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Abrus Precatorius (L.): An Evaluation of Traditional Herb

^aManisha Bhatia, ^bSiddiqui NA, ^aSumeet Gupta*

^aDepartment of Pharmaceutical Sciences, M. M. College of Pharmacy, M. M. University, Mullana, (Ambala), Haryana, India.

^bDepartment of Pharmacognosy, College of Pharmacy, King Saud University, Riyadh. Kingdom of Saudi Arabia

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ABSTRACT

Abrus Precatorius is one of the important herb commonly known as Indian licorice belonging to family Fabaceae. It is reported to have a broad range of therapeutic effects, like anti-bacterial, anti-fungal, anti-tumor, analgesic, anti-inflammatory, anti-spasmodic, anti-diabetic, anti-serotonergic, anti-migraine, including treatment of inflammation, ulcers, wounds, throat scratches and sores. It is now considered as a valuable source of unique natural products for development of medicines against various diseases and also for the development of industrial products but still additional information needs to be updated. Therefore the present review is aimed to compile up the updated data and highlighting the special features on its pharmacological activities in various diseases.

Corresponding author

Sumeet Gupta,

Assoc Prof, Department of Pharmacology, M. M. College of Pharmacy,
M. M. University, Mullana, (Ambala), Haryana, India.

Telephone: +91 9872620252, +918059930156, Email: sumeetgupta25@gmail.com

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Introduction

Medicinal plants, herbs, spices and herbal remedies are known to Ayurveda in India since long times. The value of medicinal plants, herbs and spices as herbal remedies is being lost due to lack of awareness, and deforestation. The result is many valuable medicinal herbs are becoming rare and precious information is lost. The current accepted modern medicine or allopathic has gradually developed over the years by scientific and observational efforts of scientists. But again in last few decades some of the countries are trying to come in the field of herbal medicine for their growth and development. Slowly it is getting popularized in developing and developed countries owing to its natural origin and lesser side effects (1).

In absence of modern medicinal remedies, people relied on herbal remedies derived from herbs and spices. There are many medicinal herbs and spices, which find place in day-to-day uses, many of these, are used as herbal remedies. In the early 1500s Indian fever bark was one of the first appreciative consumers in Europe. Another example is jaborandi tree (*Pilocarpus jaborandi*) secretes alkaloid-rich oil, including the alkaloid pilocarpine, American Indians on the islands of Guadeloupe used pineapple (*Ananas comosus*) poultices to reduce inflammation in wounds and other skin injuries, to aid digestion and to cure stomach ache. So numerous molecule have come out of ayurvedic experimental base, example include rauwolfia alkaloids in amoebiasis, guggulsteons as hypolipidemic agents, mucuna pruriens for Parkinson's disease. India is one of the largest producers of medicinal herbs and is rightly called the botanical garden of the world as it is sitting on a gold mine of well-recorded and traditionally well practiced knowledge of herbal medicine. About 17,000 species of Indian flora about 7500 species of higher plants are reported to possess medicinal value and in other countries it is projected about 7% and 13% (2). In this regard India has a unique position in the world, where a number of recognized indigenous systems of medicine are available for the health care of people. No doubts that the herbal drugs are popular among rural and urban community of India. The demands for plant based medicines are increasing very fast in India. From this, we can say that search is going on for more plants which can give therapeutic activity in treatment of various diseases. Among the traditional system of medicine *Abrus precatorius* Linn (figure 1) is one of the important herb commonly known as Indian licorice belonging to family Fabaceae. Only [Anand et al 2010](#) reported the information (3) on this plant as a review but article needs to be updated with additional information (plant species and pharmacological activities). So our aim is to add the lack of information with reported data and we are trying to incorporate the latest information with older data which is not reported till now for benefit of public interest to implement in daily life to give a new shape. So in this review, the literature tells us about the different species around the world, different common name in India and pharmacological uses.



Figure 1: Picture of *Abrus precatorius* herb

Methodology

For update our article, we had done literature survey from different sources in the form of full text papers and abstracts (figure 2).

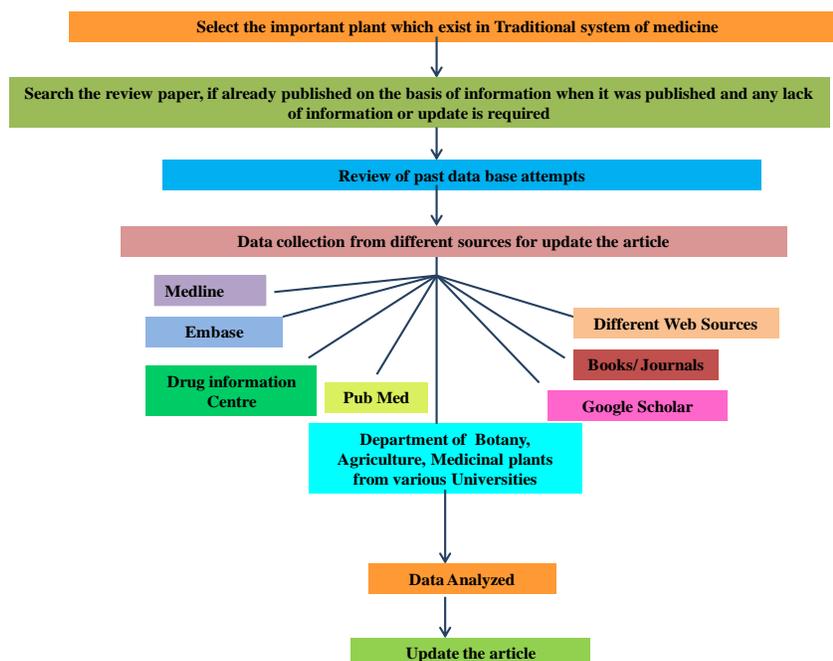


Figure 2: Flow chart of different steps involved in literature survey.

Species

- *Abrus aureus* ([Madagascar](#))
- *Abrus baladensis* ([Somalia](#))
- *Abrus bottae* ([Arabia Sauditā](#)) ([Yemen](#))
- *Abrus canescens* ([Africa](#))
- *Abrus diversifolius* (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](#))

Taxonomical classification (3)

Kingdom: Plantae

Division: Magnoliophyta

Order: Fabales

Family: Facaceae

Subfamily: Facoideae

Tribe: Abreae

Genus: *Abrus*

Species: *Abrus precatorius*

Common names in India (3)

1. [Sanskrit](#) (Gunja)
2. [Hindi](#) (Rati, Gaungchi, Gunchi, Gunja)
3. [Bengali](#) (Kunch, Koonch, Chunhali)
4. [Gujarati](#) (Gumchi, Chanothi)
5. [Kannada](#) (Gurugunji)
6. [Kashmiri](#) (Shangir)
7. [Malayalam](#) (Kunni, Gundumani)
8. [Persian](#) (Gunchi, Chashami-Khurosa)
9. [Punjabi](#) (Mulati)
10. [Tamil](#) (Gundumani, Kunthamani)

11. [Telugu](#) (Guruginia) (wikipedia).

Common name according to different countries (4)

1. Rosary pea (Egypt)
2. Crab's eye (Nepal)
3. Jequerity (Philippines)
4. Precatory bean (USA)
5. Saga (Indonesia)
6. Gunchi (Pakistan)
7. Rati gedi (Nepal)
8. Weglis (Indonesia)

Plant description

Abrus precatorius is a woody twinning plant with characteristic toxic red seeds with black mark at the base (5). It is native to India, at altitudes up to 1200 m on the outer Himalayas. It is now naturalized in all tropical countries (6). 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 x 0.4-1.2 cm, turgid, oblong, obtuse, truncate at both ends, appressed hairy. They are alternate and glabrous with many paripinnate leaflets arranged in pairs. Flowers in axillary racemes, shorter than leaves, fascicled on the swollen nodes, pink or pinkish-white; calyx-lobes short, appressed hairy. Pods 1.5-5.0 x 0.8-1.5 cm, turgid, oblong, appressed hairy, with a sharp deflexed beak, silky-textured, 3 to 5-seeded. Seeds elliptic to sub-globose, 0.5 cm in diam., smooth, glossy, shining red with black blotch around the hilum (7).

Chemical constituents

Abrus is rich in various chemical constituents such as abrol, abrasine, precol and precasine from the roots. Seeds are rich in several essential amino acids like serine, alanine, valine, choline and methyl ester (8). Seeds are poisonous and contain principle compound Abrine, Abraline, Abrasine, Abricin, Abrin, Abrusgenic-acid, Abrusgenic-acid-methyl-ester, Abruslactone, Abrussic-acid, Anthocyanins, Calcium, Campesterol, Choline, Cycloartenol, Delphinidin, Gallic-acid, Glycyrrhizin, Hypaphorine, N, N-dimethyl-tryptophan, N,N-dimethyl-tryptophan-metho-cation-methyl-ester, P-coumaroylgalloyl glucodelphinidin, Pectin, Pentosans, Phosphorus, Delphinidin, Gallic-acid,, Glycyrrhizin, Hypaphorine, N,N-dimethyl-tryptophan, N,N-dimethyl-tryptophan-metho-cation-methyl-ester, P-coumaroylgalloyl-lucodelphinidin, Pectin, Pentosans, Phosphorus, Picatorine, Polygalacturonic-acids, Precasine, Precatorine and Protein Trigonelline (9, 10). Isoflavonoids and quinones - Abruquinones A, B, C, O, E, F and G are present in the root and abrusalactone A, abrusgenic acid and methyl abrusgenate '2 in the aerial parts. Triterpenoids and saponins -Glycyrrhizin and oleanolic acid are found in the root B and abrusosides A, B, C, O and E in the aerial parts. Abrus-saponins I and II, abrisapogenol, β -amyryn, squalene, abricin, abridin, cycloartenol, campesterol, cholesterol and $\hat{\alpha}$ -Sitosterol have all been found in the seeds. Proteins-Abrins I, II and III, Abrus Precatorius agglutinin (APA) I and (APA) II 20 are present in the seeds. Alkaloids and nitrogen compounds-Precatorine, trigonelline, choline and abrine are present in the seeds.

Flavonoids and anthocyanins-Abrectorin, dimethoxycentaureidin-7-0-rutinoside, precatorins I, II and III, and xyloglucosyl-delphinidin and p-coumaroyl-galloyl-glucosyl-delphinidin have been isolated from the seeds. Carbohydrates-Galactose, arabinose, and xylose 25 are present in the aerial parts.

Ethno botanical uses

Abrus precatorius is traditionally used to treat tetanus, and to prevent rabies. Leaves, roots and seeds are used for medicinal purposes. 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. They have anti-suppurative properties. They are ground with lime and applied on acne sores, boils and abscesses. Decoction of leaves is taken orally for cough and flu (11, 12, 13). The roots of *Abrus* herb are used to treat jaundice and haemoglobinuric bile. Paste of roots is administered to cure abdominal pains, tumors and also for abortion. Grinded roots of *Abrus precatorius* are taken with pure clarified butter thrice a day for four days to cure cough (9, 14). Root is chewed as a snake bite remedy (15). Hot water extract of fresh root is administered orally as an anti-malarial and anti-convulsant (16). Decoction of dried root is taken orally to treat bronchitis and hepatitis (17). For graying of hair, a paste of leaves and seeds is applied. Dry seeds of *Abrus precatorius* are powdered and taken one teaspoonful once a day for two days to cure worm infection (9, 14). In veterinary medicine, it is used in the treatment of fractures. The brightly-colored seeds attract children. Boiled seeds are eaten in certain parts of India (18, 19). They have a uniform weight of 1/10th of a gram, hence used as weighing unit (20). Seeds have also the potential of good insecticide (21) and antimicrobial activity (22). They are considered abortifacient (23, 24), anodyne, aphrodisiac, antimicrobial, diuretic, emetic, expectorant, emollient, febrifuge, hemostat, laxative, purgative, refrigerant, sedative, vermifuge, antidote and used in various ailments to cure headache, snakebite, blennorrhagia, boil, cancer, cold, colic, conjunctivitis, convulsion, cough, diarrhoea, fever, gastritis, gonorrhoea, jaundice, malaria, night-blindness, ophthalmia, rheumatism, diabetes and chronic nephritis (9). Dried seeds are taken orally as an aphrodisiac (25, 26). Hot water extract of seeds is taken orally for malaria (27). Various African tribes use powdered seeds as oral contraceptives (11, 12, 13, 28, 29, 30). *Abrus* seeds are also taken for tuberculosis and painful swellings (31).

Pharmacological activities

1) Metabolic disorder

a) Anti-diabetic activity

The anti-diabetic effect of chloroform-methanol extract of *Abrus 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 *Abrus precatorius* seed has anti-diabetic properties having Trigoneline similar to that of chlpropamide (32, 33). Different observation was found in another study on rat model after treated with Ethanol/water (1:1) extract of the aerial parts of *Abrus precatorius* at a dose of 250 mg/kg which was shown to reduce only 30% blood sugar level (34).

b) Anti-oxidant activity

An ethanol seed extract of *Abrus precatorius* was evaluated using in-vitro method to determine anti oxidant activity. Total phenolic compound in ethanol seeds extract of *Abrus precatorius* was found to be 95 mg/g of extract calculated as gallic acid equivalent ($r^2=0.9976$) and total flavonoids compound was found to be 21 mg/g of extract calculated as rutin equivalent ($r^2=0.9985$). *Abrus precatorius* seeds ethanol extract possess potent antioxidant activity in different enzymes levels when compared with reference compound butylated hydroxytoluene (BHT) (35).

2) Neuron disorder

a) Neuroprotective effect

The neuroprotective effects of petroleum ether extract from aerial parts of *Abrus precatorius* Linn at different concentration (100 mg/kg and 200 mg/kg) was evaluated in hypoxic neurotoxicity induced rats. The extract at tested doses promoted spatial behavior significantly when compared with hypoxic rats. The extract restored the decreased levels of enzymes such as glutamate, dopamine and acetylcholinesterases, showing neuroprotective effects when given orally (36).

b) Anti-convulsant

Ethanol (70%) extract of fresh root of *Abrus precatorius* administered intraperitoneally to mice of both sexes at variable dosage levels was significantly active in metrazole induced convulsions but results were opposite when tested in strychnine-induced convulsions (16). In the same study, ethanol/water (1:1) extract of the aerial parts of *Abrus precatorius* showed no statistical significant difference at a dose of 500 mg/kg in electroshock-induced convulsions (35).

c) Neuromuscular effects

Crude extracts from the leaves of *Abrus precatorius* were investigated on different isolated tissue like rectus abdominis, rat phrenic nerve-diaphragm muscle and isolated tissue of young chicks. The ethanol extract of the leaves inhibited acetylcholine-induced contractions on rectus abdominis and rat phrenic nerve-diaphragm muscle preparations. The effects were concentration-dependent and reversible. The extract also caused flaccid paralysis when injected intravenously into young chicks. The ethanol extract had no effect on direct electrical stimulation of rat diaphragm. The inhibitory effect of the ethanol extract on the rat phrenic nerve-diaphragm preparation was potentiated in the presence of reduced calcium ions, elevated magnesium ions, or reduced potassium ions. Thus, the ethanol extract showed a similarity to *d*-tubocurarine in respect of the pattern of neuromuscular blockade. (37)

d) Anti-depressant activity

The anti depressant activity was shown after treatment with ethanol (70%) extract of fresh root of *Abrus precatorius* on mice of both sexes at variable dosage levels (16).

e) Neuromuscular blocking activity

Ethanol (95%) extract of dried leaves of *Abrus precatorius* were administered at a concentration of 0.5µg/ml and it showed blocking action on phrenic nerve-diaphragm (37).

f) Memory enhancer activity

Abrus precatorius has been studied in Alzheimer's disease model by identification of glycohistochemically the microglial cells (MGC) activation in autoptic brain samples. *Abrus precatorius* agglutinin recognizes MGC in the cerebral white matter showed rod-like cells and appear to be particularly dense in those areas proximal to an oligodendroglial cell. Active constituent lectin from *Abrus precatorius* plant has been used to histochemically identify the microglial cells activation in autopic brain samples from Alzheimer's disease subjects (38).

g) Antiepileptic activity

In a cross-sectional study performed in Temeke District (Dares Salaam, Tanzania) it was proved that *Abrus 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 [39].

3) Renal Protectivity

a) Diuretic activity

The diuretic activity was studied in male rats after oral administration of ethanol/water (1:1) extract of the aerial parts at a dose of 250 mg/kg and showed non significant results (35). Another study was investigated in Sprague dawley wistar rats induced renal damage when orally administered alcohol (1.6g/kg). The crude extract (200mg/kg) in addition to alcohol for six weeks with normal feeds and water showed decrease significant elevation of potassium, sodium, creatinine and malondialdehyde in serum levels. Histological studies confirmed with structural alterations in renal tubules, glomerular infiltration when compared with chronic inflammatory cells induced renal damage by alcohol. Concurrent administration of same doses of alcohol and seed extract of *Abrus precatorius* resulted in a suppression of alcohol induced renal injury. Measurement of malondialdehyde level indicated that this effect is related to the attenuation of alcohol induced lipid peroxidation by the seed extract ($p < 0.05$). It was concluded that seed extract of *Abrus precatorius* could protect the kidney against alcohol-induced parenchymal injury (40).

b) Nephroprotective activity

Arial parts of aqueous extract were investigated to determine the recovery effect after administration of cisplatin and acetaminophen induced nephrotoxicity on HEK 293. The assay showed that *Abrus precatorius* had best recovery effect and can be used for the prevention or treatment of renal disorders [41, 42].

4) Antimicrobial activity

The anti-microbial effects of *Abrus precatorius* extracts from leaves, stem and the seed oil were tested against some of the microorganisms Staphylococcus aureus, Staphylococcus epidermidis, Enterococcus faecalis, Streptococcus anginosus, Bacillus subtilis, Corynebacterium spp Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa and Candida albicans using the agar well diffusion technique. Among these, Staphylococcus aureus was the most sensitive organism with an MIC of 8ug/ml for the leaf extract. Extract from the stem and seed oil were potent against some of the gram-positive bacteria and Candida albicans but not against S anginosus, E. faecalis and some gram-negative bacteria. This study demonstrates that *Abrus precatorius* particularly the seed oil has a potent antimicrobial activity (43). Another study in vitro antibacterial activity of hexane, chloroform and methanolic crude extracts of *Abrus precatorius* seeds were tested against ten clinical isolates using the agar well diffusion technique. Methanolic seed extracts showed more potent anti microbial activity when compared with hexane and chloroform extracts. (44). One of the researcher reported the anti bacterial activity on root extracts of the *Abrus precatorius* L. Various solvent fractions exhibited inhibitory activity against thirteen gram-positive and gram-negative bacteria. The antibacterial activity was localized to specific chromatophores in the chloroform fraction through a bioautography assay. It was found localized to four chromatophores out of seven. Among the four active principles isolated, AP 3 (Rf 0.87) exhibited maximum activity i.e. 56% inhibition of growth of *S. aureus* A, in disc diffusion assay compared to the standard antibiotic Ampicillin (45). Different study was investigated on ethanol/water (1:1) extract of the aerial parts, at a concentration of 25.0 mg/ml on agar plate, was inactive on Bacillus subtilis, Escherichia coli, Salmonella typhosa, Staphylococcus aureus and Agrobacterium tumefaciens. Ether extract of seeds, on agar plate, was active on Staphylococcus aureus. The ethanol (95%) extract was active on Escherichia coli and Staphylococcus aureus (46). Another study also confirmed the antibacterial activity of *Abrus precatorius* L. against five medically important bacterial strains, namely Bacillus subtilis ATCC6633, Staphylococcus epidermidis ATCC12228, Pseudomonas pseudoalcaligenes ATCC17440, Proteus vulgaris NCTC8313 and Salmonella typhimurium ATCC23564. The different extracts (aqueous and methanol) was investigated using agar disk diffusion and agar well diffusion method. The methanol extracts were more

active than the aqueous extracts against Gram-positive bacteria than against Gram-negative bacteria. The most susceptible bacteria were *B. subtilis*, followed by *S. epidermidis*, while the most resistant bacteria were *P. vulgaris*, followed by *S. typhimurium* (47). Antibacterial and antifungal activity of powdered seed extracted materials of *Abrus precatorius* Linn using methanol solvent was assessed. The antibacterial activity was tested against *Staphylococcus aureus* MTCC-902, *Escherichia coli* MTCC-405 and *Pseudomonas aeruginosa* MTCC-1934 by Agar well diffusion method. The antifungal activity was determined in terms of inhibition of mycotic infection of Jowar seeds using standard blotter method. *S. aureus* was inhibited to more extent than *E. coli* and *P. aeruginosa* as revealed by greater inhibition zone around the wells. Among extracts, antifungal activity of extracts revealed inhibition of fungal growth on seeds. In extract treated seeds, 100% germination was recorded and seed infection was considerably lesser when compared to control (10% DMSO). The presence of flavonoids, alkaloids and saponins in both the extracts may be responsible for the antibacterial and antifungal activity (48). One of the study reported for antifungal activity using ethanol/water (1:1) extract of the aerial part, at a concentration of 25 mcg/ml on agar plate was inactive on *Microsporum canis*, *Trichophyton mentagrophytes*, and *Aspergillus niger* (35).

5) 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 (49).

6) Anti-yeast activity

Dried seeds at a concentration of 1.0% on agar plate were active on *Cryptococcus neoformans* (50) 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* (35).

7) General activity

a) Anti-inflammatory activity

The anti-inflammatory activity of *Abrus precatorius* 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 (51). 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 (52).

b) Anti arthritic activity and analgesic activity

The anti arthritic activity was studied on croton oil induced inflammation rat model. Two different concentration (200 and 400mg/kg) of water extract of leaves of *Abrus precatorius* were administered orally and both the extracts showed reduction in paw inflammation (53). Another study reported about white (APW) and red (APR) seed extracts of *Abrus precatorius* on Freund's complete adjuvant induced arthritis in rats. The observation showed that the APW significantly ($p < 0.001$) inhibited the FCA induced arthritis and increased paw withdrawal latency indicating a protective effect against arthritis but in case of APR, the inflammation was suppressed at significant level ($p < 0.05$) at the later phase. APW treatment found to possess anti-arthritic activity significantly inhibited the development phase of arthritis, which is further supported by its radiographic

analysis. Both the extracts exhibited significant ($p < 0.001$) anti pyretic activity in brewer's yeast induced pyrexia (54).

8) Anti cancer activity

a) Antitumor activity

A protein extract isolated from the seeds of *Abrus precatorius* L. is shown to exhibit antitumor activity on Yoshida sarcoma (solid and ascites forms) in rats and a fibrosarcoma in mice. The extract has a direct cytotoxic effect on the tumor cells which results in vacuolation, disruption of cytoplasm followed by karyolysis and chromosomal abnormalities are seen in ascites tumor cells treated with the protein in vivo which is confirmed by in vitro studies (55). Other study reported the high anti-tumor activity of agglutinin protein purified extract from the seeds of *Abrus precatorius*. About 90% of the tumour growth was inhibited with abrine A than abrin B after 1ng administered into mice Binding inhibition studies with sugars suggested that abrins A and B have different binding sites to inhibit sarcoma in mice (56).

Abrus agglutinin (AAG), a hetero tetrameric specific lectin isolated from seeds of *Abrus Precatorius*. In vitro studies, 1 $\mu\text{g}/\text{ml}$ of AAG showed the growth inhibition in the treatment of Dalton's lymphoma ascites cells (DLAC) Whereas AAG at lower concentration (1 ng/ml) stimulate peritoneal macrophage and spleen derived NK cells demonstrating cytotoxicity against DLAC (56a).

b) Carcinogenic activity

The study was reported on protective effects of *Abrus precatorius* L. (Leguminosae) in HepG2 cells and *N*-nitrosodiethylamine (NDEA) against hepatocellular carcinoma in swiss albino rats. Aqueous/ethanol (50%) extract of *Abrus precatorius* showed strong cytotoxic effects on HepG2 cells. The expression of p53 was markedly increased and maintained at high level from 6-12 hr with 100 $\mu\text{g}/\text{ml}$. A decrease in the mean and relative liver weights in AP extract treated group at a dose of 100 and 200 mg/kg was observed compared to the control group (57). Similar findings was observed against sarcoma when administered intraperitoneal of water extract (5mcg/kg) and subcutaneously of protein fraction of seed extract (20mcg/kg) (58) vice versa was found in other study (59) at a dose of 100mg/kg of ethanol extract of *Abrus precatorius* against Sarcoma 180 (ASC) in mice. Agglutinin protein, as a precipitant from the seeds, produced a high antitumor activity (56).

c) Tumor inhibiting activity

There is another findings reported about water extract of fresh seeds at a concentration of 2.0 microliters/ml was inactive against mitogenic activity on human lymphocytes (60). Similar results were reported of methanol extract at 10 mg/ml on *Salmonella typhimurium* TM677 (61) and ethanol (95%) extract of dried stem (30.0 mcg/ml) against CA-9KB, ED50 (62).

Another two extracts (water and methanol) of dried seeds give promising results on Sarcoma Yoshida ASC (63) and cell culture strain CA-9KB (64). Water extract of seeds was active on the testes of *Poecilocera picta* (65). The isolated compound abrin from the seeds of *Abrus Precatorius* showed in vitro and in vivo antitumor properties by the induction of apoptosis (66). Negative results were obtained on virus-avian myeloblastosis at $\text{IC}_{50} > 1000$ mg/ml (67).

9) Immunomodulating activity

The immunomodulating activity was done by various researchers and one of the activities reported the effect of abrin on the cellular immune responses in normal and tumor-bearing animals. Natural killer cell activity was

enhanced significantly by abrin in both the normal (49.8% cell lysis on day 9) and the tumor-bearing group (51.7% cell lysis on day 9), and it was found to be earlier than the control. Antibody dependent cellular and complement mediated cytotoxicity was also enhanced in the abrin treated tumor-bearing group on the ninth day (44% cell lysis) as well as 15 day ((27.6% cell lysis) which confirmed the immunomodulatory property of abrin (68). Another study reported about the activity of abrus agglutinin on native (NA) and heat denatured (HDA) condition for murinesplenocyte proliferation, cytokine secretion, NK-cell activation, and thymocyte proliferation. Native agglutinin and HDA induced conditioned media of adherent splenocytes could stimulate non-adherent splenocytes and vice versa. Heat denatured agglutinin was able to induce NK-cell activation at much lower concentration than that of NA, but the extent of NK-cell activation was higher for NA. Proliferation of thymocytes by NA and HDA was also observed. This study indicates that abrus agglutinin could be a potential immunomodulator both in native as well as in heat denatured form (69).

A non-toxic dose of abrin, (1.25 mg/kg body wt) consecutively for five days in normal mice stimulated specific humoral responses. Increasing in number was observed in total leucocyte count, weights of spleen, thymus, circulating antibody, antibody forming cells, bone marrow cellularity and alpha-esterase positive bone marrow cells. The results suggest that abrin can potentiate the humoral immune response of the host (70).

In vitro immunostimulatory effect of abrus lectins derived peptide fractions was investigated and both AGP and ABP act as immunostimulants in vitro in DL bearing mice (71).

10) Anti fertility activity

Chloroform/methanol extract of seeds administered subcutaneously to female rats at a dose of 50.0 mg was active (72). Similar results were obtained in experiment on male rats when ethanol extract of seeds administered intra-gastrically at a dose of 100.0 mg/kg and 250.0 mg/kg for 60 days. No pregnancies were reported for the 20 females paired with 10 males (73). Opposite findings were shown to ethanol (80%) extract of seeds administered orally and subcutaneously to female rats at a dose of 1.0 mg/animal (74) and same results were found with ethanol (95%), water extracts of seeds to mice but pet ether showed active with pet ether. The anti-fertility activity remains inactive when ethanol (95%), water and petroleum ether extracts of leaves, administered orally to female mice (75). There was a significant decrease in the number of pregnant females (76). The clinical study reported with hot water extract of dried plant with other extracts (*Embelia ribes* (fruit), *Piper longum* (fruit), *Ferula assafoetida*, *Piper betele*, *Polianthes tuberosa* and *Abrus precatorius*) administered orally to human females at a one dose of 0.28 gm/person starting from the second day of menstruation, twice daily for 20 days was active. The biological activity of this plant has been filed for patent (77). Seed oil of this plant also been reported as anti-fertility to female mice at a dose of 25.0 mg and on rats at a dose 150.0 mg (78). Another study reported on sperm production with seed extract of *Abrus precatorius* and noted the DNA integrity of spermatozoa in adult male albino mice of BALB/c strain. The intraperitoneal administration of 20 and 60 mg/kg of ethanol seed extract of *Abrus precatorius* caused a highly significant ($p < 0.001$) decrease in daily sperm production and increasing in sperm production was observed in all the treated animals after 20 days of withdrawal of treatment. Similarly, a highly significant increase ($p < 0.001$) in DNA damage was observed in all the treated animals and no significant reversibility in DNA damage was observed during treatment period. This study suggests the role of seed extract of *Abrus precatorius* as an anti-fertility agent or contraceptive with a risk of DNA damage in spermatozoa and may lead to teratogenic effects (79). Other study reported as anti fertility with pet ether extracts of seed oil (80).

b) Abortifacient activity

An aqueous seed suspension (125 mg/kg) induced abortion in 51 % of rats after administration from day 1 to day 10. The activity was reduced when the same dose was administered from day 6 to day 15. Positive results were found in chloroform/methanol extract (50mg) and water extract (125 mg/kg) of seeds given to rats to rats (81). Ethanol extract of seeds given orally at a dose of 200 mg/kg was shown inactive on pregnant hamsters and active on pregnant rats (82). Another study reported on anti-estrogenic effect of ethanol (95%) root extract (10mg/kg) administered orally to mice was active (83). Some of the articles reported on embryotoxic activity on different extracts. Ethanol seed extract was inactive at 200mg/kg to pregnant hamsters and female rats 82. Petroleum ether extract showed inactive results to rats at dose of 150 mg/kg (84). Water extract of dried seeds administered intragastrically to pregnant rats at a dose of 125 mg/kg was inactive (85).

c) Estrous cycle disruption effect

Seeds extract administered orally to female rats at different doses were inactive (86). Chloroform/methanol (2:1) seed extract (1 mg/kg) administered subcutaneously to female rats at a dose of was active (87). Other study showed same results on different doses (10, 5 and 2 gm/kg) but it was 80%, 50%, and 25% respectively, of the rats depicted extensive leukocytic smears with no significant effect on uterine weight (88). Ethanol (95%) dried seed extract administered orally to mice at a dose of 150 mg/kg was found anti-gonadotropin effect (89).

d) Anti-implantation effect

Anti-implantation activity was also observed in case of pregnant rats with 50mg/kg of chloroform/ methanol seeds extract (72). Ethanol root and pet ether extract (100) was also active but ethanol and water seed extract (200mg/kg) was found negative results similarly same plant of different extract (water, ethanol & pet ether extract).

Ethanol (95%) root extract (100 mg/kg) gave significant results when administered orally to rats (90) vice versa results were obtained in ethanol (95%) seed extract to rats and hamsters at a dose of 200.0 mg/kg (82). Same in the case of water seed extract but petroleum ether extract show positive results. Another study reported on ethanol (95%), water and petroleum ether extracts of leaves administered orally to female rats showed no activity (74). Luteal suppressant effect was seen treated with chloroform/methanol (2:1) seed extract to rats (72). The semen coagulation was reported in rat semen after treated with ethanol/water (1:1) aerial extract (35).

e) Anti-spermatogenic effect

Ethanol seed extract (100 mg/kg) administered intragastrically to male rats for 60 days showed insignificant results (75) opposite results were seen in dried seeds (250 mg/ kg) ethanol/water (1:1) extract to rats. Although no significant histological changes in the testes and sperm concentration was reported in both cauda epididymis after 60 days (76). Sterol fraction of dried seeds showed very good results after administered intramuscular. Testicular lesions marked by the cessation of spermatogenesis and a significant reduction in the diameter of the seminiferous tubules were also noted (91).

11) Activity on blood cells

The isoflavoquinones and abruquinones A, B and D significantly inhibited platelet aggregation (17). The agglutinin activity was reported in cell culture with water seeds extract cell (2.0 microliters/ml) on human lymphocytes (60). Another study showed positive results against the red cells of human A, B, O groups and fifteen other animals. Water seeds extract was active on the red blood cells of ant (leafcutter), buffalo, cat, chicken, dog, duckling, guinea pig, horse, lamb, mice, pigeon, rabbit, rat, and ox; weakly active on cow and human adult (blood groups A, B, and O) but it was inactive on goat (92,93). Methylene chloride and methanol

fraction of *Abrus precatorius* plant was evaluated for anti-thrombin activity. Methylene chloride and methanol fraction showed 53 % and 31 % of inhibition (94).

12) Cardiovascular activity

Hot water extract of dried entire plant at a concentration of 320 microliters, showed negative inotropic effect on guinea pig atria (95).

13) Anti-helmintic activity

Seeds extract (10.0%) produced weak activity on *Musca domestica* compared 0.25% DDT (96, 97). Acetone dried root extract and dried stem was inactive on *Culex quinquefasciatus* (97). The anti-schistosomal activity of *Abrus precatorius* was proved as the extract showed lethal effect at 0.6 mg/ml against *Schistosoma mansoni* (98). Abrin inhibited acetylcholinesterase, lactic dehydrogenase and acid and alkali phosphatase activity in the nervous tissue of *Lymnaea acuminata*. It also decreased the levels of protein, free amino acid, DNA and RNA to confirm molluscicidal activity (99). Water extract of dried seeds produced weak activity on *Caenorhabditis elegans*. Similar results were reported after extract of stem and root treatment against trematode *Schistosoma mansoni* and cestode *Hymenolepis diminuta*. Aqueous extract of stem and root of *Abrus precatorius* was evaluated for its anthelmintic activity. It was also observed lethal effect against cestodes. Whereas root extracts (0.6mg/ml) and stem (1.5mg/ml) extract showed best result against schistosomules. Indole alkaloids (abrine) amino acids, tannins, terpenes, steroids and flavonoids have been detected in *Abrus precatorius*. A high concentration of one of these constituents or a combination of them may be responsible for the anthelmintic effect, and without doubt makes *Abrus precatorius* a potent plant in the vernacular treatment of schistosomiasis (100).

14) Insect sterility induction

Petroleum ether extract of dried seeds (1.0 microliter) applied externally to both the sexes of rats but it was active in male only against *Dysdercus cingulatus* and the saline extract produced weak activity in both males and females (102).

15) Anti-malarial activity

An isoflavanquinone, abruquinone, was isolated from the extract of aerial parts and exhibited anti-malarial activity (103). Antiplasmodial activity and cytotoxicity in the assessment of antimalarial activity was evaluated and *Abrus precatorius* extract presented an IC 50 value below 20 g/ml (104).

16) GIT activity

a) Smooth muscle stimulant activity

Chromatographic fraction of a methanol-water (1:1) seed extract (0.2 mg/ml) was active on guinea pig ileum and 0.5 mg/ml was active on the rat stomach (105). Such type of results were seen in ileum of guinea pigs after treated with seed oil (1.8 mcg/ml) (52).

Another anti spasmodic activity was also reported with same above extract on rat uterus contraction induced by PGE, Ach, oxytocin and epinephrine. The relaxation effect of the phrenic nerve diaphragm was reported with ethanol (95%) leaves extract. The inhibition was potentiated by D-tubocurarine but reversed by physostigmine. At different concentration, the extract (4.0 mg/ml) was active on muscle stimulation and 1.0 mg/ml showed active on toad rectus abdominus muscle induced by Ach. Negative results were seen on phrenic nerve-diaphragm after treated with water and hot water extracts of dried leaves (6.72 mg/ml). Petroleum ether extract

at different concentrations (19.2 and 48.0 mg/ml) were inactive on rat phrenic nerve-diaphragm induced by nerve stimulation and on toad rectus abdominus muscle induced by Ach (37). Ethanol/water (1:1) extract of the aerial parts was inactive on guinea pig ileum induced by ACh and histamine spasms (35).

The intestinal fluid retention, intestinal motility inhibition and anti-diarrheal activity was reported with chromatographic fraction of dried seeds (10.0 mg/kg) and found to be active on the small intestines (106). Similar results were seen in intestinal motility model with chromatographic fraction of dried seeds (106).

17) Activity on Skin

a) Anti-allergic activity

Abruquinones A, B, D and F showed strong anti-allergic effects. Inhibition of superoxide formation was less than 0.3 $\mu\text{g/ml}$ from rat neutrophils and less than 1 $\mu\text{g/ml}$ for histamine from mast cells. Polymyxin B-induced hind paw oedema was suppressed by abruquinone A, in normal as well in adrenalectomised mice. Histamine, serotonin, bradykinin and substance P-induced plasma extravasation in ear oedema was also suppressed to a greater extent than with diphenhydramine and methysergide with these chemical constituents (17).

The wound healing activity of red and black colored seed of and methanol insoluble fractions of white form resulted in early wound healing activity which may be due to the presence of gums, mucilages, tannins or phenolic compounds in the seeds. This support the effectiveness of the seed extracts and fraction in controlling the infection in vivo (107). The anti-serotonergic activity was done by in-vitro studied on albino rat and frog fundus muscle preparations. Petroleum ether extracts showed smooth muscle contraction at different concentrations, as the dose increases the response also increased, while the ethyl acetate extract showed only the base line elevation and were compared with Sumatriptan at different doses (108). The body temperature was observed by ethanol/water extract (500mg/kg) of the aerial parts and was inactive (35).

Conclusion

Numerous drugs have entered the international market through exploration of ethnopharmacology and traditional medicine. Although herbal medicines have also been used for thousands of years. The above collected information regarding the pharmacognostical and pharmacological use of this plant is verified with available literature. It is seen that *Abrus precatorius* is a very important plant for its large number of medicinal properties which includes antidiabetic, nephroprotective, neuroprotective, analgesic and many more. Thus *Abrus precatorius* is quite promising as a multipurpose medicinal agent and addition to this, the future prospects for preclinical study on small animals will be screening out in some disorders like obesity, viral, Parkinsonism and thyroid. Clinical trials should be performed to prove its efficacy in larger population.

Conflict of interested statement

There no conflicts of interest

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