REVIEW ARTICLE

ABRUS PRECATORIUS: COSMETICS USES AND PHARMACOLOGICAL ACTIVITIES OVERVIEW

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Abstract:

Abrus precatorius (Gunja), commonly known as the rosary pea or jequirity bean, is a perennial climber from the Fabaceae family, widely distributed across tropical and subtropical regions. While its brightly colored seeds are used in ornaments, they contain abrin, a highly toxic protein, necessitating careful handling. Despite its toxicity, the plant has long-standing applications in traditional medicine and cosmetics. Gunja seed oil and formulations are employed in hair care for dandruff, hair fall, and bald patches, as well as in skin-brightening, anti-aging, and anti-acne preparations. Pharmacological investigations have demonstrated a broad spectrum of bioactivities, including anti-diabetic, antioxidant, neuroprotective, antidepressant, neuromuscular blocking, antiepileptic, nephroprotective, antimicrobial, anti-inflammatory, immunomodulatory, antifertility, antimalarial, and anti-cancer effects. Studies also report wound healing, anti-allergic, anti-arthritic, and gastrointestinal activities. Extract type, plant part, dosage, and model system greatly influence outcomes, with some findings showing variability or contradictory results. While modern research validates several traditional claims, the plant's high toxicity emphasizes the need for cautious application, standardized extraction, and rigorous clinical evaluation. Overall, *Abrus precatorius* represents a promising yet challenging medicinal resource with significant therapeutic and cosmetic potential.

Keyword: *Abrus precatorius*, Gunja, Herbal Cosmetics, Gunja Seed Oil, Pharmacological Activities, Antioxidant.

1. Introduction:

Abrus precatorius, also known as rosary pea and jequirity bean. It's a perennial plant belongs to the family Fabaceae. It is indigenous to tropical and subtropical areas of Asia and Africa, and can

also be found in certain regions of Australia. The plant is best known for its vibrant red seeds with a distinct black spot, often used in ornaments, jewelry, and decorative crafts. While visually appealing, these seeds contain abrin, a highly poisonous protein that can be fatal if consumed. Nevertheless, different parts of the plant—including the roots, leaves, and carefully processed seeds—have been traditionally employed in medicine. In various traditional healing systems, especially in India, *Abrus precatorius* has been used to treat fever, inflammation, digestive disorders, pain, and infections. Modern research has highlighted its antimicrobial, anti-diabetic, antioxidant, and anti-cancer properties, which support some of its traditional uses. However, due to its toxic potential, careful handling and thorough scientific evaluation are essential to safely explore its medicinal value.

2. Cosmetic Uses

i. *Abrus precatorius* (Gunja) Seed Oil

Dandruff, often caused by the fungus Malassezia furfur, leads to itching, dryness, scalp redness, and hair loss. Gunja seed oil has traditionally been used on affected areas of the scalp to help reduce dandruff and prevent hair loss.

Regular use, such as weekly application on the scalp, is also believed to promote healthy hair growth.

Preparation and Application Methods

Gunja Seed Oil

- Grind 1 teaspoon of Gunja seeds
- 1 tablespoon of Bhringraj extract mix and stir thoroughly.
- Add this mixture to 2 tablespoons of sesame oil in a pan.
- *Allow the oil to cool.
- Store in a clean glass bottle.
- Apply a small amount to the scalp, leave overnight, and rinse the next day.

ii. **Gunja Herbal Hair Mask**

- Take ½ teaspoon powdered Gunja seed
- Add 1 teaspoon each of triphala, brahmi, and bhringraj powders.
- Mix with 2 tablespoons of coconut oil to form a paste.
- Apply to the scalp and hair, leave for 30 minutes, and rinse with lukewarm water.
- Use twice in a week for improvements.

iii. Gunja Seed Paste (for Bald Patches)

- To make it a paste consistent mix 1 teaspoon of gunja seed powder with 2 tablespoon water.
- Apply directly to bald spots on the scalp.
- Leave for 30 minutes and wash with plain water.
- This is traditionally believed to support hair regrowth and scalp renewal.

iv. Other Cosmetic Applications

- **Anti-aging creams**: The antioxidant properties of *Abrus precatorius* extracts may help reduce fine lines, wrinkles, and age spots.

- **Skin-brightening products**: Extracts are believed to balance skin tone and reduce hyperpigmentation.
- **Hair growth serums**: Strengthens hair follicles, stimulates growth, and minimizes dandruff.
- **Acne treatments**: Antibacterial and anti-inflammatory properties may reduce acne and prevent
- breakouts.
- **Natural dyes**: The reddish-brown pigments of the seeds can be used as natural hair and skin dyes.
- **Lip balms**: Extracts act as emollients, moisturizing and protecting the lips.
- **Face masks**: Sometimes used in detoxifying formulations to purify and refresh the skin.

v. Pharmacological Activities

1. **Metabolic Disorders**

a) Anti-diabetic activity

The anti-diabetic potential of *Abrus precatorius* seeds was investigated using chloroform–methanol extracts (50 mg/kg) in alloxan-induced diabetic rabbits. A notable reduction in blood glucose levels was observed at different time intervals, suggesting significant hypoglycemic activity. This effect was attributed to the presence of trigonelline, which showed comparable efficacy to chlorpropamide. However, in another study, ethanol/water (1:1) extract of the aerial parts (250 mg/kg) administered to diabetic rats reduced blood glucose by only 30%, indicating variability in activity depending on extract type and plant part used.

b) Antioxidant activity

Ethanolic seed extracts of *Abrus precatorius* were evaluated in vitro for antioxidant properties. The total phenolic content was found to be 95 mg/g (expressed as gallic acid equivalents, $r^2 = 0.9976$), while total flavonoid content was 21 mg/g (expressed as rutin equivalents, $r^2 = 0.9985$). These extracts demonstrated potent antioxidant activity across multiple enzymatic assays, showing comparable effects to the standard antioxidant butylated hydroxytoluene (BHT).

2. Neurological Disorders

a) Neuroprotective effect

Petroleum ether extracts of aerial parts (100–200 mg/kg) were tested in hypoxic neurotoxicity-induced rats. The treated groups exhibited improved spatial behavior and restoration of decreased neurotransmitter levels, including glutamate, dopamine, and acetylcholinesterase, confirming neuroprotective potential upon oral administration.

b) Anticonvulsant activity

Ethanolic (70%) extracts of fresh roots showed significant protection against metrazole-induced seizures in mice, though they were ineffective against strychnine-induced convulsions. Similarly, ethanol/water (1:1) aerial part extracts at 500 mg/kg did not show significant results in electroshock-induced convulsions.

c) Neuromuscular effects

Leaf extracts were evaluated using isolated tissue models such as the rectus abdominis, rat phrenic nerve–diaphragm, and chick muscle preparations. The ethanolic extracts inhibited

acetylcholine-induced contractions in a concentration-dependent and reversible manner. When injected intravenously in young chicks, the extracts caused flaccid paralysis but had no effect on direct electrical stimulation of the diaphragm. Interestingly, the inhibitory activity was potentiated under altered ionic conditions (low calcium, high magnesium, low potassium), showing similarities to d-tubocurarine in neuromuscular blockade.

d) Antidepressant activity

The ethanolic (70%) root extract exhibited antidepressant activity when tested on mice of both sexes at variable dosages.

e) Neuromuscular blocking activity

Ethanolic (95%) extracts of dried leaves, administered at 0.5 µg/ml, demonstrated blocking effects on phrenic nerve–diaphragm preparations, further supporting neuromuscular inhibitory potential.

f) Memory-enhancing activity

Abrus precatorius lectins were studied in Alzheimer's disease models using glycohistochemical techniques. The agglutinin component identified activated microglial cells (MGCs) in cerebral white matter, particularly near oligodendroglial cells, suggesting a role in memory-related neuroprotection and as a marker for microglial activation in Alzheimer's pathology.

g) Antiepileptic activity

In a cross-sectional ethnopharmacological study conducted in Temeke District, Dar es Salaam (Tanzania), decoctions of *Abrus precatorius* leaves (administered orally, three tablespoonfuls twice daily) were traditionally used to manage epilepsy, supporting its folk use as an anti-epileptic remedy.

3. Neuromuscular and Neuroprotective Effects of *Abrus precatorius*

a) Neuromuscular effects

Crude leaf extracts of *Abrus precatorius* were tested on isolated tissues, including the rectus abdominis, rat phrenic nerve–diaphragm muscle, and chick muscle preparations. The ethanol-based extracts showed a reversible, dose-dependent inhibition of contractions induced by acetylcholine in both the rectus abdominis and the rat phrenic nerve–diaphragm muscles.

When administered intravenously to young chicks, the extract caused flaccid paralysis but did not affect direct electrical stimulation of the diaphragm. Furthermore, the inhibitory effects were enhanced under conditions of reduced calcium, elevated magnesium, or lowered potassium ions, resembling the neuromuscular blockade mechanism of d-tubocurarine.

b) Antidepressant activity

Ethanolic (70%) root extracts demonstrated antidepressant effects in mice of both sexes at varying dosage levels.

c) Neuromuscular blocking activity

A 95% ethanolic extract of dried leaves, administered at a concentration of 0.5 µg/ml, exhibited blocking action on phrenic nerve–diaphragm preparations, further supporting neuromuscular inhibitory potential.

d) Memory-enhancing activity

In Alzheimer's disease models, lectins obtained from *Abrus precatorius* were employed in glycohistochemical techniques to detect the activation of microglial cells (MGCs).The agglutinin specifically recognized MGCs in cerebral white matter, Rod-shaped cells were observed in areas adjacent to oligodendroglial cells.This indicates that *Abrus precatorius* lectin may serve as a marker for microglial activation and could play a role in memory enhancement and neuroprotection in Alzheimer's pathology.

e) Antiepileptic activity

An ethnopharmacological study in Temeke District, Dar es Salaam (Tanzania) documented that decoctions of *Abrus precatorius* leaves (prepared by boiling in water and given orally as three tablespoonfuls twice daily) were traditionally used to treat epilepsy, demonstrating its folk medicinal value as an antiepileptic agent.

4. Renal Protective Effects of *Abrus precatorius*

a) Diuretic activity

The diuretic effect of ethanol/water (1:1) extracts from aerial parts (250 mg/kg) was tested in male rats, but the results were found to be non-significant. In another experiment, Sprague Dawley Wistar rats were given alcohol (1.6 g/kg) to induce renal damage. Concurrent administration of crude seed extract (200 mg/kg) with alcohol for six weeks reduced serum levels of potassium, sodium, creatinine, and malondialdehyde, compared to alcohol-only treated rats. Histopathological studies showed that the extract minimized structural alterations in renal tubules, glomerular infiltration, and inflammatory cell infiltration, suggesting a protective role. Overall, the co-administration of *Abrus precatorius* extract with alcohol was found to reduce alcohol-induced kidney damage.

b) Nephroprotective activity

Aqueous extracts of aerial parts were tested for recovery effects against cisplatin and acetaminophen-induced nephrotoxicity in HEK-293 cell models. The results revealed that *Abrus precatorius* provided a strong recovery and protective effect, indicating its potential in the prevention and management of renal disorders.

4) Antimicrobial Activity

The antimicrobial potential of *Abrus precatorius* extracts (leaves, stem, and seed oil) was evaluated against a range of microorganisms including *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 method.

Leaf extract showed the strongest effect, with *Staphylococcus aureus* was found to be the most sensitive organism, with a minimum inhibitory concentration (MIC) of 8 µg/ml. Both the stem extract and seed oil showed activity against certain Gram-positive bacteria and *Candida albicans*. but ineffective against *S. anginosus, E. faecalis*, and several Gram-negative strains.

In another study, methanolic seed extracts exhibited higher antibacterial activity than hexane and chloroform extracts against ten clinical isolates.

Root extracts also showed activity: chloroform fractions contained four bioactive chromatophores, with AP-3 (Rf 0.87) demonstrating the highest inhibition (56%) against *S. aureus*, comparable to ampicillin.

However, ethanol/water (1:1) extracts of aerial parts (25 mg/ml) were inactive against *B. subtilis, E. coli, Salmonella typhosa, S. aureus,* and *Agrobacterium tumefaciens*. In contrast, ether seed extracts were active against *S. aureus*, and ethanol (95%) seed extracts inhibited both *E. coli* and *S. aureus.*

Additional testing against *B. subtilis*, *S. epidermidis*, *Pseudomonas pseudoalcaligenes, Proteus vulgaris*, and *Salmonella typhimurium* revealed that methanol extracts were more effective than aqueous extracts, particularly against Gram-positive species. *B. subtilis* was most sensitive, whereas *P. vulgaris* and *S. typhimurium* were most resistant.

Methanolic extracts of powdered seeds also displayed antibacterial activity against *S. aureus* MTCC-902, E. coli MTCC-405, and *P. aeruginosa* MTCC-1934, with *S. aureus* showing greatest inhibition. The same extracts exhibited antifungal activity by preventing mycotic infection in Jowar seeds, leading to 100% seed germination and reduced fungal contamination compared to controls. The activity was attributed to flavonoids, alkaloids, and saponins present in the extracts.

Conversely, ethanol/water (1:1) extracts of aerial parts (25 µg/ml) showed no activity against *Microsporum canis, Trichophyton mentagrophytes*, or *Aspergillus niger*.

5) Antiviral Activity

Ethanol/water (1:1) extracts from the aerial parts, at a concentration of 50 µg/ml, were tested in cell cultures and showed no activity against Ranikhet and Vaccinia viruses. Similarly, water and methanol seed extracts did not show activity against HTLV-1 virus.

6) Anti-yeast Activity

- Dried seed extracts (1.0% concentration) inhibited the growth of *Cryptococcus neoformans*.
- However, ethanol/water (1:1) extracts of aerial parts (25 µg/ml) were inactive against Candida

7) General Pharmacological Activities

a) Anti-inflammatory activity

Anti-inflammatory effects were tested in croton oil-induced ear inflammation in rats. Co-application of the precatorius extract, when combined with croton oil, led to a significant reduction in the inflammatory response within 6 hours, showing a 2% decrease in inflammation compared to the group treated with croton oil alone. Isolated triterpenoid saponins and their acetate derivatives were also evaluated; acetate derivatives demonstrated greater inhibition, particularly at 600 µg, than their parent compounds.

b) Anti-arthritic and analgesic activity

In croton oil-induced paw inflammation models, aqueous leaf extracts (200 and 400 mg/kg, orally) significantly reduced inflammation, suggesting both anti-arthritic and analgesic properties.

8) Anti-Cancer Activity

a) Antitumor activity

A protein fraction derived from the seeds of *Abrus precatorius* L. demonstrated potent antitumor activity against Yoshida sarcoma (both solid and ascites forms) in rats and fibrosarcoma in mice. The extract exerted direct cytotoxic effects on tumor cells, leading to vacuolation, cytoplasmic disruption, karyolysis, and chromosomal abnormalities.

Another study highlighted the strong antitumor potential of agglutinin protein isolated from the seeds of *Abrus precatorius*. Tumor growth inhibition was found to be about 90%, with abrine A showing greater efficacy than abrin B after administration of 1 ng in mice. Binding inhibition assays with sugars suggested that abrins A and B target different binding sites to suppress sarcoma in mice.

Additionally, Abrus agglutinin (AAG), a heterotetrameric lectin isolated from the seeds, exhibited significant in vitro growth inhibition against Dalton's lymphoma ascites cells (DLAC) at a concentration of 1 µg/ml. At a lower concentration (1 ng/ml), AAG stimulated peritoneal macrophages and spleen-derived NK cells, enhancing their cytotoxic activity against DLAC (56a).

b) Carcinogenic/Anti-carcinogenic activity

P rotective effects of *Abrus precatorius* L. extracts were observed in HepG2 cells and in N – nitrosodiethylamine (NDEA)-induced hepatocellular carcinoma in Swiss albino rats. Aqueous/ethanol (50%) extracts showed strong cytotoxicity on HepG2 cells, with p53 expression significantly elevated and maintained for 6–12 hours at 100 µg/ml. A reduction in mean and relative liver weights was noted in groups treated with the extract at 100 and 200 mg/kg compared to controls.

Similar antitumor effects were reported with intraperitoneal administration of aqueous extract (5 µg/kg) and subcutaneous injection of protein fraction (20 µg/kg) from seed extracts. Conversely, another study using ethanol extract (100 mg/kg) against Sarcoma 180 (ASC) in mice reported varying results. The agglutinin protein fraction consistently demonstrated high antitumor potential.

c) Tumor-inhibiting activity

Contradictory results have also been observed. Fresh seed water extract (2.0 µl/ml) was inactive against mitogenic stimulation of human lymphocytes (60). Similarly, methanol extract (10 mg/ml) showed no activity in Salmonella typhimurium TM677 (61), and ethanol extract of dried stem (95%, 30 µg/ml) was inactive against CA-9KB cells (62). However, water and methanol seed extracts produced promising results against Sarcoma Yoshida ASC (63) and CA-9KB cultures.

Poecilocera picta were too affected by seed water extract. Isolated abrin displayed strong antitumor properties in vitro and in vivo via apoptosis induction. Negative results were reported against avian myeloblastosis virus at IC_{50} >1000 mg/ml.

9) Anti-Fertility Activity

Chloroform/methanol extracts of seeds administered subcutaneously to female rats at a dose of 50 mg demonstrated antifertility effects. Similar outcomes were observed in male rats, where ethanol seed extract administered intragastrically at doses of 100 mg/kg and 250 mg/kg for 60 days prevented pregnancies in 20 females paired with treated males.

Contradictory findings were reported with ethanol (80%) seed extract administered orally and subcutaneously at 1 mg/animal, which did not show antifertility activity. Likewise, ethanol (95%), water, and petroleum ether extracts of seeds tested in mice were largely inactive, although petroleum ether extract exhibited activity. In contrast, leaf extracts (ethanol 95%, water, petroleum ether) administered orally to female mice showed no antifertility effects.

A clinical trial combining hot water extract of dried *Abrus precatorius* with extracts of *Embelia ribes* (fruit), *Piper longum* (fruit), *Ferula assafoetida*, *Piper betle*, and *Polianthes tuberose*, administered orally at 0.28 g/person twice daily for 20 days (from the second day of menstruation), demonstrated antifertility effects in women. This formulation has been patented.

Seed oil also exhibited antifertility effects in female mice (25 mg) and rats (150 mg). Additionally, ethanol seed extract administered intraperitoneally (20–60 mg/kg) significantly reduced sperm production and compromised sperm DNA integrity in adult male BALB/c mice. Normal sperm production resumed 20 days after withdrawal of treatment, suggesting reversible male antifertility activity ($p < 0.001$).

e) Anti-spermatogenic Activity

Ethanol seed extract (100 mg/kg) administered intragastrically to male rats for 60 days produced no significant effect. Conversely, ethanol/water (1:1) extract of dried seeds (250 mg/kg) altered spermatogenesis in rats. Sterol fractions of dried seeds given intramuscularly produced strong anti-spermatogenic effects, including testicular lesions, cessation of spermatogenesis, and reduced seminiferous tubule diameter.

10) Effects on Blood Cells

Both Isoflavoquinones and abruquinones (A, B, D) shows promising aggregation of platelet activity. Water seed extract (2 µl/ml) showed agglutinin activity in human lymphocytes (60) and was active against red blood cells of multiple animals, including buffalo, cat, dog, guinea pig, and ox, but weak against human blood groups (A, B, O) and inactive against goat. Methylene chloride and methanol fractions inhibited thrombin by 53% and 31%, respectively.

11) Cardiovascular Activity

by guinea pig atria negative inotropic activity showed by hot water extract of the whole plant.

12) Anthelmintic Activity

Seed extract (10%) produced weak activity against Musca domestica compared to 0.25% DDT. Acetone extracts of dried roots and stems were inactive against Culex quinquefasciatus. However, extracts showed strong anti-schistosomal activity, being lethal at 0.6 mg/ml against Schistosoma mansoni. abrin ia an imporatant enzyme for this activity. Aqueous extracts of seeds, roots, and stems showed weak activity against Caenorhabditis elegans and Hymenolepis diminuta, while root extract (0.6 mg/ml) and stem extract (1.5 mg/ml) were most effective against schistosomules. The anthelmintic potential is attributed to alkaloids, tannins, steroids, flavonoids, and other secondary metabolites.

13) Insect Sterility Induction

Topical application of 1 µl petroleum ether extract from dried seeds was effective against male *Dysdercus cingulatus*, but showed no activity in females. Saline extract produced weak activity in both sexes.

14) Anti-malarial Activity

Aerial parts of this plant constituents possess anti-malarial effects. Extracts demonstrated antiplasmodial activity with IC_{50} values below 20 µg/ml.

15) Gastrointestinal Activity

a) Smooth Muscle Stimulation

Methanol/water (1:1) seed extract fractions at a concentration of 0.2 mg/ml stimulated the guinea pig ileum, while a concentration of 0.5 mg/ml activated the rat stomach. The same extract also exhibited Evaluation of antispasmodic activity through the suppression of uterine contractions in rats induced by prostaglandin E (PGE), acetylcholine (ACh), oxytocin, and epinephrine. Ethanol (95%) leaf extract relaxed rat diaphragm muscle, potentiated by d-tubocurarine but reversed by physostigmine. Seed extract (4.0 mg/ml) stimulated skeletal muscle, while lower concentrations (1.0 mg/ml) activated toad rectus abdominis induced by ACh. Hot water and water extracts of leaves were inactive on rat phrenic nerve-diaphragm (6.72 mg/ml). Petroleum ether extract (19.2–48 mg/ml) was inactive on both rat diaphragm and toad muscle. Ethanol/water (1:1) aerial extract was inactive on guinea pig ileum. Dried seed fractions (10 mg/kg) reduced intestinal motility and fluid retention, showing anti-diarrheal potential.

16) Skin Activity

a) Anti-allergic Effects

Abruquinones A, B, D, and F demonstrated strong anti-allergic activity, suppressing superoxide generation (<0.3 µg/ml) and histamine release (<1 µg/ml). Abruquinone A inhibited edema induced by polymyxin B, histamine, serotonin, bradykinin, and substance P, with effects greater than diphenhydramine and methysergide.

b) Wound Healing

Methanol-insoluble fractions of white seeds and extracts of red/black seeds accelerated wound healing, possibly due to tannins, phenols, gums, and mucilage.

c) Anti-serotonergic Activity

Petroleum ether extracts caused smooth muscle contractions in a dose-dependent manner, while ethyl acetate extracts produced only baseline elevation. Effects were compared with sumatriptan **d) Thermoregulation**

Ethanol/water aerial extract (500 mg/kg) had no significant impact on body temperature.

Conclusion:

Abrus precatorius (Gunja) is a powerful medicinal plant known for its dual nature—high toxicity due to abrin and broad therapeutic potential. Traditionally used in Ayurveda and folk medicine, it treats ailments ranging from inflammation and infections to infertility and neurological issues. Modern studies confirm its diverse pharmacological properties, including antioxidant, antimicrobial,

anticancer, and cosmetic benefits. However, its toxicity poses serious risks, requiring detoxification and strict dosage control. Future research should focus on isolating safe bioactive compounds, standardizing extracts, and ensuring clinical safety. With careful scientific validation, *Abrus precatorius* holds great promise in medicine and wellness.

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Declaration of Competing Interest:

The authors declare that they have no competing interests.

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