

## Phytopharmacology study of *Calotropis gigantea* (L.)

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### ABSTRACT:

Plants can be used in both conventional and modern medicines. The phytochemical properties of *Calotropis gigantea* include secondary metabolites such as tannins, saponins, alkaloids, and glycosides. The plant is used to treat fever, colds, coughs, asthma, and other conditions, and its extracts are derived from methanol rather than petroleum. The chemical components include cardenolides, resins, and glycoside flavonoids, which are present in different parts of the plant. The herbs are used to treat leprosy, tumours, piles, and other ailments. The pharmacological activities of *C. gigantea* include antimicrobial, antifungal, anti-inflammatory, central nervous system (CNS) effects, antidiarrheal, antitussive, analgesic, hepatoprotective, antiasthmatic and anticancer properties.

### KEY WORDS:

*Calotropis gigantea* (L), phytopharmacology, screening

### INTRODUCTION:

Ayurveda is a branch of medicine that has been practiced for 5,000 years. According to Ayurveda, the universe encompasses everything, including the human body, which is formed by the union of Vata, Pitta, and Kapha (1), collectively referred to as tridosha. Some essential plants in Ayurveda include *Cassia angustifolia*, *Piper longum*, *Sesamum indicum*, and *Rauwolfia serpentina* (2). In Ayurveda, *Calotropis gigantea* is known as "Sweta Arka" and commonly referred to as "Arka" in Hindi. Therapeutic plants form the foundation of herbal and traditional medicine. India has significant expertise in conventional medicine (3). However, *Calotropis gigantea* is rapidly expanding in subtropical and tropical areas. Traditional medicine provides clinical treatments to 75-80% of people worldwide. The flowers of *C. gigantea* are utilized in medicine for their antibacterial, cytotoxic, and analgesic properties (4).

Taxonomic grouping:

- **Kingdom: Plantae**
- **Division: Gentianales**
- **Family: Asclepiadaceae**
- **Subfamily: Asclepiadoideae**
- **Genus: Calotropis**
- **Species: *Calotropis gigantea*. (5)**



Fig.1: *Calotropis gigantea*

**Table.1: Various Other Uses:**

Activities	Part Used
Arrow poison	Latex
Cleansing water	Leaves & its saps
Energy plantation	Whole plant
Brewing & to curdle milk	Bark & latex
Fungicidal, Insecticidal	Whole plant
Mosquitocidal potential	Whole plant
Fodder	Leaves & flowers
Molluscicidal activity	Whole plant
Biogas &, substituted for petroleum product	Whole plant
Indicators of heavy metals	Leaf & stem

Chemical components are:

The plant includes a variety of components, including oxypregnane oligoglycosides, cacardenolides, sterols, resins, non-protein products, and fatty acids. Several different types of chemicals are present in *Calotropis gigantea*, including enzymes in latex, alkaloids, resins, flavonoids, and cardiac glycosides.

1. **Leaves:** The chemical composition of leaves mostly consists of anytime acetate, beta-sitosterol, calotropin, and urosolic acid (6).
2. **Flowers:** The chemical components of *C. gigantea* flowers include proceroside, taraxast-20(30)-en-3-(4-methyl-3-pentenate), lupeol, sterol, and flavonoids.
3. **Latex:** Latex contains 0.5% calotroxin, calotropin, voruscharin, and trypsin, and 0.15% calactin.
4. **Bark:** The bark of *C. gigantea* contains triterpenes, a novel norditerpenoid phenyl ester, quercetin-3-rutinoside, and akudarol isovalerate (7).

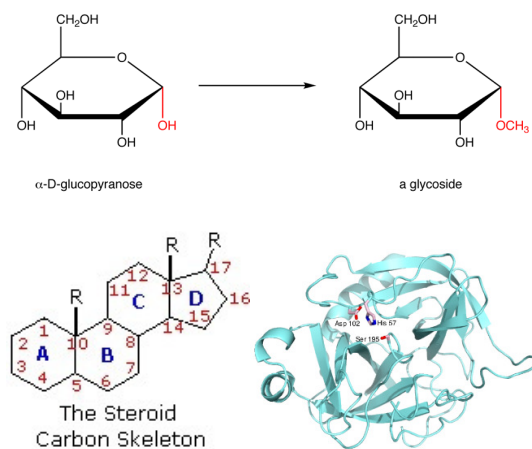


Fig.2: Chemical Structure

#### PHYTOCHEMICAL SCREENING:

Phytochemical screening can identify bioactive substances such as phenols, flavonoids, tannins, and saponins (8). Secondary molecules found in leaf extracts include tannins, saponins, alkaloids, and glycosides. Phytochemicals extracted using methanol and petroleum extracts show the presence (+) or absence (-) of various compounds. (9)

**Table.2: Phytochemicals**

Phytochemicals	Methanol extract	Petroleum Extract
Carbohydrates	-	-
Flavonoids	+	-
Glucoside	-	+
Alkaloids	+	-
Tannins & phenolic	+	-
Fats & oil	-	+
Saponins	-	+

**Pharmacological activities:****1. Antidiabetic activity:**

Blood glucose levels in *Calotropis gigantea* exhibit antidiabetic effects. It also reduces body weight in diabetic cases (10). Research has tested the flower's antidiabetic properties in normal and alloxan-induced diabetic rats by extracting it with chloroform and ethyl alcohol (11). Blood samples were taken, and glucose levels were evaluated using a glucometer on days 1, 4, 8, and 12 of receiving therapy with *C. gigantea*. The acetate and chloroform extracts at doses of 500 mg/kg demonstrated a considerable and progressive reduction in blood sugar levels (12).

**2. Anticancer:**

*Calotropis gigantea* is used as a cancer preventative by damaging DNA. Cardiac glycosides inhibit the growth of malignant cells in breast cancer (13). *C. gigantea* flowers are reported to prevent cancer-related complications. Research using HEK293 and other cancer and non-cancer cell lines found that while most CGS were inactive, three CGS showed significant activity against MDA-MB-231 cells (14). Overall, these experiments indicate that CGS may have cytotoxic effects against breast cancer cells, warranting further research into cancer prevention and treatment (15).

**3. Anti-inflammatory activity:**

Inflammation is mediated by prostaglandins, which *Calotropis gigantea* helps reduce (16). In vitro methods evaluated the anti-inflammatory properties of *C. gigantea* leaf extracts (17). Leaves were sequentially extracted using petroleum ether, chloroform, ethyl acetate, butanol, ethanol, and distilled

water. Ibuprofen served as the standard reference medication. The ethanolic extract of *C. gigantea* leaves showed a strong anti-inflammatory effect compared to ibuprofen (18).

#### **4. Anti asthmatic activity:**

Chronic inflammatory diseases cause airway inflammation and bronchoconstriction, leading to bronchial asthma (19). Chemo mediators control eosinophil, resulting in bronchial constriction. *Calotropis gigantea* helps relax the bronchi, thus acting as an anti-asthmatic (20).

#### **5. Analgesic activity:**

The analgesic activity of the alcoholic floral extract of *Calotropis gigantea* was tested in mice using thermal and chemical models (21).

#### **5. Hepato protective activity:**

The methanol extract of *C. gigantea* leaves has significant hepatoprotective properties (22). Hepatotoxicity in rats, often induced by CCl<sub>4</sub>, was used to study the hepatoprotective effects. Different solvent extracts of *C. gigantea* leaves, including acetone, petroleum oil, chloroform, and methanol, were administered to separate animal groups at a rate of 450 mg/kg body weight. A thorough investigation of this plant's hepatoprotective properties has been undertaken (23).

#### **6. Anti-inflammatory activity:**

The anti-inflammatory efficacy of *Calotropis gigantea* was assessed using cotton pellet granuloma, carrageenin, and kaolin-induced rat paw edema. Yeast-induced pyresis was used to test antipyretic activity (24).

#### **7. Antitussive activity:**

The leaves of *C. gigantea* contain glycosides and alkaloids, exhibiting antitussive properties (25). The antitussive and anti-asthmatic activities of aqueous extracts were tested on albino Wistar rats, guinea pigs, and mice using ammonia and sulphur dioxide-induced cough models (26).

#### **8. Antiviral Activity:**

Medicinal plants are commonly used to treat and manage various diseases through antimicrobial activity (inhibition of T cells). In this investigation, the IBD virus was tested in human PBMC with a range of leaf extract concentrations from 0.5 to 30 mg/ml (27). The aqueous leaf extract of *C. gigantea* significantly reduced IBD proliferation and CD14 surface monocyte markers in human PBMC at high doses. Combined results from *C. gigantea* and *Terminalia arjuna* demonstrated antiviral action by reducing T cell numbers (28).

#### **9. Anti-diarrheal activity:**

The extensively cultivated *Calotropis gigantea* is used for its therapeutic benefits, including antidiarrheal effects. The antidiarrheal activity of *C. gigantea* extract was tested against castor oil-induced diarrhea in rats. The intestinal content's weight and volume were examined using the enter pooling method, showing significant antidiarrheal activity. The sea giantay extract's actual anti-dairy activity against the Castrol-induced diarrhoea model arrest makes it useful in a variety of diarrhoea situations (29).

#### **10. Anti-bacterial activity:**

Using the well diffusion method on MH agar, *Calotropis gigantea* was evaluated for its antagonistic activity against *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Bacillus cereus* (30). The zones of inhibition were  $12.6 \pm 1.52$  mm against *Klebsiella pneumoniae* and  $17.6 \pm 1.15$  mm against *E. coli*. According to the researchers' findings, *C. gigantea* is a rich source of valuable medicinal compounds, and its leaves exhibit strong antibacterial properties. These findings suggest that further investigation is warranted to isolate the specific bioactive components responsible for these effects (31).

#### **11. CNS Activity:**

*Calotropis gigantea* R.Br. (Asclepiadaceae) alcohol extracts were evaluated for CNS activity in albino rats at doses of 250 and 500 mg/kg body weight. The results showed a delay in paw-licking time, indicating fewer writhings and suggesting analgesic effects (32). Rats treated with the extract also spent more time in the elevated plus maze (EPM) arm, which demonstrates its antianxiety action. Additionally, motor coordination deteriorated as locomotor activity decreased. No mortality was observed even at a higher dose of 1 g/kg. These findings suggest that *\*C. gigantea\** exhibits analgesic, anxiolytic, and anticonvulsant activities.

#### **CONCLUSION:**

Traditional medicines utilize herbs with a long history, and *Calotropis gigantea* is one such plant that has been incorporated into the creation of conventional medicines. This plant is notable for its ability to grow in various soil types and withstand harsh environmental conditions without the need for extensive farming practices. Studies on the roots, bark, leaves, flowers, and other components of *C. gigantea* have revealed their use in treating various diseases, as well as their distinct physical, chemical, and morphological characteristics (33). The plant contains a variety of chemical components, including flavonoids, alkaloids, tannins, and resins. Phytochemical screening using methanol and petroleum extracts helps in detecting these bioactive substances (34). The pharmacological activities of *C. gigantea*, supported by various tests, highlight its potential and functionality as a medicinal plant (35). Future research should focus on isolating and characterizing the specific bioactive compounds responsible for these effects, with the aim of developing novel therapeutic agents. Additionally,

understanding the molecular mechanisms underlying these activities will be crucial in translating traditional knowledge into evidence-based medical applications.

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