



## PHARMACOGNOSY, PHYTOCHEMISTRY AND PHARMACOLOGY OF *ABRUS PRECATORIUS* LEAF: A REVIEW

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### ABSTRACT

Herbal medicines referred to as botanical medicine or phytomedicine is defined as the use of whole plant or part of plants to prevent or treat illness. India is one of the most medico culturally diverse countries in the world where the medicinal plant sector is part of a time-honored tradition that is respected even today. Here, the main traditional systems of medicine include Ayurveda, Unani & Siddha. *Abrus precatorius* leaf commonly known as Chanoti, has been used in folk remedies by Tribes for over many years, and is reported to have a broad range of therapeutic effects, like antibacterial, antifungal, antitumor, analgesic, anti-inflammatory, antispasmodic, anti diabetic, antiserotonergic, anti-migraine, including treatment of inflammation, ulcers, wounds, throat scratches and sores. Hence, an attempt has been made to address a bird's eye view mainly on the morphology, microscopy, phytochemistry and pharmacological activities of leaf of *Abrus precatorius*.

**Keywords:** *Abrus precatorius*, Phytochemistry, Pharmacology.

### INTRODUCTION

The search for new pharmacologically active agents from natural resources, such as plants, animals and microbes led to discovery of many clinically useful drugs over the past two decades. *Abrus precatorius* plant has been used in Hindu medicine from very early times, as well as in China and other ancient cultures. In certain tribal regions people chew leaf of *Abrus precatorius* for the relief of the mouth ulcer. It also contains tri-terpenoid saponins and used in the treatment of inflammation, ulcers, wounds, throat scratches and sores.

Synonyms<sup>1</sup>: *Abrus precatorius*, *Abrus aureus*, *Abrus baladensis*

Indian name: Gunj, Gumchi, Chanoti, Chirmiti, Sanskrit Name: Rati gunj, English name: Indian liquorice, Jacquirity

Taxonomical Classification:<sup>2-4</sup>

Kingdom	:	plantae
Divison	:	magnoliophyta
Class	:	magnoliopsida
Order	:	fabales
Family	:	fabaceae
Subfamily	:	faboideae
Tribe	:	abreae
Genus	:	<i>Abrus</i>
Species	:	<i>Abrus precatorius</i> linn.
Parts used	:	leaf

Habitats: A slender vine growing wild in thickets, farms and secondary clearings, generally supported by other plants or a fence. It is native to India, from the Himalayas down to southern India and Sri Lanka, but now grows in

all tropical regions throughout the world, most commonly in Florida and Hawaii, Africa, South America and the West Indies. *Abrus* is a genus of 13-18 species in the family Fabaceae<sup>5, 6</sup> best known for one species are used in beading. Different varieties found are *Abrus aureus*<sup>7</sup> (Madagascar), *Abrus baladensis* (Somalia), *Abrus bottae* (Saudi Arabia and Yemen), *Abrus canescens* (Africa), *Abrus diversifolius* (Madagascar), *Abrus fruticosus* (India), *Abrus gawenensis* (Somalia), *Abrus laevigatus* (Laos and Vietnam), *Abrus madagascariensis* (Madagascar), *Abrus parvifolius* (Madagascar), *Abrus precatorius* (India)<sup>8</sup>, *Abrus pulchellus* (Africa), *Abrus sambiranensis* (Madagascar), *Abrus schimperi* (Africa), *Abrus somalensis* (Somali).



Figure 1: Morphology of leaf

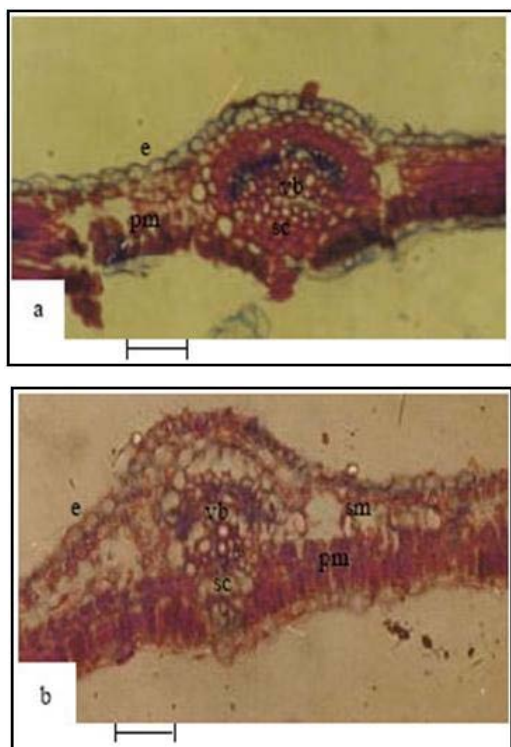
## Botanical description

*Abrus precatorius*<sup>9</sup> is a twining herb with delicate feathery leaves, climbing shrub, with greenish yellow branches. Leaves 5-17 compounds, leaflets obovate or oblong; Flowers are crowded racemes, sub sessile, pale purple to yellowish growing at the end of a stalk. Fruits are short pods containing hard, shiny, scarlet and black seeds. The seeds are slightly smaller than ordinary peas; ovoid scarlet with a black spot round the hilum. The root is woody, tortuous and much branched, with a sweet taste, rather like liquorice. *Abrus precatorius* is a slender, perennial, much branched, perennial climber that twines around trees, shrubs, deciduous, woody, prickly twinning herbaceous.

## PHARMACOGNOSTICAL CHARACTERISTICS

### Morphology of leaf<sup>10</sup>

The alternately arranged<sup>11</sup> leaves (5-13 cm long) are once-compound (i.e. pinnate) with 5-17 pairs of leaflets. These leaflets (5-25 mm long and 2-8 mm wide) are mostly hairless (i.e. glabrous), oblong in shape, and have rounded tips (i.e. obtuse apices).



**Figure 2:** Cross-section of leaf of *Abrus* species (2a- *A. canescens*; 2b- *A. pulchellus*)

### Microscopy of leaf

Observation on the leaf anatomy<sup>12, 13</sup> showed that the three species and the new collection are dorsiventral, with uniseriate and irregularly shaped epidermal cells. The epidermis is uniseriate in *A. canescens*.

Two layers of palisade mesophyll cells were observed in all species with those shown in figure 2 (a) *precatorius* open in arrangement. Apart from in the new collection *Abrus* sp., where 2-4 layers of spongy mesophyll cells

were observed, others had 2-3 layers. Collenchymas and sclerenchyma layers around the vascular bundles differed 2-4 layers in *A. precatorius*, 2-5 layers in *A. pulchellus*, 2-4 layers in *A. canescens*.

In *A. precatorius*, upper and lower epidermis of the lamina with wavy anticlinal walls<sup>13</sup>, the cells of the former being bigger in size, at places with underlined palisade cells and devoid of stomata unlike the later one, and embedded with paracytic and anomocytic stomata.

Simple, bicellular, straight or bent trichomes with a short, squarish to rectangular basal cell and long thick walled warty apical cell with acicular apex from the leaf and unicellular, lignified thick walled trichomes from the rachis scattered as such, in broken fragments or attached to the cells of the epidermis<sup>14</sup>. Glandular trichomes are very rare, few being sessile with unicellular head while others with 3 to 4 celled multicellular uniseriate thick walled stalk and multicellular head filled with yellowish contents.

Transversely cut fragments of lamina showing a layer of palisade underneath the upper epidermis and aerenchymatous spongy parenchyma underneath the lower epidermis.

Thin walled, lignified broad lumened fibers associated with idioblast containing prismatic crystals of calcium oxalate. Lignified pitted parenchymatous cells from the rachis.

Elongated narrow lumened rectangular cells from the margin of the rachis embedded with sunken stomata. Prismatic crystals of calcium oxalate and few simple starch grains scattered as such throughout or embedded in the parenchymatous cells of the rachis.

### Traditional and Medicinal uses

The plant *Abrus precatorius* is used in Ayurveda, Folk, Homeopathy, Sidha, Tibetan and Unani. Its leaves are used as nerve tonic, applied on cuts and swellings and mouth ulcer. *Abrus precatorius* is also used as an abortifacient, laxative, sedative and aphrodisiac<sup>15</sup>. The roots<sup>16</sup> are used for gonorrhoea, jaundice and haemoglobinuric bile. The oil extracted from seeds is said to promote the growth of human hair. The leaves are used for their anti-supportive properties. The plant contains glycyrrhizin as an active phytoconstituents<sup>17</sup>.

Leaves are used as a substitute for liquorice (mulethi)<sup>18</sup>. It was considered to be useful in biliousness, in leucoderma, itching and other skin disease. Decoction widely used for cough, cold and colic. Juice employed as a cure for hoarseness, mixed with oil, applied to painful swellings. Dried leaf pastes as a germicidal to wounds in cattle<sup>19</sup>.

Leaves are chewed orally for 2 to 3 days for early cure of white blinch and red<sup>20</sup>. Leaf paste is mixed with starch of rice and given orally to cure anthrax. Leaves are grinded with milk of goat and given orally in insect bite. Fresh leaf extract along with boiled water is given orally in retained



placenta. Fresh leaves are used as an ingredient in cough mixtures. In cough, 2 or 3 teaspoonful leaves juice is taken in the morning and evening for 3 days. Powder of leaves is used for convulsion and conjunctivitis in children<sup>21</sup>.

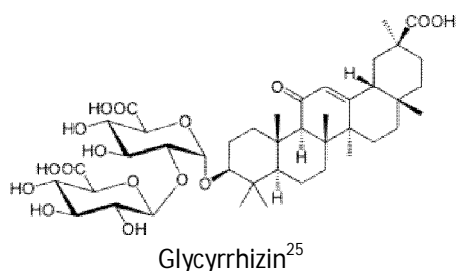
Ethanoveterinary usage<sup>22</sup>: The Leaf is used to treat fowl pot in poultry.

#### Ayurvedic properties<sup>22</sup>

- Rasa : Tikta (bitter)
- Guna : Laghu (light), Ruksha (dry), Tikshna (sharp)
- Veerya : Ushna (Hot)
- Vipaaka : Katu (Pungent)
- Dosha Dosage : Pacifies vata and pitta
- Leaf decoction : 56-112 ml

#### PHYTOCHEMISTRY OF LEAF

**Glycyrrhizin:** As the roots and leaves of *Abrus precatorius* contain glycyrrhizin<sup>23</sup>. Glycyrrhizin is an important phytoconstituent of liquorice<sup>24</sup> which is widely used in the pharmaceutical and food industry.

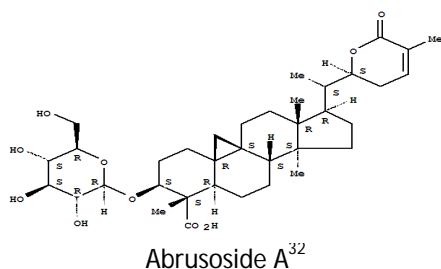


#### New triterpenoid

Three new triterpenoids and one known triterpenoid were isolated from an acid hydrolyzed methanol-soluble extract<sup>26</sup> of the leaves of *Abrus precatorius*.

#### Abrusosides A to D and Four Novel sweet triterpene Glycosides

In addition to abrusoside A<sup>27</sup>, abrusosides B<sup>28</sup>, C, and D, three further sweet glycosides based on the novel cycloartane-type aglycone, abrusogenin<sup>29</sup>, were isolated from an n-butanol soluble extract of the leaves of *Abrus precatorius*<sup>30</sup>. It was observed that compounds 1-4 were neither acutely toxic with mice nor mutagenic with *Salmonella typhimurium* strain. TM677, isolated from leaf were found by a human taste panel to exhibit sweetness potencies in the range 30-100 times greater than sucrose<sup>31</sup>.



#### Sweet testing cycloartane-type triterpene glycosides and abrusogenin

Abrusosides A–E<sup>33</sup> was isolated as prototype sweet-tasting cycloartane-type triterpene<sup>34</sup> glycosides from the leaves of *Abrus precatorius*. (Leguminosae)<sup>35</sup>. The Abrusosides A–D were obtained which passes preliminary safety testing (acute toxicity in mice and bacterial mutagenicity), and were found to be innocuous. Abrusosides A–D was also isolated from a second species, namely, *Abrus fruticosus*<sup>36</sup> of Thai origin. Since abrusoside E was found to be only marginally sweet<sup>37</sup>, abrusogenin was isolated from *A. precatorius* leaves.

#### MEDICINAL AND PHARMACOLOGICAL ACTIVITIES OF LEAF

##### Effect on milk-induced leukocytosis and eosinophilia

The ethanol extract<sup>38</sup> of leaves of *Abrus precatorius* showed marked effect on milk-induced leukocytosis and eosinophilia in the management of asthma. Results of the present investigation showed that ethanol extract of *A. precatorius*<sup>39</sup> at (100-150 mg/kg, i.p.) significantly decreased milk-induced leukocytosis and eosinophilia in mice in a dose dependent manner when compared with control group<sup>40</sup>.

##### Bronchodilator activity

The methanol extract of the leaves of *Abrus precatorius* was evaluated for possible bronchodilator activity by using various *in vivo* and *in vitro* models in guinea pigs<sup>41</sup>. The extract offered a maximum degree of protection of 41.62% which was comparable to that of salbutamol 47.52%<sup>42</sup>. The effect of the methanol extract of the leaf exhibited muscle relaxant activity. The results revealed that the methanol extract produced dose-dependent bronchodilator activity, thus justifying to some extent the traditional use of the plant *Abrus precatorius* in asthma<sup>43</sup>.

##### Effect on Neuromuscular

Some neuromuscular effects of the crude extracts of the leaves of *Abrus precatorius*<sup>43</sup> assessed through ethanol extract. The ethanol extract of leaves inhibits muscle preparations, like toad rectus abdominals and rat diaphragm. The effects were reversible and depending on the contraction.

##### Effects on snails

*Abrus precatorius* components, such as abrin and glycyrrhizin were used against the snail *Lymnaea acuminata*<sup>44</sup>. They cause a significant decrease in the levels of protein, free amino acids, DNA and RNA in the nervous tissue of *Limnaea acuminata*.

##### Antispasmodic activity

The ethanol (95%) extract of dried leaves, was active on the phrenic nerve-diaphragm of rats against nerve stimulation<sup>45</sup>. The petroleum ether extract, was inactive on rat phrenic nerve-diaphragm against nerve stimulation and direct muscle stimulation and on toad rectus abdominus muscle against ACh-induced contractions,

respectively. The ethanol/water (1:1) extract of the aerial parts was inactive on guinea pig ileum against ACh- and histamine-induced spasms.

#### Anti diabetic activity

Ethnobotanical survey by means of semi-structured questionnaire of medicinal plants in five districts of Lagos State of Nigeria<sup>46, 47</sup> reputed for the treatment of diabetes. The 100 respondents<sup>48</sup> from the predominantly Yoruba tribe mostly males (76%) were knowledgeable in traditional treatment of diabetes. About half of the respondents with 20–30 years experience in treating diabetes used mainly herbs (96%) and have developed effective and easily recognized diagnostic tools. Fifty multi-component herbal recipes covered in the survey were mainly liquid preparations often administered without serious side effects (92%). The principal anti-diabetic plants<sup>49</sup> included *Abrus precatorius*, leaves of *Abrus precatorius*, *Alchornea cordifolia* and *Blighia sapida* should be squeezed with water until the juice comes out and used as infusion to cure diabetes therapy<sup>50</sup>.

#### Anti-tumor activity

The ethanol (95%) extract<sup>51</sup> of dried leaves, administered intra-peritoneal to mice was inactive on Sarcoma 180 (ASC) AP074<sup>52</sup>. The water extract of seeds, administered intra-peritoneal to mice was active on Sarcoma (Yoshida solid and ASC)<sup>53</sup>. If it administered subcutaneously was inactive on Sarcoma (Yoshida ASC) AP012<sup>54</sup>.

#### Mutagenic activity

The methanol (75%) extract of dried leaves, at a concentration of 10.0 mg/ml on agar plate, was inactive on *Salmonella typhimurium*<sup>55</sup> TM677.

#### Neuromuscular blocking activity

The ethanol (95%) extract of dried leaves, at a concentration of 0.5 µg/ml, was active on phrenic nerve-diaphragm<sup>56</sup>.

#### Taste aversion

The butanol extract<sup>57</sup>, at a concentration of 10.0 mg/ml; ethanol (80%) extract, at a concentration of 2.0 mg/ml; water extract, at a concentration of 10.0 mg/ml of dried leaves, in the drinking water of gerbils<sup>58</sup>, were active. The ether and petroleum ether extracts<sup>59</sup>, at concentrations of 5.0 mg/ml, were inactive.

#### Anti-bacterial activity

*Abrus precatorius* belonging to the family *Fabaceae* was screened for potential of antibacterial activity<sup>60</sup> against four medically important human pathogen namely *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus subtilis*, *Pseudomonas aeruginosa*<sup>61</sup>. The antibacterial activity of aqueous and ethanol extracts were determined by agar disc diffusion method<sup>62</sup>. The ethanol extracts was more active than the aqueous extract for *Abrus precatorius*<sup>63</sup>. The most susceptible bacteria were *Staphylococcus aureus*, followed by *Bacillus subtilis*<sup>64</sup>.

#### Anti -migraine activity

Anti migraine activity<sup>65</sup> of *Abrus precatorius* proved by using male Wister albino rat and frog fundus muscle preparations using Sherrington rotating drum. Muscle contraction effect of petroleum ether and ethyl acetate crude extracts of *Abrus precatorius* performed on both muscle preparations.

#### Anti-serotonergic Activity

Anti-serotonergic activity of ethyl acetate extract of *Abrus precatorius* leaves<sup>66</sup> on a frog fundus strip by using sumatriptan as a standard. This plant also use as an abortifacient, anodyne, aphrodisiac, antimicrobial, antibacterial, diuretic, emetic, expectorant, febrifuge, hemostat, laxative, purgative, refrigerant, sedative, vermifuge<sup>67</sup>. Studies indicated that their propensity to develop migraine<sup>61</sup> headache. Moreover, fluctuating hormone levels indicate a migraine relation. The leaves of *Abrus precatorius* was on soxhlet extraction with ethyl acetate shown presence of alkaloids, carbohydrate, proteins, tannins, saponins and amino acids and antiserotonergic activity on frog fundus strip shown<sup>68</sup> (Graded dose response) comparison with sumatriptan as a standard.

#### Effect on blood glucose concentration

The effect of leaf extract of *Abrus precatorius* on blood glucose level of alloxan-induced diabetic albino wistar rats was evaluated<sup>69</sup>. There was a significant reduction in blood glucose level. The findings of this study suggest that extract of *Abrus precatorius* has hypoglycemic effect.

#### Larvicidal activity

As the preliminary study was conducted on the forth in star larvae of *Culex quinquefasciatus*<sup>70</sup> using leaf and seed of *Abrus precatorius*<sup>71</sup>. A maximum mortality<sup>72</sup> of 77% was observed in 300 ppm petroleum ether leaf extract at 96h.

#### In vitro cytotoxic activity

The coarse dried leaf powder was extracted with chloroform and ethanol using soxhlet. HPTLC studies have been evaluated for ethanol extract. Both the extract was screened for in-vitro cytotoxic activity by MTT assay<sup>73</sup> method using human cancer cell lines, (A549) lung cancer, (hepG2) liver cancer, (HCT116) colon cancer, (HeLa) cervical cancer. Doxorubicin was used as a standard. The ethanol extract showed better cytotoxic effect than chloroform extracts against the above mentioned cancer cell lines<sup>74</sup>.

#### Anti microbial activity

The aqueous extract of *A. precatorius* inhibited all the test bacteria but has no effect on the fungal strain<sup>75</sup>.

#### Safety profile

It was observed that the extract of *A. precatorius*<sup>76</sup> caused decreased levels of packed cell volume, haemoglobin concentration, red blood cell count, and white blood cell



count, mean corpuscular volume and mean corpuscular haemoglobin<sup>77, 78</sup>. The extract also resulted in increased levels of total serum protein, albumin, alanine amino transaminase, aspartate amino transferase, alkaline phosphatase and total bilirubin. It showed that aqueous extract of *Abrus precatorius* was toxic and care should be taken during usage. Fatal poisoning in children has been reported after the thorough chewing of one seed<sup>79</sup>. They were highly toxic and cause severe stomach cramping accompanied by nausea, severe diarrhea, cold sweats, tachycardia, coma and circulatory collapse. The loss of abrin (IP) in mice was found to be 8.34 mg/kg<sup>80</sup>. Prolonged administration of abrin in mice produced initial anemia, which normalized at the end of the experiment, and an increase in white blood cell count. Intra-peritoneal injection of abrin to pregnant rats produced both maternal and fetal changes, whereas abrin given orally produced significant fetal effects. The ethanol-water (1:1) extract of the aerial parts was much less toxic and the ethanol (95%) extract of the dried leaves, administered to chickens, produced a loss of 12 mg/kg body weight.

### CONCLUSION

Here, an attempt was made to address pharmacognosy, phytochemistry and pharmacology of the leaf of *Abrus precatorius*. Therefore, the review of leaf of *Abrus precatorius* revealed that it has got a variety of pharmacologically and medicinally significant constituents, which are being utilized in the field of Ayurveda. There is very limited literature available for the study of *Abrus precatorius* leaf. The above review provides information of its phytopharmacology, which may be useful for the further study of Ayurvedic drugs of medicinal practice of present era.

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