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Ethno botanical and Phytophrmacological potential of *Abrus precatorius* L.: A review

Narendra Garaniya*, Atul Bapodra

M. D. Science College, Porbandar, Saurastra University, Rajkot, Gujarat, India

PEER REVIEW

Peer reviewer

Mr. Narendra H Garaniya
Tel: 097254 56394
E-mail: narendra.biochem@gmail.com

Comments

This is a valuable research work in which authors have demonstrated the importance of *Abrus precatorius* plant as it contains various phytochemicals due to which this plant is very much applicable to cure various diseases. This article also makes data strengthen regarding this plant which can leads other research to proper direction in the field of research.

Details on Page S31

ABSTRACT

Medicinal plants are being widely used, either as a single drug or in combination in health care delivery system. Medicinal plants can be important source of previously unknown chemical substances with potential therapeutic effects. *Abrus precatorius* L. is commonly known as Gunja or Jequirity and abundantly found all throughout the plains of India, from Himalaya down to Southern India and Ceylon. This plant is having medicinal potential to cure various diseases. The roots, leaves and seeds of this plant are used for different medicinal purpose. It principally contains flavonoids, triterpene glycosides, abrin and alkaloids. The plant have been reported for neuromuscular effects, neuro-protective, abortifacient, antiepileptic, anti-viral, anti-malarial, antifertility, nephroprotective, immunomodulator, immunostimulatory properties, anti-inflammatory activity, antidiabetic effect, *etc*. As this is a potential medicinal plant, present review reveals chemical constituents of leaf, root and seeds of *Abrus precatorius*. The plant is considered as a valuable source of unique natural products for development of medicines against various diseases and also for the development of industrial products.

KEYWORDS

Abrus precatorius, Abrin, Alkaloids, Isoflavanoquinones, Ethnobotanical

1. Introduction

Medicinal plants are part and parcel of human society to combat diseases, from the dawn of civilization[1]. India is one of the largest producers of herbs and herbal products. Nature around us provided everything of necessity of mankind. The large resources of vegetables, medicinal plants have been used continuously for the treatment of various diseases[2]. Medicinal plants can be important source of previously unknown chemical substances with potential therapeutic effects. The world health organization has estimated that over 75% of the world's population still relies on plant derived medicines, usually obtained from traditional healers, for its basic health care needs[3]. 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[4].

The present review attempt is to strengthen the data regarding active potent compounds present in *Abrus precatorius* (*A. precatorius*) and compile updated information on pharmacognostic characteristics, traditional uses, phytochemistry and pharmacological actions of the plant and its various applications all over the world. This information may leads to some valuable research in the field of medicine and phytopharmacology.

*Corresponding author: Narendra Garaniya, M. D. Science College, Porbandar, Saurastra University, Rajkot, Gujarat, India; At. Damanagar, Police Quarter, Station Road, Damanagar, Taluka: Lathi, Dist: Amreli-365220, Gujarat, India.
E-mail: narendra.biochem@gmail.com
Tel: 097254 56394

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2. Plant profiles

Table 1 presents *A. precatorius* plant profile:[5,6,8,9]

Table 1
Abrus precatorius plant profile.

Plant taxonomy	Kingdom	Plantae
	Division	Magnoliophyta
	Order	Fabales
	Family	Fabaceae
	Subfamily	Faboideae
	Tribe	Abreae
	Genus	Abrus
	Species	*Abrus precatorius*
Common names	Jequirity (English), Gumchi, Chanothi (Gujarati), Gunchi, Gunja, Gaunchi, Rati (Hindi), Gunja (Marathi), Mulati (Punjab), Gunja (Sanskrit), Guruginia (Telugu), Ghunchi (Urdu), Kunch, Koonch, Chunhali (Bengali), Gurugunji (Kannada), Shangir (Kashmiri), Kunni, Gundumani (Malyalam), Gunchi, Chashami -Khurosa (Persian).	
Common name according to different countries	Rosary pea (Egypt), Crab´s eye (Nepal), Jequirity (Philippines), Precatory bean (USA), Saga (Indonesia), Gunchi (Pakistan), Rati gedi (Nepal), Weglis (Indonesia).	

2.1. Plant description

A. precatorius is a woody twinning plant with characteristic toxic red seeds with black mark at the base (Figure 1)[10,11]. Leaves resemble tamarind leaves having 20-40 leaflets. It is native to India, at altitudes up to 1 200 m on the outer Himalayas but now found in all tropical countries[12]. It is a beautiful, much-branched, slender, perennial, deciduous, woody, prickly twining or climbing herb. Stem cylindrical, wrinkled, bark smooth-textured, brown. Leaves stipulate, pinnately compound; leaflets 7-24 pairs, 0.6-2.5 cm×0.4-1.2 cm, turgid, oblong, obtuse, truncate at both ends, appressed hairy. Flowers in auxiliary racemes, shorter than leaves, pink or pinkish-white. Pods 1.5-5.0 cm ×0.8-1.5 cm, turgid, oblong, appressed hairy, with a sharp deflexed beak, silky-textured, 3 to 5-seeded[13].

2.2. Habitat

A. precatorius is found in South Africa, China, Islands, West Indies, India, Brazil, *etc*. Plant found all throughout the plains of India, from Himalaya down to Southern India and Ceylon[5,6].

2.3. Phenology

Flowers in winter; fruits ripen in summer[6].

2.4. Parts used

The roots, leaves and seeds of the plant are used medicinally[5,14].

Ethnobotanical use: *A. precatorius* is traditionally used to treat tetanus, and to prevent rabies. The plant is used in some traditional medicine to treat scratches and sores and wounds caused by dogs, cats and mice, and are also used with other ingredients to treat leucoderma. The leaves of the herb are used to cure fever, cough and cold. The roots are used to treat jaundice and haemoglobinuric bile. Paste of roots is used to cure abdominal pains, tumors and also for abortion. Root is chewed as a snake bite remedy. Hot water extract of fresh root is an anti-malarial and anti-convulsant. Decoction of dried root is used to treat bronchitis and hepatitis. For graying of hair, a paste of leaves and seeds is applied. Dry seeds of *A. precatorius* are used to cure worm infection. In veterinary medicine, it is used in the treatment of fractures. Seeds have also the potential of good insecticide and antimicrobial activity. Various African tribes use powdered seeds as oral contraceptives. Abrus seeds are also taken for tuberculosis and painful swellings[8]. In the Ayurvedic medicine leaves of *A. precatorius* are laxative, expectorant and aphrodisiac medicines and are used in urticaria, eczema, stomatitis, conjunctivitis, alopecia areata, migraine, lymphomas/leukemia and dysmenorrhoea[15]. Seeds are said to be purgative, emetic, tonic, antiphlogistic, aphrodisiac and anti-ophthalmic. Seed of this plant are very beautiful and they attract children. These seed are used to make Necklaces and other ornaments. Leaves and seeds are nutritious as boiled seeds are eaten in certain parts of India. It is said that cooking destroys the poison of seeds[16,17] Seeds have uniform weight of 1/10th of a gram, hence used as weighing unit[18].

2.5. Chemical constituents

Several groups of secondary compounds have been isolated from this species, including alkaloids[19], steroids and other triterpenoids[20,21], isoflavanoquinones, anthocyanins, starch, tannin[22-24], protein, flavanoids[25], phenolic compound, fixed oil, amino acid[26] and the flavones luteolin, abrectorin, orientin, isoorientin and desmethoxycentaureidin 7-0-rutinoside[27].

2.5.1. Leaves

Several compounds like abrine, trigonelline[28], abruslactone A, hemiphloin[29], abrusoside A[30], abrusoside B, abrusoside C, abrusoside D[31], arabinose, galactose, xylose[32], choline, hypaphorine, precatorine [19],

Figure 1. *A. precatorius* flower, pod and fruits[114].

glycyrrhizin[33], montanyl alcohol[34], inositol, D monomethyl ether, pinitol[35] are identified in the leaves of *A. precatorius*.

2.5.2. Root

Abrus is rich in various chemical constituents such as abrol, abrasine, precasine and precol[36,37] present in the roots. Protein, abraline, abricin, abrusgenic-acid, abrusgenic-acid-methyl-ester, abruslactone, abrussic-acid, anthocyanins, calcium, campesterol, cycloartenol, delphinidin, gallic-acid, trigonelline, hypaphorine[19,28], 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[19], polysaccharide[38], isoflavonoids and quinones-abruquinones A, B, C, D, E, F[39], O, G, abruslactone a, abrusgenic acid-methanol-solvate[21,40], arabinose, galactose, xylose[29] are present in the root. Triterpenoids and saponins[21], glycyrrhizin[33] and oleanolic acid are found in the root and abrusosides A, B, C, D[30,31] and E[41] in the aerial parts. Carbohydrates-Galactose, arabinose, and xylose 25 are also present in the aerial parts. New 7,5-dihydroxy-6,49-dimethoxy isoflavone 7-O-b-D- galactopyranoside (1) from the roots of *A. precatorius* are reported by V.K. Saxena, D.N. Sharma, 1999[42].

2.5.3. Seed

Seeds are rich in several essential amino acids like serine, Abrusin, Abrusin-2′-0-apioside, hederagenin, kaikasaponin III, sophoradiol, sophoradiol-22-0-acetate, tryptophan[43], trimethyl[44], alanine[45], amyrin, alpha, ursolic acid[46], valine[44,45], and methyl ester. They contain poisonous protein, a fat-splitting enzyme, aglucoside abrussic acid, haemagglutinin, albuminous substance named abrin[47] and a quantity of ureas[5]. Seeds are poisonous and contain principle compound, abrine[19], abrin A, abrin B[48], abrin C[49], abrin l, abrin ll, abrin lll, abrus agglutinin APA-l, Abrus agglutinin APA-ll[50], abrus-saponins I and II, abrisapogenol, β-amyrin, arachidyl alcohol, brassicasterol, decan-1-ol, docos-13-enoic acid, docosan-1-ol, docosane, N, dodecan-1-ol, dotriacontane, N, eicos-11-enoic 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[34,51], squalene, abricin, abridin[52], abrulin[53], 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[28], choline [19], flavonoids and triterpenoids, steroids, saponins, flavones, flavonol glycosides, reducing sugars, phenolic compounds glycosides[54-57], and precatorine are present in the seeds and leaves. Lectin[58-60], flavonoids and anthocyanins-abrectorin, dimethoxycentaureidin-7-0-rutinoside, precatorins I, II[19], and III, abrectorin, centaureidin, demethoxy 7-O-beta-drutinoside, luteolin, orientin, iso, orientin[27], *A. precatorius* plant growth inhibitor[61], and xyloglucosyl-delophinidin have been isolated from the seeds. A new triterpinoid saponin 3-O-β-D-glucopyranosyl-(1→2)-β-D-glucopyranosyl subprogenin D together with six known terpinoids[62]. C-glucosylscutelarein 6,7-dimethylether (abrusin) and its 2″-O-apioside have been identified as minor components in the seeds of *A. precatorius*. Both are new natural products and are the first examples of flavone-cglycosides containing a trioxygenated A-ring. Abrusin 2″-0-apioside is the only known apioside of a flavone-cglycoside[63]. Seed of this plant also contain calcim, magnesium, sodium, potassium, phosphorous, manganese, zinc, iron, copper, cellulose and muscilase[7] Cystalline abrin contained 4-9 per cent of neutral sugar in addition to 9-3 residues of glucosamine per mole of

abrin (molecular weight 65 000). The neutral sugars consist of mannose, xylose and fucose in ratios of 2.08:1.00:0.94[64]. Tetracos-15-enoic acid, tetracosan-1-ol, tetracosane, N, tetradecan-1-ol, tetradecanoic acid, tetratriacontane, N, triacosan-1-ol, triacontane, N, tricosane, N, tridecan-1-ol, tritriacontan-1-ol, tritriacontane, N, undecan-1-ol[34], anthocyanins[65], arabinose[32], arachidic acid, behenic acid, linolenic acid, palmitic acid: stearic acid (Begum), oleic acid[34,66,67], aspartic acid, cysteine, glutamic acid, glutamine, glycine, lysine, phenylalanine, serine[68], callistephin, chrysanthemin, delphin, pelargonidin-3,5-diglucoside[69], heneicosane,7,9,15-trimethyl, pentacosanoic acid, cholanic acid, 5-beta[51,70], cystine, galacturonic acid, glucuronic acid, leucine, tyrosine[43], delphinidin glycoside[71], delphinidin, (para-coumaroyl-galloyl) glucoside, delphinidin-3-sambubioside[32], docosadienoic acid, docosenoic acid, eicosadienoic acid, eicosenoic acid, eicosatrienoic acid, hexadecenoic acid, lignoceric acid, octadecadienoic acid, octadecatrienoic acid, octadecenoic acid, pentadecanoic acid[72,73], docosatetraenoic acid, docosatrienoic acid, myristic acid[72,73,67], galactose, xylose [32], gallic acid, lauric acid, linoleic acid[74], p-sterone[75], rhamnose, N-N-dimethyl metho-cation[43] have been found in the seed of this plant.

2.6. Pharmacological activities

Various parts of *A. precatorius* are having different pharmacological activity. This plant is having anti-diabetic [76], anti-oxidative[77], neuroprotective, anti-viral[78], neuromuscular, anti-convulsant, anti-epileptic, immune-modulating, abortifacient[11,79], anti-implantation[52,80], anti-helmintic, anti-depression[8], memory enhancing 13, anti-serotonin 14, diuretic[8,81], anti-microbial[82-86,42,74,76] anti-yeast[8,87,88], anti-inflammatory[8,11,89,90], anti-arthritic and analgesic[11,90-92], anti-cancer[11, 93-98], anti fertility[8,52,87,99-104], anti-spermatogenic[101,105], anti estrogenic[74], anti-malarial[8,106], anti-allergic[90,107], anti-asthmatics[108], anti-cataract[109], anti-insecticide[110], anti-toxicity activity[111-113].

3. Conclusion

There are many drugs have entered the international market through exploration of ethnopharmacology and traditional medicine. The present review reveal that *A. precatorius* is a unique source of many potential phytochemicals which makes this plant very important and versatile for its large number of medicinal properties *i.e.* antidiabetic, neuro-protective, anti-microbial, analgesic and many more. For present review, I couldn't find very latest articles and most of the review this article are very old. This may indicate that extensive research yet to be done in this very potent medicinal plant. Hence extensive research should be done to exploit the therapeutic utility to fight against various dieses. Above collected literature conclude that *A. precatorius* is quite promising as a multipurpose medicinal agent as it is having very potential pharmacognostical and pharmacological applications.

Conflict of interest statement

Authors do not have any conflict of interest.

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Comments

Background

The present review attempt is to strengthen the data regarding active potent compounds present in *A. precatorius* and compile updated information on pharmacognostic characteristics, traditional uses, phytochemistry and pharmacological actions of the plant and its various applications all over the world. This information may leads to some valuable research in the field of medicine and phytopharmacology.

Research frontiers

The present review reveal that *A. precatorius* is a unique source of many potential phytochemicals which makes this plant very important and versatile for its large number of

medicinal properties. This plant is having antidiabetic, neuro-protective, anti-microbial, analgesic and many more potential activity. As various phytochemicals have been found in this plant and henceforth it is having various potential activity, this article reveals that still research are yet to be done on its practical applications *i.e.* on clinical bases.

Related reports

As this is a review article, authours have extensively review several article which says about the potential application of this plant. More that hundred articles have been used as reference for same.

Innovations and breakthroughs

A. precatorius commonly known as jequirity, is a medicinal plant used in various ayurvedic formulations used to treat various diseases. In the present study, authors have demonstrated the applicability of this plant as it is having several potential phytochemicals and henceforth clinical applications. Beauty of this review is that it covers almost all the applications and chemical constituent of this plant and by reviewing this article someone can use this article as guidance for further research i.e. it gives a proper direction to the research.

Applications

From the literature survey it has been found that *A. precatorius* is very valuable medicinal plant for its chemical constiuents. This scientific study support and suggest the use of this plant as an alternative medicine in the field of medicine. This article also strengthen data regarding *A. precatorius* and it may help research for further advance research in the field of phytopharmacology.

Peer review

This is a valuable research work in which authors have demonstrated the importance of *A. precatorius* plant as it contains various phytochemicals due to which this plant is very much applicable to cure various diseases. This article also make data strengthen regarding this plant which can leads other research to proper direction in the field of research.

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