



The Potential Therapeutic Advantage of *Abrus precatorius* Linn. an Alternative to *Glycyrrhiza glabra*: A Review

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Authors' contributions

This work was carried out in collaboration between both authors. Author AVO designed the study, managed the literature searches, and wrote the first draft of the manuscript. Author MFV edited the manuscript and supervised corrections. Both authors read and approved the final manuscript.

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ABSTRACT

Far back since the existence of the human race, plant species have been used as herb or medicine to either treat, suppress or cure the human numerous sicknesses. This poses the truth that green medicine is safe, cost-efficient, and effective with little or no side effects. Up-till date, the medicinal plant has gained world attraction which has led to global development and discovery of new drug formulations. The beneficial features of plant medicine are enormous and should not be underestimated. However, in this study, *Abrus precatorius* Linn., an alternative to *Glycyrrhiza glabra* has been extensively reviewed to expose this herb secret to the scientific research world for the development of possible novel drug formulations in response to the present global diseases around the globe.

Keywords: *Abrus precatorius* Linn.; drug development; drug discovery; novel drug.

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1. INTRODUCTION

By the end of the year 2020, the world population is likely to hit 7.5 billion. The World Health Organization [WHO] has reported that 80% of the population of developing countries use conventional medicines for their health care needs. The use of conventional medicines is gaining greater interest today. This is

largely due to the current conviction that green medicine is healthy, cost-effective, and has few or no side effects. Second, compared to expensive harmful antibiotics and chemotherapeutic agents, plant-based drugs are biodegradable, do not accumulate in the eco-system that induces biomagnification, or do not cause environmental contamination.

Table 1. Universally accepted names of *Abrus precatorius* L.

Countries	Common names	Countries	Common names
India	Aainud-dik	West Indies	Areglisse
Guinea- Bissau	Benambo	Guyana	Buck bean
Pakistan	Chanoti	Pakistan	Cham-I-Kharosh
Pakistan	Chirmu	India	Chunhati
Guam	Crab's eye	India	Crab's eye
Nepal	Crab's eye	USA	Crab's eye
Thailand	Crab's eye	India	Crab's stone
Ivory coast	Damabo	India	Gaungchi
India	Gchi	India	Ghongchi
India	Ghumchi	India	Ghun
Ivory coast	Goassien	India	Guinea pea
India	Gunch	Pakistan	Gunchi
India	Gundamani	India	Gunja
India	Guri-ginja	India	Gurivinda
India	Gurje-tiga	Sudan	Habat al arus
Sudan	Habat-elmlook	India	Indian licorice
Nigeria	Indian licorice	Taiwan	Jequiriti bean
Philippines	Jequirity plant	Taiwan	Jequirity
India	Jequirity	Brazil	Jequiriti
Virgin Islands	Jumble bean	Ivory Coast	Jumble bean
India	Kalyani	Tanzania	Kikerewe
Guam	Kolales halomtanto	India	Koonch
Ivory Coast	Kripke	India	Kunni
Ivory Coast	Laboma	India	Latuwani
USA	Love bean	East Africa	Lufyambo
Haiti	Lyann legliz	Thailand	Ma Klam taanuu
Mozambique	Minimini	Peru	Mishquina
Peru	Miski miski	East Africa	Motipitipi
Ivory Coast	Moudie-bi-titi	East Africa	Mwanga-la-nyuki
Tanzania	Mwanganaruchi	Mozambique	Namugolokoma
Guinea	Ndebie ni	Brazil	Olho de Pombo
India	Olinda	East Africa	Ombulu
Tanzania	Orututi	East Africa	Osito
USA	Prayer bean	USA	Precatory bean
Nepal	Rati gedi	India	Rati
Pakistan	Ratti	Pakistan	Rosary bean
USA	Rosary bean	Egypt	Rosary pea
India	Safed chirami	Indonesia	Saga
Philippines	Saga saga	Ivory Coast	Sanga
India	Sonkach	Egypt	Sus
West Indies	Weglis		

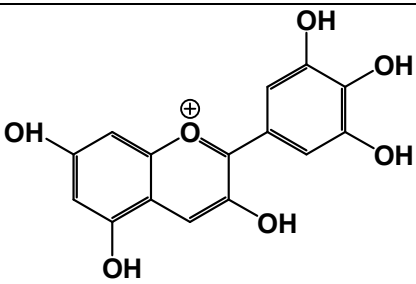
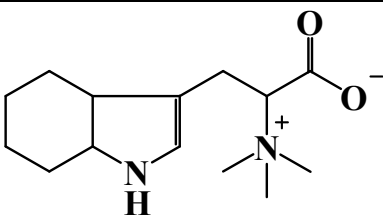
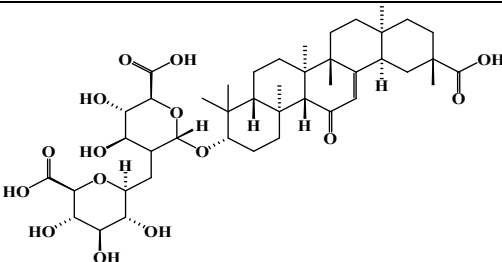
These beneficial features of herbal medicines have turned the attention of scientists towards herbal drugs of plant origin. Determining the biological activities of plants in traditional medicine is helpful to rural communities to whom primary health care is not available. Several studies are currently being undertaken to isolate bioactive compounds by bioassay-guided fractionation from species that show high biological activities during screening. This will make primary information available to the scientific and research society. Among the traditional system of medicine, *Abrus precatorius Linn* is one of the important herbs commonly known as Indian licorice belonging to family Fabaceae an alternative to *Glycyrrhiza glabra*. This plant is grown in all tropical regions throughout the world. It is a woody climber, profusely branched with compound leaves. The seeds of the plant are slightly smaller than an ordinary pea. The root of the plant is woody with a sweet taste rather like licorice. In

this review, we will be discussing the existing therapeutic and medicinal use of *Abrus precatorius L.* as an ancient herb yet a hidden alternative plant to *Glycyrrhiza glabra*. Below is the list of universally accepted names of *Abrus precatorius* from different countries.

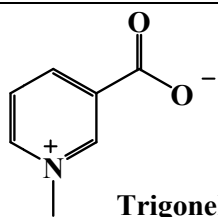
1.1 Phytochemistry of *Abrus precatorius Linn.*

Secondary metabolites present in *Abrus precatorius Linn.* includes alkaloids, flavonoids such as abrectorin, luteolin, orientin, isoorientin, and desmethoxycentaviridin-7-O-rutinoside, triterpene glycosides, saponins, steroids, and other terpenoids, fixed oil, carbohydrate, protein, tannins, anthocyanins, and amino-acids. The plant root and leaves contain sweet-tasting glycyrrhizin as a major phytoconstituent also present in *Glycyrrhiza glabra*. Here are some of the dominant phyto-compounds present in *Abrus precatorius Linn.*

Table 2. Chemical structures of Phyto-compounds in *Abrus precatorius Linn.*

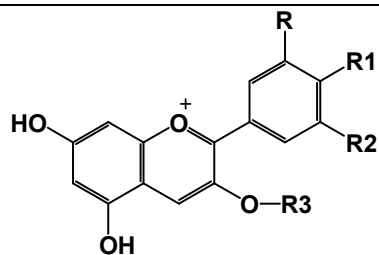
1 Delphinidin	
2 Hypaphorine	
3 Glycyrrhizin	

4 Trigonelline



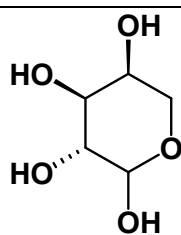
Trigonelline

5 Anthocyanin

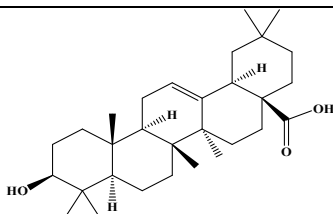


Anthocyanin

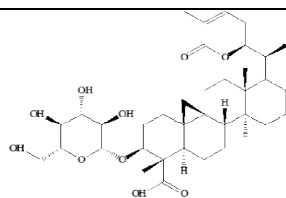
6 Arabinose



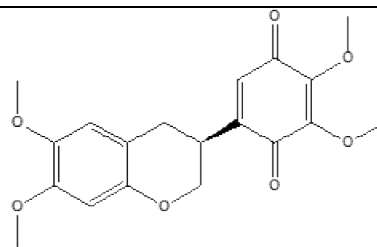
7 Oleanolic acid

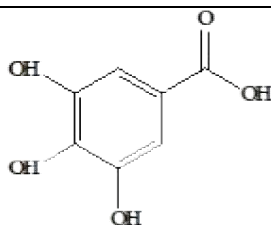


8 Abrusoside



9 Abruquinone A



10 Gallic acid**2. THERAPEUTIC ACTIVITIES OF *Abrus precatorius* Linn.****2.1 Anti-microbial Activity**

The agar well diffusion method of *precatorius* seed extracts was assayed in vitro against ten bacterial organisms. Extracts of methanol demonstrated antibacterial activity against almost all bacterial microorganisms. Three plants with hexane and chloroform extracts display little to no antibacterial activity. Methanolic crude extracts, on the other hand, demonstrated maximum antibacterial activity on *Klebsilla pneumonia*, followed, respectively, by *Staphylococcus aureus*, *Streptococcus mitis* and *Micrococcus luteus*. The plants examined were the most successful against all the tested bacteria. The important antibacterial activity of the active plant extracts was close to that of the regular Streptomycin (10 µg / disc) antibiotic. This research therefore provides a theoretical basis for the conventional use of *Abrus precatorius* solvent extracts as a potential source of new and efficient herbal medicines for the treatment of infections caused by multi-drug resistant strains of microorganisms [1].

2.2 Anti-oxidant Activity

99.9 percent of ethanol was used to extract the raw, dry seed powder. The phytochemical test suggests that there is a higher degree of overall phenol and flavonoids in the extract. The total phenolic compound was found to be 95 mg / g of extract calculated as gallic acid equivalent ($r^2=0.9976$) in the ethanolic seed extract of *Abrus precatorius* and 21 mg / g of extract calculated as rutin equivalent ($r^2=0.9985$) in the total flavonoid compound. Using tests such as hydroxyl radical-scavenging activity, reducing power activity, and hydrogen peroxide-scavenging activity, the extract was screened for its possible antioxidant activities. In comparison with the reference compound butylated hydroxytoluene (BHT), the in-vitro antioxidant assay showed that ethanolic seed extract of

Abrus precatorius ASEt has potent antioxidant activity. ASEt may be useful as a potent antioxidant for the preparation of nutraceuticals to treat various human diseases and their complications [2].

2.3 Antibacterial Activity

Seven strains of bacteria called *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Salmonella paratyphi A*, *Salmonella paratyphi B*, *Klebsiela pneumonia* and *Staphylococcus aureus* have been isolated from the soil. Against all of the above bacterial strains, antimicrobial activity of different sections of *Abrus precatorius* such as roots, seeds, and leaves was examined. The root extract of *Abrus precatorius* was found to be active against *Staphylococcus aureus*, a gram-positive organism. Root extracts, particularly against *Staphylococcus aureus*, possess good antibacterial potential. The minimum inhibitory concentration (MIC) of the petroleum ether extract was found to be 0.44 mg / ml (440 µg / ml) against *Staphylococcus aureus* and 0.40 mg / ml (400 µg / ml) against the same methanol extract. It was considered that the antimicrobial activity was strong if the extracts showed a MIC lower than 100 µg / ml; the antimicrobial activity was moderate from 100 to 500 µg / ml; the antimicrobial activity was poor from 500 to 1000 µg / ml; the extract was considered inactive above 1000 µg / ml. Thus, the root extract's antimicrobial activity is mild [3].

2.4 Anti-yeast Activity

Dried seeds of 1.0 percent concentration on agar plate were active on *Cryptococcus neoformans* and contrary results were observed using ethanol / water (1:1) aerial component extract (25.0 mcg / ml) on agar plate inactive on *Candida albicans*, *Cryptococcus neoformans* [4,2,5].

2.5 Antiviral Activity

Researchers reported that ethanol / water (1:1) extract from the aerial parts at a concentration of

50 mcg / ml in cell culture was inactive on Ranikhet virus and Vaccinia virus, and similar results were found using cell culture method by water administration and methanol extracts from dried seeds of this plant were inactive against HLTV-11 virus [6].

2.6 Anti-diabetic Activity

The anti-diabetic activity of *Abrus precatorius* seed chloroform-methanol extract (50 mg / kg) was studied in alloxan diabetic rabbits. After treatment with chloroform-methanol extract at different intervals, a percentage reduction in blood glucose was observed, which indicates that the chloroform-methanol extract of *Abrus precatorius* seed has antidiabetic properties close to that of chlorpropamide with Trigonelline [6]. Different findings were made in another rat model study after treatment with ethanol / water (1:1) extract of the aerial components of *Abrus precatorius* at a dose of 250 mg / kg, which showed that blood sugar levels were reduced by only 30 percent [7,8].

2.7 Anti-inflammatory Activity

In the rat ear model, the anti-inflammatory role of *Abrus precatorius* extract was examined in relation to inflammation caused by croton oil. The A. extract. When co-administered with croton oil to the rat ear, *precatorius* provided a decrease in the inflammatory response observed after 6 hours compared with croton oil alone. In the croton oil community alone, the extract provided a 2 percent reduction in the inflammatory response. This result explains the utility of the leaves of this plant in traditional healers' treatment of inflammatory disease conditions [9]. Another analysis using the isolated active constituents of triterpenoids, saponins, and their acetate derivatives was also published in the same model. Inflammation reduction was observed in various test compounds, but both 300 µg and 600 µg acetates demonstrated higher inhibition than the parent compounds. Acetate derivatives of parent compounds were more successful among all test-treated groups at 600 µg concentration [10,11].

2.8 Diuretic Activity

After oral administration of ethanol / water (1:1) extract of the aerial parts at a dose of 250 mg / kg, diuretic activity was tested in male rats and showed non-significant results [2]. In Sprague

Dawley Wistar rats, another study was investigated to cause renal damage when alcohol was given orally (1.6 g / k g). In addition to alcohol, the crude extract (200 mg / kg) showed a decrease in the substantial elevation of potassium, sodium, creatinine and malondialdehyde in serum concentrations for six weeks with regular feeding and water. Histological studies confirmed structural changes in renal tubules; glomerular infiltration, when compared to chronic inflammatory cells, induced alcohol-induced renal damage. The concomitant administration of the same doses of *Abrus precatorius* alcohol and seed extract resulted in the suppression of alcohol-induced renal injury. Malondialdehyde level measurements suggested that this effect was related to the attenuation of seed extract lipid peroxidation caused by alcohol ($p < 0.05$). It was concluded that the *Abrus precatorius* seed extract could protect the kidney against parenchymal injury caused by alcohol [12].

2.9 Nephroprotective Activity

In order to evaluate the recovery effect after administration of cisplatin and acetaminophen-induced nephrotoxicity on HEK 293, arial sections of aqueous extract were investigated. The assay showed that the strongest recovery effect was *Abrus precatorius* and can be used to prevent or treat renal disorders [12,13].

2.10 Anti-arthritic Activity and Analgesic Activity

Using the croton oil-induced inflammation rat model, anti-arthritic activity was studied. Two separate concentrations (200 and 400 mg / kg) of *Abrus precatorius* leaf water extract were administered orally and both extracts showed a decrease in paw inflammation [14]. Another research on Freund's complete adjuvant-induced arthritis in rats recorded white (APW) and red (APR) seed extracts of *Abrus precatorius*. The observation showed that the APW significantly prevented FCA-induced arthritis ($p < 0.001$) and improved paw withdrawal latency, suggesting a protective effect against arthritis, but inflammation was suppressed at a significant level ($p < 0.05$) in the later stage in the case of APR. The development process of arthritis, which is further confirmed by its radiographic study, was substantially inhibited by APW therapy, found to have anti-arthritic activity. Both extracts demonstrated important ($p < 0.001$)

antipyretic activity in the pyrexia-induced brewer's yeast [15].

2.11 Cardiovascular Activity

Hot water extract of the dried entire plant at a concentration of 320 microliters, showed a negative inotropic effect on guinea pig atria [16].

2.12 Anti-helminthic Activity

Seeds extract (10.0%) produced weak activity on *Musca domestica* compared to 0.25% DDT [17], Hartzell A, et al. [18]. Acetone dried root extract and dried stem were inactive on *Culex quinquefasciatus* [18]. The anti-schistosomal activity of *Abrus precatorius* was proved as the extract showed a lethal effect at 0.6 mg/ml against *Schistosoma mansoni* [19]. 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 [20]. Water extract of dried seeds produced weak activity on *Caenorhabditis elegans*. Similar results were reported after the 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 a lethal effect against cestodes. Whereas root extracts (0.6mg/ml) and stem (1.5 mg/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 a doubt makes *Abrus precatorius* a potent plant in the vernacular treatment of schistosomiasis [21].

2.13 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 males only against *Dysdercus cingulatus* and the saline extract produced weak activity in both males and females [22].

2.14 Anti-malarial Activity

Isoflavanquinone, abruquinone, has been isolated from an aerial extract and has

demonstrated antimalarial activity [23]. In the assessment of antimalarial activity, antiplasmodial activity and cytotoxicity were assessed and *Abrus precatorius* extract posed an IC 50 value below 20 g / ml [24].

2.15 Anti-allergic Activity

Abruquinones A, B, D, and F showed strong anti-allergic effects. The inhibition of superoxide formation was less than 0.3 µg/ml from rat neutrophils and less than 1 µg/ml for histamine from mast cells. Polymyxin B-induced hind paw oedema was suppressed by abruquinone A, in normal as well in adrenalectomized mice. Histamine, serotonin, bradykinin, and substance P-induced plasma extravasation in-ear oedema were also suppressed to a greater extent than with diphenhydramine and methysergide with these chemical constituents [25]. The wound healing operation of red and black coloured seeds and insoluble white methanol fractions resulted in early wound healing activity due to the involvement in the seeds of gums, mucilages, tannins, or phenolic compounds. This encourages the efficacy of seed extracts and fractions to control in vivo infection [26]. 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 baseline elevation and was compared with Sumatriptan at different doses [27]. The body temperature was observed by ethanol/water extract (500 mg/kg) of the aerial parts and was inactive [2].

2.16 Smooth Muscle Stimulant Activity

The 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 [28]. Such type of results was seen in the ileum of guinea pigs after treated with seed oil (1.8 mcg/ml) [11]. Another anti-spasmodic activity was also reported with the 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 concentrations, 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) was inactive on rat phrenic nerve-diaphragm induced by nerve stimulation and on toad rectus abdominus muscle induced by Ach. Ethanol/water (1:1) extract of the aerial parts was inactive on guinea pig ileum induced by ACh and histamine spasms. The intestinal fluid retention, intestinal motility inhibition, and anti-diarrheal activity was reported with a chromatographic fraction of dried seeds (10.0 mg/kg) and found to be active on the small intestines [29]. Similar results were seen in the intestinal motility model with a chromatographic fraction of dried seeds [29].

2.17 Activity on Blood cells

The isoflavoquinones and abruquinones A, B, and D significantly inhibited platelet aggregation [25]. The agglutinin activity was reported in cell culture with water seeds extract cell (2.0 microliters/ml) on human lymphocytes [30]. Another study showed positive results against the red cells of human A, B, O groups, and fifteen other animals. Due to the participation of gums, mucilages, tannins, or phenolic compounds in the seeds, the wound healing process of red and black coloured seeds and insoluble white methanol fractions resulted in early wound healing activity. This facilitates the in vivo infection control efficacy of seed extracts and fractions [31,32].

2.18 Anti-fertility Activity

Chloroform/methanol extract of seeds administered subcutaneously to female rats at a dose of 50.0 mg was active [33]. Similar results were obtained in an experiment on male rats when ethanol extract of seeds administered intragastrically 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 [34]. 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. Zia-Ul-Haque et al. [35] and the same results were found with ethanol (95%), water extracts of seeds to mice but pet ether showed active with pet ether. The antifertility activity remains inactive when ethanol (95%), water, and petroleum ether extracts of leaves, administered orally to female mice [36]. There was a

significant decrease in the number of pregnant females [37]. 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 [38]. The seed oil of this plant has also been reported as anti-fertility to female mice at a dose of 25.0 mg and on rats at a dose of 150.0 mg [39]. Another study reported on sperm production with seed extract of *Abrus precatorius* and noted the DNA integrity of spermatozoa in the BALB / c strain of adult male albino mice. Intraperitoneal administration of 20 and 60 mg / kg of *Abrus precatorius* ethanol seed extract resulted in a highly significant ($p < 0.001$) decrease in daily sperm output and an increase in sperm production in all treated animals after 20 days of withdrawal. Similarly, in all treated animals, a highly significant increase ($p < 0.001$) in DNA damage was observed and no significant reversibility of DNA damage during the treatment period was observed. The role of *Abrus precatorius* seed extract as an anti-fertility agent or contraceptive with a risk of DNA damage in spermatozoa is suggested by this study and can lead to teratogenic effects [40]. Other studies have documented the anti-fertility of pet ether seed oil extracts [41].

2.19 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 (50 mg) and water extract (125 mg/kg) of seeds given to rats to rats [42]. Ethanol extract of seeds given orally at a dose of 200 mg/kg was shown inactive on pregnant hamsters and active on pregnant rats [43]. Another study reported on the anti-estrogenic effect of ethanol (95%) root extract (10 mg/kg) administered orally to mice was active [44]. Some of the articles reported on embryotoxic activity on different extracts. The ethanol seed extract was inactive at 200mg/kg to pregnant hamsters and female rats. Petroleum ether extract showed inactive results to rats at a dose of 150 mg/kg. Water extract of dried seeds administered intragastrically to pregnant rats at a dose of 125 mg/kg was inactive [45].

2.20 Estrous Cycle Disruption Effect

Seeds extract administered orally to female rats at different doses were inactive [46]. Chloroform/methanol (2:1) seed extract (1 mg/kg) administered subcutaneously to female rats at a dose was active [47]. Other studies showed the 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 [36]. Ethanol (95%) dried seed extract administered orally to mice at a dose of 150 mg/kg was found anti-gonadotropin effect [48].

2.21 Anti-implantation Effect

Anti-implantation activity was also observed in the case of pregnant rats with 50 mg/kg of chloroform/ methanol seeds extract [49]. Ethanol root and pet ether extract [20] was also active but ethanol and water seed extract (200 mg/kg) were found negative results similarly the 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 [50] vice versa results were obtained in ethanol (95%) seed extract to rats and hamsters at a dose of 200.0 mg/kg [43]. 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 [35]. Luteal suppressant effect was seen treated with chloroform/methanol (2:1) seed extract to rats. The semen coagulation was reported in rat semen after treated with ethanol/water (1:1) aerial extract [2].

2.22 Anti-spermatogenic Effect

Ethanol seed extract (100 mg/kg) administered intragastrically to male rats for 60 days showed insignificant results Samad F, et al. [36] 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 were reported in both cauda epididymis after 60 days [37]. 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 [40].

3. ANTI-CANCER ACTIVITY

3.1 Antitumor Activity

A protein extract isolated from *Abrus precatorius* L's seeds. Yoshida sarcoma (solid and ascite) in rats and fibrosarcoma in mice have been shown to exhibit antitumor activity. The extract has a direct cytotoxic effect on tumour cells resulting in vacuolation, cytoplasm disruption accompanied by karyolysis, and chromosome abnormalities are seen in in vivo protein-treated ascites tumour cells confirmed by in vitro studies [51]. The high anti-tumor activity of the distilled extract of agglutinin protein from the seeds of *Abrus precatorius* was documented in another study. Around 90% of tumour growth was inhibited by abrine A compared to abrin B after 1ng was administered to mice. Binding sugar inhibition studies indicated that abrinins A and B had different binding sites in mice to inhibit sarcoma Panneerselvam K, et al. [52]. Abrus agglutinin (AAG), a heterotetrameric specific lectin isolated from seeds of *Abrus precatorius*. In vitro studies, 1 µgm/ml of AAG showed 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.

3.2 Carcinogenic Activity

A analysis of the protective effects of *Abrus precatorius* L has been published. (Leguminosae) against hepatocellular carcinoma in HepG2 cells and Nnitrosodiethylamine (NDEA) in Swiss albino rats. Significant cytotoxic effects on HepG2 cells were demonstrated by aqueous / ethanol (50 percent) extract from *Abrus precatorius*. The p53 expression was markedly increased and sustained at a high level of 100µg / ml from 6-12 hr. Compared to the control group [Ghosh D.], a decrease in mean and relative liver weights was observed in the AP extract-treated group at 100 and 200 mg / kg doses. Similar results were observed for sarcoma when water extract (5 mcg / kg) was administered intraperitoneally and seed extract protein fraction (20 mcg / kg) subcutaneously [53], was discovered in other studies [54] at a dosage of 100 mg / kg of *Abrus precatorius* ethanol extract against Sarcoma 180 (ASC) in mice. Agglutinin protein, as a precipitant from the seeds, produced a high antitumor activity Panneerselvam K, et al. [52].

3.3 Tumor Inhibiting Activity

Further results have been reported on the inactivity of fresh seed water extract at a concentration of 2.0 microliters / ml against mitogenic activity on human lymphocytes Itokawa H. From et al. [31]. Similar findings have been reported with 10 mg / ml methanol extract for *Salmonella typhimurium* TM677 [55] and ethanol (95%) dried stem extract (30.0 mcg / ml) vs. CA-9 KB, ED50 [56]. Two additional dried seed extracts (water and methanol) give promising results on Sarcoma Yoshida ASC Hussein Ayoub SM, et al. [57] and the CA-9 KB strain of cell culture [58]. Seed water extract was active on *Poecilocera picta* testicles [59]. The isolated compound abrin from *Abrus precatorius* seeds demonstrated in vitro and in vivo tumour antitumor properties by apoptosis induction [60]. Negative results for virus-avian myeloblastosis at IC50 > 1000 mg / ml were obtained [61].

3.4 Immunomodulating Activity

Different researchers carried out the immunomodulating activity, and one of the activities recorded the impact of abrin on cellular immune responses in normal and tumour-bearing animals. In both the normal (49.8 percent cell lysis on day 9) and the tumour-bearing community (51.7 percent cell lysis on day 9), natural killer cell activity was greatly improved by abrin and was found to be earlier than the control. In the abrin-treated tumour-bearing community on the ninth day (44 percent cell lysis) as well as 15 days ((27.6 percent cell lysis), an antibody-dependent cellular and complement-mediated cytotoxicity was also enhanced, confirming the immunomodulatory property of abrin [62]. The activity of abrus agglutinin on native (NA) and heat denatured (HDA) conditions for murine splenocyte proliferation, cytokine secretion, activation of NK cells, and proliferation of thymocytes was documented in another study.

Conditioned media induced by native agglutinin and HDA of adherent splenocytes could stimulate non-adherent splenocytes and vice versa. At a much lower concentration than that of NA, heat denatured agglutinin was able to induce NK-cell activation, but the degree of NK-cell activation for NA was higher. Thymocyte proliferation by NA and HDA has also been observed. This study indicates that both native and heat-denatured abrus agglutinin may be a possible immunomodulator [63]. Relevant humoral responses were induced by a non-toxic

dose of abrin (1.25 mg / kg body wt) consecutively for five days in normal mice. Total leucocyte count, spleen weights, thymus, circulating antibody, antibody-forming cells, bone marrow cellularity, and alpha-esterase positive bone marrow cells have been observed to increase in size. The results indicate that abrin can potentiate the host's humoral immune response [64]. In vitro immunostimulatory effects of peptide fractions derived from abrus lectins have been studied and both AGP and ABP function as in vitro immunostimulants in DL bearing mice [65].

3.5 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 spoonful's in a twice-daily dosage regimen for the treatment of epilepsy.

3.6 Memory Enhancer Activity

In the Alzheimer's disease model, *Abrus precatorius* was examined by identifying the activation of microglial cells (MGC) glycohistochemically in autopic brain samples. In the cerebral white matter rod-like cells, *Abrus precatorius* agglutinin recognises MGC and tends to be especially dense in those areas proximal to an oligodendroglial cell. For histochemical identification of the activation of microglial cells in autopic brain samples from Alzheimer's disease subjects, an active constituent lectin from the *Abrus precatorius* plant was used [66].

3.7 Anti-depressant Activity

The antidepressant activity was shown after treatment with ethanol (70%) extract of the fresh root of *Abrus precatorius* on mice of both sexes at variable dosage levels [67].

3.8 Neuromuscular Blocking Activity

Ethanol (95%) extract of dried leaves of *Abrus precatorius* was administered at a concentration of 0.5 µg/ml and it showed blocking action on phrenic nerve-diaphragm [68].

3.9 Anti-convulsant

Ethanol (70%) extract of the 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 [67]. In the same study, ethanol/water (1:1) extract of the aerial parts of *Abrus precatorius* showed no statistically significant difference at a dose of 500 mg/kg in electro-shock-induced convulsions [2].

3.10 Neuroprotective Effect

In hypoxic neurotoxicity-induced rats, the neuroprotective effects of petroleum ether extract from aerial components of *Abrus precatorius* Linn at different concentrations (100 mg / kg and 200 mg / kg) were evaluated. The extract significantly encouraged spatial activity in contrast with hypoxic rats at the measured doses. Reduced levels of enzymes such as glutamate, dopamine and acetylcholinesterases were restored by the extract, showing neuroprotective effects when orally administered [69].

3.11 Neuromuscular Effects

In various isolated tissues, such as rectus abdominis, rat phrenic nerve-diaphragm muscle, and isolated tissue of young chicks, rudimentary extracts from the leaves of *Abrus precatorius* have been investigated. Acetylcholine-induced contractions on rectus abdominis and rat phrenic nerve-diaphragm muscle preparations were inhibited by the leaves' ethanol extract. Concentration-dependent and reversible were the results. When injected intravenously into young chicks, flaccid paralysis was also caused by the extract. There was no effect of the ethanol extract on direct electrical stimulation of the rat diaphragm. In the presence of decreased calcium ions, elevated magnesium ions, or

decreased potassium ions, the inhibitory effect of the ethanol extract on the preparation of the rat phrenic nerve diaphragm was potentiated. Therefore, the ethanol extract displayed a similarity in the neuromuscular blockade pattern to d-tubocurarine [68].

3.12 Toxic Effect

Abrus precatorius seeds contain the toxic lectins, namely abrin (ABR)A-D and the relatively less toxic agglutinin known as Abrus agglutinin (AGG). Abrin is a 63 kD heterodimeric glycoprotein, but agglutinin is a heterotetrameric glycoprotein having a molecular weight of 134 kD. Both of these lectins belong to the ribosome-inactivating proteins-II (RIP-II) family, and consist of a toxic subunit A chain (molecular weight 30 kD) (Lin EY et al, 2004) a galactose-binding B subunit (molecular weight 31 kD, (Lin EY et al, 2004) connected by a single disulfide bond (Olsnes et al, 1974). Abrins immobile the protein biosynthesis by inhibiting the 60S-ribosomes of animal cells, permanently. The protein synthesis inhibitory concentration for Abrus agglutinin is (IC₅₀=3.5 nM) is weaker than Abrin. Abrin-a, one of four isoabrin from the plant, has the highest inhibitory effect on protein synthesis and consists of an A chain of 250 amino acids and a B chain of 267 amino acids (Tahirov, Lu & Liaw 1994). Decreased toxicity of Abrus agglutinin than abrin is due to the substitution of Asn200 in abrin-A with Pro199 in agglutinin, though the overall protein folding of agglutinin-I is similar to that of abrin. Misra A. et al. 2012, [70,71].

Following the ingestion of well-chewed *Abrus precatorius* seeds, fatal incidents were reported. It can pass through the gastrointestinal tract

Table 3. Summary of biological activity of *Abrus precatorius* Linn.

Plant part	Extract	Activity
Root, seed and leaf	Methanol-petroleum ether	Antibacterial
Seed	Petroleum ether	Anticancer
Seed	Chloroform-methanol extract	Antidiabetic
Seed	Ethanolic-aqueous extract	Antifertility
Leaf	Aqueous extract	Anti-inflammatory
Seed	Hexane, chloroform, methanol and aqueous	Antimicrobial
Seed	Ethanol	Antioxidant
Seed	Aqueous	Nephroprotective
Leaf	Methanol	Bronchodilator
Seed	Ethanol	Antiarthritic
Leaf	Ethyl acetate	Antiserotonergic
Leaf	Chloroform-ethanol	Cytotoxic
Shoot	Methanol	Larvicidal

undigested and remain harmless due to its hard seed coat. The unripe seed has a seed coat that is fragile and easily broken and is therefore more harmful. It has been confirmed that poisoning while stringing the seed has been encountered via a finger prick. After a few hours to several days after ingestion, symptoms can develop. They have serious with marked nausea and vomiting gastroenteritis. Mydriasis, including muscle fatigue, tachycardia, cold sweat, and trembling, can also occur. No physiological antidote is known [66].

4. TRADITIONAL MEDICINAL USES OF *Abrus precatorius* L.

Afghanistan: Dried seeds are taken orally as an aphrodisiac [72]

Brazil: Leaves and stems are said to be toxic when eaten by cattle [73]. Water extract of dried leaves and root is taken orally as a nerve tonic [69]

Cambodia: Hot water extract of seeds is taken orally for malaria [73].

Central Africa: The root is chewed as a snake bite remedy. Seeds are taken orally by several Central African tribes for intestinal worms and as an oral contraceptive. The effect of a single dose (200 mg) is said to be effective for 13 menstrual cycles [74].

East Africa: For gonorrhoea, a decoction of the aerial portions is taken orally. A decoction is taken from the plant plus 3 or 4 seed pods. In order to treat gonorrhoea, bilharziasis, stomach disorders, and as an antiemetic, fresh leaf juice is taken orally. For cuts and swellings, powdered leaves are added. For chest pains, a leaf decoction is taken orally. For inflamed eyes, the steam of boiling leaves is used. For purulent eye infections, dried seed water extract is applied to the eyes; the seeds are macerated in the water [75]. As an aphrodisiac, the new root is chewed as [74,76].

Egypt: Seeds are taken orally with honey as an aphrodisiac [77]. Guam. Seeds are reported to be toxic; half of one seed is reported as lethal. Seed coat must be broken to be toxic. Symptoms include acute gastroenteritis with vomiting, nausea, and diarrhea, followed by dehydration, convulsions, and death [78].

Guinea-Bissau: Leaf pulp is taken orally by men as an aphrodisiac and by women to facilitate childbirth. Seeds taken orally are considered an aphrodisiac and abortive [79].

Haiti: A decoction of leaves is taken orally for coughs and flu [80].

India: Hot water extracts of dried leaves and roots are applied to the eye for eye diseases [81]. Hot water extract of the root is taken orally as an emmenagogue [82]. Root brew is taken orally to produce abortion [83,70]. Hot water extract of seeds is taken orally as an antifertility agent as an abortifacient [84], and to prevent conception [Subba Reddy et al, 1969]. Seeds are used as a poultice in the vagina in Ayurvedic and Unani medicine as an abortifacient.

5. CONCLUSION

Medicinal plants are part and parcel of human society to combat diseases from the dawn of civilization. Nature has been a source of medicinal agents for thousands of years. There is a long history of the use of plants to improve and promote hygiene. Herbal medicine plays a vital role in restoring the health of individuals and communities, but there is a need to develop a quality assurance method for their standardization.

Different biological activities of plant-derived compounds are well documented. Undoubtedly several researchers had given their contributions to finding hidden therapeutic potentials of several Ayurvedic drugs, but several plants like *Abrus precatorius* still need a comprehensive study on them as in Asia it is being used as a substitute to *Glycyrrhiza glabra*. However, more research exploration is required to investigate the potential efficiency and phytochemical properties of the active drug constituent of *Abrus precatorius* extracts and focus on one such very effective and potent medicinal herb- *Abrus precatorius* concerning the above-mentioned scientific trend.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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