wjpmr, 2023, 9(11), 245-250

SJIF Impact Factor: 5.922

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Review Article

ISSN 2455-3301

WJPMR

IMPORTANT APPLICATIONS OF ARKA (CALOTROPIS GIGANTEA LINN) IN INDIAN MEDICINE SUPPORTED BY PHARMACOLOGICAL DATA

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Article Received on 20/09/2023 **Article Revised on 10/10/2023** **Article Accepted on 30/10/2023**

ABSTRACT

Calotropis gigantea Linn. is a medicinal plant that belongs to the family Apocynaceae. It is commonly known as giant milkweed, madar, or arka in different languages. It is widely distributed in tropical and subtropical regions of Asia and Africa. It has been used in various traditional systems of medicine, such as Ayurveda, Unani, Siddha, and Chinese medicine, for the treatment of various diseases and disorders. The plant contains various bioactive compounds, such as cardiac glycosides, flavonoids, terpenoids, alkaloids, and latex, that exhibit a range of pharmacological activities, such as analgesic, anti-inflammatory, antimicrobial, antioxidant, antidiabetic, anticancer, antifertility, hepatoprotective, and wound healing. The plant also has some toxic effects and adverse reactions, such as skin irritation, eye damage, and abortion. Therefore, it should be used with caution and under the guidance of a qualified practitioner. This reviews presents pharmacognostical, pharmacological and uses of *Calotropis Gigentia* Linn. in Ayurveda.

KEYWORDS: *Calotropis Gigentia*, pharmacological uses, Ethnopharmacological properties, ayurvedic uses.

INTRODUCTION

In the developing world, herbal medicines are presently in high demand for primary healthcare not only due to their low cost but also due to their higher cultural acceptance and better compatibility with the human body. In this country, arka (*Calotropis gigantea*), a significant Ayurvedic medication, has been used for centuries. The oldest Hindu writers made reference to it, and the Vedic literature uses the ancient name of the plant, Arka, which alludes to the shape of the leaves employed in sacrifical rituals. The Sanskrit writers identified two common species of Calotropis: *Calotropis gigantea* (Linn.) R.Br. and *Calotropis procera* (Ait.) R.Br.[1] Common wasteland weed C. gigantea is also referred to as giant milkweed. Bangladesh, Burma, China, India, Indonesia, Malaysia, Pakistan, Philippines, Thailand, and Sri Lanka are all natural home countries for this plant. The traditional Indian medical system makes use of C. gigantea for a number of different medical conditions.[2] Most recently C. gigantea is scientifically reported for several medicinal properties Leaves and areal parts of the plant are reported for anti-diarrhoeal activity[3] antioxidant activity,[4] anti-Candida activity,[5] antibacterial activity,[6] Roots are reported to contain cytotoxic activity,[7] anti-pyretic activity.[8] flowers are reported to possess analgesic activity, antimicrobial and cytotoxic activity.[9]

Plant Name in Different Language[10]

Common names: Giant Milkweed, Crown Flower, Swallow Wort.
Hindi: Safed aak, Aak, Alarkh, Madar, Sveta Arka, Akanda, Bara Akand.
Gujarati: Aakando
English: Crown flower, giant Indian milkweed. Bowstring hemp, crownplant, madar

Botanical Analysis

Calotropis gigantea leaf twig morphology with subsessile leaves placed in opposition; elliptical to broadly ovate, cottony, hairy when young, and glabrous when mature; Part of the lamina displaying the venation pattern]*Calotropis gigantea* often grows as a single or several soft-wooded shrub, and sporadically as a tree growing to a height of 6 meters. When the plant is cut, all sections emit a white, milky latex.Calotropis's botanical description includes the following elements.

Branch & Bark-The bark is thick, corky, and yellow-brown in color; the twigs are green and meaty, and they

may be covered with tomentum (white hairs that resemble fur).

Leaves-Leaves are opposite-decussate, simple, ovate to obovate, with a sharp apex, sessile (nearly decurrent) base, and 4-6 pairs of subopposite nerves evident on the abaxial surface. They are also rather large, measuring around 30x25cm.

Inflorescences-At the base of the leaves, pedunculate (c. 7 cm) cymes of 3–20 inflorescences appear.

Flowers-Flowering plants have five tiny, dirty-white triangular sepals, five thick, ovate petals that are white at the base and purple at the ends, and five purple-tipped stamens that surround a five-lobed, white stigma.

Fruits-Fruits are green, spongy, ovoid fruits (follicles) that can measure up to 15 cm long and 10 cm wide. They split apart to reveal plumed, papery, light brown seeds that have a pappus of up to six-centimeter-long white filaments on one side. From March to October would be the primary blossoming time.[11]

Chemical Composition[12]

The root bark contains amyrin, amyrin, wax, gigantin, giganteol, isogiganteol, taraxasterol and its isomers taraxasteryl isovalerate, and taraxasteryl acetate.Additionally, root sections include calotroposides A–G, seven oxypregnane-oligoglycosides, and cardiac glycosides. Calotropeol and amyrin are also present in latex, along with akundarin, 0.45% uscharin, 0.15% calactin, and 0.15 percent calotoxin. Glutathione is also present in latex.

Consequences of C. Gigantean

The medication induces nausea, vomiting, and diarrhea in high dosages. Long-term higher doses result in leucorrhoea, burning in the mouth, and headaches.

Various uses of *Calotropis giggntea* in Ayurvedic medicine practice[13,14]

Use of flowers in cough and asthma-Inhalation therapy involves the use of bark-derived smoke. Flowers are gathered, dried in the shade, then powdered.For chewing, combine 1-2 pinches of this with a little amount of rock salt powder; alternatively, combine this mixture with warm water.

Use of leves in swelling-The ventral side (fine area) of three to four adult arka leaves are heated. It is covered with a small amount of sesame oil and placed over the swollen or inflammatory area. Regular fomentation for five to six days effectively reduces the edema.

Use of leaves in joint pain-Without using any water, mature leaves are ground into a fine paste. Salt may be added if necessary. Joints that are inflamed are covered with this paste. Medication works really well to lessen the pain and swelling over the course of 2-3 days.

Use of leaves in muscular pain and ezema-Sesame oil (200ml), water (200ml), and 50g of leaves are combined to form a paste, which is then boiled until all of the water has evaporated. It is screened and kept. Both muscular problems and painful joints can be treated with this.

Ethnopharmacological properties of Calotropis gigantean[15,16,17]

Leaf -Skin ulcers, Leprosy, eye problems
Flower-Bile suppression, elimination of intestinal worms, coughs, colds and asthma
Bark-Analgesic, curative of fever, neurodermatitis, syphilis, (powdered bark) diarrhoea, dysentery, elephantiasis, leprosy,(stem bark) expectorant, and is used for dysentery, spleen complaints, convulsions, lumbago, scabies, ringworm, pneumonia.
Fruit-Piles, intestinal worms, eye problems, diabetes, abortive (fruit pulp).
Latex-Dysentery, leprosy, elephantiasis, epilepsy, asthma
Bud-Earache (Juice of young buds).
Seed-Leprosy and intestinal worms.

Ayurvedic Significance[18,19]

Classifidied in followings varg
Charak: Bedaniya, Svedopaga, Vamonopaga
Susruta: Arkadi, Adhobahagahara,
Vagbhata: Arkadi

In Ayurvedic System of Medicine, the properties of this plant describe as *Guna* (Quality), *Laghu* (lightness), *Ruksha* (dryness), *Tikshan, Rasa* (Taste), *Katu* (pungent), *Tikta* (bitter), *Vipak* (Metabolism), *Katu Virya* (Potency), *Ushan* (Hot potency): Effect on *Tridosha.*

Pharmacological Activity

Anti-microbiological action-The leaves of C. gigantea were reported to have anti-Candida action against clinical isolates of Candida albicans, C. parapsilosis, C. tropicalalis, and C. krusei in aqueous, methanol, ethanol, and petroleumether.[20] According to reports, the aqueous extract of C. gigantea leaves has antibacterial action against Klebsella pneumonia, Escherichia coli, Bacillus cereus, Pseudomonas aeruginosa, and Staphylococcus aureus.[21] S. aureus, B. cereus, E. coli, and C. krusei have all been shown to be strongly inhibited by the aqueous extract of C. gigantean latex.[22] C. gigantea was discovered to have antifungal action against plant pathogenic fungi like Fusarium mangiferae, which poses a severe threat to the cultivation of mangos.[23]

Cytotoxic activity- Cardenolide glycosides extracted from the roots of C. gigantea were found to have cytotoxic effects on a number of human and mouse cell lines. The active ingredients were discovered to be calotropin, frugoside, and 4'-O-Dglucopyransy lfrugoside.[24] Two substances (compounds 1 and 2) extracted from ethanol extract of C. gigantea roots were shown to have inhibitory effects on human gastric cancer SGC-7901 and chronic myelogenous leukemia K562 cell lines.[25] C. gigantea flower crude ethyl acetate extract

has been shown to prevent the Ehrlich's ascites cancer in mice. A 50, 100, or 200 mg/kg intraperitoneal injection of the extract considerably reduces the viable tumor cells and body weight growth brought on by the tumor burden and extended survival duration. At a dose of 200 mg/kg bodyweight, the extract showed the highest activity in restoring the haematological and biochemical parameters (glucose, cholesterol, triglyceride, blood urea, ALP, SGPT, and SGOT) that were altered during tumor progression.[26]

Anti-diarrhoeal activity-Rats were given a castor oil-induced diarrhea model to test the hydroalcoholic (50:50) extract of the aerial portion of C. gigantea for anti-diarrheal activity. At intraperitoneal doses of 200 and 400 mg/kg body weight, the extract significantly reduced fecal output and the frequency of bowel movements. Additionally, the extract significantly reduced the volume and weight of intestinal material.[27]

Analgesic activity-The C. gigantea flower's alcohol extract was found to have analgesic effects on mice using thermal and chemical models. A hot plate method and an acetic acid-induced writhing test were used to determine the analgesicactivity. The amount of writhings and the amount of time it took for paws to lick after receiving an oral dose of C. gigantea flower ethanolic extract were both significantly reduced.[28] On albino rats, the alcohol extract of the peeled roots of C. gigantea was tested for its CNS activity (analgesic activity). Eddy's hot plate method and acetic acid-induced writhings both showed analgesic efficacy. The amount of time the paws licked their paws and the number of writhings were dramatically reduced when the extract was administered orally at doses of 250 and 500 mg/kg body weight.[29]

Wound healing activity-In Wistaralbino rats, the ability of a root bark extract from C. gigantea to promote wound healing was examined. For excision wound healing models, extract was applied topically to the rats; for incision wound healing models, extract was administered orally in doses of 100, 200, and 400 mg/kg. The findings show that extract administration sped up rat wound healing.[30] Using excision and incision wound models, the crude latex of C. gigantea was tested for its capacity to speed up the healing of wounds in albino rats. C. gigantea latex shown considerable wound healing activity at a dose of 200 mg/kg/day, as treated rats showed an 83.42 percent reduction in wound area compared to controls (76.22%). Wounds treated with extract are shown to epithelize more quickly than controls.[31]

Anti-pyretic activity-The water: ethanol (50:50) extract of C. gigantea roots' anti-pyreticactivity was reported by Chitme et al. in 2005. Yeast and Typhoid vaccine-induced hypothermia were used to study anti-pyretic efficacy in Albino Swiss rats and rabbits. The extract considerably lowered fever at doses of 200 and 400 mg/kg body weight (intraperitoneal injection), and body temperature returned to normal.[32]

Insecticidal activity-Tribolium castaneum larvae and adults were tested for residual film toxicity, fumigant toxicity, and repellent effects using methanol extract of C. gigantea root bark and its chloroform and petroleum ether fractions. Following the petroleum ether fraction and chloroform fraction in terms of insecticidal activity against T. castaneum was the methanol extract. No sample displayed fumigant toxicity.[33]

Anti-inflammatory activity-C. gigantea ethanol extract was found to have anti-inflammatory properties against carrageenan-induced paw edema in Wistar albino rats. Significant anti-inflammatory action was reported following oral administration of 400mg/kg of C. gigantea; the activity was greater than that of 100mg/kg of ibuprofen.[34]

Antioxidant activity-According to reports, the leaves of C. gigantea possess antioxidant properties. The hydroalcohlic extract of C. gigantea leaves was tested for DPPH radical scavenging, reducing power activity, and nitric oxide scavenging activity. At a concentration of 400 g/ml, the extract displayed the highest DPPH radical-scavenging activity (85.17%). The extract displayed 54.55% nitric oxide scavenging activity at a concentration of 100 g/ml. It was discovered that the extract's reducing power increased as extract concentration did.[35]

Anticoagulant Activity- behaviorAccording to reports, C. gigantea's latex has procoagulant properties. Human fibrinogen, casein, and crude fibrin hydrolyzed by the latex extract clot dose-dependently. The fibrinogen subunits are hydrolyzed by the extract, starting with subunit Aa and progressing to subunits Bb and g. Similar to trypsin and papain, the crude extracthydrolysis crude fibrin clot aggressively. Strongly proteolytic proteins found in C. gigantea's latex are what cause the plant's procoagulant action.[36]

Pregnancy-interrupting properties-Different organic C. gigantearoot solvents have been found to have action that can prevent conception in rats. At a dose of 100 mg/kg, the extract displayed 100% pregnancy-interceptive efficacy.When given in the Days 1-5 and 1-7 postcoitum regimens, the extract likewise demonstrated 100% effectiveness at a dose of 12.5 mg/kg.[37]

Effects on liver protection-In male Wistar rats, an ethanol extract of C. gigantea stems was found to have liver-protective properties against carbon tetrachloride-induced liver damage. The extract showed efficient liver protection by drastically lowering AST, ALT, and lipid peroxide levels. Additionally, the extract shields the rats from oxidative damage.[38]

Vasodilation Effect-Effect of Calotropis gigantea latex on the green frog's vasodilation The cardiac output of R hexadactyla increased significantly. Evidence points to alterations in cation (Ca, Na) permeability as the primary mechanism by which latex affects the cardiovascular system, activating Ca channels in the heart muscle and increasing coronary flow. Therefore, the latex's dilatation feature is probably to blame for its pharmacologic effects.[39]

Anti-asthmatic Activity: The smooth muscle of the tracheobronchioles is overly sensitive in those with bronchial asthma. It is a chronic inflammatory disease that results in broncho-constriction, airway inflammation, and obstruction as a result of various noxious stimuli. Various cells are important in this disease because they release chemical mediators that cause broncho-constriction, such as mast cells, eosinophils, and T lymphocytes. In the initial stage of an asthmatic episode, histamine is the main inflammatory mediator that causes airway hypersensitivity and bronchial constriction. Eosinophils, neutrophils, and lymphocytes may be inhibited by Calotropis gigantea in bronchoalveolar lavage fluid (p 0.05). The herb Calotropis gigantea has broncho-relaxing properties. There is evidence that the roots of the calotropis gigantea have anti-lipoxygenase activity.[40]

Antidiabetic activity-*Calotropis gigantea* exhibits antidiabetic action by lowering increased blood sugar levels that have been documented in several investigations. *Calotropis gigantea* plant extracts have hypoglycemic effects. When diabetes is present, Calotropis gigantea prevents weight loss. The pancreatic islet's cellular population (granulated cells and regular beta cells) is increased by *Calotropis gigantea*. According to reports, the plant's extract is particularly successful at lowering experimental animals' raised serum glucose levels.[41]

CNS Activity- *Calotropis gigantea* extract stimulated early neuronal growth. Collateral branching, as well as axonal and dendritic lengths, numbers, and branching orders, all improve in *Calotropis gigantea*. Due to the presence of the flavonoids chrysin and apigenin, *Calotropis gigantea* exhibits neuropharmacological activities such as antidepressant, sedative and hypnotic, antianxiety, anticonvulsant, analgesic, and neurogenesis.[42]

Anticancer Activity-*Calotropis gigantea* has been described as an anticancer shrub. The plant has cardiac glycosides with cytotoxic properties. By disrupting the DNA of leukemia cells in breast cancer, cardiac glycosides (calactin) typically cause growth suppression in neoplastic cells.Cardinolides and calotroposides A exhibit anticancer properties. Anhydrosophoradiol-3-acetate, one of the active components isolated from *Calotropis gigantea* flowers, has been shown to reduce cancer-related problems in vivo.[43]

CONCLUSION

Calotropis gigantea, also known as Madar in Hindi, is a perennial herb with a long history of usage in traditional medicines. It is widely dispersed throughout India.According to estimates from the World Health Organization, more than 80% of the population in developing nations relies mostly on herbal medicines to meet their essential medical needs. Traditional and ethnobotanical uses of natural substances, particularly those with plant origins, have drawn a lot of attention in recent years due to their well-known efficacy and largely accepted safety for use by humans. In order to find new compounds that can treat a variety of ailments, it is best to follow the conventional method. *Calotropis procera* Linn. is a highly-liked remedy among many ethnic groups, as well as Ayurvedic and traditional practitioners, for the treatment of a number of illnesses, according to a thorough study of the published literature on the plant. In order to turn the property into a useful drug product that is used to treat many infections and diseases affecting people in the modern world, scientists would benefit from having a compilation of research studies on the pharmacology of the plant.

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