

Review on *Calotropis gigantea*

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ABSTRACT:

Calotropis gigantea, members of the Asclepiadaceae family. There have been reports of *Calotropis gigantea*, in a number of locations around Asia. The phytochemical makeup, bioactive components, and medicinal applications of these plants are covered in detail in this article. To get a deeper comprehension of these distinct plants, the vegetative and floral traits of *Calotropis gigantea*, have been distinguished. There are examples of the pharmacological and medical uses of *Calotropis gigantea*,

Key words : *Calotropis gigantea*, Asclepiadaceae, Polyphenols, Terpenes & Flavonoids

I. INTRODUCTION

Over the millennia, Indian medicine has been an integral component of Indian culture and tradition [1]. Any plant that contains all or most of a chemical that has therapeutic value or that serves as

a starting point for the creation of effective medications is considered medicinal. A plant is classified as a "Medicinal plant" if it has medicinal qualities or has positive pharmacological effects on an animal's body [2, 3]. One of the most sought-after medicinal plants is *Calotropis*. *Calotropis* is a member of the family Asclepiadaceae. Three species of *Calotropis* plants—*Calotropis gigantea*, *Calotropis procera*, and *Calotropis acia*—have been recognized for their medicinal qualities, according to the International Plant Name Index (IPNI) [4].

Calotropis gigantea is a shrub that grows in several forms. This salt-tolerant, drought-resistant weed is common along highways and lagoon borders. It is used to treat piles, rheumatism, indigestion, cold fever, scalp ringworm, swelling, and soreness. Various plant components, including the leaves, roots, bark, flowers, and latex, include analgesic, antimicrobial, anti-candida, anti-nematicide, and wound-healing properties. (5).



Figure 1: *Calotropis gigantea*

Taxonomic Classification:

Table:1 Systematic position of *Calotropis gigantea*[6,7]:-

Classification	<i>Calotropis gigantea</i>
Kingdom	Plantae – Plants
Sub kingdom	Tracheobionta-Vascular plants
Super division	Spermatophyta-Seed plants
Division	Mangliophyta-Flowering plants
Class	Mangliopsida-Dicotyledons
Sub class	Asteridae
Order	Gentianales
Family	Apocynaceae
Sub Family	Asclepiadoideae
Tribus	Asclepiadeae
Sub Tribus	Asclepidinae
Genus	CalotropisR.Br-Calotropis
Species	Calotropis gigantea

Table:2 Vernacular Names:[8,9,10,11,12,13,14]

Languages	<i>Calotropis gigantea</i>
English	Crown flower, Asclepiadaceae gigantea, Giant Calotrope, Swallow-wort, Giant Milk weed, Kapal-kapal, bowstring hemp
Tamil	Erukku,Malaiyerukku, Arrkam, Yerkkku
Hindi	Aaka, Safed Aak
Sanskrit	Alanka, Arki,Sadapushpa, Hrasvagnih, Arka, Aditya
Malayalam	Erikkalachedi, Dinesam, Vellerikk, Vellaerriku, Chuvanneerikk
Telugu	Jilledi Puvvu, Uhcinta, Nallajilledu, Uccinta
Kannada	Ekka, Ekkemale
Maruthi	Arki, Rui,Ruiti, Lal Arka
Gujarati	Akondo
Manipuri	Angkot
Nepali	Aank, Madaar
Assamese	Akonda, Akon
Turkish	Ipekag
Spanish	Lechoso
French	Faux arbre de soie, Mercure vegetal
Malaysia	Remiga, Rebinga,Kemengu
Thai	Po thuean, Paan Thuean,Rak
Vietnamese	B[oot]ng b[oot]ng, l[as]hen, Namt[ot]b[at], Bang bien.
Arabic	Ushar
Japanese	Rubik
Laos	Kok may, Dok kap, Dok hak
Italian	Calotropo
German	Kronenblume, Madar-Strauch, Mudarpflanze, Akonfaserstrauch
Chinese	Niu jiao gua
Portuguese	Saco-de-velho
Spanish	Mata de sela, Alogon de seda

Table:3 Vegetative Character Of Calotropis gigantea,:[15,16]

Vegetative Characters	Calotropis gigantea
Habit and Habitat	It is a shrub or a small tree about 4m tall. Crown flower grow in any habitat, but it thrives in hot, sunny and dry environment, including the areas near the coast that are exposed to salt.
Stem	They are erect, branched and herbaceous
Root	They are simple, branched and woody at the base and covered with a fissured, corky bark. Branches are succulent. They are covered with tomentose (covered with densely matted hairs) when the plants are tender and in later stage they become glabrescent and glaucous.
Bark and Branches	The bark is raked and corky. They grow wild on a variety of soil in different climates.
Leaves	They are obovate or oblong, sessile or with petiole. 0.2-0.7mm long; lamina elliptic to oblong, 10cm long, 3 to 8cm wide, cordate to articulate, acute to round. Colleters 19 or 20 pointed at the tip and heart shaped at the base.
Flowers	They have a faint odour, downy on outside, arranged in axillary or sub terminal. They have simple or compound inflorescence.

Ecology and Distribution

Natural habitat

Calotropis grows naturally up to 900 meters (msl) across the nation [17], is somewhat tolerant of salt, and likes disturbed sandy soils with 300–400 mm of mean annual rainfall. It swiftly establishes itself as a weed along deteriorated roadsides, lagoon borders, and in overgrazed native grasslands thanks to the seeds it disperses via wind and animals. It prefers and frequently takes over abandoned agricultural sites, particularly those with disturbed sandy soils and little rainfall. It's thought to be a sign of excessive farming [18].

The Primary attributes

In a range of soil types and environmental circumstances, the plant grows extremely well. Cultivation procedures are not necessary. Among the few plants that grazing animals do not eat is this one. It is especially happy on poor soils when native grasses have been driven out of competition due to overgrazing. Sometimes in places when nothing else grows, this plant is the sole one that survives. It is resistant to dehydration and the first plant to appear in desert soil. The xerophytic adaptations include latex production, a highly branching root system, and thick, waxy leaves. Thus, it may be found all throughout India and in tropical and subtropical regions of the world.

Geographic distribution :

India, China, and Malaysia are the nations where it is native. It is dispersed in Afghanistan,

Algeria, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Gambia, Ghana, Guinea-Bissau, India, and Iran. Iraq; Israel; Kenya; Kuwait; Lebanon; Libya; Arab Jamahiriya; Mali, Mauritania; Morocco; Mozambique; Myanmar; Nepal; Niger; Nigeria; Oman; Pakistan; Saudi Arabia; Senegal; Sierra Leone; Somalia, Sudan; Syrian Arab Republic; Tanzania; Thailand; Uganda; United Arab Emirates; Vietnam; Yemen; Republic of Zimbabwe Exotic: Antigua and Barbuda, Colombia, Ecuador, French Guiana, Grenada, Guadeloupe, Guatemala, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Puerto Rico, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Surinam, Bolivia, Brazil, Chile, Trinidad and Tobago, Uruguay, Venezuela and Virgin Islands (US) [18].

Propagation and management :

Naturally occurring regeneration is widespread, and the seeds float freely in the air. Large-scale replication of better genotypes can be achieved by vegetative propagation using stem and root cuttings. Calotropis has been grown for its fiber at a distance of 1-1.5 meters in South America and the Caribbean Islands. Annual yields of up to 500 kg/ha are anticipated while cultivating. It is better to have one harvest every season as opposed to two or three, since this would save energy input on the form and in the processing facility. In dry or

semi-arid areas where frost is not a limiting issue, it

works well for intensive energy farming.



Fig:2 Morphological Characters :
 A.Mature fruits, B. dehisized fruits, (C,D), seeds with pappus (E) seeds without Pappus (F)Fiber yaru

Table:4 Floral Characters:[22,23,24,25]

Floral characters	Calotropis gigantean
Flowers	They are composed of bracteate, complete, actinomorphic bisexual, hypogynous, pedicellate and pedicel upto 1-3 cm
Inflorescence	They appear in clusters (umbellate cymes)
Calyx	They consists of five sepals, polypetalous, five lobed, shortly united at the base, glabrescent quincinal aestivation.
Corolla	They have five petals gamopetalous, five lobed, twisted aestivation
Androecium	They have five stamens, gynadrous, and anther ditheous and coherent.
Gynoecium	They have bicarpellary apocarpous ovary (having carpels free from each other) and styles are united at their apex. Pellate stigma with five lateral stigmatic surfaces.

Phytochemistry of Calotropis :

Numerous phytochemical compounds, particularly in the leaves of *Calotropis gigantea*, have been documented by earlier researchers. There are additional substances reported to be present, including usharin, gigantol, calcium oxalate, alpha and beta-calotropin, beta-amyrin, fatty acids (both saturated and unsaturated),

hydrocarbons, acetates, and benzoates; a combination of tetracyclic triterpene compounds, terols, giganteol, and giganteol [26,27, 28]. Numerous activities of this compound are caused by cardenolide calotropin [29], α -amyrin, β -amyrin, taraxasterol, β -sitosterol, α -amyrin methylbutazone, β -amyrin methylbutazone, α -amyrin acetate, β -amyrin acetate, taraxasteryl acetate, lupeol acetate

B, gigantursenyl acetate A, gigantursenyl acetate B, flavonol glycoside, akundarol, uscharidin, calotropin, frugoside, and calotroposides A to G [32]. Calactin, calotoxin, calotropagenin, proceroside, syriogenine, uscharidin, uscharin, uzarigenin, and voruscharin are other cardenolides that have been reported in the literature [33, 34, 35]. Benzoylisolineolon and benzoyllineolone are additional chemicals that were discovered [36]. Various components of the plant *Calotropis gigantea* have been used to separate flavonoids, triterpenoids [37], alkaloids, steroids, glycosides,

saponins, terpenes, alcohol, resin, fatty acids and esters of calotropeols [38], volatile long chain fatty acids, glycosides, and proteases [39]. The enzymes cysteine proteinase and aspartic proteinase were shown to exhibit significant proteolytic activity in the laticifer fluid of *Calotropis* [40]. These elements give the plants resistance against insects and phytopathogens, especially in the leaves where there is a lot of latex circulation. The plant's milky latex contains high concentrations of calotoxin, lupeol, calotropin, and the latex protein uscharidin.

Table:5 Phytochemical components in *Calotropis* [41]

Sl. No	Class of Compounds	Plant Part			Tests performed
		Flower	Bud	Root	
1.	Alkaloids	+	+	+	Dragendorff's test, Mayers test
2.	Carbohydrates	+	+	+	Molish test, Fehling test
3.	Glycosides	+	+	+	Keller killiani test
4.	Phenolic compounds/tannins	+	+	+	Ferric chloride test
5.	Proteins and amino acids	+	+	+	Xantho protein test
6.	Flavanoids	+	+	+	Ammonia test
7.	Saponins	+	+	+	With water With Na ₂ CO ₃
8.	Sterols	+	+	+	Liebermann-Burchard test, Salkowski reaction, Hesse's reaction
9.	Acid compounds	+	+	+	With Na ₂ CO ₃ , With litmus paper
10.	Resins	+	+	+	With double distilled water, With acetone and conc. HCl
11.	Peroxides	-	-	-	Potassium Iodide test
12.	Polyuronoids	-	-	-	Haemotoxylin test

Phytochemical Studies of *Calotropis* species:

Table:6 The phytochemical studies of *Calotropis gigantea*, have been tabulated.

Calotropis gigantea [42,43,44]					
Aqueous extract	Methanolic Extract		Ethanolic Extract		Benzene Extract
Root	Root	Leaves	Stem	Root	Root
+	+	+	+	+	+
+	-	-	+	+	-
+	-	+	-	+	+

+	-	+	-	-	+
+	-	+	-	+	-
+	-	+	-	+	+
+	+	-	+	-	-
-	+	+	+	-	+
-	+	+	+	-	-
+	-	-	+	+	-
-	+	+	-	-	+

Table:7 Bio active compounds extracted from Calotropis gigantea

Sl. no	Compounds	Common name or IUPAC name of the compound	Calotropis gigantea
1	Phytol[47]	3,7,11,151-tetramethyl-2-hexadecen1-ol	Present
2	6,10,14-trimethyl-2-pentadecanone[47]	Farnesyl acetone	#
3	3,7,11,15-tetramethyl-2-hexadecene-1-ol[47]	Phytol	Present
4	3-Buten-2-one-4,2,6,6-trimethyl-1-cyclohexenyl[47]	Cyclocitryideneacetone	#
5	1-Nonadecene[47]	Nondec-1-ene	#
6	5,9,13-pentadecatriene-2-one6,10,14-trimethyl[47]	Farnesyl acetone	#
7	Z-5-Nonadecene[47]	(Z)-nonadec-5-ene	#
8	Hexadecanal[47]	Palmitaldehyde	#
9	9-Nonadecene[47]	(E)-9-Nondecene	#
10	Octadecadienal[47]	Linoleyl aldehyde	#
11	1-Hexadecanol-2-methyl [47]	2-Methylhexadecan-1-ol	#
12	4,8,12,16-Tetramethylheptadecan-4-olide[47]	2(3H)-Furan one	#
13	2-Butanone-4,2,6,6-trimethyl-1-cyclohexen-1-yl [47]	Dihydro-beta-ionone	#
14	3-O-{1-rhamnopyranosyl(1→2)-β-D-glucopyranoside}(1→2)-β-D-glycopyranosyl-(1→3)-β-D-glucopyranoside]-3β-hydroxyolean-12-ene-oic acid [48]	Oleanolic acid	#
15	3β-Hydroxy olean-12-ene-28-oic acid-28-O-β-D-glucopyranoside [48]	Oleanolic acid	#
16	Furan-2-carbaldehyde [49]	Furfural	Present
17	3-Hexyn-1-ol[49]	Cis-3-Hexen-1-ol;Blatteralkohol	Present
18	Gentanol[49]	Heptan-1-ol	Present
19	Benz aldehyde[49]	Melonol	Present

20	2-Methyl-6-hepten-1-ol [49]	6-Hepten-1-ol,2 methyl	Present
21	6-Methyl-5-hepten-2-ol [49]	Sulatacol	Present
22	(+) β -citronellene [49]	D-Rhodinol	Present
23	4-methyl-1-heptenol [49]	Isobutylene	Present
24	Cis-Linalool oxide [49]	Linalool oxide-B	Present
25	2,2,6-Trimethyl-1,4-cyclohexandione [49]	Tetrahydro-2,2,6trimethyloxane	Present
26	Phenethyl alcohol [49]	Benzyl alcohol	Present
27	Oct-3-en-2-ol [49]	CIS-3-Oct-1-ol	Present
28	3-Thiophenemethanol [49]	Thiophen-3-ylmethanol	Present
29	n-Eicosane	Icosane	Present
30	Tetradecanoic acid, trimethyl ester[49]	Methyl myrisate	Present
31	Diisobutyl phthalate[49]	1,2-benzene dicarboxylic acid, bis(2- methyl propyl) ester	Present
32	Stearic acid[49]	Cetylacetic acid	Present
33	n-Tetracosane[49]	Lignocerane	Present
34	n-Docasane[49]	Heneicosane	Present
35	DL-Menthol[49]	Bis(hydroxymethoxy)ethane	Present
36	Nerol [49]	Cis-Geraniol	Present
37	α -Terpiene [49]	1-Isopropyl-4-methyl-1,3-cyclohexadiene,p-Menth-1,3,diene	Present
38	Undecane[49]	Hendecane	Present
39	2,3,epoxygeranyl acetate[49]	6,7-Epoxy-3,7-dimethyl-2-octene-1-ol acetate	Present
40	2,4-dimethyl-Acetophenone[49]	Ethanone6	Present

Medicinal applications and Pharmacological activities of Calotropis gigantea

Anti bacterial activity :

Methanol extract from Calotropis gigantea leaves was tested for its antibacterial properties in vitro against Salmonella typhi, Pseudomonas fluorescens, Pseudomonas aeruginosa, and Escherichia coli. This investigation unequivocally demonstrated that Calotropis gigantea positively impacted Pseudomonas fluorescens. Research on the growth and survival dynamics of Xanthomonas campestris, Staphylococcus aureus, Candida albicans, and Escherichia coli using ethanolic extracts of apical buds and flowers has revealed that Calotropis gigantea grows more quickly than S. aureus, C. albicans, and E. coli. Calotropis gigantea exhibited the maximum zone of inhibition against Escherichia coli, while the lowest inhibition was observed against Klebsiella pneumonia, according to the antagonistic activity of the aqueous extract against Staphylococcus aureus, Escherichia coli, Bacillus cerus, Pseudomonas aeruginosa, Micrococcus luteus, and Klebsiella pneumonia.[50]

Hepatoprotective activity:

By causing liver damage in Wistar rats with D-galactosamine, the alcoholic extract of Calotropis gigantea's root and bark suspended in 0.6% carboxymethyl cellulose (CMC) was tested for hepatoprotective effects. (51).

Cytotoxicity:

According to the results of a sub-acute toxicity study using ethanolic and methanolic extract of Calotropis gigantean latex over a 28-day period in mouse models, the latex is thought to be a phyto medicinal therapeutic agent because it does not cause sub-acute toxicity up to a dose of 1000 mg/kg body weight per day.(52,53,54,55,56,57)

Anti-diarrhoeal activity:

In rats, castor oil-induced diarrhoea was tested against the hydroalcoholic extract of Calotropis gigantea aerial parts. The results showed that the extract has anti-diarrheal properties against castor oil-induced diarrhoea in a variety of diarrhoeal states. * [58, 59,60,61]

Control of Struvite crystals:

Crystals of struvite composed of magnesium phosphate, calcium phosphate, and calcium oxalate. The findings demonstrated that the development and nucleation rate of Struvite crystals were lowered by an increase in the content of *Calotropis gigantea* leaf methanol extract. Using HPTLC and NMR methods, the chemical was discovered, isolated, and characterized. In [62]

Economic importance of calotropis species :

The plant's many components offer enormous promise for treating a wide range of illnesses. It is a component of many polyherbal concoctions. More than a hundred actions have been thoroughly detailed by Duke. *Calotropis* treats a range of illnesses in people and animals, both alone itself and occasionally in combination with other plants.

1. *Calotropis* spp. binds soil and keeps it from eroding. It's also used for mulching and as green manure.[63]:
2. *Calotropis* spp., leaf, and latex extracts are utilized to test for nematode activity.[63]:
3. *Calotropis gigantea* bark yields fine fiber that is used to make fishing nets, bowstrings, and textiles. It may be combined with other fibers to produce clothing and used to manufacture cushions.[64, 65]

II. CONCLUSION

Phytochemical analysis were performed on of *Calotropis gigantea* Correct identification, characterization, and other significant discoveries should be aided by the results of these research. With the recognized characteristics, a typical of *Calotropis gigantea* profile may be made. The outcomes of preliminary phytochemical investigations may provide direction for the isolation and refinement of lead compounds that are indicated for use in traditional medicine. Additionally, because of *Calotropis gigantea* is a safe and effective herbal remedy, the current review highlights the herb's chemical components, pharmacological activity, and therapeutic value.

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