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Orcinols and Phloroglucinols

• Cannabis (Indian Hemp), *Cannabis sativa* L., Cannabaceae

A drug of ancient use in the Ayurvedic and Chinese systems of medicines (among other things as an analgesic and anesthetic), hemp diffused westward very quickly: the Assyrians used it as incense, and the Scythians inebriated themselves with the vapors released by the drug when thrown onto heated stones. Its subsequent spread followed the expansion of Islam. The British physicians of the army of India and Bonaparte's expedition to Egypt shared the main responsibility for its introduction into Europe, in the nineteenth century. There, it was to be consumed in intellectual circles (it was frequently ingested as a thick jam, *dawamesk*) and exploited by medicine, which attempted to use it in the treatment of epilepsy, migraines, neuralgias, convulsions, spasms, and miscellaneous pains. The inconsistency of its therapeutic activity, the poor conservation of its preparations, the difficulty in deciding optimal doses, and the emergence of synthetic analgesics and hypnotics lead to the gradual abandon of its use, and to its disappearance, in the first half of the twentieth century, from most of the occidental pharmacopoeias. Its use has been forbidden in France for forty years, but this did not prevent the rapid spread (in France and in most of the European Union countries) of its illicit use *, supplied by an international trafficking network of considerable proportions. The prevalence of this abuse, particularly in the United States, has led to a multiplication of scientific studies designed to determine the true impact of its chronic or occasional use on health: the plethora of publications (bibliography estimated in 1987 at about 8500 references!) is in itself a proof of the controversies generated by this narcotic, and of the challenge faced by many authors in formulating definitive conclusions. Although the immediate effects of cannabis intoxication on behavior are well known, this is far from being the case for long term effects—whether they exist is a topic of debate.

* Estimates from the most recent surveys are that in France, five to seven million individuals (out of a population of about 60 millions) have used cannabis at least once; of those, two million used it at least once during the year preceding the survey. The results also show that cannabis use was high since the early 1990s and relatively stable from 1990 to 1997 (Observatoire français des drogues et des toxicomanies : la consommation de cannabis, niveau et tendances; http://www.ofdt.fr).

In the United States—in 1990—10 million individuals used cannabis at least once a month (Inaba, D.S. and Cohen, W.E. (1997). Excitants, calmants, hallucinogènes, Piccin, Padoue).

The Plant. The morphology of the leaves of this tall dioecious herb varies as a function of their insertion point: at the base of the stalk, they are opposite and digitate with five to seven folioles, whereas near the apex of the stalk they are alternate, and either uni- or trifoliolate; the folioles are lanceolate and dentate. The staminate flowers are grouped in panicles, and the pistillate flowers are tightly gathered into compact cymes mixed with foliaceous bracts. The fruit (hemp seed) is an ovoid akene. Under the microscope, the leaf displays, on both surfaces, many covering trichomes, unicellular, smooth, and curved. Some of them are enlarged at the base, due to the presence of calcium carbonate crystals (cystoliths); they overlap one another like fish scales. Glandular trichomes are rare on the leaves, but not on the pistillate inflorescence bracteoles, where there are hairs with multicellular multiseriate stalks often separated from their heads, globose, and consisting of 8 to 16 cells.

Fiber Variety, Resin Variety

Although it had been thought for a long time that the *sativa* species comprised at least two varieties, it is now known that in fact hemp adapts to almost all ecological conditions: "what ensues is a plasticity which manifests itself in the botanical, chemical, and consequently, pharmacological domains" (G. Fournier). The plant genotype is also a determinant factor. Three types of hemp are distinguished, based on the concentrations in *Δ⁹-tetrahydrocannabinol* (pharmacologically active Δ⁹-THC, commonly referred to as THC), and in *cannabidiol* (= CBD, inactive, but a good identification marker):

- the "drug" (resin) type with high THC concentration (>1%) and no CBD; this type of composition is observed in all of the hemp growing in warm climates, and producing abundant resin;

- the "hemp" (fiber) type with very low THC concentration (<0.3% and in fact <0.1% for the majority of the "textile" varieties cultivated in northern temperate climates) and high CBD concentration;

- the "intermediate" type, with high concentrations of both THC and CBD; this type is characteristic of hemp from the Mediterranean rim.

Hemp Type. Regulations for its culture (in France).

The production, marketing, and uses: 1. of Indian hemp, of its plant and of its resin, and of preparations that contain them (or of those prepared from hemp, its plant, or its resin) and 2. of THC and its derivatives, are prohibited, except with a waiver for research or control purposes, or for the manufacture of authorized compounds (Article R 5181 of the French Public Health Code or *Code de la Santé Publique* = CSP). The same text has provisions to authorize the culture, import, or export of *Cannabis* varieties devoid of narcotic properties. These varieties were

subsequently specified (enforcement decree or *arrêté d'application*, 22 August 1990, *Journal Officiel de la République Française*, 4 October 1990, p 12041); there are twelve of them, and they contain not more than 0.3% THC (determined by the method defined and published in the annex of the above decree, i.e., by GC of a petroleum ether extract).

This authorization covers hemps cultivated for the manufacture of specialty papers, non-woven products, furniture particle board, animal litter, cellulose bulk foods, and so on. Producers must hold a production contract specifying a buyer, and use certified seeds from authorized varieties. Sowing and harvesting are subject to mandatory declarations.

Drug Type

There is a large number of clandestine forms whose specifications vary with the country being considered, the users' populations, and more. They fall into three main groups:

• forms with low THC concentration (2-6%): marijuana (also known as grass, pot, reefer, weed, or Mary Jane). This consists of the flowering tops. They are often more or less mixed with leaves, sometimes with stems, seeds, or both, dried, and sometimes pressed together. This is the most classic form of drug to be smoked, mixed with tobacco (*pétard* or *tarpet* in French);

• concentrated THC preparations (5-20%): hashish. This is the resin *, which is usable, like marijuana, by inhalation of the smoke (joint). In the past few years, new varieties have appeared, obtained by hydroponic cultivation and selected for their high level of THC ("Nederwiet" varieties). A recent analysis of specimens of Dutch origin (Super Skunk®) showed levels reaching 13.4 % (and 16.8% when stem and leaf fragments were removed)**.

• very concentrated THC preparations: hash oil (>50% THC). Obtained by a solvent extraction of hashish in home-made apparati based on the principle of a Soxhlet extractor, this form is used dropwise, on a cigarette, or on various other supports.

Chemical Composition. Hundreds of different compounds have been isolated from hemp: essential oil with terpenoid compounds, flavonoids, sugars, fatty acids, phenolic spiroindanes, dihydrostilbenes, nitrogen-containing compounds (amines,

* According to Paris and Moyse, the pure resin is referred to as *chara*, whereas *hashish* (Arabia, Egypt) or *ganja* (India) are the flowering tops caked in resin. In practice, the term hashish is synonymous with resin.

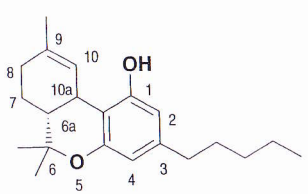
** Fournier, G., Fournier, C. and Walbilic, S. (1997). À propos du Nederwiet, *Psychotropes - RIT*. 3. 19-21.

ammonium salts, and alkaloids derived from spermidine). The most interesting constituents are the cannabinoids: theoretically absent from the seeds and stems, they are found in the leaves, and concentrated in the bracts and the resin.

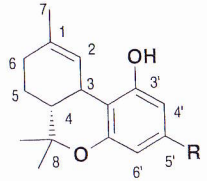
Cannabinoids—about 70 are known—are terpenophenolics classified in several groups as a function of their structure. The chief representatives of these groups are:

- *Δ⁹-tetrahydrocannabinol* (Δ⁹-THC or THC), a benzotetrahydropyran;
- *cannabinol* (CBN), a dibenzopyran (a degradation product of THC);
- *cannabidiol* (CBD), a diphenol.

THC and CBD occur in the fresh plant, in part, as carboxylic derivatives (at C-2), alongside their homologs with shorter side chain (propyl- and methylcannabinoids), their precursors (e.g., *cannabigerol* = CBG), chromane derivatives (cannabicyclol, cannabichromeme), and more.



Tetrahydrocannabinol



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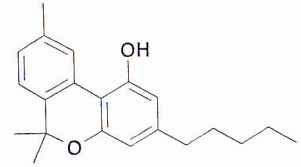
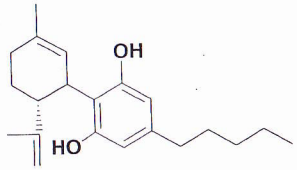
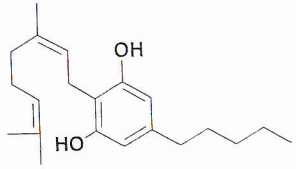


Cannabinol

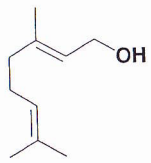


Cannabidiol

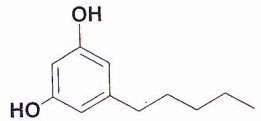


Cannabigerol

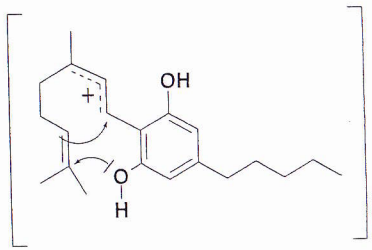
Cannabinoid Biosynthesis. These compounds arise, in all likelihood, from the condensation of a molecule of geranyl pyrophosphate with a phenol such as olivetol, and this may explain the formation of cannabigerol; the latter leads, by oxidation and allylic rearrangement, to CBD, then THC. The occurrence of *Cannabis* forms that do not elaborate CBD suggests the existence of other pathways from cannabigerol to THC.



GPP



Olivetol



Pharmacological Properties. The activity of hemp is based on Δ⁹-tetrahydro-

of them, found only in traces, have never been studied). CBD may inhibit the anxiety caused by high doses of THC.

THC is particularly lipophilic, and is rapidly absorbed (peak plasma concentration after inhalation: 7-8 min). It is metabolized in the liver to hydroxylated compounds (e.g., 11-hydroxy-THC), which are neutral or acidic (e.g., 9-carboxylic), inactive or active, and excreted in the feces or urine. The half-life of THC is 8 days; THC or its metabolites are still detectable in urine several weeks after absorption: thus, it is constantly present in the tissues of most "occasional" smokers.

THC binds to specific receptors located in the limbic system. These CB1 receptors have been characterized in rats as well as in humans. The stereospecificity is very high, since only 6a*R*,10a*R* -(–)-Δ^9-THC possesses pharmacological activity. The existence of a THC receptor has implicitly raised the question of the existence of endogenous ligands: in 1992, Mechoulam *et al.* isolated from pig brain a molecule, namely anandamide, which binds specifically to the THC receptor. Anandamide, whose name was derived from the Sanskrit *ananda* (bliss), is the ethanolamide of arachidonic acid (hence the common term, cannabimimetic eicosanoid). Since its discovery, it has been the topic of extensive molecular pharmacology research. As a result, a second subtype of cannabinoid receptor (CB2) has been characterized on the macrophages of the marginal zone of the spleen. They may play a role in the modulation of immunity. Cannabinoids interact with GABA receptors and interfere with the different types of central neurotransmission.

The acute toxicity of THC is very low—its lethal dose is not known—and as emphasized by R. Mechoulam*, "there is no single documented case of human death caused by THC or hemp".

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* Mechoulam, R. (1984). Cannabis: le point sur les recherches, *Impact : science et société*, (UNESCO), n° 133, 23-35; the author indicates, however, that a latent mortality may have been observed in animals (due to the accumulation of THC?).

** "External objects, one by one, slowly assume peculiar appearances; they become deformed and transformed. [...] Sounds put on colors, and colors put on music. [...] Sometimes it happens that your personality disappears, [...] that the contemplation of external objects makes you forget your very own existence, and that you become one with them. [...] Your attention will rest a little too long on the bluish clouds exhaled by your pipe [...]. Through a peculiar ambiguity, by some sort of transposition or intellectual quid pro quo, you will feel yourself evaporating, and you will find yourself again in your pipe [...] the weird ability to *smoke yourself*. [...] Luckily, this endless fantasy will have lasted only one minute [...]. But another flow of ideas sweeps you away; it will roll you for another minute in its live swirl, and this extra minute will be another eternity. For the proportions of time and of existence are completely warped by the multitude and intensity of your feelings and ideas. It is as if you were living several human lives in the space of one hour." Further: "But you should see the results [...] hashish annihilates [willpower], hashish is a suicide weapon [...] will isolate you [...] belongs in the category of lonely joys; it is for idle bastards. [...] Hashish is useless and dangerous." Baudelaire, C. Les paradis artificiels, Garnier-Flammarion (1966), Paris. (Le poème du haschich, chapter III, p. 47-48; see also another rendition *in*: "Du vin et du haschich comparés comme moyens de multiplication de l'individualité". *ibid.*, IV, p. 177)

Effects of THC and of *Cannabis*.

The effects of THC and of *Cannabis* on behavior are the best known: they were described, as early as the middle of the nineteenth century, in medical texts (Moreau de Tours, J. [1845]. *Du haschich et de l'aliénation mentale – Etudes psychologiques*, cited by Pelt, J.-M. [1981]. *Les drogues*, Doin, Paris), and in literary writings (T. Gauthier, C. Baudelaire ** p. 450), which accurately describe the alteration of perceptions caused by the absorption of *Cannabis*. The physical effects are far more modest (except in very young children who can get intoxicated inadvertently: ingestion of joint butts, resin fragments, hashish-containing pastries).

Acute Manifestations. A single dose of THC (or of cannabis) may cause only a few somatic symptoms, which remain minor in the vast majority of cases: blood-shot eyes, dry mouth, tachycardia, increased appetite, and only at high doses, orthostatic hypotension. THC intoxication manifests itself mostly by psychic symptoms. These have a wide range of variability, and may be characterized as inappropriate behaviors. Feelings of well-being, euphoria, and relaxation commonly result from cannabis intake. Users report effects on sensorium (distance, shapes, sounds, and colors), and on the perception of time. There is impairment of short-term memory, which perturbs verbal communication (short sentences, slow speech, non sequiturs). The dose, subject's history, and environmental context have a direct influence on the symptoms. THC perturbs motor coordination, therefore cannabis intake endangers motor vehicle drivers, airplane pilots, and machine operators.

Cannabis rarely induces hallucinations (massive doses, psychotic individuals). Syndromes with delirium and anxiety, panic, and depersonalization seem to occur more frequently, at least in some individuals and with high doses, or with preparations with high concentrations of THC. The hallucinations can also be relived long after product intake: these are the flashbacks, well known in the case of LSD.

Chronic Manifestations. Chronic cannabis use induces functional alterations in the bronchi (THC is a bronchodilator). Like the combustion of tobacco, with which it is often mixed, the combustion of cannabis produces carcinogens. Data on a potential immunosuppression linked to cannabis use are highly contradictory, difficult to interpret, and not confirmed by clinical observations. What seems certain is that regular use causes memory problems that can persist for weeks after drug discontinuation. The development of an "amotivational" syndrome, especially in adolescents, is common (the patient is apathetic, socially withdrawn, and unable to concentrate), but whether this is an independent syndrome in and of itself is often questioned: is cannabis at the origin of the "demotivation" or is cannabis use just one facet of the behavior of some demotivated individuals? Psychotic manifestations (confusion) can be observed in long-term users of very high doses.

THC decreases intraocular pressure and increases the heart rate, but this effect diminishes very rapidly when the use become chronic (tolerance). The significance of the changes in hormone secretion, studied in animals and observed in humans

Tests. Under this heading, we shall succinctly mention the problems in *Cannabis* identification. They face the French pharmacist often, and we must emphasize that although morphological identification is fairly easy, the same cannot be said of TLC analysis and interpretation * for chemical identification, and that it is probably advisable to refer dubious samples to a specialized laboratory.

The suspicious sample may consist of more or less chopped plant fragments **; often it is a cigarette containing various products. A search is in order for yellowish-green leaf fragments, furrowed and ramified stems, and hemp seeds, either green or brownish depending on the degree of maturity: stems and seeds are completely innocuous because they are devoid of THC. The search must also look for agglutinated resinous fragments, brown or greenish, and fragments of resin slabs. After rough bruising and mounting in water or dilute potassium hydroxide, the fragments may be examined under the microscope to search for the characteristic elements described above (cystoliths). Although this examination makes possible the identification of *Cannabis*, in no way does it allow evaluation of the toxicity of the sample. Chemical analysis is absolutely required.

Some authors recommend completing the morphological and microscopic examination of the sample with a color reaction: actually, the known reactions are characteristic of cannabinoids but not of THC, which leads other authors to judge them useless (and dangerous, as some of them are even positive with nutmeg or coffee grounds...).

TLC Analysis. TLC on silica gel is conducted after extracting the cannabinoids with petroleum ether. Reference standards are used (THC, CBD), and visualization is usually accomplished by spraying fast blue B (di-*o*-anisidine tetrazolium); the different cannabinoids are identified by their Rf and by the color of the spots: purple for THC, orangy red for CBD, violet for CBN, and so on.

Cannabinoid Quantitation. Only specialized laboratories can carry it out. It relies on conventional GC techniques, the only method capable of estimating the relative amounts of the different cannabinoids, and therefore of defining the true toxic potential of the sample: "drug" type with high THC concentration and no CBD, "hemp" type poor in THC and rich in CBD, or "intermediate" type. GC can be applied directly or after derivatization, which is sometimes required for detection in biological matrices (other techniques include immunoassays, HPLC, GC-MS; see specialized articles and books).

Uses of Cannabis. In France there are no legitimate uses of "drug"-type *Cannabis*. In contrast, its illicit use is widespread: it is by far the most consumed illicit poison.

* Custody of the necessary reference standards requires a special license. Commercially available test kits are simpler to use.

** In contrast, whole cakes (ganja or other compact forms) or hash oil are extremely

The principal producers of marijuana are Colombia, Mexico, the United States, the Caribbean Islands, but also central Africa and southeast Asia. Morocco *, as well as Lebanon and the countries of western Asia (Afghanistan, Pakistan) are the main producers of hashish.

Chronic intoxication by *Cannabis* leads to a weak physical dependence; the induction of tolerance, although real, does not seem to be a problem for "small" or occasional users (the occurrence of an inverse tolerance was discussed for a while, but could never be proved). Psychological dependence is substantial and highly dependent on the user's history. Overdose (which may be caused by the erratic quality of the available products) is essentially marked by a psychotic state which subsides spontaneously. Drug discontinuation, especially in chronic and heavy users, can cause a withdrawal syndrome (anxiety, irritability, alternating agitation and sleepiness), which subsides rapidly (3-4 days), and only requires symptomatic treatment. These signs may have a psychosomatic origin, in which case they would reflect a strong psychic dependence.

Cannabis and Therapeutics: Potential. Within the broad therapeutic potential of cannabinoids, at least one deserves to be mentioned: their antiemetic activity. On the basis of observations by cancer patients undergoing chemotherapy, who were also joint smokers, these properties of THC, and later of synthetic analogs, were studied, then exploited.

Clinical trials have confirmed the significant activity of THC by the oral route on the vomiting induced by most chemotherapy regimens (except for cis-platinum). It is marketed as an antiemetic in the United States, in capsules of 2.5, 5, and 10 mg in solution in sesame oil (Marinol®). The drawback of THC lies in the psychic side effects: these are often modest, and disappear at the end of the treatment; they do not occur with classic antiemetics (i.e., ondansetron, metoclopramide, or domperidone). Structural analogs have been developed, particularly nabilone and levonantradol; they underwent successful clinical trials, but still have non-negligible side effects.

Among other potential applications of cannabinoids and of their structural analogs, note the antiglaucoma, antiasthmatic, anticonvulsant, spasmolytic, analgesic, and orexigenic properties, and the constant challenge throughout this series of dissociating the desired activity from the central effects.

Uses of the Seeds. Hemp seed oil is rich in essential fatty acids, therefore some authors propose a dietary use (oil for salad dressing) and use in cosmetic formulations.

The ingestion of hemp seed oil can cause gastrointestinal and psychological problems. Controlled ingestion experiments have shown that cannabinoids can be found—in very small quantities—in the urine of hemp oil or hemp seed users.

* Most of the drug seized in France is hashish from Moroccan origin. It is often cut, for

MALLOTUS PHILIPPINENSIS
(Lour.) Muell Arg.

• HOPS, *Humulus lupulus*, Cannabaceae

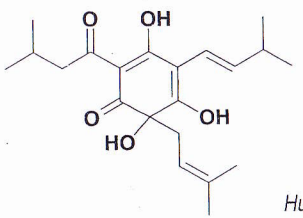
The dried pistillate inflorescence of hop (= hops) is listed in the 3rd edition of the European Pharmacopoeia (1998 add.). This drug is used in phytotherapy for its "sedative" virtues. Its inflorescences are mostly used in the brewing industry, as such or as the oleoresin obtained by supercritical carbon dioxide extraction.

The Plant, the Drug. Hop is a tall dioecious perennial herb, with tri- to pentalobate leaves, with pistillate flowers gathered in racemes commonly referred to as hops, hop cones, or strobiles. It grows wild in the hedges and wood skirts of Europe and North America, and is widely cultivated.

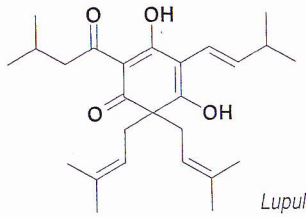
The hop cone, greenish-yellow, ovoid, is formed of numerous bract and bracteoles, ovate, sessile, membranous, and imbricate. The base of the bracts and the induvial fold are covered with small glands with orangy-yellow oleoresin that appear as small orangy red granules, and constitute lupulin.

Chemical Composition. Hops contain flavonoids: rutin, quercitrin, astragalin, but also an isoprenylated chalcone and an isoprenylated flavanone, xanthohumol and isoxanthohumol, respectively. Steam distillation produces 0.3 to 1% essential oil. Chief constituents are mono- and sesquiterpenoid hydrocarbons (β-myrcene, humulene, caryophyllene). They also contain oxygenated derivatives and 2-methyl-3-buten-2-ol, with the level of the latter increasing with storage time.

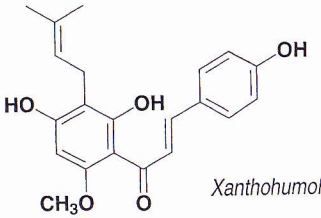
The compounds responsible for the characteristic bitterness of hops are prenylated derivatives of a 1-acylphloroglucinol: lupulone, humulone, and related compounds. Their concentration is greater than 15%, and can reach 30%.



Humulone



Lupulone



Xanthohumol

Methylbutenol

Tests. Hops are identified by their morphology and, after pulverization, by their

and biseriate stalk, and with a bowl-shaped structure at the end, 150-250 µm in diameter; its cuticle is detached and distended by the accumulated oleoresin secretion. Hops identification is confirmed by TLC analysis of an extract in 70% methanol to show chalcone and phloroglucinols (visualization with phosphotungstomolybdate). Hop cones must contain not less than 25% matter extractible in 70% alcohol.

Pharmacological Activity and Uses. Although many authors admit that hop preparations are sedative, the nature of the active ingredients remains mysterious; it is only known that in animals, methylbutenol induces narcosis (mouse) and a decrease in spontaneous movement (rat). Better known is the origin of the bactericidal activity: it is due to the phloroglucinol-type keto-enols. Regarding the estrogenic properties that tradition attributes to hop cones, animal experiments have not demonstrated them.

Although phytopharmaceuticals based on hop strobiles may be used traditionally as an appetite stimulant, they have the following main indication: traditionally used for the symptomatic treatment of neurotonic conditions in adults and children, especially for minor sleeplessness [French Expl. Note, 1998]. The drug is seldom used in France.

In Germany, the Commission E monograph describes that hops are used as a sedative for insomnia, states of anxiety, and nervousness.

• KAMALA, *Mallotus philippinensis* (Lamk.) Muell. Arg., Euphorbiaceae

This species is a small tree growing from India and Sri Lanka to the south of China and Malaysia. Its fruits are covered with globose glands producing red resin, and with unicellular trichomes, which used to be collected by threshing or by stirring in water; they were used to dye silk; the seeds produce an unstable oil, which polymerizes rapidly. The coloring principle—rottlerin—is a phloroglucinol derivative and a taenifuge.

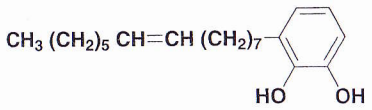
The structure of this molecule is closely related to that of other phloroglucinols found in the inflorescences of the kusso tree, an anthelmintic Ethiopian Rosaceae (*Hagenia abyssinica* Gmelin), or in the rhizome of male fern (*Dryopteris filix-mas* [L.] Schott *str. s.*, other forms and hybrids), a drug now obsolete, but which had long been used to treat nematode and tapeworm infestations. The efficacy of this drug, which had long been used in western veterinary medicine and is still used in India and Pakistan, was recently evaluated experimentally in cestode-infested goats. Its activity (375 mg/kg, dried fruit powder) was comparable to that of commonly prescribed synthetic agents.

Other Phenolics

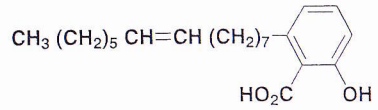
• *Allergenic Anacardiaceae:* SUMACS

Sumacs are typically North American plants of the genus *Toxicodendron* (= *Rhus*). They are trees or shrubs, often climbing shrubs.

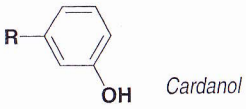
Poison ivy (*T. radicans* [L.] Kuntze), poison sumac or poison dogwood (*T. vernix* [L.] Kuntze), (western) poison oak (*T. diversilobum* [Torr. & Gray] Greene and *T. quercifolium* [Michx] Greene) are common in the United States. There, they cause real problems since over 50% of the population is sensitive to the action of the phenolics contained in the juice that these plants exude when bruised.



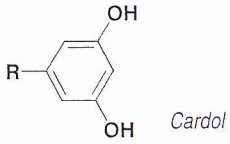
Urushiol



Anacardic acid



Cardanol



Cardol

These phenols, collectively referred to as urushiol, are *o*-diphenols substituted by an aliphatic chain of 15 to 17 carbon atoms, and more or less unsaturated (one to three double bonds). Oxidized to quinones, they form covalent bonds with proteins, and yield an antigenic complex. Contact with the fresh plant results in severe and extended dermatitis with blisters. Hands and clothing, objects and pets disseminate the phenols that remain intact (and active) for months.

Specimens of these sumacs have been introduced in Europe where they can cause similar problems (fortunately rare). Another species introduced there for its ornamental value—staghorn sumac, *R. typhina* L.—appears to be innocuous; also harmless are the California pepper tree (*Schinus molle* L.) and fustet or Venetian sumac (*Cotinus coggygria* Scop.).

Close species include the Japanese lacquer or varnish tree (*T. verniciferum* [Stokes] Barkley). An oxidase, laccase, transforms the juice obtained by incision into a black lacquer, traditionally used in Asia to finish various objects. The juice of this species, *kiurushi* (hence "urushiol"), contains the same type of compounds as other *Toxicodendron*, and this explains the dermatitis reported in some people after handling or contact with lacquer or items of lacquered wood.

The dermatitis caused by the pericarp of the cashew nut or that of mangoes (*Anacardium occidentale* L., *Mangifera indica* L., two Anacardiaceae) is induced by

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