

CALOTROPIS GIGANTEA: A BRIEF STUDY ON PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE

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ABSTRACT

Medicinal plants have been a major source of medications since antiquity. The important thing to remember is that there are numerous life-saving drugs available, either directly as extracts or in modified synthetic form. *Calotropis gigantea* is a massive shrub with several branches that is gregarious. Its younger branches produce milky latex and cottony, white hairs. Often called "milkweed," this plant is found almost everywhere in the world and is native to China, Malaysia, and India. The Siddha, Ayurvedic, and Unani medical systems have long used it. This medicinal plant has a broad variety of isolated compounds, including alkaloids, tannins, resins, flavonoids, terpenoids, cardiac glycosides, and certain chemical compounds including giganteol, α and β calotropeol, β -amyrin, giganteol, and isogiganteol. In addition to these chemical compounds, *C. gigantea* has some pharmacological action, including anti-asthmatic, antioxidant, antibacterial, antiviral, wound healing, anti-inflammatory, anti-diarrheal, hepatoprotective, and hypoglycemic properties.

KEYWORDS: *Calotropis gigantea*, cardiac glycosides, α and β calotropeol, antioxidant, anti-inflammatory.

INTRODUCTION

Natural gifts include a number of plants with enigmatic dragging qualities that are widely utilized to heal a variety of ailments. First aid with medicinal plants and herbs is a common practice. For their fundamental medical requirements, up to 80% of people worldwide today rely solely on traditional medicine. Ayurveda is an important medical system that originated thousands of years ago in India. Herbal blends or formulations, which combine the advantages of multiple

plants, usually have a positive effect while lessening the possible negative effects of a single plant. The antiviral, anti-cancer, and immunoregulating properties of herbs provide unique advantages that are severely restricted in conventional therapy. Herbs have antibacterial, antifungal, and antiviral qualities that make them excellent alternatives to antibiotics when treating a range of infectious diseases. Many herbal remedies are employed as cleansing, antioxidant, and anti-cancer therapies. The current effort aims to investigate native botanicals that are used in our country as a prophylactic measure against cognitive impairment.^[1] Here, we discussed the possibility of cognitive impairment caused by the herb *Calotropis gigantea*.^[2] *Calotropis gigantea* comes in a variety of forms, and its biological properties include antidiarrheal.^[11], anti-inflammatory.^[12,14] anti-bacterial.^[15] analgesic.^[16] CNS action.^[17,18] and anti-malarial.^[21]

Plant Profile

Biological Source

Throughout the country, *Calotropis* grows wild up to 900 meters (msl) and can withstand dry and salt to a moderate degree. It prefers sandy, disturbed soils with 300–400 mm of mean annual rainfall.^[9] Because its seeds are dispersed by wind and animals, it quickly becomes a weed along abandoned roads, lagoon shores, and in native grasslands that have been overgrazed. It usually predominates in areas with disturbed sandy soils and low rainfall, and it loves abandoned agricultural sites. It is thought to indicate overcultivation.^[3]

Synonyms:- Giant milkweed, safed aak, crown flower, bara akand.^[24]

Images^[22]

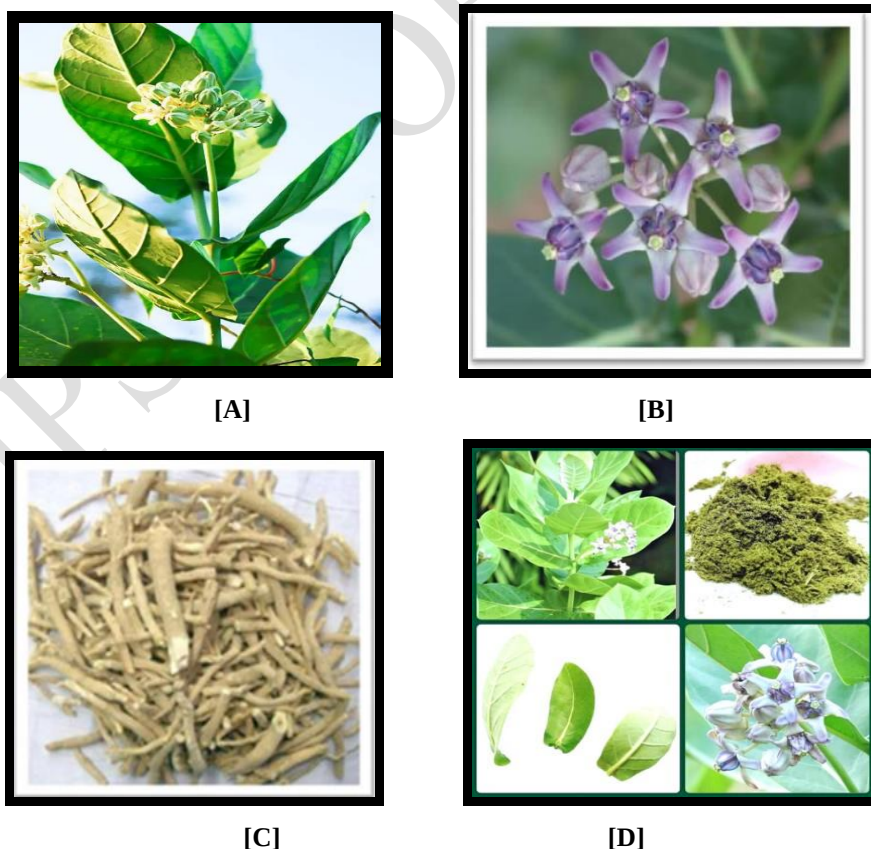


Fig. no. 1: A. Plant B. Flower C. Bark D. Leaves powder.

❖ **Morphology**

Simple, branched, woody at the base, and covered in a fissured bark, the root bears thick, white tomentose branches that are mildly tasty and early glabrescent. Every part of the plant releases white latex when it is cut or broken. The leaves are 5-30X 2.5-15.5 cm, oblong-obovate to completely obovate, with a base that is cordate, an apex that is abruptly and rapidly acuminate to apiculate, and edges that are whole, delicious, and white tomentose when young, but subsequently lustrous and glaucous. Fruit: A simple, plump, expanded, laterally ovoid to subglobose follicle with a minimum diameter of 10 cm. Many small, rectangular, flat, 6 × 5 mm seeds that are at least 3 cm long and filled with smooth white pappus. Pentamerous, hypogynous, actionmorphic, bracteate, complete, sexually neutral, pedicellate, with a pedicel that is 1-3 cm long.^[7]

❖ **Taxonomical Classification**^[6]

Kingdom	<i>Plantae</i>
Order	<i>Gentianales</i>
Family	<i>Apocynaceae</i>
Subfamily	<i>Asclepiadaceae</i>
Genus	<i>Calotropis</i>
Species	<i>C. gigantea</i>

❖ **Botanical and Geographical Distribution**

Calotropis gigantea is a massive shrub that can grow up to 4 meters (13 feet) in height. It is adorned with clusters of waxy flowers that are either lavender or white in hue. The stamens are held in place by the small, elegant crown that arises from the middle of the blooms' five pointed petals. Because plants have valvate aestivation, the sepals or petals of a whorl do not overlap; instead, they just touch at the perimeter. The plant features spherical, light-green leaves and a milky stalk. *Calotropis gigantea* latex contains different concentrations of cardiac glycosides, fatty acids, and calcium oxalate.^[8] The Andaman Islands are home to the complete plant *Calotropis gigantea*, which may reach elevations of up to 900 meters. It is well-liked all over India. It can also be found in dry waste regions, which are referred to as *mudar* in English. It can be found throughout India, from West Bengal and Assam in the east to Punjab and Rajasthan in the north and Kanniya Kumari in the south.^[4] One common weed in wasteland is *Calotropis gigantea*. It's commonly known as massive milkweed. This plant was native to Bangladesh, Burma, China, India, Indonesia, Malaysia, Pakistan, the Philippines, Thailand, and Sri Lanka. This plant is usually available in India. All traditional medical systems have used it for a number of medicinal purposes since ancient times.^[9]

❖ **Phytochemical Evaluation**^[23]

Table no. 1: Phytochemical screening of *Calotropis Gigantea*.

Phytoconstituents	Test performed	Result
Alkaloidal tests	Ferrous sulphate test	(+)
	Hagers test	(+)
	Wagners test	(-)
	Murexide test	(+)
Fluorescence test	Sulphuric acid	(+)
	Nitric acid	(+)
Terpenoids test	Salkowskis test	(+)
Steroids test	Acetic anhydride	(-)
Flavonoid test	Lead acetate test	(+)
	Zinc hydrochloride test	(-)
Tannin test	Ferric chloride test	(+)

	Gelatin test	(+)
Saponin test	Frothing test	(+)

❖ Chemical Constituents

Numerous substances, including cardenolide, triterpinoids, alkaloids, resins, anthocyanins, and proteolytic enzymes, have been found in the latex by studies on the phytochemistry of *Calotropis*. Cyclisadol, multiflorenol, and terpenes are found in flowers.^[4]

❖ Therapeutic Uses^[5]

1. The root bark of *Calotropis gigantea* works similarly to ipecac and can be substituted.
2. In trace concentrations, the root bark contains diaphoretic and expectorant qualities. It can act as a mild stimulant when combined with carminatives for dyspepsia.
3. It also relieves leprosy and eczema.
4. Dysentery and diarrhea were treated with root bark powder.
5. It is also used to treat cough, asthma, and fever.
6. The homeopathic medical system claims that it can alleviate severe elephantiasis, arthritis, and chronic inflammation.

❖ Advantages

1. *Calotropis gigantea* relieves respiratory, neurological, and digestive issues.
2. The herb's milky latex, which is used to prevent cancer.
3. An efficient remedy for snake bites is *Calotropis gigantea*.
4. It helps thin mucus and facilitates coughing.

❖ Review of Literature

1. Antidiarrheal activity

In a rat model of castor oil-induced diarrhea, the anti-diarrheal qualities of *Calotropis gigantea* aerial component hydroalcoholic (50:50) extract were assessed. By dividing the percentage of the charcoal's greatest travel distance by the entire length of the small intestine, the gastrointestinal transit rate was calculated. The enteropooling method was used to measure the weight and volume of intestinal content generated by castor oil.^[10] At intraperitoneal doses of 200 and 400 mg/kg body weight, the extract dramatically decreased fecal production and dropping frequency. The weight and volume of intestinal material were also significantly reduced by the extract. Alkaloids, tannins, flavonoids, saponins, and glycosides are among the chemical components of *Calotropis gigantea* that are responsible for this activity.^[11]

2. Anti-inflammatory activity

The anti-inflammatory qualities of *Calotropis gigantea* were evaluated in a number of experimental animal models. The anti-inflammatory qualities of leaf extracts in ethanol, distilled water, chloroform, and n-butanol were examined. This activity was compared to that of the common drug paracetamol using the carrageenan-induced rat paw oedema method.^[12] Conversely, a model of cotton-pellet granuloma, adjuvant-induced arthritis, and carrageenin-induced kaolin-induced rat paw oedema are used to assess the anti-inflammatory efficacy for acute and chronic inflammation, respectively.^[13] The albumin denaturation method has also been used to test the anti-inflammatory qualities. The

chemical components of *Calotropis gigantea*, such as flavonoids, alkaloids, cardenolides, and triterpenoids, are responsible for this activity. A range of dosages, from 100 mg/kg to 500 mg/kg of body weight, were administered.^[14]

3. Antibacterial Activity

Numerous medicinal applications have been discovered for the widespread wasteland weed *Calotropis gigantea*. The purpose of the current study was to examine the antibacterial activity of *Calotropis gigantea* leaves in addition to clinical bacterial isolates. The effectiveness of the aqueous extract against *S. aureus*, *E. coli*, *P. aeruginosa*, *B. cereus*, *M. luteus*, and *K. pneumoniae* was examined and applied. The in vitro antibacterial action was tested using the well diffusion method. The extract had a major effect on the organisms under study. The extract showed the highest zone of inhibition in addition to *E. coli* bacteria. Numerous chemical components, such as cardiac glycosides, fatty acids, calotropone, quinones, steroids, and phthalates, are responsible for the activity of *Calotropis gigantea*.^[15]

4. Analgesic activity

In several preclinical studies, an alcoholic extract from *Calotropis gigantea* flowers has demonstrated modest analgesic effects. Alcoholic extract taken orally dramatically lowers the frequency of writhing reflexes and paw licking time. The activity is studied using the acid writhing model and the acetic hot plate method. The chemical components of *Calotropis gigantea*, such as flavonoids, alkaloids, triterpenoids, and glycosides, are responsible for this activity. Rats and mice are used to test the analgesic properties of *Calotropis gigantea*. 250 mg/kg and 500 mg/kg of body weight are the most popular dosage amounts.^[16]

5. CNS activity

Because it includes the flavonoids chrysin and apigenin, *Calotropis gigantea* extract demonstrates a range of neuropharmacological activities, such as sedative and hypnotic, antidepressant, antianxiety, analgesic, and more. Even in this type of activity, the *C. gigantea* extract increases collateral branching, axonal and dendritic length, quantity, and branching orders. In experimental animal models (rats and mice), CNS activity of *Calotropis gigantea* usually uses two or three distinct doses, with the most popular doses being 250 and 500 mg/kg of body weight.^[17,18]

6. Wound healing activity

Animal models are used in several studies on the activities of wound healing. Using an excision and incision wound procedure, albino rats are initially treated with *Calotropis gigantea* latex. In comparison to the control, which had a wound area of 76.22%, the latex-treated animal had an 83.42% reduction using framycetin sulphate cream (1%) as a reference.^[19] In the second, rats with diabetes caused by streptozocin (50 mg/kg) were anesthetized and given a 2 cm excision wound. The treatment then included a 14-day course of *Calotropis gigantea* latex extract ointment (2%). The healing duration was significantly ($p < 0.05$) shortened and the rate of wound contraction increased in the test drug-treated animals. Furthermore, the numerical density of fibroblasts, the volume density of collagen fibers, and the length density of arteries all showed a substantial ($p < 0.05$) increase. According to the aforementioned study, *Calotropis gigantea* promotes diabetic wound healing by stimulating collagen synthesis and improving histological factors that are necessary for normal wound healing. These activities of *Calotropis gigantea* are attributed to chemical constituents such as flavonoids, tannins, alkaloids, saponins, triterpenoids, and glycosides.^[20]

7. Anti-Malarial Activity

The mosquito-repelling properties of *Calotropis gigantea* flower extract. In the investigation, the female grown mosquito that had been blood-starved for several days was defeated by the special plant extract. The alcoholic extract showed greater mosquito repellency against female *Culex quinquefasciatus* mosquitoes when compared to petroleum ether and chloroform extract. The extract was found to have insect-repelling qualities that were dose-dependent. The chemical components of *Calotropis gigantea*, such as flavonoids, alkaloids, triterpenoids, tannins, saponins, and cardiac glycosides, are responsible for this activity. A range of dosages, including 200, 400, 600, 800, and 1000 mg/kg body weight/day, were used in preclinical research on mice to assess the antimalarial efficacy of the methanolic leaf extract of *Calotropis gigantea*.^[21]

CONCLUSION

Calotropis gigantea, also known as Madar in Hindi, is a member of the Asclepiadaceae family and is widely distributed throughout our nation. This perennial herb has been used in traditional medicine for a very long time. The pharmacological activity and phytochemical analysis of this plant have been closely examined in this review. Neuropharmacological and antibacterial properties are examples of pharmacological activity. They have antidiarrheal, cytotoxic, and antitumor properties, among others. With larger antibacterial properties as well as a variety of antifungal and antiviral activities, herbs become a great substitute for antibiotics in the treatment of infectious disorders.

Future scope:-The future scope of *calotropis gigantea* lies in the development and commercialization of its diverse applications in medicine.

The future scope of *Calotropis gigantea* in medication formulation is promising due to its diverse range of pharmacological activities. Here are some potential areas for future research and development.

Cardioprotection: The plant's potential cardioprotective properties, particularly against ischemia and oxidative stress, could lead to new therapeutic agents for cardiovascular diseases.

Antimicrobial and Anticancer Agents: The plant's antimicrobial and anticancer activities could be explored for their potential in treating infections and cancers.

Wound Healing: The plant's wound-healing properties could be harnessed for developing wound dressings and other topical treatments.

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