ABRUS PRECATORIUS L. - AN IMPORTANT MEDICINAL PLANT: A REVIEW

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Abstract: Abrus precatorius L. is a plant that originates from Southeast Asia and now can be found in subtropical areas of the world and commonly known as Crab’s eye. This is a medicinally important plant species belonging to the Fabaceae – Pea family. This plant species has been found to display a wide variety of biochemical activities. A Number of Constituents have been reported From A. precatorius L. leaves, root and seeds. This review gives a Crab’s eye view mainly on the pharmacognostic characteristics, phytochemistry and pharmacological actions of the plant.

Keywords: Abrus precatorius L, Medicinal Plant, Fabaceae

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INTRODUCTION

Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources. \textit{A. precatorius} \textit{L.} (Fabaceae) is a climbing shrub, widely distributed in most districts of Tamil Nadu in hedges and among bushes on open lands. There exists a plethora of knowledge, information and benefits of herbal drugs in our ancient literature of Ayurvedic (Traditional Indian Medicine), Siddha, Unani and Chinese medicine. According to the World Health Organization, 2003 about 80% of the population of developing countries being unable to afford pharmaceutical drugs rely on traditional medicines, mainly plant based, to sustain their primary health care needs. Herbal medicines are in great demand in the developed as well as developing countries for primary healthcare because of their wide biological and medicinal activities, higher safety margins and lesser costs.

History

The Greek word \textit{abrus} means delicate and refers to the leaflets. \textit{Precatorius} is Latin for "one who prays" and alludes to the use of the seeds for rosaries.

General Description

Crab’s eye, also known as jumbie or gunchi bean and licorice plant in English, peronías and ojos de cangrejo in Spanish, and guen légilise in French, is a slender woody vine that climbs shrubs and low trees. Its older stems are dark gray and the younger ones are green and very fine. The alternate, pinnately compound leaves are 5 to 10 cm long and have five to 20 pairs of leaflets. The racemes have tight clusters of white to purple flowers. The most notable thing about this species is the 6-mm, spherical red and black seeds. Crab’s eye produces a tap and lateral root system with abundant fine roots. The larger roots are dark reddish brown. The lateral roots produce white nodules.

Range

Crab’s eye is possibly native of India or of Guinea in Africa, but today has naturalized throughout most of the tropics.

PLANT PROFILES

\textbf{Table 1: Scientific classification of \textit{A. precatorius} \textit{L.}}

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>:</th>
<th>Plantae – Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subkingdom</td>
<td>:</td>
<td>Tracheobionta – Vascular plants</td>
</tr>
<tr>
<td>Super division</td>
<td>:</td>
<td>Spermatophyta – Seed plants</td>
</tr>
<tr>
<td>Division</td>
<td>:</td>
<td>Magnoliophyta – Flowering plants</td>
</tr>
</tbody>
</table>
Class: Magnoliopsida – Dicotyledons
Subclass: Rosidae
Order: Fabales
Family: Fabaceae – Pea family
Genus: Abrus Adans. – abrus
Species: A. precatorius. – rosarypea

Common name according to different countries

Rosary pea (Egypt), Crab's eye (Nepal), Jequerity (Philippines), Precatory bean (USA), Saga (Indonesia), Gunchi (Pakistan), Rati gedi (Nepal), Weglis (Indonesia).

Fig 1: -Wide spread in most tropical and sub
Tropical areas of India *as marked in blue Boundary in the Map

Fig 2: -A. precatoriu L. - Seeds

Table 2: Common names of A. precatoriu L. in India

A. precatorius L.

<table>
<thead>
<tr>
<th>Language</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabic</td>
<td>Ainuddeek</td>
</tr>
<tr>
<td>Bengali</td>
<td>Gunja, Guñjika, Kuncha, Rosary Plant, Sága</td>
</tr>
<tr>
<td>Gujarati</td>
<td>Ratti</td>
</tr>
<tr>
<td>Hindi</td>
<td>Crab’s eye, Gunchi, Gunja, Kunch, Masha, Patahika</td>
</tr>
</tbody>
</table>
Species

Abrus aureus (Madagascar), Abrus baladensis (Somalia), Abrus bottae (Arabia Saudită) (Yemen), Abrus canescens (Africa), Abrus diversifoliatus (Madagascar), Abrus fruticosus (India), Abrus gawenensis (Somalia), Abrus laevigatus (Africa de Sud), Abrus longibracteatus (Laos Vietnam), Abrus madagascariensis (Madagascar), Abrus parvifolius (Madagascar), Abrus pulchellus (Africa), Abrus sambiranensis (Madagascar), Abrus schimperi (Africa), Abrus somalensis (Somalia), Abrus wittei (Zair).

Traditional uses

In the Ayurvedic medicine leaves of A. precatorius are laxative, expectorant and aphrodisiac medicines. Seeds are said to be purgative, emetic, tonic, antiphlogistic, aphrodisiac and antiopthalmic. For the indigenous people they are potent phytomedicines, many of them in mixtures with other plants. Their toxicity is underestimated. They are even sold via internet (Tan-Hord Exports List of herbs). In some countries of Asia beans are used as weights and jewellery is made from them by drilling. In Tanzania traditional healers claim the competence in the treatment of epilepsy. A. precatorius can be found between 60 plants commonly used against this illness. In Zimbabwe extracts of 58 plants popularly known to be effective against schistosomiasis were tested in vitro against excysted cysticercoids. Extracts of stem and root of
A. precatorius were under the ten most effective samples\textsuperscript{16,17}. In the Indian Central Drug Research Institute in Lucknow discussions about an antifertility program are going on. One of the plants with priority is A. precatorius because of its “estrogenicity”, nor because of its lectins\textsuperscript{18}. In Germany necklaces from India were sold in the seventies, but soon warnings were propagated because of toxicity of the components. Investigations resulted that they were made with A. precatorius beans and warnings were propagated\textsuperscript{19}. In Christian countries the beans are used for wreaths of roses (precatory beans), for necklaces and for ornamentals together with other flowers in garlands. In China the herb of A. precatorius is used as a folk-medicine for the treatment of bronchitis, laryngitis and hepatitis. Because of their platelet inhibiting activity abruquinones are supposed to be the active substances\textsuperscript{20}.

**PHYTOCHEMISTRY**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Plant part</th>
<th>Phytoconstituents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Leaves</td>
<td>Leaves of this plant also contain - Abrine, trigonelline\textsuperscript{21}, abruslactone A, hemiphloin\textsuperscript{22}, abrusoside A\textsuperscript{23}, abrusoside B, abrusoside C, abrusoside D\textsuperscript{24}, arabinose, galactose, xylose\textsuperscript{25}[32], choline, hypaphorine, precatorine\textsuperscript{26}, glycyrrhizin\textsuperscript{27}, montanyl alcohol\textsuperscript{28}, inositol, D monomethyl ether, pinitol\textsuperscript{29}.</td>
</tr>
<tr>
<td>2.</td>
<td>Root</td>
<td>Root of this plant also contain - Abrol, abrasine, precasine and precol\textsuperscript{30,31}. Protein - abraline, abricin, abruginic-acid, abruginic-acid-methyl-ester, abruslactone, abrussic-acid, anthocyanins, calcium, campesterol, cycloartenol, delphinidin, gallic-acid, trigonelline, hypaphorine\textsuperscript{21,26}, choline, n, n dimethyl-tryptophan, n, ndimethyl- tryptophan-metho-cation-methyl-ester, p coumaroylgalloyl glucodelphinidin, pectin, pentosans, phosphorus, delphinidin, gallic-acid, picatorine, polygalacturonic-acids, precatorine\textsuperscript{26}, polysaccharide\textsuperscript{32}, isoflavonoids and quinones-abruquinones a, b, c, d, e, f\textsuperscript{33}, o, g, abruslactone a, abrusgenic acid-methanol-solvate\textsuperscript{34,35}, arabinose, galactose, xylose\textsuperscript{22} are present in the root. Triterpenoids and saponins\textsuperscript{34}, glycyrrhizin\textsuperscript{27} and oleanolic acid are found in the root and abrusosides a, b, c, d\textsuperscript{23,24}.</td>
</tr>
<tr>
<td>3.</td>
<td>Seed</td>
<td>Seed of this plant also contain poisonous and contain principle compound – abrine\textsuperscript{21}, abrin A, abrin B\textsuperscript{36}, abrin C\textsuperscript{37}, abrin I, abrin II, abrin III, abrus agglutinin APA-I, Abrus agglutinin APA-II\textsuperscript{38}, abrus-saponins I and II, abrisapogenol, β-amyrin, arachidyl alcohol, brassicasterol, decan-1-ol, docos-13-enolic acid, docosan-1-ol, docosane, N, dodecan-1-ol, dotriacontane, N, eicos-11-enolic</td>
</tr>
</tbody>
</table>
acid, eicosane, N, elaidic alcohol, heneicosan-1-ol, lignoceric acid, heneicosane, N, heptacosan-1-ol, heptadecan-1-ol, hexacosane, N, Hexacosan-1-ol, hexadec-9-enoic acid, hexadecane, N, hexadecan-1-ol, nonacosane, N, nonadecan-1-ol, octacosan-1-ol, octacosane, N, octadeca-
9,12-dienoic acid, octadecane, n, octanoic acid, pentacosan-1-ol, pentacosane, N, pentatriacontane, N, pentadecan-1-ol\textsuperscript{28,39}, squalene, abricin, abridin\textsuperscript{40}, abrulin\textsuperscript{41}, cycloartenol, campesterol, cholesterol and â-sitosterol have all been found in the seeds. Alkaloids and nitrogen compounds- methyl ester of N, N-dimethyltryptophan metho cation (I) and precatorine (II), hypaphorine, trigonelline\textsuperscript{21}, choline\textsuperscript{21}, flavonoids and triterpenoids, steroids, saponins, flavones, flavonol glycosides, reducing sugars, phenolic compounds glycosides\textsuperscript{42-45}. Lectin\textsuperscript{46-48}, flavonoids, anthocyanins-abrectorin, dimethoxycentaureidin-7-0-rutinoside, precatorins I, II\textsuperscript{21}, abrectorin, centaureidin, demethoxy 7-O-beta-drutinoside, luteolin, orientin, iso, orientin\textsuperscript{49}, C-glucosylscutelarein 6, 7-dimethylether (abrusin)\textsuperscript{50}.

**Amino acids** - serine, Abrusin, Abrusin-2'-0-apioside, hederagenin, Kaikasaponin III, sophoradiol, sophoradiol-22-0-acetate, tryptophan\textsuperscript{51}, trimethyl\textsuperscript{52}, alanine\textsuperscript{53}, amyrin, alpha, ursolic acid\textsuperscript{54}, valine\textsuperscript{52,53}, and methyl ester. They contain poisonous protein, a fat-splitting enzyme, aglucoside abrussic acid, haemagglutinin, albuminous substance named abrin\textsuperscript{55} and a quantity of ureas\textsuperscript{56}.

**Ions** - calcim, magnesium, sodium, potassium, phosphorous, Manganese, zinc, iron, copper, cellulose and muscilase\textsuperscript{57}.

**PHARMACOLOGICAL ACTIVITIES**

1. **Antibacterial Activity**

Seven bacterial strains has been isolated from the soil named Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi, Salmonella paratyphi A, Salmonella paratyphi B, Klebsiela pneumonia and Staphylococcus aureus. Antimicrobial activity of different parts of *A. precatorius* like roots, seeds and leaves were studied against all above mentioned bacterial strains. Root extract of *A. precatorius* was found to be active against the Gram positive organism Staphylococcus aureus. Root extracts possess good antibacterial potential particularly against Staphylococcus aureus. The Minimum Inhibitory Concentration (MIC) of the Petroleum ether extract against Staphlococcus aureus was found to be 0.44 mg/ml (440 μg/ml) and of Methanolic extract was found to be 0.40 mg/ml (400 μg/ml) against same. It was
considered that if the extracts displayed an MIC less than 100 μg/ml, the antimicrobial activity was good; from 100 to 500 μg/ml the antimicrobial activity was moderate; from 500 to 1000 μg/ml the antimicrobial activity was weak; over 1000 μg/ml the extract was considered inactive. Thus, the antimicrobial activity of the root extract is moderate.

2. Anti-diabetic activity

The anti-diabetic effect of chloroform–methanol extract of A. precatorius seed (50mg/kg) was studied in alloxan diabetic rabbits. The percentage reduction of blood glucose was found after treatment with chloroform – methanol extract at different intervals which shows that the chloroform – methanol extract of A. precatorius seed has anti-diabetic properties having Trigoneline similar to that of chlorpropamide. Different observation was found in another study on rat model after treated with Ethanol/water (1:1) extract of the aerial parts of A. precatorius at a dose of 250 mg/kg which was shown to reduce only 30% blood sugar level.

3. Anti-oxidant activity

An ethanol seed extract of A. precatorius was evaluated using in-vitro method to determine anti oxidant activity. Total phenolic compound in ethanol seeds extract of A. precatorius was found to be 95 mg/g of extract calculated as gallic acid equivalent (r2=0.9976) and total flavonoids compound was found to be 21 mg/g of extract calculated as rutin equivalent (r2=0.9985). A. precatorius seeds ethanol extract possess potent anti oxidant activity in different enzymes levels when compared with reference compound butylated hydroxytoluene (BHT).

4. Anticancer activity

In Preliminary phytochemical screening of PEEAP (petroleum ether extract of A. precatorius Linn) phytoconstituents like Flavonoids, Alkaloids, tannins, phenolic compounds, saponins, triterpenoids were detected. Oral administration of PEEAP increased the mean survival time of EAC (Ehrlich Ascitis Carcinoma) bearing mice. In the EAC control group the mean survival time was 18.16 ± 0.4773, while it increased to 20.5±0.6009 (250mg/kg), 20.33±0.4944 (500mg/kg) and 21.166±0.6009 (1000mg/kg) respectively in PEEAP treated groups. The group treated with standard 5-FU (20mg/kg) showed 24.5±0.4282 for the same. The percentage increase in survivals, it was found to be 11.01%, 11.94%, 16.51% respectively as compared to control group. The EAC bearing mice treated with the PEEAP showed excellent increase in life span when compared to control. Treatment with PEEAP at the doses of 250, 500 and 1000mg/kg reduced the body weight, PCV and viable tumour cell count as compared to that of EAC control group and increased the haemoglobin content and RBC count towards normal level. Administration of PEEAP at the doses of 250, 500 and 1000mg/kg in EAC bearing mice reduced the WBC count as compared with the control. Treatment with PEEAP at different doses changed these altered parameters towards normal levels.
5. Anti-inflammatory activity

The anti-inflammatory activity of *A. precatorius* L. extract was investigated on inflammation induced by croton oil on rat ear model. Extract of *A. precatorius* when co-applied with croton oil to the rat ear produced a reduction in the inflammatory response were observed after 6 hrs compared with croton oil alone. The extract produced 2% reduction of the inflammatory response in croton oil alone group. This finding explains the usefulness of the leaves of this plant in the treatment of inflammatory disease conditions by traditional healers. Another study was also reported in the same model using isolated active constituents triterpenoid, saponins and their acetates derivatives. Reduction in inflammation was observed in different test compounds but the acetates showed greater inhibition at both 300 μg and 600 μg than the parent compounds. Acetates derivatives of parent compounds were more effective at 600 μg concentration among all test treated group.

6. Anti-depressant activity

The anti-depressant activity was shown after treatment with ethanol (70%) extract of fresh root of *A. precatorius* on mice of both sexes at variable dosage levels.

7. Neuromuscular blocking activity

Ethanol (95%) extract of dried leaves of *A. precatorius* L. were administered at a concentration of 0.5μg/ml and it showed blocking action on phrenic nerve-diaphragm.

8. Antiepileptic activity

In a cross-sectional study performed in Temeke District (Dares Salaam, Tanzania) it was proved that *A. precatorius* leaves showed anti epileptic activity when boiled with water and it is given orally as three table spoonfuls in twice daily dosage regimen for the treatment of epilepsy.

9. Antiviral activity

Ethanol/water (1:1) extract of the aerial parts at a concentration of 50 mcg/ml in cell culture was inactive on Ranikhet virus and Vaccinia virus reported by researcher and similar results was found using cell culture method by administered water and methanol extracts of dried seeds of this plant were inactive against virus-HLTV-1.

10. Anti-yeast activity

Dried seeds at a concentration of 1.0% on agar plate were active on Cryptococcus neoformans and opposite findings were observed using ethanol/water (1:1) extract of the aerial parts (25.0mcg/ml) on agar plate was inactive on Candida albicans, Cryptococcus neoformans.
11. Anti-malarial activity

An isoflavanquinone, abruquinone, was isolated from the extract of aerial parts and exhibited anti-malarial activity. Antiplasmodial activity and cytotoxicity in the assessment of antimalarial activity was evaluated and *A. precatorius* extract presented an IC 50 value below 20 g/ml.

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