Pharmacological, biological activities and phytochemical constituents of *Calotropis gigantea*

Snehal K Bhavsar*, Sadhana N Patil, Pooja S Murkute, Sanjay J Surana

**ABSTRACT**

*Calotropis gigantea* is a class of *calotropis* belonging to the family Apocynaceae. *C. Gigantea* is resident in Cambodia, Indonesia, Malaysia, the Philippines, Thailand, Sri Lanka, India, China, Pakistan, Nepal, BoocBooc in Somalia and tropical Africa. This herb produced large amount of latex thus includes in latex bearing plants generally known as giant milk weed. *C. Gigantean* is known for a multiplicity of pharmacological properties in ancient medicinal system and utilizes to cure a various disease. From few decades, it is broadly studied for its pharmacological as well as medicinal properties by highly developed scientific techniques and various medicinally active compounds obtained from the different parts of the plant and this are analysed pharmacologically. The plant is reported for its various activities like: analgesic, antimicrobial, antioxidant, anti-pyretic, insecticidal, cytotoxicity, hepatoprotective, pregnancy interceptive properties, pro-coagulant activity and wound healing. Antivenom activity, CNS activity. The therapeutic properties of calotropis gigantean plant signify it as aimportant source of therapeutic compound. This study is combined information about the ethnobotany, pharmacology, phytochemistry and natural medicinal activities of the *C. gigantea*.

**Keywords:** *Calotropis gigantea*, Antimicrobial activity, Cytotoxicity, Ethnobotany, Phytochemistry.

**INTRODUCTION**

**History:**

Calotropis gigantea is anative plant of India, China and Malaysia and distributed in the following countries: Afghanistan, Algeria, Antigua and Barbuda, Argentina, Australia Burkina Faso, Antilles, Arab Jamahiryya Bahamas, Barbados, Bolivia, Brazil, Cameroon, Chad, Cote d’Ivoire, Colombia, Cuba, Democratic Republic of Congo, Dominica, Dominican Republic, Egypt, Eritrea, Ethiopia, Ecuador, French Guinea, Grenada, Guadeloupe, Guatemala, Guyana Paraguay Haiti, Gambia, Ghana, Honduras, India, Iraq, Israel, Jamaica, Kenya, Kuwait, Lebanon, Libyan, Martinique, Mexico, Montserrat, Mauritania, Morocco, Mozambique, Myanmar, Mali, Nepal, Niger, Nigeria, Netherlands Nicaragua, Oman, Pakistan, Panama, Peru, Puerto Rico, Saudi Arabia, Senegal, Somalia, Sudan, Syrian Arab Republic, St Lucia, St Vincent, Surinam, Thailand, Tanzania, Trinidad Uganda, Uruguay, United Arab emirates, Vietnam, Venezuela, Yemen. [1]

**Scientific classification:**

- **Kingdom:** Planatae
- **Subkingdom:** Tracheobionta
Calotropis gigantea is a minor tree or a shrub, 4–10m tall. Its stem is straight, about 20 cm in diameter. The leaves are broadly elliptical in shape, with the size of 9–20 cm × 6–12.5 cm but subsessile. The inflorescence stalk is 5–12 cm elongated; the stalk of flower is 2.5–4 cm extended. Sepal lobes are broadly-egg-shaped with a size of 4–6 mm × 2–3 mm. The diameter of Petal is 2.5–4 cm. The plant has bunches of waxy flowers that are either buff white or lavender in colour. Each flower contains of five-pointed petals and a tiny, stylish "crown" rising from the centre. The plant has elliptical, light green leaves and milky stem. The petal parts are generally triangular 5–8 mm × 10–15 mm; they are cream and pale lavender coloured near the tips. Calotropis is drought-resistant shrub, it is naturally grows up to 900 meters all over the country [2]. It is a plant which is not consumed by animals [3]. It grows well on poor soils particularly where overgrazing has removed competition from native grasses [4].

Herbs and plants have been in use as a source of therapeutically active compounds in old medicinal system since prehistoric time [5]. There is a continuous needed of the growth of new effective antimicrobial drugs because of the coming out of new infectious diseases and drug resistance [6]. The plant opposed to various communicable diseases and to the intense unknownsituation are partly recognized to the presence of hydrolytic enzymes of the latex especially proteases [7, 8].

### Morphology and Distribution

The plant has bunches of waxy flowers that are either buff white or lavender in colour. Each flower contains of five-pointed petals and a tiny, stylish "crown" rising from the centre. The plant has elliptical, light green leaves and milky stem. The petal parts are generally triangular 5–8 mm × 10–15 mm; they are cream and pale lavender coloured near the tips. Calotropis is drought-resistant shrub, it is naturally grows up to 900 meters all over the country [2]. It is a plant which is not consumed by animals [3]. It grows well on poor soils particularly where overgrazing has removed competition from native grasses [4].

### Table 1: Therapeutic activities of phytoconstituentsisolated from Calotropisgigantean [9].

| Species/plant parts | Compounds isolated | Therapeutic activity |
|---------------------|--------------------|----------------------|
| Root bark           | Milky sap extract, β-sitosterol, Sterols Gigantidine, Stigmasterol, | Anti syphilis, Purgative, anti-worm, insecticidal, antipyretic, contraceptiv, anti-oxidant, Anticoagulant, anti-diarrhea, analgesic, anti-tumor, Anti metastatic, anticanicancer, Pro-coagulant Fibrinogenesis, Cytotoxic and antimicrobial, wound healing, ant-proliferative, Cytotoxic, anti-oxidant Toxic, pesticidal, anti-inflammatory myocardium, stimulatory effect on smooth muscle motility, Analgesic, antiplasmodial, antiproliferative, sedative, antipyretic Analgesic, anti-convulsant, ant arthritis, allergic, larvicidal, anti-helminthic, ascarcidical, Protective to oxidative stress and renal damage, insecticidal, schizonticidal, anti-fugal, insecticidal, anti-oxidant anticancer, insecticidal, proteolytic activity, anti-mycoplasmal, anti-bacterial, Antihelminthic, antimicrobial, Wound healing activity) Asthma, CNS activity, A Novel Insect Antifeedant Non protein Amino Acid, antioxidum, cytotoxic, Coagulant, hepatoprotective, ant venom |
| Latex of Flower     | 20-Epoxy-cardenolides Di-(2-ethylhexyl) phthalate Glyceryl mono-octyl-2-phosphate Proceranol 2, Glycerol-1,2-dicapriate-3-phosphate Pocerensyl acetate 1.Methyl myristate, 19-Nor-and18, | |
| Leaves              | 19-Nor- and 18,20-Epoxy-cardenolides, 16alpha-hydroxycal actinic acid methyl ester, 15beta-hydroxy cardenolides | anti-inflammatory myocardium, stimulatory effect on smooth muscle motility, Analgesic, antiplasmodial, antiproliferative, sedative, antipyretic Analgesic, anti-convulsant, ant arthritis, allergic, larvicidal, anti-helminthic, ascarcidical, Protective to oxidative stress and renal damage, insecticidal, schizonticidal, anti-fugal, insecticidal, anti-oxidant anticancer, insecticidal, proteolytic activity, anti-mycoplasmal, anti-bacterial, Antihelminthic, antimicrobial, Wound healing activity) Asthma, CNS activity, A Novel Insect Antifeedant Non protein Amino Acid, antioxidum, cytotoxic, Coagulant, hepatoprotective, ant venom |
| Dried Latex         | Calotropins DL, Calotropins DII, Calotropain-F1 and Calotropain-FII 3’-methylbutanoates of α-amyrin, ψ-taraxasterol, | |
| Roots               | Calotropesesterpenol, Calotropenonzuranone, Calotropone, Calotropesesterpenol, Eugoside Coroglaucigenin, Isorhamnetin-3-O-rutinoside, Isorhamnetin-3-O-Glucopyranoside Taraxasterol acetate [18] | |
| Aerial parts        | Calotropin |
| Pharmacological Activity | Part of plant used | Extract                  | Model                                      | Interpretation                                                                                                                                                                                                 | Reference |
|--------------------------|-------------------|--------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1) Anti diarrheal activity | Aerial parts      | anti-diarrheal activity  | Castor oil model of diarrhoea in rats      | C. gigantean extract helpful in a broad range of diarrheal states, functional diarrheas, radiation diarrhea or the diarrhea due to abnormal secretary mechanisms like in cholera or E.coli enterotoxin induced diarrhea.                                                | [10, 11]  |
| 2) Antimicrobial activity | Roots             | Aqueous and Alcoholic extract | Anthelmintic activity animal model paralysis and death of individual earthworm | The aqueous extract has a better anthelmintic activity as compared to the alcoholic extract at all the doses                                                                                       | [12, 13]  |
| a) Anthelmintic          | Leaves            | Aqueous, extracts        | Mueller Hinton agar plates (Gram positive bacteria like B.subtilis) | Dichloromethane and Ethyl acetate extracts showed better and broader spectrum of activity compared to other extracts.                                                                                 | [14]      |
| 3) Procoagulant activity | Leaves            | aqueous extract          | Modified agar well diffusion technique.   | The C. gigantean leaves aqueous extract of show the antibacterial Extract exhibited maximum antibacterial activity next toE. coli and lowly activity besideK. pneumonia.                                                   | [15]      |
| 4) Anti diabetic activity | Leaves            | Aqueous, petroleum ether methanol, ethanol extract | Agar well diffusion method in potato dextrose agar | The results prove Calotropis gigantea a potent source of natural anti-Candida compounds.                                                                                                        | [16]      |
| b) Antimicrobial Activity | Leaves            | Aqueous, petroleum ether methanol, ethanol extract | Agar well diffusion method in potato dextrose agar | The results prove Calotropis gigantea a potent source of natural anti-Candida compounds.                                                                                                        | [16]      |
| c) Anti-Candida activity | Leaves            | aqueous extract          | Modified agar well diffusion technique.   | The C. gigantean leaves aqueous extract of show the antibacterial Extract exhibited maximum antibacterial activity next toE. coli and lowly activity besideK. pneumonia.                                                   | [15]      |
| d) Antifungal activities | Leaves            | Aqueous, petroleum ether methanol, ethanol extract | Agar well diffusion method in potato dextrose agar | The results prove Calotropis gigantea a potent source of natural anti-Candida compounds.                                                                                                        | [16]      |
| e) Antimicrobial Activity | Flower            | ethyl acetate extract    | disc diffusion method                      | Dr-(2-ethylhexyl) phthalate and ethyl acetate extract exhibited a enhanced broad spectrum of antibacterial activity beside equally Gram positive and gram negative bacteria.                     | [17]      |
| 3) Procoagulant activity | Crude latex      | Crude latex extract      | human blood samples                        | Latex extract of calotropis gigantea showed wound healing activity in rats and thus helps to its conventional use.                                                                                     | [18]      |
| 4) Anti diabetic Activity | Root bark         | Defatted by petroleum ether and soaked in ethanol and kept aside for 4 days. After that ethanolic layer be decanted off. | rats. (Wistar albino rats) | Calotropis gigantea show wound healing activity in rats and thus helps to its conventional use.                                                                                     | [19]      |
| 5) Asthma                 | Latex             | Latex extract            | albino rats by excision and incision wound models | Calotropis gigantea show wound healing activity in rats and thus helps to its conventional use.                                                                                     | [20]      |
| 6) CNS activity           | Flowers           | Liquid nitrogen and dissolved in PBS (pH 5) buffer to form aqueous fine flowers powder. | diabetic human blood sample                | The obtained results support whole in vivo antidiabetic activity of the extracts that may confirm the be of therapeutically important to improve the organization of diabetes.                                    | [21]      |
| a) Antidiabetic Activity  | Flower            | Ethyl acetate and chloroform extracts | alloxan-induced and normal diabetic Wistar albino rats | Acidic proteases from Calotropis gigantea showed anti-diabetic activity.                                                                                                                                   | [22]      |
| 7) Wound healing activity | Root              | methanolic extract       | Male Wistar rats                           | The latex extract of calotropis gigantean treated wounds are establish to epithelise quicker as compared to controls.                                                                                  | [23]      |
| 8) Wound healing activity | Latex             | Latex extract            | albino rats by excision and incision wound models | The latex extract of calotropis gigantean treated wounds are establish to epithelise quicker as compared to controls.                                                                                  | [24]      |
| a) Sedative and anxiolytic effects | Leaves | Aqueous extract          | Animal behaviour model in mice             | The latex extract of calotropis gigantean treated wounds are establish to epithelise quicker as compared to controls.                                                                                  | [25]      |
| b) Antidepressant activity | Root              | methanolic extract       | Male Wistar rats                           | Calotropis gigantea might be potential therapeutically active drug for treating asthma.                                                                                                                  | [26]      |
| 9) CNS activity           | Peeled root       | Alcoholic extract        | Eddy’s hot plate method using albino rats at different dose level of CNS activity. | Alcohol extract of the peeled roots retains anxiolytic, Anticonvulsant, analgesic and sedative activity.                                                                                     | [27]      |
The anti-diarrheal effect of aerial part of hydroalcoholic (50:50) extract of *Calotropis gigantea* was studied by Chitme H.R. concluded that the aerial part extract having the diarrheal effect is a significant decrease in the amount of jerk and stay in paw licking time. The extract also show 100% efficiency at the amount of 12.5 mg/kg dose when administered in the Days 1-5 and 1-7 post costume schedules. As the concentration of extract increases the anti-diarrheal effect increases and it also enhance retin important antitumor activity. The result of *calotropis gigantea* significantly reduced the fever and body temperature was Regulated at the dose of 200 and 400 mg/kg body weight. The flower extract also repairs the haematological and biochemical parameters (ALP, SGPT and SGOT, glucose, cholesterol, triglyceride, blood urea,) that wassulated throughout tumour progression, at 200 mg/kg body weight dose extract display the greatest Action. The flower extract was also utilized for the growth of new anticancer drug leads. The extract also show 100% efficiency at the amount of 12.5 mg/kg dose when administered in the Days 1-5 and 1-7 post costume schedules. As the concentration of extract increases the antitumor activity increases and it also enhances antitumor activity. The result of *calotropis gigantea* significantly reduced the fever and body temperature was Regulated at the dose of 200 and 400 mg/kg body weight. The flower extract also repairs the haematological and biochemical parameters (ALP, SGPT and SGOT, glucose, cholesterol, triglyceride, blood urea,) that was altered throughout tumour progression, at 200 mg/kg body weight dose extract display the greatest Action. The flower extract was also utilized for the growth of new anticancer drug leads.

**1) Anti Diarrheal Activity**: [10, 11]

The anti-diarrheal effect of aerial part of hydroalcoholic (50:50) extract of *Calotropis gigantea* was studied by Chitme H.R. concluded that the aerial part extract having the anti-diarrheal effect but for the best results additional studies are necessary to completely know the mechanism of anti-diarrheal action of *C. gigantea* extract.

**2) Antimicrobial Activity**[12-19]

The antibacterial effect of *Calotropis gigantea* leaf extract by using Well plate method against certain Gram positive (B. subtilis, M. luteus, S. aureus) and Gram negative (K. pneumoniae, P. vulgar and E. coli) bacteria was studied by Argal A result shown that dichloromethane and Ethyl acetate extracts exhibited better and broader spectrum of activity when compared to other extracts.

**3) Wound Healing Activity**[20-30]

The therapeutic activity of *Calotropis gigantea* root bark was studied for wound healing effect in rats was examined with the help of excision, incision and dead space wound healing models by Deshamukh P. T. and from the study he concluded that *Calotropis gigantea* enhanced the wound healing effect in rats.
4) **Antidiabetic Activity** [23, 24]

Fresh flowers of *Calotropis gigantea* plant were harvested and gathered early in the morning and macerated with liquid nitrogen and dissolved in PBS (pH 5) buffer to form aqueous fine flowers powder. He studied the activity on human blood sample and concluded that acidic proteases from *Calotropis gigantea* showed anti-diabetic activity.

5) **Asthma** [25]

Study has shown that methanolic extract of root tested on Male Wistar rats CGigantea proved potential therapeutic drug for treating asthma owing to its anti-inflammatory, anti-lipoxygenase and antioxidant activity.

6) **CNS activity** [26-28]

The alcoholic extract of *Calotropis gigantea* peeled roots possesses sedative, anxiolytic, anticonvulsant and analgesic activity tested by Eddy’s hot plate method on albino rats but constituents responsible for activity are still unknown.

7) **Hepatoprotective effects** [29]

The hepatoprotective effect of *calotropis gigantea* stem ethanolic extract of on Wistar albino rats study showed that it lower the lipid peroxidation and enhanced serum biochemical parameters such as ALT and AST.

8) **Analgesic activity** [30]

The analgesic effect of flower alcoholic extract on thermal models in mice. He concluded that the flower produced significant decrease in the amount of jerk and stay in paw licking time.

9) **Pregnancy interceptive properties** [31]

The pregnancy interceptive activity of calotropis gigantean root extract was studied on rat to by Srisastava S. R. And from the results he concluded that The root extract exhibited 100% effectiveness at the dose of 12.5 mg/kg when administer in the Days 1-5 and 1-7 postcoitum schedules.

10) **Antioxidant activity** [30]

The leaves hydrochloric extract studied on in-vitro models like DPPH (1,1-Diphenyl-2-Picryl-Hydrazyl) free radical scavenging effect. The study shows that the antioxidant activity of the calotropis gigantea extract was found to enhance with increasing of concentration.

11) **Antitumor activity** [32]

The antitumor activity of the methanolic extract of root bark tested on Swiss albino mice for and concluded that C. gigantea root bark Methanol extract and its chloroform soluble portion possesses significant antitumor activity.

12) **Anti-pyretic activity** [30]

The Water : ethanol extract of root was studied on yeast and typhoid vaccine induce pyrexia in albino Swiss rat and rabbits and the effect of this study At the dose of 200 and 400 mg/kg body weight/intraperitoneal injection) extract considerably lower the fever and body heat was normalized.

13) **Cytotoxic activity** [17, 33]

Cytotoxic activity of flower extract in ethyl acetate was studied carcinoma in mice. The extract restores the haematological and biochemical parameters (ALP, blood urea, cholesterol, glucose, triglyceride, SGOT and SGPT) that was changed through tumour sequence, at the dose 200 mg/kg body weight extract show themost excellent activity.

14) **Anti venom activity** [34]

*Calotropis gigantea* Methanolic extract was used to study the antivenom effect on Wistar albino rats, and Swiss albino mice and current study confirms the strong anti snake venom effect of methanolic extract of C. gigantea.

15) **Free radical scavenging activity** [30]

The free radical scavenging activity studied on Leaf ethanolic extract or latex 1,1DiphenylPicrylhydrazyl radicals The latex extracts C. gigantea shows betterability to scavenge DPPH radicals whereas leaf extract showed reasonable free radical scavenging activity.

16) **Antitussive activity** [36]

Jalilwala Y.A. studied the flower extract of *Calotropis gigantea* for its antitussive effect of by using the method Albino Wistar rats, guinea pigs and mice and concluded that Aqueous extract of *Calotropis gigantea* has shown important antitussive effect.

17) **A Novel Insect Anti feedant Non protein Amino Acid** [38]

A nonprotein amino acid, has been isolated from arooot bark methanol extract of *Calotropis gigantea* and its structure recognized by spectroscopic methods. It show a important anti feedant activity next to nymphs of the desert locust Scistocercagregaria.

**CONCLUSION**

From the above study the obtained results in this work show the diversity of medicinal effects of C. gigantea. The wide-ranging pharmacological outline exposed by *Calotropis gigantea* plant should be operated by the pharmaceutical industry for the improvement of novel drugs, so the beneficial arsenal for many diseases could be extended benefit to humankind.

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