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REVIEW ON CALOTROPIS GINGETIA

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ABSTRACT:
Calotropis gigantea, known locally as Aak or Madar in Hindi, is recognized as milkweeds due to their latex production. These Calotropis species are acknowledged as common weeds in specific regions and have been integral to traditional Indian medicinal practices. This review delves into the systematic position, plant introduction, morphological examination, phytochemistry, and economic significance of Calotropis gigantea within the Apocynaceae family and Asclepiadoideae subfamily. Flourishing in diverse soils and natural environments, this plant necessitates no cultivation practices. The review explores various pharmacological activities, including antioxidant, anti-malarial, antimicrobial, cytotoxic, and antipyretic effects.

Keywords: Calotropis gigantea Linn, pharmacological investigations.

INTRODUCTION:

Throughout various regions worldwide, spanning ancient times to the present era, the influence of plants, animals, and natural elements on human culture and civilization has been profound. Since the inception of civilization, humans have held plants in high regard, recognizing them as invaluable genetic resources utilized for diverse purposes such as food, fiber, fuel, fertilizers, and medicinal applications (1).

Within traditional Ayurvedic medicine, Calotropis gigantea and Calotropis procera are known as "Sweta Arka" and "Raktha Arka," respectively. These plants share botanical characteristics and pharmacological effects (2,3,4). Calotropis gigantea, commonly found in arid lands and colloquially known as giant milkweed, is native to India, Bangladesh, Burma, China, Indonesia, Malaysia, Pakistan, the Philippines, Thailand, and Sri Lanka. Recognizable by its oval, light green leaves, milky stem, and clusters of waxy flowers in white or lavender hues, C. gigantea holds medicinal significance in traditional Indian medicine. Recent scientific reports have highlighted its various medicinal properties, including analgesic, antimicrobial, and cytotoxic activities in flowers, as well as antidiarrheal, anti-candida, antibacterial, and antioxidant activities in leaves and aerial parts. The roots exhibit antipyretic, cytotoxic, antimicrobial,

insecticidal, wound healing, CNS activity, and load-blocking properties. Latex from the plant demonstrates laxative, procoagulant, wound healing, and antimicrobial properties, while the stem has been associated with hepatotoxic effects. This comprehensive review aims to provide an overview of the medicinal and biomolecular properties of C. gigantea, with a focus on potential avenues for future scientific research in developing effective therapeutic compounds (5).

(Figure No. 1 Calotropis Gigantea Plant)

DESCRIPTION OF THE PLANT

TOXONOMICAL CLASSIFICATION

Kingdom **Plantae**

- Subkingdom : Tracheobionta
- Class : Dicotyledone
- Order : gentianales
- Family : Apocynacea
- Subfamily : Asclepidiaceae
- Genus : Calotropis
- Species : Calotropis gingantea
- Sub class : Asteridae

Table 1 : VERNACULAR NAMES

India	(sanskarit) Arka Mandara Vasuka , svetapushpa, sadapushpa, (Hindi) Aak, Madar, (Malalyam) Erukku, (Telugu) Jilledi Puvvu
Thailand	Po theuean paan thuean (northern), rak (central)
Vietnam	B[oot]ng b[oot]ng, 1[as] hen, nam t [it]
Indonesia	Bidhuri (sudanses,madures), Sidaguri (Javanese), rubik (Aceh)

DISTRIBUTION:

Calotropis gigantea Linn belongs to the Asclepiadaceae family, comprising 180 genera and around 2,200 species, predominantly distributed in tropical and subtropical regions globally. Its initial presence is noted in the Afro-Asiatic monsoon regions, extending from Northwest Africa (Mauritania and Senegal) through the Arabian Peninsula. The plant is commonly found in the sub-Himalayan regions, spanning from the Deccan to Kanyakumari, including Bangladesh, Burma, and Pakistan. Notably, it also exhibits its floral presence in subtropical America, the Mascarene Islands, and the arid parts of Australia.

The natural habitat of Calotropis gigantea ranges from sea level up to 1300 meters, primarily in semi-arid conditions with annual rainfall variations between 150 and 1000 mm. Thriving in sandy, well-drained soils and abandoned lands, this adaptable plant withstands a diverse range of soil textures and environmental conditions. It displays resilience against soil salinity, drought, heat, and seaside salt spray. With a capacity to endure an annual rainfall of up to 2,000 mm, the plant quickly establishes itself in open habitats with minimal competition.

Calotropis gigantea demonstrates remarkable adaptability to various biological structures and can be found growing along degraded roadsides, lake edges, native pastures, and areas subjected to overgrazing. In the face of damage, the plant readily develops suckers from its roots, swiftly regenerating and producing adventitious shoots (6).

MORPHOLOGY (7)

Root: The root is simple, branched, woody at the base, covered with fissured, corky bark. Branches are somewhat succulent and densely covered with white tomentum, becoming glabrescent early. All parts of the plant exude white latex when cut or broken.

Leaves: Opposite-decussate arrangement, straight, subsessile, exstipulate; with an oval to broadly obovate shape, ranging from 5-30 cm in length and 2.5-15.5 cm in width. The apex is abruptly and shortly acuminate to apiculate, with a cordate base. The edges are entire, succulent, initially white tomentose when young, later becoming glabrescent and glaucous.

Fruit: The fruit is a simple, fleshy, swollen, subglobose to laterally ovoid follicle, reaching up to 10 cm or more in diameter. Seeds are numerous, small, flat, obovate, measuring 6 × 5 mm, compacted with silky white pappus, extending to 3 cm or more in length.

Flowers: Bracteate, complete, sexually unbiased, actinomorphic, pentamerous, hypogynous, pedicellate, with pedicels measuring 1-3 cm in length. Calyx has five sepals, polysepalous, and 5-lobed, momentarily fused at the base, glabrescent, exhibiting quincuncial aestivation. Androecium comprises five stamens, gynandrous, with dithecous, sound anthers. Inflorescence forms a dense, multi-flowered, umbellate, peduncled cyme, emerging from the nodes and appearing axillary or terminal. Gynoecium is bicarpellary, apocarpous, with styles joined at their apex, forming a peltate stigma with five parallel stigmatic surfaces. Anthers are adnate to the stigma, creating a gynostegium structure.

BIOLOGICAL SOURCE/GEOLOGICAL SOURCE/NATURAL HABITAT:

Calotropis thrives in its wild state up to an altitude of 900 meters across the nation, displaying notable resilience to drought and a moderate tolerance to saline conditions. Flourishing in disturbed sandy soils with a mean annual rainfall ranging from 300 to 400 mm (8), this plant readily establishes itself as a weed along degraded roadways, lagoon edges, and overgrazed native grasslands, facilitated by wind and animal-mediated seed dispersal. Its affinity for abandoned agricultural sites is evident, often dominating such areas, particularly where sandy soils are disturbed, and rainfall is scarce, serving as an indicator of overcultivation (9).

C. gigantea demonstrates a preference for wide habitats with low competition. This species can be found in areas with well-drained soils where annual precipitation reaches up to 2000 mm, as well as in arid habitats experiencing rainfall between 150 and 1000 mm. Typical habitats include roadside sand dunes, seashore dunes, and densely populated urban areas, with its presence extending up to 1,000 meters above sea level.

Occasionally planted as an ornamental in dry or coastal locations, the plant is valued for its ease of cultivation, reproductive capabilities, and adaptability to xerophytic conditions (10,11).

Native to Southern Asia, Indo-China, Madagascar, the Arabian Peninsula, West Africa, North and East Africa, Macaronesia, and South Asia, C. gigantea has become a native species in Australia, Central America, North America, South America, and the West Indies. The plant is widely accepted and cultivated in numerous countries, including Mexico, Central and South America, the Pacific Islands, Australia, and the Caribbean (12).

Chief Features:

• The plant thrives in various soil types and climatic conditions.

• It is particularly abundant in tropical and subtropical regions, often dominating in areas where overgrazing has eliminated competition from natural grasses (13).

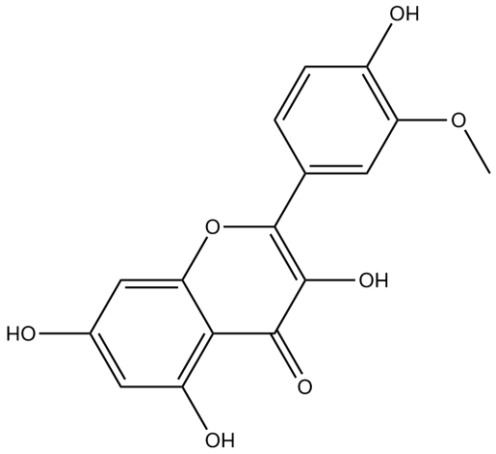
• Requiring no cultivation practices, it stands out as one of the few plants that grazing animals avoid consuming (14).

• Indigenous to India, it is also found in Afghanistan, Algeria, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Gambia, Ghana, Guinea-Bissau, China, Malaysia, Senegal, Sierra Leone, Somalia, Sudan, Syrian Arab Republic, Tanzania, Thailand, Uganda, United Arab Emirates, Vietnam, Yemen, Iraq, Israel, Kenya, Kuwait, Lebanon, Libya, Mali, Mauritania, Morocco, Myanmar, Nepal, Niger, Nigeria, Oman, Pakistan, Saudi Arabia, and Senegal. Additionally, it has been introduced in Argentina, Antigua, and Barbuda (16).

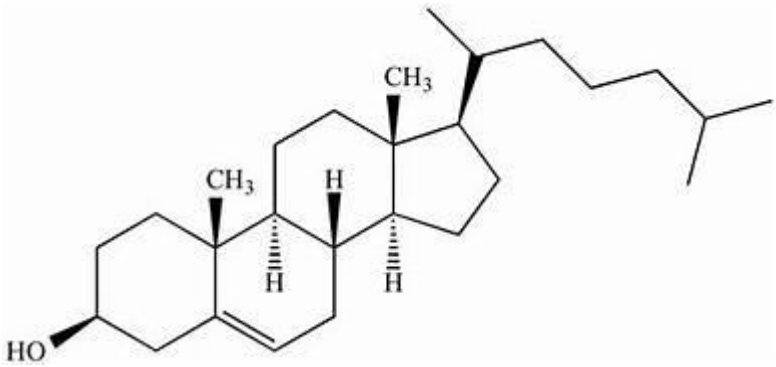
CHEMICAL CONSTITUENTS :- various chemical constituents isolateds from Calotropis gingantea Linn(17)

Table 2: Various chemical constituents isolated from C. gigantea Linn

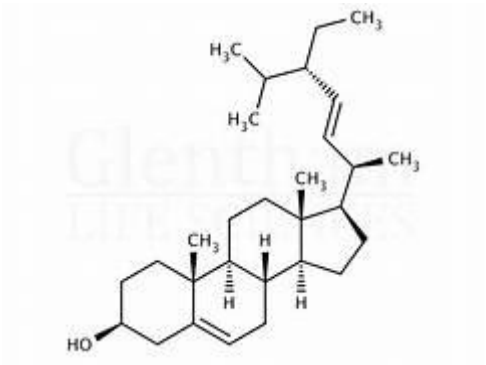
Class of chemical constituents	**Name of chemical constituents**	**Plant part used**	**Extract taken**
Triterpenoids	Di-(2-ethylhexyl)phthalate Anhydrosophoradiol-3-acetate Lupeol α-Taraxerol	Flowers Aerial parts Root bark	Ethyl acetate extract Latex Ethyl acetate extract
Triterpene esters	ϒ-Taraxasterol Lupenyl-1-acetate	Aerial parts Root bark	Hexane and menthanol soluble extract Petroleum ether extract
Cardiac glycosides	Calotropone Gofruside	Roots	Ethanol extract
Flavonol	Isorhamnetin	Aerial parts	Methanol extract
Steroids	Stigmasterol β-Sitosterol β-Sitosterolactate	Root bark	Methanol extract Ethyl acetate extract
Resin	β-Amyrin β-Amyrin acetate	Root bark	95%Alcohol extract
Fatty acids	Isovaleric acid	Root bark	95%Alcohol extract
Miscellaneous	Asclepin	Roots	Latex



Isohamneti



calotropone



Stigmasterol

Chemical structure of various chemical constituents isolated from C gingatea

THERAPEUTIC USES:

The plant's juice exhibits anthelmintic properties and is employed in the treatment of leucoderma, tumors, ascites, and various abdominal disorders. Known for its purgative nature, the plant serves as an anthelmintic and alexipharmic agent, addressing conditions such as leprosy, leucoderma, ulcers, tumors, piles, as well as ailments affecting the spleen, liver, and abdomen. Utilized for the treatment of wounds, paralyzed or painful joints, and swellings, the leaves offer therapeutic relief. Furthermore, a tincture derived from the leaves functions as an antiperiodic remedy in the management of sporadic fevers (18,19).

The plant's efficacy extends to addressing tumors, rat bites, inflammation, and ascites. The milk extracted from the plant demonstrates laxative and purgative properties, presenting a bitter taste and proving beneficial in the treatment of piles. The root bark, characterized by its diaphoretic qualities, is specifically utilized in treating conditions such as syphilis and asthma. Notably, the flower, with its sweet, bitter, anthelmintic, analgesic, astringent, and curative attributes, contributes to the plant's diverse therapeutic applications.

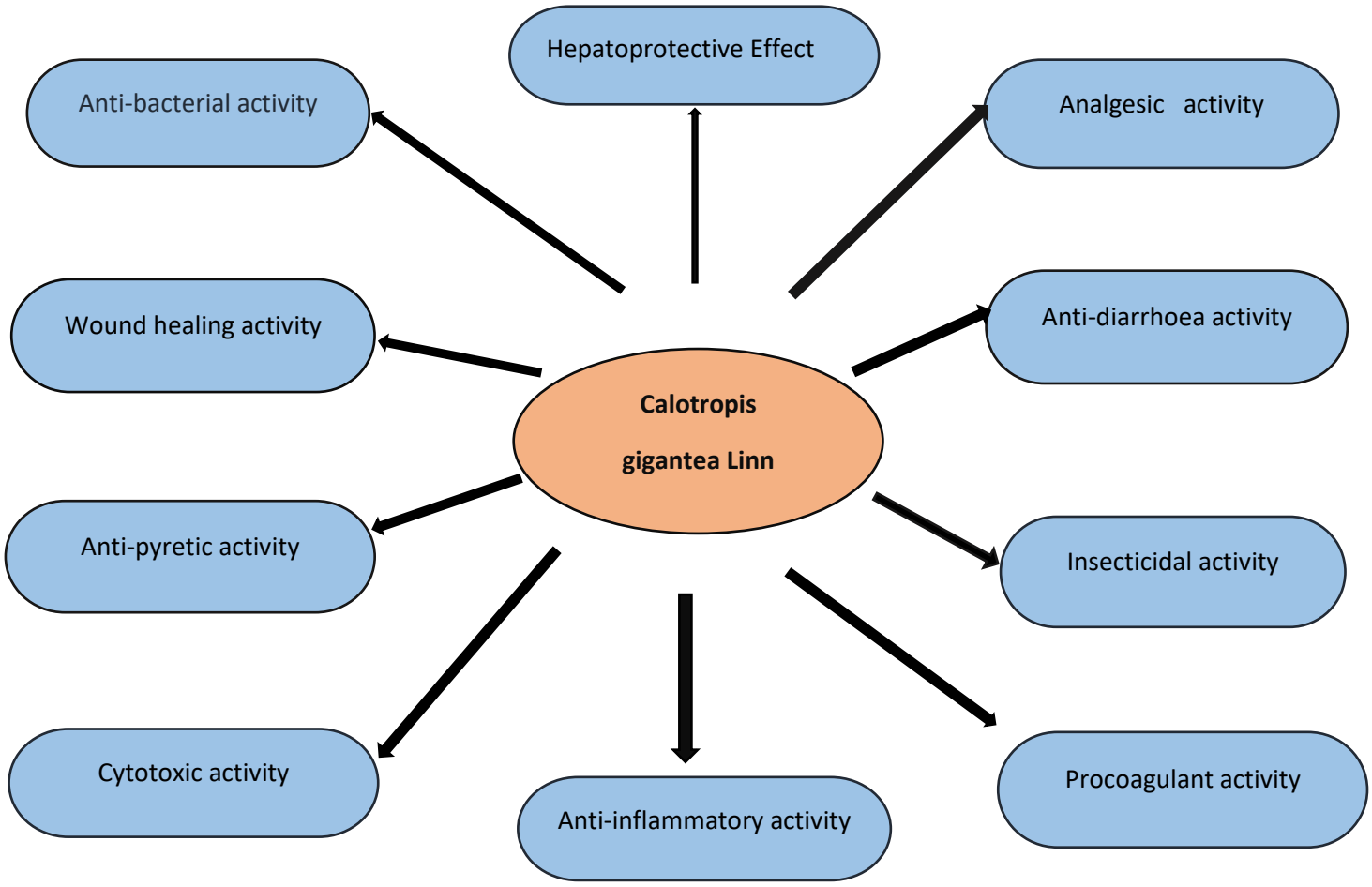


Figure 2: Medicinal properties of C. gigantea Linn.(20)

PHARMACOLOGICAL STUDIES:

1. **Antidiarrheal Activity of Calotropis gigantea:**

   The hydroalcoholic extract (50:50) derived from the aerial parts of Calotropis gigantea was investigated for its anti-diarrheal effects using a rat model of castor oil-induced diarrhea. The extract, administered intraperitoneally at doses of 200 and 400 mg/kg body weight, demonstrated a significant reduction in fecal production and frequency, along with a notable inhibition of intestinal content weight and volume induced by castor oil (21).

2. **CNS Activity of Calotropis gigantea:**

   Albino rats were subjected to oral administration of an alcoholic extract from the peeled roots of Calotropis gigantea at doses of 250 and 500 mg/kg body weight. The study revealed substantial analgesic effects through the Eddy's hot plate method and acetic acid-induced writhings, along with anticonvulsant efficacy against pentylenetetrazole-induced convulsions. Additionally, the extract exhibited anti-anxiety properties, decreased locomotor system activity, and a shortened motor coordination fall-off period. The sedative effect was evident in potentiated pentobarbitone-induced sleep (23).

3. **Analgesic Activity of Calotropis gigantea:**

   Calotropis gigantea flower alcohol extract was orally administered to mice and evaluated for analgesic efficacy using chemical and thermal models. The inhibition of writhes in the acetic acid-induced writhing test at doses of 250 and 500 mg/kg was 20.97% and 43.0%, respectively. The hot plate approach revealed prolonged paw licking periods, indicating analgesic impact. The study also compared the analgesic potential of dry latex from C. gigantea with aspirin, showing a more pronounced effect against acetic acid-induced writhing (24,25).

4. **Anti-inflammatory Activity of Calotropis gigantea:**

   The anti-inflammatory effect of Calotropis gigantea was investigated using various models, including carrageenin-induced and kaolin-induced rat paw edema, cotton-pellet granuloma, adjuvant-induced arthritis, and yeast-induced pyresis. The alkaloid fraction exhibited variable anti-inflammatory efficacy, with peak activity observed after two hours. The study also explored the

inhibitory effects of leaf and flower extracts on mitochondrial malate dehydrogenase and malic enzyme (26).

5. **Wound Healing Activity of Calotropis gigantea:**

   The wound healing capacity of Calotropis gigantea was studied in Guinea pigs, employing a sterile 1.0% plant latex solution topically. The application significantly accelerated the healing process by enhancing collagen, DNA, and protein synthesis, as well as epithelization. Another study focused on the root bark extract's ability to expedite wound healing in Wistar albino rats, showing accelerated healing in both excision and incision wound models (27).

SCOPE OF THE WORK:

Enhanced Anti-Inflammatory Nature:

This investigation not only affirmed the robust anti-inflammatory efficacy resulting from the synergistic impact of C. gigantea and T. procumbens with Ibuprofen but also highlighted the superior action compared to Ibuprofen alone. The evaluation was conducted using the yeast-induced pyresis method.

Antibacterial Activity:

The screening of Calotropis gigantea leaves extract encompassed an analysis of its antibacterial and phytochemical attributes, providing insights into its potential medicinal properties.

Antitumor Activity:

The methanol extract (ME) derived from C. gigantea root bark, along with its chloroform soluble fraction (CF), exhibited notable antitumor activity. Furthermore, the flower of Calotropis gigantea demonstrated a potent inhibitory effect against EAC cells in a dose-dependent manner.

Cytotoxic Activity:

The study aimed to explore the cytotoxic properties of C. gigantea, focusing on potential preferential cytotoxicity of the insect extract on human cancer cell lines. Comparative chemical characterization using HPTLC, UV, and IR studies revealed the presence of cardenolides in both extracts. The ethanolic root extract of C. gigantea demonstrated substantial cytotoxicity comparable to a standard drug, suggesting its potential for the development of novel anticancer drug leads.

Mosquito Repellent Activity:

The findings indicate that C. gigantea leaves possess significant mosquito repellent properties. This suggests the potential utilization of the plant as a natural source for the development of new, safe, and eco-friendly insecticides for the control of C. gelidus and C. tritaeniorhynchus mosquitoes.

- Good anti-inflammatory nature.

- Rid Blemishes of the skin.
- Treat ear pain.
- Cures diarrhea.
- Hypoglycemic effect.
- Spasmogenic property.
- Good antifungal property.
- Act as an antidote for snake poison.
- Treat skin disease.
- Hepatoprotective Activity
- Anticancer Activity
- Antivenom Activity
- Antipyretic Activity
- Procoagulant Activity
- Antitussive Activity
- Antifeedant Activity

CONCLUSION:

Calotropis gigantea Linn, belonging to a family with 180 genera and 2,200 species primarily distributed in tropical and subtropical regions, exhibits remarkable adaptability, thriving in diverse soils and environmental conditions without necessitating cultivation practices.

Recent emphasis on ethnomedicine studies has brought attention to the vast and often untapped medical benefits derived from plants. In-depth pharmacological analyses of C. gigantea have unveiled its therapeutic potential, positioning it as a valuable medicinal plant endowed with various therapeutic qualities. The findings underscore the prospect of harnessing C. gigantea for the development of contemporary pharmaceuticals, providing a promising avenue for controlling a myriad of disorders. Pharmacologists are increasingly motivated to explore and develop novel medications derived from the rich pharmacopeia of natural sources, such as C. gigantea, to contribute to the advancement of medical science.

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