taken internally, aconite acts very notably on the circulation, the respiration, and the nervous system. The pulse is slowed, the number of beats per minute being actually reduced, under considerable doses, to forty, or even thirty, per minute. The blood-pressure synchronously falls, and the heart is arrested in diastole. Immediately before arrest, the heart may beat much faster than normally, though with extreme irregularity, and in the lower animals the auricles may be observed occasionally to miss a beat, as in poisoning by veratrine and colchicum. The action of aconitine on the circulation is due to an initial stimulation of the cardio-inhibitory centre in the medulla oblongata (at the root of the vagus nerves), and later to a directly toxic influence on the nerve-ganglia and muscular



fibres of the heart itself. The fall in blood-pressure is not due to any direct influence on the vessels. The respiration becomes slower owing to a paralytic action on the respiratory centre and, in warm-blooded animals; death is due to this action, the respiration being arrested before the action of the heart. Aconite further depresses the activity of all nerve-terminals, the sensory being affected before the motor. In small doses, it therefore tends to relieve pain, if this be present. The activity of the spinal cord is similarly depressed. The pupil is at first contracted, and afterwards dilated. The cerebrum is totally unaffected by aconite, consciousness and the intelligence remaining normal to the last. The antipyretic action with considerable doses of aconite display is not specific but is the result of its influence on the circulation and respiration and of its slight diaphoretic action.

**Symptoms:** Rapid respiration. Anxiety, with suffocation from feeling of paralysis in respiratory muscles, Cheyne-Stokes breathing.

**Uses:** The dried root is alterative, anaesthetic, antiarthritic, deobstruent, diaphoretic, diuretic, sedative, stimulant. It is best harvested in the autumn as soon as the plant dies down. This is a very poisonous plant and should only be used with extreme caution and under the supervision of a qualified practitioner. It has been used in India and Nepal in the treatment of neuralgia, leprosy, fevers, cholera and rheumatism. When the roots are soaked in cow's urine, they become soft and lose their depressant action on the heart, becoming a stimulant instead. As a hunting poison, Aconitum has been used in areas of Africa, Asia, Europe and the Americas. In places as far apart as Greece, Germany, India, Alaska and Japan.

### 3. Anamirta cocculus

**Common names:** Commonly known as Cocculus. The English common names are fishberry or Levant nut. It is variously known as ligtang, aria (Mindanao), bayati (Tagalog).



**Description:** *Anamirta cocculus* (Menispermaceae) is a Southeast Asian and Indian climbing plant. Its fruit, *Cocculus indicus*, is the source of picrotoxin, a poisonous alkaloid with stimulant properties. Plant is large-stemmed (up to 10cm in diameter); the bark is "corky gray" with white wood. The "small, yellowish-white, sweet-scented" flowers vary between 6 to 10 centimeters across; the fruit produced is a drupe, "about 1 cm in diameter when dry"

**Habitat:** Ilana

**Distribution:** It is distributed in many places in world likely, Philippines, East India, Malaysia, and New Guinea. Calawagan, Dayamat, Tungloy, Tikotiko, Bantulinao, Ipil, Purnaga, Occidental Mindoro.

**Poisonous Part:** Fresh fruit

**Main Toxins:** The seeds deliver picrotoxin, a sesquiterpene, while the seed shells contain the tertiary alkaloids menispermene and paramenispermene.

**Mode of Action:** It appears to competitively depress presynaptic inhibition in the vertebrate spinal cord and not to effect postsynaptic inhibitory processes. The generalization that only its picrotoxinin (II) component was active and that picrotin (III) was inactive was also of interest since their only difference is hydration of the isopropenyl group.

**Symptoms:** Motion sickness is a complex condition.

**Uses:** The powdered berries are sometimes used as an ointment for destroying lice. The entire fruits are used to stupify fish, being thrown on the water for that purpose. Picrotoxin is a powerful convulsive poison used principally to check night sweats in phthisis by its action in accelerating respiration, but it is not always successful. It was at one time used to adulterate beers, increasing their reputation as intoxicants; it is an antidote in Morphine poisoning.

#### 4. *Cannabis sativa*

**Common Name:** Hemp, Marijuana



**Description:** *Cannabis* is an annual, dioecious, flowering herb. The leaves are palmately compound, with serrate leaflets. The first pair of leaves usually have a single leaflet, the number gradually increasing up to a maximum of about thirteen leaflets per leaf (usually seven or nine), depending on variety and growing conditions. The upper leaves are alternate, stipulate, long petiolate, palmate, with 3-11, rarely single, lanceolate, serrate, acuminate leaflets up to 10 cm long, 1.5 cm broad. The flowers are monoecious or dioecious. The female flowers germinate in the axils and terminally, with one-ovulate ovary; fruit is a brown, shining achene, tightly embracing the seed with its fleshy endosperm and curved embryo. Seeds weigh 1.5-2.5 gm/100 seeds.

**Habitat:** Hemp occurs occasionally in central and northern Illinois, while in the southern portion of the state it is uncommon or absent.

**Distribution:** Native to Central Asia, and long cultivated in Asia, Europe, and China now a widespread tropical, temperate and subarctic cultivar and waif. The oldest use of hemp seems to be for fiber, and later the seeds began to be used for culinary purposes. Plants yielding the drug seem to have been discovered in India, cultivated for medicinal purposes as early as 900 BC. In medieval times it was brought to North Africa where today it is cultivated exclusively for hashish or kif.

**Poisonous part:** Dried flowers and fruits.

**Toxin parts:** Cannabin, cannabimon, cannabinol.

**Mode of Action:** The mechanism shows the blockade of ion channels, inhibition of adenylate cyclase and retrograde inhibition of neurotransmitter release.

**Symptom:** Psychotic reactions.

**Uses:** A multiple-use plant for furnishing fiber, oil, medicine, and narcotics. Fibers are best produced from male plants. In the temperate zone, oil is produced from females which have been

left to stand after the fiber-producing males have been harvested. Leaves are added to soups in Southeast Asia. Varnish is made from the pressed seeds. Three types of narcotics are produced: hashish (bhang), the dried leaves and flowers of male and female shoots; ganja, dried unfertilized inflorescences of special female plants; and charas, the crude resin, which is probably the strongest. Modern medicine uses cannabis in glaucoma and alleviating the pains of cancer and chemotherapy. More resin is produced in tropical than in temperate climates.

## 5. *Papaver somniferum*

**Common Name:** Poppy seed. Dwarf poppy, Bearclaw poppy, Coville,

**Description:** The opium poppy, *Papaver somniferum* L., belongs to the *Papaveraceae* family. The members of *Papaveraceae* are dicotyledonous, dialypetalous superovaryed plants. Six genera: *Papaver*, *meconopsis*, *glaucium*, *roemeria*, *chelidonium*, *hypecoum*. Within the genus *Papaver*, six species: *Somniferum*, *rhoeas*, *dubium*, *argemone*, *hybridum*, *alpinum*. Its flowers vary in colour from white to reddish-purple and the capsules contain numerous minute, kidney-shaped seeds. All parts of the plant, particularly the capsule, contain white latex that yields opium. Opium is derived from the cut immature capsule. Score capsule, return and scrap off exudate, dry, roll in ball. This is the crude opium. Interestingly, poppy seeds (as in muffins, etc) come from this same plant.



**Habitat:** It is a herb.

**Distribution:** It is native to Middle East/Asia. Traditional areas of cultivation include Afghanistan, India, South East Asia. Now lots produced in Mexico and the Golden Triangle (Burma, Thailand, Laos) and the Golden Crescent (Iran, Pakistan and Afghanistan).

**Poisonous part:** All parts.

**Toxin part:** Morphine (7 to 23%), codeine (max. 3%), thebaine (max. 3%).

**Mode of action:** It acts on Opoid receptor.

**Symptoms:** The smallest dose will cause nausea, emesis, and gastro-intestinal spasm; in others it will occasion feverishness, headache, watchfulness, restlessness, startling, disagreeable visions, delirium, anxiety, and afterward, an aggravated degree of the more familiar subsequent effects of this drug; these phenomena constitute what is called the *idiosyncratic action of opium*.

**Uses:** The patient with the *hard*, small pulse, the dry tongue, dry, contracted skin, the flushed face, bright eye, and contracted pupil, is always injured by the administration of opium. Opium, as a pain-reliever, is of inestimable value when properly used, while, when improperly administered, it still relieves the pain, but may mask conditions of disease so that the physician may be unable to properly watch the progress of the case, the amount of pain often being his best guide to the seriousness and extent of the trouble. As an antispasmodic, opium is valuable in *asthma*, *colic*, *cholera*, *hysteria*, *tetanus*, some forms of *dyspepsia*, *spasmodic* and *convulsive affections*, especially in spasms accompanying the passage of *biliary* and other *calculi*, or which

are present during an attack of *nephritis* or *gout*. Not only does opium relieve the pain, but it also relaxes the spasm attending the passage of the concretions. Morphine is generally employed in place of opium where pain and spasm are very severe. Codeine is effective for mild pain and relieves cough. Papaverine is used for circulatory diseases.

## 6. *Citrullus colocynthis*

**Common Name:** Colocynth, Indian wild Gourd or bitter apple, bitter cucumber.

**Description:** This plant is annual or perennial (in wild) herbaceous vine (Cucurbitaceae); stems angular and rough. Leaves rough, 3- to 7-lobed, 5-10 cm long, middle lobe sometimes ovate. Flowers are monoecious, solitary, peduncled, axillary, corollas 5-lobed, ovary villous, fruit a pepo, nearly globular, 4-10 cm in diameter with somewhat elliptical fissures. Seeds obovate, dark brown, about 7.5 mm long, 5 mm broad and 1.5 mm thick.



**Habitat:** Sandy and gypsum desert, sandy gravel.

**Distribution:** Native to dry areas of North Africa, being common throughout the Sahara, areas of Morocco, Egypt and Sudan, eastward through Iran to India and other parts of tropical Asia. It has been known since Biblical times and cultivated in the Mediterranean region, especially in Cyprus and in India for many centuries.

**Poisonous part:** The dried pulp, fruit, roots.

**Toxin part:** Colocynthin

**Symptoms:** Ascitis, Jaundice, Amenorrhea, Fever, Constipation.

**Uses:** Dried pulp of unripe fruit is used medicinally for its drastic purgative and hydragogue cathartic action on the intestinal tract. When the fruit is ripe its pulp dries to form a powder used as a bitter medicine and drastic purgative. This powder is so inflammable that the Arabs collect it to use as kindling. The fruit is used to repel moths from wool. In India, the vine is planted as a sand binder. Seed, often removed from the poisonous pulp and eaten in Central Sahara regions, contains a fixed oil.

## 7. *Croton tiglium*

**Common name:** Rushfoil and croton

**Description:** It is a small shrub or tree (Euphorbiaceae) up to 12 m tall, evergreen; leaves alternate, membranous, ovate with broadly rounded, sometimes slightly decurrent base, acuminate, acute or blunt, very shallowly serrate, with few stellate hairs beneath, 7.5-17 cm long, 4-9.5 cm broad, metallic green to bronze or orange; petiole slender, about 4 cm long; stipules caducous, subulate, 1.5- 3.5 mm long; axis of inflorescence glabrous; flowers small, inconspicuous; male flowers stellately hairy with narrowly oblong petals and 15-20 stamens; female flowers apetalous; capsule scabrid with stellate hairs, triangular, 15-20 mm long, 10-15 mm broad, oblong or ellipsoid, 3-lobed; seeds 3 per fruit, oblong-ovoid, orange.

**Distribution:** It is native to tropical Asia from India to New Guinea and Java, north into Indonesia and China. It is also grown in southern California.



**Poisonous part:** Seed, oil.

**Toxin Part:** Tiglic acid, Crotonic, or quarternylic acid.

**Symptoms:** GIT irritant & Cardiac poison.

**Uses:** A powerful drastic purgative, in large doses apt to excite vomiting and severe griping pains capable of producing fatal effects. It acts with great rapidity, frequently evacuating the bowels in less than an hour. The dose is very small; a drop placed on the tongue of a comatose patient will generally operate. It is chiefly employed in cases of obstinate constipation, often being successful where other drugs have failed. Applied externally, it produces inflammation of the skin attended with pustular eruption, and has been used as a counter-irritant in rheumatism, gout, neuralgia, bronchitis, etc. It should be diluted with three parts of olive oil, soap liniment or other vehicle and applied as a liniment. Must always be used with the greatest care and should never be given to children or pregnant women.

## 8. *Gloriosa superba*

**Common Name:** Methonia Superba Lamk, Lindley, Glory lily, Lily flower.

**Description:** This plant belongs to the Liliaceae family. The genus *Gloriosa* is comprised of about 10 to 15 known species. In general, octoploid species are comparatively short-statured and constitute a medium group of plants. The important species found in India are *G. superba* and *G. rothschildiana*. Leaves are ovate, lanceolate, acuminate, the tips spirally twisted. Flowers are large, solitary or may form a lax corymbose inflorescence, twisted and crisped with six recurved or reflexed petals. There are numerous seeds in a capsule and the seeds are warty and compressed.

**Habitat:** Common in forests, under cultivation in fairly large areas of India. Red soil preferred. Hard soil is not suitable for growth. pH of soil 6% to 7% neutral to acid, must be of free draining.

**Distribution:** Naturally it occurs in semi-shade areas among bushes on hillsides, India, along the Cape coast, Natal, Swaziland, Northern Province, Botswana, Namibia, and Zimbabwe.





**Poisonous part:** Tubers (roots)

**Toxin Part:** Superbine & Glucosine.

**Symptoms:** GIT irritant & Respiratory poison.

**Uses:** *Gloriosa superba* is a good abortifacient causing expulsion of foetus from the womb. Roots are anti-periodic, purgative, cholagogue, anthelmintic: It is bitter, acrid, astringent, anthelmintic and germicidal. It cures leprosy, swelling, piles, chronic ulcers, colic pain in bladder. Tubers are tonic and anthelmintic when taken in doses of 5 to 10 grains. Tubers abortifacient: extract of root, ecboic. Paste is antidote in snakebite. Powder of root is given for treatment of rheumatic fever. Various plant parts are used in spleen complaints, sores, tumours and syphilis. Extract of plant is CNS depressant.

## 9. *Nerium oleander*

**Common Name:** Oleander, Roseberry spurge.

**Description:** This plant grows to only 4 ft and belongs to the family Apocynaceae. This fast growing evergreen shrub can reach up to 20 ft (6.1 m) tall but is usually seen trimmed at 6-10 ft (1.8-3.1 m). It forms a rounded mound to about 10 ft (3.1 m) wide. It is a tough, versatile plant with showy summertime flowers in white, red, pink, salmon and light yellow. Leathery, lens shaped leaves range from about 4-10 in (10.2-25.4 cm) long, depending on variety and are a bright green.



**Habitat:** Generally it is available in many areas within its hardiness range.

**Distribution:** *Nerium oleander* is native to northern Africa, the eastern Mediterranean basin and Southeast Asia. Oleander prefers dry, warm climates and may naturalize in such areas.

**Poisonous part:** Root & root-bark

**Toxin Part:** Neriodorin

**Symptoms:** Cardiac poison. The gastrointestinal effects can consist of nausea and vomiting, excess salivation, abdominal pain, diarrhea that may or may not contain blood, and especially in horses, colic. Also it includes drowsiness, tremors or shaking of the muscles, seizures, collapse, and even coma that can lead to death. Oleander sap can cause skin irritations, severe eye inflammation and irritation, and allergy reactions characterized by dermatitis.

**Uses:** Oleander leaf extract is taken to treat congestive heart disease, and applied topically to treat skin disorders. It should only be taken under supervision and dosage of a licensed herbalist and physician.

## 10. *Plumbago zeylanicum*

**Common Name:** Ceylon leadwort, White leadwort.

**Description:** This plant is native to SE Asia. It is a much branched, evergreen shrub that reaches about 6 feet (2 meters) in nature. Dark green leaves are ovate to 6 inches (30 cm) long by half as wide. They are fast growing plants.

**Habitat:** Sand dunes, dry forest.

**Distribution:** This herb is found throughout India. It grows wild as a garden plant in East, North and Southern India and Ceylon.

**Poisonous part:** Root

**Toxin Part:** Plumbagin.

**Symptoms:** Externally it produces rashes & Gastro intestinal poison



**Uses:** The root of this herb is a powerful acro-narcotic poison. It causes abortion. It will expel fetus, dead or alive. The root of the herb is used in cases of enlarged spleen. This herb is used as part of many ayurvedic compound remedies for rubifacient applications. Root reduced to a paste is applied to abscesses to open them. A paste made of milk, vinegar, or salt and water may be applied in leprosy and other obstinate skin diseases, unhealthy ulcers, scabies etc. Ayurvedic doctors recommend the root of this herb for dyspepsia, piles, anasarca, diarrhea, skin diseases etc. A tincture of the root- bark is employed as an antiperiodic.

## 11. *Cicuta maculata*

**Common Name:** Water hemlock, spotted water hemlock, spotted cowbane.



**Description:** It is a Perennial herb (Apiaceae) with short tuberous roots and purple-striped or -mottled, hollow stems with cross-partitions at the nodes and many of these at the base of the stem. It is having 2850 species in 275 genera of global distribution but mostly in north temperate regions. The leaves alternate, clasping the stem, 2-3 pinnately divided the leaflets with the veins ending in the notch between the teeth; flowers small, white, in umbrella-like clusters.

**Habitat:** Forest or natural area in wet areas, pond, stream, or ditch banks.

**Distribution:** Himalaya (Sirmore to Sikkim), Burma, Malaysia, N. Australia.

**Poisonous Part:** All parts, mainly roots.

**Toxin Part:** Cicutoxin and cicutol.

**Symptoms:** Muscle spasms, dilated pupils, dizziness, diarrhea, stomach pain, convulsions.

**Uses:** Water hemlock is probably the most poisonous plant in Utah, containing alkaloids. The roots are the most toxic part of the plant. When roots become exposed and are eaten by livestock, death occurs in 1 to 12 hours. The leaves and stems lose most of their toxicity as they mature. Sheep do not seem to be as affected as cattle.

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