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GOOD AND BAD EFFECTS OF *ABRUS PRECATORIUS* LINNAEUS - A REVIEW

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ABSTRACT
Abrus precatorius Linnaeus (*A. precatorius* L.), commonly known as Gunja / Indian liquorices, is a plant of the family 'fabaceae'. The plant has multidimensional medicinal properties. It has broad range of therapeutic effects like anti-diabetic, anti-microbial, anti-migraine, anti-inflammatory, anti-serotonergic, anti-tumor, analgesic, anti-spasmodic etc. Due to these medicinal values, the plant is being used for therapeutic purpose since Vedic period. Even today different parts of the plant are being used in traditional medicine throughout the world. But, the plant is not free from toxicity. Leaves of *A. precatorius* L. was found toxic for cattle. It is toxic for other animals also. Experiments showed that extract of *A. precatorius* L. leaves could decrease hemoglobin concentration, RBC and WBC counts and increased levels of total serum protein, bilirubin, albumin as well as activities of glutamate pyruvate transaminase, glutamate oxalo acetate transaminase and alkaline phosphatase in rats. Testicular degeneration was also noted. Further, leaves of *A. precatorius* L. could induce cardiotoxicity, hepatotoxicity and nephrotoxicity in rats. Report from our laboratory suggested that *A. precatorius* L. leaf has *in vitro* anti thiamine activity and could cause body weight loss in growing rats. Due to these good and bad effects, *A. precatorius* L. occupies a distinct place in the plant world. In present review an attempt has been made to discuss these dual effects of *A. precatorius* L.

INTRODUCTION
Of the 2,50,000 higher plant species on earth, more than 80,000 are medicinal. These plants are from different families but all have medicinal values and are popular for their pharmacological properties like anti diabetic activity, anti cancer potential, anti microbial property, anti oxidant activity, anti ulcer property, liver stimulant, wound healing activity etc.[1]

There are many more medicinal plants efficacious in many other diseases. Medicinal plants, therefore, are widely used in the preparation of traditional medicine. In many developing countries even today a large proportion of population, more than 80% according to World Health Organization (WHO), depends on traditional medicine to meet their primary health care needs (UNESCO,1996).[2] In China, Sri Lanka, Thailand, Africa, India and Pakistan, about 30-40% of the total medicinal consumption is attributed to traditional medicines. In China and Africa, knowledge of traditional medicine has been passed through generations by oral communication and indigenous practices.[3]

It has been estimated that more than 3500 million people in the world utilize medicinal plants on a regular basis in the form of traditional medicine.[4] These people believe that the medicine is cheap, locally available and safe because they are 'natural'. However, recent evidence suggests that some of the plants considered to be safe over last many decades have proven to be associated with health hazards.[5] Medicinal plants, therefore, should be evaluated periodically for their ill effects.

ABRUS PRECATORIUS LINNAEUS
A. precatorius L. (family, fabaceae) is one such medicinal plant. The plant is known by different names in different countries. In German the plant is known as Paternostererbse but the people of Arab call the plant in the name of Ain-ed-dik. In China *A. precatorius* L. is known as Siang-sztsze, people of Spain and France call the plant Tento muido and Pois rouge respectively.

***Abrus Precatorius* Linnaeus leaves**

***Abrus Precatorius* Linnaeus flowers**

***Abrus Precatorius* Linnaeus beans**

***Abrus Precatorius* Linnaeus pods**

***Abrus Precatorius* Linnaeus seeds**

Ornament *with* seeds

Figure: 1 *Abrus Precatorius* Linnaeus & its different parts

English people identified *A. precatorius* L. by several names like prayer bean, precatory bean, jequirity bean, rosary pea, and Indian liquorice. They also called the plant as jequirity, crab eye, cock's eyes, John Crow Bead, coral bead, red-bead vine etc. In India *A. precatorius* L. has different names too. In Sanskrit, Hindi and Marathi the plant is known as gunja. In Telugu and Tamil the plant is identified as Guruginia and Kundumani respectively. In Urdu *A. precatorius* L. is known as Ghunchi while people of Punjab and Gujrat call the plant as Mulati and Gumchi respectively.[6]

GOOD EFFECTS OF *ABRUS PRECATORIUS* LINNAEUS

In Ayurveda roots and seeds of *Abrus precatorius* Linnaeus (*A. precatorius* L.) are used for treatment of cervical adenitis, dental caries, baldness, defect of vision and to remove dandruff. [6] In traditional & folklore Medicine the plant is reported to possess beneficial effects in snake bite, in avabahuk, erysipelas and for promoting growth of ear lobes. Seeds of the plant are recommended to be applied locally in sciatica, stiffness of the shoulder joint, paralysis, and other nervous

diseases.[7]

In a recent review article[8] it was mentioned that *A. precatorius* L. is considered beneficial for hair and the seeds extract is used in the treatment of ulcer and skin affection. Seeds are also reported to have anti diabetic property, anti oxidative property as well as anti–inflammatory analgesic activity. Antimicrobial activity of the aqueous extract of *A. precatorius* L. against *Salmonella typhimurium*, *Escherichia c*oli, *Klebsiella pneumoniae*, *Streptococcus pyogenes* and *Streptococcus pneumoniae* was noted in different laboratories. Other uses of the plant are observed in cancer and in malaria. Report from our laboratory showed that *A. precatorius* L. leaves has anti gastric ulcer activity in albino rats.[9]

Due to these medicinal values different parts of the plant *A. precatorius* L. are being used in traditional medicine throughout the world. Medicinal uses of different parts of *A. precatorius* L. in few countries are given below.

Afghanistan
As aphrodisiac dried seeds of *A. precatorius* L.are taken orally.[10]

Brazil
As nerve tonic water extract of dried leaves and root of *A. precatorius* L. is taken orally.[10]

Cambodia
Hot water extract of *A. precatorius* L. seeds is taken orally during malaria.[11]

Central Africa
For treatment of intestinal worms and as an oral contraceptive seeds of *A. precatorius* L are taken orally. As a snake bite remedy root of the plant is chewed.[12]

East Africa
Fresh root of *A. precatorius* L. is chewed as an aphrodisiac.[12] During gonorrhea decoction of the aerial parts of the plant is taken orally. Fresh leaf juice is also taken orally for bilharziasis, stomach troubles, gonorrhea and as an antiemetic. Powdered leaves of *A. precatorius* L. are applied to cuts and swellings and decoction of leaves is taken during chest pain. Water extract of dried seeds of the plant is applied to eye infections.[13]

Egypt
Seeds of *A. precatorius* L. are taken orally with honey as an aphrodisiac.[14]

Guinea-Bissau
Men take leaf pulp of *A. precatorius* L. as an aphrodisiac, women take to facilitate childbirth. Seeds of *A. precatorius* L. are taken orally to induce abortion.[15]

Haiti
Decoction of leaves of *A. precatorius* L. is taken orally for coughs and flu.[16]

India
In India *A. precatorius* L. is used mainly for abortion. Root brew of *A. precatorius* L. is taken orally to produce abortion.[11] Decoction of dried seeds as well as dried seed oil of the plant are also used to induce abortion.[17] Plant juice is administered intravaginally to induce abortion.[18]

In the Unani system of medicine hot water extract of dried seeds of *A. precatorius* L. is given orally as a sexual stimulant.[19] It is also prescribed to cure from tuberculosis and painful swellings as well as used as aphrodisiac and purgative.[20] Besides, as an antifertility agent[21], as an abortifacient[22] and to prevent conception [23] hot water extract of seeds of *A. precatorius*

L. is taken orally. To cure eye diseases hot water extracts of dried leaves and roots of the plant are applied to the eye.[24] Women take seeds of *A. precatorius* L. due to the common belief that one seed covered with Jaggary, if swallowed during menstrual period, is sufficient to prevent conception for one year.[25]

Jamaica
Root of *A. precatorius* L. boiled in milk and decoction of dried leaves are used as tonic.[10]

Kenya
Leaves of *A. precatorius* L. are taken orally to get rid of coughs.[26]

Mozambique
Hot water extract of root of *A. precatorius* L. is administered orally as an aphrodisiac.[27]

Nepal
Seeds of *A. precatorius* L. are taken orally as an aphrodisiac.[28]

Nigeria
As an antimalarial and anticonvulsant agent hot water extract of fresh root *A. precatorius* L. is administered orally.[29]

Pakistan
Seeds of *A. precatorius* L. are used for inducing abortion. Hot water extract of seeds of the plant is administered orally as an aphrodisiac.[30]

Sudan
Hot water extract of *A. precatorius* L. is taken orally as an antifertility agen.[31]

Taiwan
Decoction of dried root of *A. precatorius* L. is taken orally to treat bronchitis and hepatitis.[32]

Tanzania
During asthma and as anaphrodisiac decoction of roots and leaf sap of *A.precatorius* L. is taken orally.[13]

Thailand
Leaves of *A. precatorius* L. crushed with oil are used as an anti-inflammatory agent.[33]

West Africa
In case of snake bite root of *A. precatorius* L. is chewed. In gonorrhea, chest pains and tape worm infection, decoction of dried roots of the plant is taken orally. Root of *A. precatorius* L. is also used as an antiemetic, aphrodisiac and for bilharziasis.[13]

West Indies
Seeds of *A. precatorius* L. are taken orally as purgative, emetic and anthelmintic.[34]

In spite of these good effects, plant *A. precatorius* L. has various bad effects also. Few of them are mentioned below.

Abortifacient effect
Sethi et al.(1990) noted abortifacient effect of *A. precatorius* L.[35] Water extract of dried seeds of *A. precatorius* L. when administered intragastrically to pregnant rats at a dose of 125.0 mg/kg, authors found that the extract exerted abortifacient effect. Popli (1977), however, noted that chloroform/methanol extract of seeds when administered subcutaneously to rats at a dose of 50.0 mg/animal, had no abortifacient effect.[36] Further, ethanol (95%) extract of seeds of *A. precatorius* L.was also inactive on pregnant hamsters but active on pregnant rats when administered orally at a dose of 200.0 mg/kg. Prakash and Mathur (1976) also noted that petroleum ether extract of seeds of *A. precatorius* L., administered orally to rats had no abortifacient effect.[37]

Alkaline phosphatase inhibition
Working on a Herbo-Mineral compound for long acting contraction on animals, Das et al. (1987) noted that petroleum ether extract of seed oil of *A. precatorius* L., could inhibit alkaline phosphatase when administered orally to rats.[38]

Estrous cycle disruption effect
Samad and co-workers (1974) observed that chloroform/methanol (2:1) extract of seeds of *A.*

precatorius L. had estrous cycle disruption effect in rats when administered subcutaneously to the animals at a dose of 1.0 mg/animal.[39] Munsho et al. (1977), however, did not find the said effect when seeds were administered orally to female rats at doses of 0.05, 0.5, and 5.0 mg/animal.[40] Working on effect of oral doses of *A.precatorius* L. seeds on the oestrus cycle, body weight, uterine weight and cellular structures of uterus in albino rats, Prakesh et al. (1980) found that seeds had estrous cycle disruption effect when administered by gastric intubation to the animals at doses of 10.0, 5.0 and 2.0 gm/kg, but there was no significant effect on uterine weight.[41]

Intestinal fluid retention effect
There was report that chromatographic fraction of dried seeds of *A.precatorius* L., administered intragastrically to rats at a dose of 10.0 mg/kg, could retain fluid in the small intestine against prostaglandin-2 (PGE2)-induced enteropooling. Effect was assayed after 30 minutes of oral dose of PGE2.[42]

Teratogenic activity
Teratological aspects of *A. precatorius* L. seeds in rats was studied by Sethi and co-workers (1990) as well as Nath et al. (1992). Sethi and co-workers found that water extract of dried seeds of *A. precatorius* L.when administered intragastrically to pregnant rats at a dose of 125.0 mg/kg exerted teratogenic activity.[35] While working on commonly used Indian abortifacient plants with special reference to their teratogenic effects in pregnant rats, Nath et al. also observed teratogenic activity of dried seeds of *A. precatorius* L.[17]

Spermicidal effect
As early as 1984 Sinha showed[43] spermicidal effect of seeds of *A. precatorius* L. in rats. Impaired sperm motility was observed when sperm was mixed with the ethanol/water (1:1) extract of dried seeds. Sinha further showed that there was a large decrease in motility of sperm from the cauda epididymis of the rats and structural abnormalities of sperm when the extract at a dose of 250.0 mg/kg was administered to rats by gastric intubation for 60 days.

Luteal suppressant effect
It was the observation of Zia-Ul-Haque and his co-workers in 1983 that chloroform/ methanol (2:1) extract of seeds of *A. precatorius* L., when administered subcutaneously to rats at a dose of 50.0 mg/animal, exerted luteal suppressant effect in the animals.[44]

Anti-gonadotropin effect
Working on the effects of *A. precatorius* L. seed extract on biochemical constituents of male mice, Jadon and Mathur (1984) commented that 95% ethanol extract of dried seeds of *A. precatorius* L. when administered to mice at a dose of 150.0mg/kg by gastric intubation, exerted antigonadotropin effect.[45]

CNS depressant activity
As early as 1982 Adesina studied on some plants used as anticonvulsants in Amerindian and African traditional medicine. Author observed that ethanol (70%) extract of fresh root of *A. precatorius* L., administered to mice (both sexes) intraperitoneally at variable dosage levels had CNS depressant activity.[29]

A.precatorius L. is not free from toxicity. Few toxic effects of different parts of *A.precatorius* L. are given below.

Insecticidal activity

As early as 1941 Hartzell and Wilcoxon undertook a survey of plant products for insecticidal properties. They noted that acetone extract of dried root of *A. precatorius* L. had no insecticidal activity on *Culex quinquefasciatus*. Acetone extract of dried stem of *A. precatorius* L. at low concentration also had no insecticidal activity on *Culex quinquefasciatus*. They, however, noted that seeds of *A. precatorius* L., at a concentration of 10.0%, produced weak insecticidal activity on *Musca domestica*. The activity was less than that of 0.25% DDT.[46]

Larvicidal activity

Muthukrishnan et al. (1997) studied biological effects of *A. precatorius* L. extract on *Culex.*

quinquefasciatus and noted larvicidal activity of the plant.[47] Manimegalai et al. (2011) found larvicidal activity of the leaf and seed extracts of *A. precatorius* L. against *Culex quinquefasciates*.[48] A maximum mortality (77%) of larvae of *Culex quinquefasciatus* was observed in 300 ppm petroleum ether leaf extract of *A. precatorius* L. at 96h.[49]

Effect on snail

Effect of molluscicidal components of *A. precatorius* L. on certain biochemical parameters of Lymnaea acuminate was studied by Singh and Singh in 1999. Results[50] showed that *A. precatorius* components, such as abrin and glycyrrhizin could cause a significant decrease in the levels of free amino acids, protein, DNA and RNA in the nervous tissue of *Limnaea acuminate*.

Effect on horse

Toxic effect of Ratti seeds (*A. precatorius* L.) on horse was studied by Simpson and Banerjee (1932). Results showed that seeds of *A. precatorius* L. when administered to horses orally at a dose of 15.0 gm developed toxic effects. But tolerance developed when small, incrementally-increased doses were given.[51]

Effect on chicken

Chickens were fed a mixture of *A. precatorius* seeds and *Cassia senna* fruit. It was found out that seeds of *A. precatorius* L. at a concentration of 0.5% of diet in chicken produced toxicity. Symptoms included catarrhal enteritis, hepatocellular necrosis, reduced weight, and anemia.[52]

Ethanol (95%) extract of dried leaves of *A. precatorius* L. when administered intravenously to chicken also produced toxicity.[53]

Effect on mice

Niyogi and Rieders in the year 1969 undertook[54] toxicity studies with fractions from *A. precatorius* L. seed kernels on mice. Investigators noted that 95% ethanol extract of seeds when administered subcutaneously to male mice at a dose of 500.0 mg/kg produced toxicity. Within 48–49 hours one hundred percent mortality was observed. Ethanol/water (1:1) extract of the aerial parts of *A. precatorius* L when administered intraperitoneally to mice also produced

Toxicity.[55] Oral administration of water extract of seeds of *A. precatorius* L. to mice produced toxicity.[56] Seeds when administered subcutaneously to male mice at a dose of 0.90 gm/kg produced quick toxicity. Forty-four deaths were observed in 5–21 hours.[54] However, methanol (75%) extract of dried leaves of *A. precatorius* L., administered intragastrically to mice at a dose of 2.0 gm/kg, could not produce toxicity in mice.[57]

Effect on guinea pigs

Water extract of seeds of *A. precatorius* L. was found toxic for guinea pigs. Water extract of seeds when administered subcutaneously to female guinea pigs, produced toxicity. LD50 was less than 0.40 mg/kg.[54] Genest et al. (1971), however, showed that oral administration of water extract of seeds of *A. precatorius* L. produced toxicity (LD50 was at 0.299gm/kg).[56]

Effect on goat

Toxicity of *A. precatorius* L. to goats has been studied by Liu and co-workers[58] (2000). It was observed that powdered plant is toxic for goat. Even 1gm/kg oral dose of powdered *A. precatorius* L. produced toxicity and death occurs between 2 and 5 days after administration. One goat that received powdered *A. precatorius* L. (0.5 gm/kg) orally, died on day 32. Signs of poisoning were loss of condition, dyspnea, dehydration, inappetence, bloody diarrhea, and recumbence.

Effect on cow

Apul and Mali(1982) observed that seeds of *A. precatorius* L. when administered orally to cows at a dose of 0.09 gm/kg produced toxicity. Death occurred in 1 of 44 animals. Authors, however, noted that leaf and stem of *A. precatorius* L. administered orally to cows at a dose of 15.4gm/kg did not produce toxic symptoms.[59]

Effect on rabbits

Water extract of seed of *A. precatorius* L. when administered orally to rabbits produced toxicity (ED50, 48.7 mg/kg). Water extracts of leaves and roots of *A. precatorius* L., however, were found non toxic to the animals.[56]

Effect on rat

In 1971 Genest and co-workers observed[56] that water extract of seed of *A. precatorius* L. when administered orally to rat produced toxicity (ED50, 2.711gm/kg).

In 2007 Adedapo and co-workers studied toxic effects of aqueous extract of *A. precatorius* L. in rats. Results showed that the extract caused decreased levels of red

blood cell count, white blood cell count, packed cell volume, haemoglobin concentration, mean corpuscular volume and mean corpuscular haemoglobin but increased levels of biochemical parameters like total serum protein, albumin, aspartate amino transferase, alkaline phosphatase and total bilirubin, alanine amino transaminase etc. Histologically, there was testicular degeneration and reduction in sperm cells.[60]

In 2015 Ogbuehi and co-workers[61] undertook oral acute toxicity (LD50) study of different solvent (aqueous,70% methanol, acetone, petroleum ether) extracts of *A. precatorius* L. leaves in Wistar rats. Results showed that acetone extract had the lowest LD50 value (187mg/kg) indicating higher toxicity and 70% methanol extract was least toxic (LD50, 3942mg/kg). There were significant changes in body weight and organ weight of the animals took *A. precatorius* L. leave extracts. Histopathological studies were carried out. Results showed possible pathological changes in liver, kidneys and heart at the oral limit dose.

We have also noted that *A. precatorius* L leaves could cause body weight loss in normal healthy growing albino rats.[62-63]

Effect on human

Seeds of *A. precatorius* L. is poisonous for human. Seeds administered orally to adult human could cause toxicity. Possible symptoms are, severe gastroenteritis, nausea, vomiting, diarrhea, dehydration, multiple serosal hemorrhages, swelling and inflammation of retroperitoneal lymph nodes and Peyer's patches, necrosis in the liver and kidneys, retinal hemorrhages, convulsions, and collapse. Symptoms may persist for 10–12 days. Death in children has been reported from eating even one seed.[64] In 1955 Gunsolus reported[65] death of two children who chewed seeds of *A. precatorius* L. Children became irrational. They had flushing of skin, tetany, widely dilated pupils and appeared to hallucinate. Beans of *A. precatorius* L. are also toxic for human. Beans, when ingested by human adult, produced pulmonary edema and hypertension.[66]

Cases of human poisoning due to ingestion of seeds/beans of *A. precatorius* L. are known in literature.[67-69] Poisoning is due to abrin – a toxic protein present in the seeds of *A. precatorius* L. On boiling abrin loses toxicity due to structural denaturation. Boiling seeds of *A. precatorius* L is therefore non toxic . The human fatal dose of abrin has been calculated as 0.1-1 µg/kg. It has been reported that abrin inhibits protein synthesis in the cellular level by changing the enzymatic state of the subunit in the 60S-ribosome and causes cell damage.[70]

CONCLUSION

A. precatorius L. has several good effects. It has tremendous medicinal values. But the plant has bad effects too. Seeds of the plant are highly toxic, even in high doses different parts of the plants are toxic. It is, therefore, suggested that caution should be taken before using the plant for medicinal purpose.

CONFLICT OF INTEREST

Nil.

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