



# Bioequivalence & Bioavailability of the Phytoconstituents in Some Plant Species Potentially Toxic



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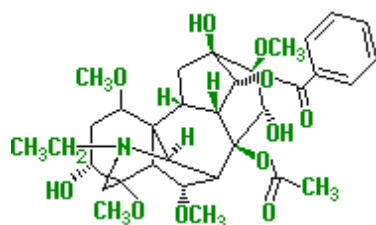
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**Keywords:** Flavonoid c-glycoside malonate; Aristolochia acid; Aristolochia Clematitidis; cyanogenic glucosides

## Aquilegia Sp Phytoconstituents

It contains cyanogenic glycoside ancolies, flavonoid c-glycoside malonate. Other substances are isocystoside (antioxidant, antimicrobial activity and hepato-protective effect), flavonoid emulsin, taiuiin, aquilegine, vitamin C, an uncharacterized alkaloid, and sphingolipid desaturase.



aconitine; C33H47NO11; CAS: 302-27-2.

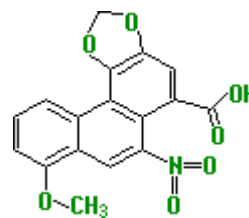
## Toxicity

The ancolies are regarded as dangerous (seeds). The alkaloids which they contain bring closer aconitine but their toxicity is definitely less. Their extreme acridness generally avoids poisonings. The plant's seeds and roots are highly poisonous however, and contain cardiogenic toxins which cause both severe gastroenteritis and heart palpitations if consumed as food. Folk medicine used very small amounts of Aquilegia root as an effective treatment for ulcers. However, the medical use of this plant is better avoided due to its high toxicity; poisonings may be fatal [1].

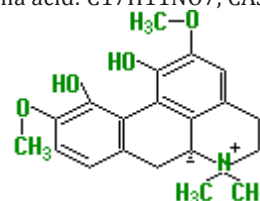
## Aristolochia Clematitidis Phytoconstituents

The plant contains Aristolochia acid; this stimulates white blood cell activity and speeds the healing of wounds, but is

also carcinogenic and damaging to the kidneys. Contains an active antitumor agent but is too toxic for clinical use and that Aristolochia acid has anticancer properties and used in conjunction with chemotherapy and radiotherapy and increases the cellular immunity or phagocytosis function of the phagocytic cells. Aristolochia acid and related alkaloids, magnoflorine and allantoin.



Aristolochia acid: C17H11NO7, CAS: 313-67-7.



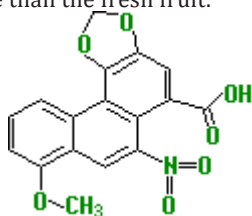
Magnoflorine: C20H24NO4, CAS: 2141-09-5.

## Toxicity

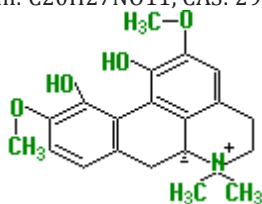
The most toxic aspect of *Aristolochia Clematitidis* is that it acts as a poison for the kidneys and liver. If taken over the course of a month or two, this can lead to outright kidney failure and death. Toxic effects in animals include anorexia, constipation, nephritis, coma, weak pulse, and accelerated heart's action. Particularly horses are very sensitive to the plant. Intoxication generally has no adverse effects, but recovery is slow [2].

### Armeniaca Vulgaris Phytoconstituents

Active constituents are amygdalin (yields hydrocyanic acid, glucose and benzaldehyde), and sitoserol. Will yield 40 to 50% express fixed oil consisting mainly of olein with small amounts of glyceride of linolic acid. Three apricots have about 2, 7 IU of beta-carotene (more 50% of RDA). The dried fruit are beta-carotene, potassium, boron and 20% of the RDA for iron (in 1/2C.). It is higher in fibre than the fresh fruit.



Amygdalin: C<sub>20</sub>H<sub>27</sub>N<sub>0</sub>O<sub>11</sub>, CAS: 29883-15-6.



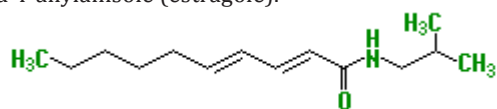
Beta-sitoserol: C<sub>29</sub>H<sub>50</sub>, CAS: 83-46-5.

#### Toxicity

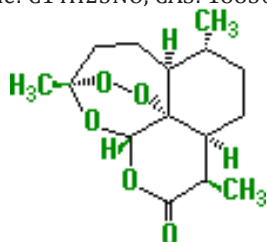
Excessive eating of the kernal can result in hydrocyanic poisoning. Excess causes central nervous system depression and respiratory failure. Toxicity of amygdalin is reduced by stir-baking or steaming and can be neutralized by a decoction of the outer bark. Hydrocyanic (prussic) acid is a general protoplasmic poison even at a dose of 2.5g. Licorice or jujube taken with it helps as an antidote (applies to wild cherry bark/ peach seed) [3].

### Artemisia Sp Phytoconstituents

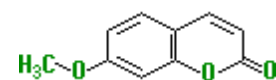
The constituents of essential oil were 1, 8-cineole (eucalyptol, 13.75%), germacrene D (10.41%), camphor (8.57%), artemisia ketone (6.96%) and calarene (5.62%). From the aerial parts, one known alkamide, pellitorine, two new alkamides neopellitorine A, neopellitorine B, and one known coumarin herniarine were isolated and 4-allylanisole (estragole).



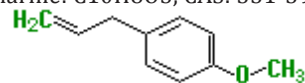
Pellitorine: C<sub>14</sub>H<sub>25</sub>NO, CAS: 18836-52-7.



Artemisinin: C<sub>15</sub>H<sub>22</sub>O<sub>5</sub>, CAS: 63968-64-9.



Herniarine: C<sub>10</sub>H<sub>8</sub>O<sub>3</sub>, CAS: 531-59-9.



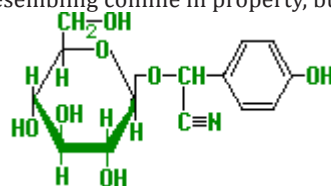
Estragole: C<sub>10</sub>H<sub>12</sub>O, CAS: 140-67-0.

#### Toxicity

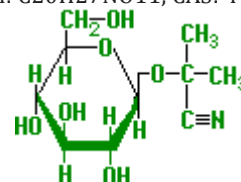
The predominant component of the essential oil was isolated and identified to be l-phenyl-2,4-hexadiyne which was found to be responsible for the insecticidal activity of the essential oil (insecticidal alkamides neopellitorine A and neopellitorine B) [4].

### Arum Maculatum, Arum Orientale Phytoconstituents

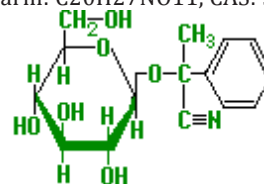
Aroin, cyanogenic glucosides, saponins, Ca<sup>2+</sup> oxalate raphides. Arum gives off prussic acid when bruised which is the result of certain cyanaphoric glycosides (linamarin, dhurrin, lotaustralin and taxiphyllin) being present. The tuber contains volatile acrid principle, starch, albumen, gum, sugar, lignin, salts of potassium and calcium, saponin and a brownish, oily liquid alkaloid resembling coniine in property, but less active.



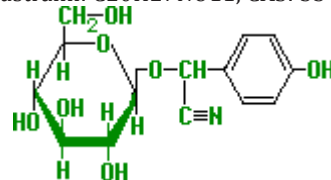
Dhurrin: C<sub>20</sub>H<sub>27</sub>N<sub>0</sub>O<sub>11</sub>, CAS: 499-20-7.



Linamarin: C<sub>20</sub>H<sub>27</sub>N<sub>0</sub>O<sub>11</sub>, CAS: 554-35-8.



Lotaustralin: C<sub>20</sub>H<sub>27</sub>N<sub>0</sub>O<sub>11</sub>, CAS: 534-67-8.



Taxiphyllin: C<sub>20</sub>H<sub>27</sub>N<sub>0</sub>O<sub>11</sub>, CAS: 21401-21-8.

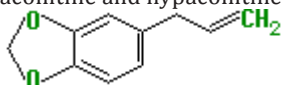
#### Toxicity

Calcium oxalate and possibly irritant proteins and aroine, arodine, aronine. The edema of the lips, tongue, and throat may be seen. Treatment usually none required. Analgesics may be

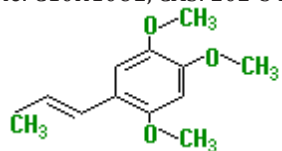
required. Swelling may be treated with cool compresses. It is unknown if diuretics or glucocorticosteroid would help with the inflammation. Rarely, swelling of the tongue, glottis, or pharynx will interfere with respiration irritates skin, eyes and mucous membranes. Oxalic acid, common in spinach and rhubarb, can combine with serum calcium to form insoluble calcium oxalate. The features of the toxicity profile for cyanide are its high acute toxicity with a very steep dose–effect curve and chronic toxicity, probably mediated through the main metabolite and detoxification product, thiocyanate. Cyanogenic glycosides are toxic, of the release of free hydrogen cyanide which occurs when the plant tissue is disturbed as during chopping, processing, or ingestion. These conditions initiate the hydrolysis of the glycoside by action of  $\beta$ -glucuronidases (or other enzymes naturally) present in plant tissue and in intestinal lumen. The process, initiated by acid, but this doesn't appear to occur in the digestive tract to any great extent despite the acid environment in the stomach. Hydrolysis by  $\beta$ -glucuronidases produces sugar and a cyanohydrin, the latter spontaneously/enzymatic ally degrades to form free hydrogen cyanide [5].

### Asarum Europaeum Phytoconstituents

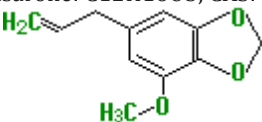
The dried whole herb of *Asarum* contains about 2.5% essential oils; toxic compositions are safrole, myristicin. Alkaloids: bishaconitine, chasmaconitine, indaconitine, pseudoaconitine, aconitine, mesaconitine and hypaconitine.



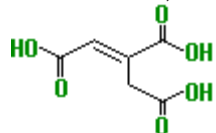
Safrole: C<sub>10</sub>H<sub>10</sub>O<sub>2</sub>, CAS: 202-345-4.



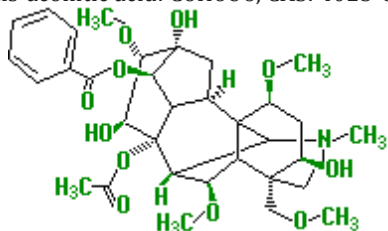
Alpha-asarone: C<sub>12</sub>H<sub>16</sub>O<sub>3</sub>, CAS: 2883-98-9.



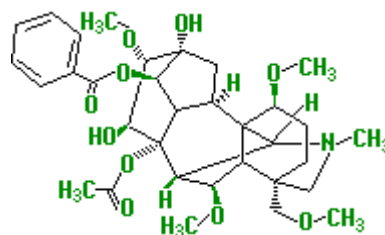
Myristicin: C<sub>11</sub>H<sub>12</sub>O<sub>3</sub>, CAS: 210-146-9.



Trans-aconitic acid: C<sub>6</sub>H<sub>6</sub>O<sub>6</sub>, CAS: 4023-65-8.



Mesaconitine: C<sub>33</sub>H<sub>45</sub>N<sub>0</sub>11, CAS: 2752-64-9.



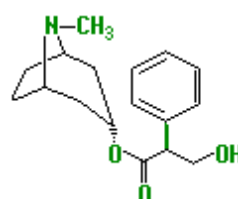
Hypaconitine: C<sub>33</sub>H<sub>45</sub>N<sub>0</sub>10, CAS: 6900-87-4.

### Toxicity

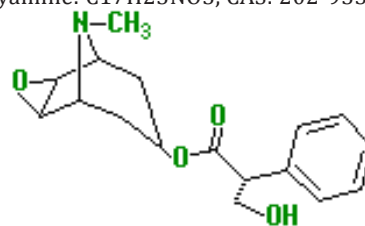
Essential oils, which are a component of *asarum*, are known to herbalists as “kidney irritants” if taken in large quantities. Thus, for example, pennyroyal, a member of the mint family, became known as a dangerous herb when at least one woman took a substantial quantity of the oil (being used as an emenagogue) and suffered kidney failure. It is possible that the concern about *asarum* expressed in the above-mentioned texts was related to its essential oil content (if the dosage were high enough) rather than aristolochic acid [6].

### Atropa Belladonna Phytoconstituents

Belladonna contains 0.3-0.6% of tropane alkaloids (hyoscyamine, atropine and scopolamine). It also contains small quantity of bases like pyridine, N-methylpyrrolone. Leaves also contain fluorescence substance  $\beta$ -methyl aesculetin and calcium oxalate.



Hyoscyamine: C<sub>17</sub>H<sub>23</sub>N<sub>0</sub>3, CAS: 202-933-0.



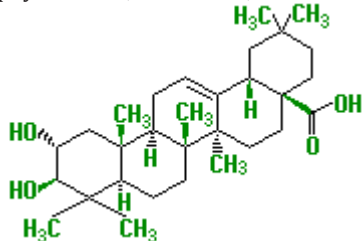
Scopolamine: C<sub>17</sub>H<sub>21</sub>N<sub>0</sub>4, CAS: 200-090-3.

### Toxicity

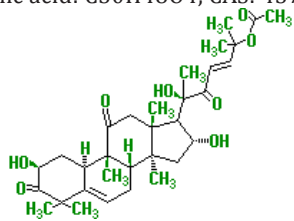
All parts contain tropane alkaloids (atropine and other belladonna alkaloids). The foliage and berries are extremely toxic. These toxins include scopolamine and hyoscyamine which cause a bizarre delirium and hallucinations, and are also used as pharmaceutical anticholinergics. Tropane alkaloids are commonly described as anti-cholinergic compounds, due to their ability to bind to muscarinic acetylcholine receptors and hence acting as competitive antagonists at these receptors. Since belladonna alkaloids have a longer half-life than physostigmine has, repeated doses of physostigmine may be required [7].

### Bryonia alba, B dioica Phytoconstituents

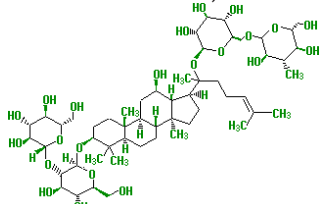
Bryonin, bryonidin, bryonicin and other cucurbitacins (most oxygenated C30 triterpenoids with a dimethyl group at C4 and methylated at C9 and C14). Strictly, they are not steroid since they are not methylated at C10; structure of cucurbitacin D is shown below an example of cucurbitacins). Dried root contains: bryonin (glucoside), starch, gum, fat, malates, bryoresin, cucurbitans, alkaloids, phytosterols, volatile oil, tannins.



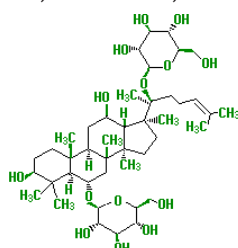
Maslinic acid: C<sub>30</sub>H<sub>48</sub>O<sub>4</sub>, CAS: 4373-41-5.



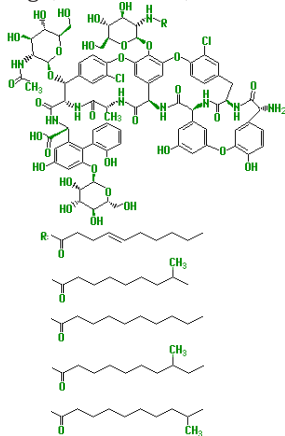
Cucurbitacin: C<sub>32</sub>H<sub>46</sub>O<sub>8</sub>, CAS: 6199-67-3.



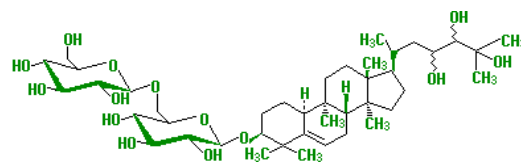
Ginsenoside: Rb<sub>1</sub>, C<sub>54</sub>H<sub>92</sub>O<sub>23</sub>, CAS: 41753-43-9.



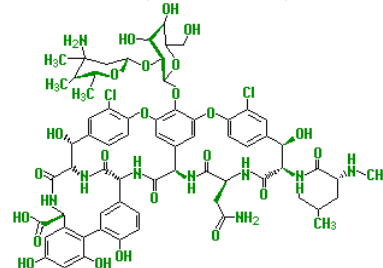
Ginsenoside: Rg<sub>1</sub>, C<sub>42</sub>H<sub>72</sub>O<sub>14</sub>, CAS: 22427-39-0



Teicoplanin: C<sub>78</sub>H<sub>78</sub>Cl<sub>2</sub>N<sub>9</sub>O<sub>32</sub>R; CAS: 61036-62-2.



Momordicoside: C, C<sub>42</sub>H<sub>72</sub>O<sub>14</sub>, CAS: 78887-72-6.



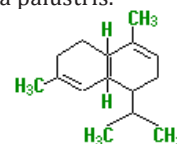
vancomycin aglycone: C<sub>66</sub>H<sub>75</sub>Cl<sub>2</sub>N<sub>9</sub>O<sub>24</sub>, CAS: 1404-93-9.

### Toxicity

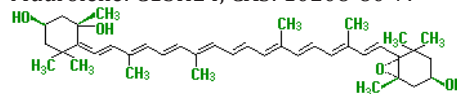
Cucurbitacins with some have strong cytotoxic properties (cytotoxic—something which damages cells). Gastrointestinal tract affected by the glycosides bryonin and bryonidin; plant also causes dermatitis. These steroids which are commonly combined in glycosides are mainly associated with cucurbitaceae species but they have also been detected in other families. About 50 species have been identified. Mammals perceived these toxic molecules as some of the bitterest substances known. They have protective effects against herbivores but are feeding stimulants for some beetles. Cucurbitacins have been shown to act as ecdysteroid receptor antagonists [8].

### Alla Palustris Phytoconstituents

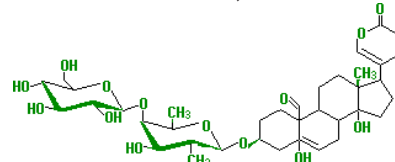
Dominant terpenoids in our study were linalool oxide (pyranoid) and α-murolene, neoxanthin, nicotine, nortriterpene lactones from *Calta palustris*.



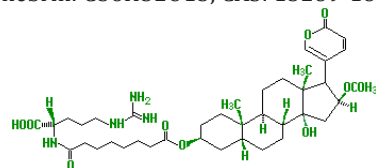
Murolene: C<sub>15</sub>H<sub>24</sub>, CAS: 10208-80-7.



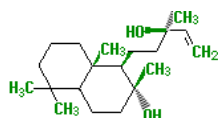
Neoxanthin: C<sub>40</sub>H<sub>58</sub>O<sub>4</sub>, CAS: 14660-91-4.



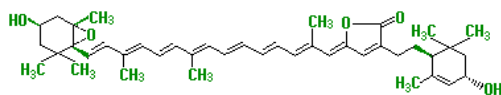
Hellebrin: C<sub>36</sub>H<sub>52</sub>O<sub>15</sub>, CAS: 13289-18-4.



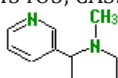
Bufotoxin: C<sub>40</sub>H<sub>60</sub>N<sub>4</sub>O<sub>10</sub>; CAS: 464-81-3.



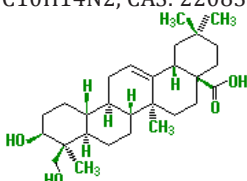
Sclareol: C<sub>20</sub>H<sub>36</sub>O<sub>2</sub>; CAS: 515-03-7.



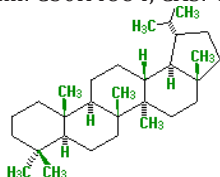
Uriolide: C<sub>40</sub>H<sub>54</sub>O<sub>5</sub>, CAS: 101527-89-3.



Nicotine: C<sub>10</sub>H<sub>14</sub>N<sub>2</sub>, CAS: 22083-74-5.



Hederagenin: C<sub>30</sub>H<sub>48</sub>O<sub>4</sub>, CAS: 465-99-6.



Palustrolide: C<sub>30</sub>H<sub>48</sub>O<sub>4</sub>, CAS: 93772-37-3.

### Toxicity

calcium oxalate and possibly irritant proteins. Toxic parts: whole plant, especially the roots. The acute inflammation of the oropharynx accompanied by salivation, pawing at the mouth, drooling. Edema of the lips, tongue, and throat may be seen. Treatment usually none required. Analgesics may be required. Swelling may be treated with cool compresses. It is unknown if diuretics or glucocorticosteroid would help with the

inflammation. Rarely the swelling will interfere with respiration. If necessary, secure the airway. The plant contains calcium oxalate crystals. These cause an extremely unpleasant sensation similar to needles being stuck into the mouth and tongue (eaten), but they are easily neutralized by thoroughly drying or cooking the plant or by steeping it in water [9].

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