



Calotropis procera: A comprehensive Review of its uses and Ecological significance

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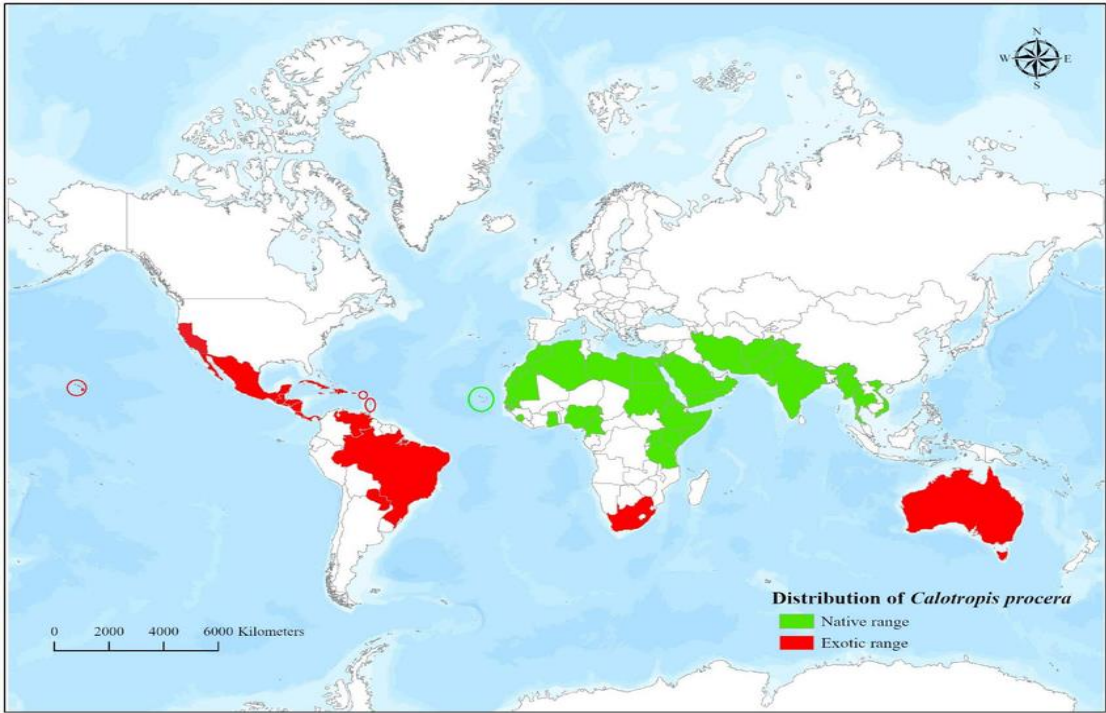
Abstract

Plants are significant sources of many drugs we use today, with *Calotropis procera* being particularly rich in beneficial phytochemicals. Each part of this plant contains various compounds valuable for human health. The phytochemical profile of **Calotropis procera** reveals the presence of triterpenoids, anthocyanins, flavonoids, cardiac glycosides, cardenolides, α -amyrin, β -amyrin, lupeol, β -sitosterol, flavanols, mudarin, resin, the potent bacteriolytic enzyme calactin, and the non-toxic proteolytic enzyme calotropin. This plant exhibits a wide range of pharmacological effects, including antimicrobial, anthelmintic, anti-inflammatory, analgesic, antipyretic, anticancer, antiangiogenic, immunological, antidiabetic, cardiovascular, hypolipidemic, gastroprotective, hepatoprotective, renal protective, antidiarrheal, antioxidant, anticonvulsant, and wound-healing properties. This review aims to consolidate the phytochemical and pharmacological activities of *Calotropis procera*.

Key word: Cytotoxicity, melanoma, Glioblastoma, Hela cell lines, Neuritis, Hydrocele, *Calotropis procera*

1. Introduction:

Calotropis procera is a soft-wooded, evergreen, perennial shrub from the family Apocynaceae. This xerophytic plant thrives in arid and semi-arid regions, typically in dry, sandy, and alkaline soils. It is widely found in India, Malaysia, and Indonesia. There are two main species of *Calotropis* documented in literature: *C. procera* and *C. gigantea*. Ancient Hindu texts, specifically the *Dhanvantari Nighantu*, mention three varieties of *Calotropis*: *suklarah*, *rajarkah*, and *sveta mandarrah*. Among these, *sveta mandarrah* is the variety most commonly used in traditional Indian medicine (Sharma *et al.*, 2011). The genus name "*Calotropis*" originates from a Greek word meaning "beautiful," likely alluding to its flowers, while "*procera*" is a Latin term that refers to the cuticular wax present on the plant's leaves and stems. (Rowailly *et al.*, 2020)



Worldwide-distribution-of-Calotropis-procera

1.1 Plant profile: *Calotropis procera* (commonly known as Raktha Arka) is an upright, tall, and heavily branched perennial shrub, reaching a height of 4–5 meters and characterized by milky latex throughout. The flowers measure between 5–20 cm in length and 4–6 cm in width, are regular and bisexual, and display shades of purple or light greenish-yellow with a faint aroma, typically appearing in pairs. The stem is yellowish-white, furrowed, and rough, with stout branches. The leaves are opposite, decussate, elliptic-oblong, sessile, and range from 10–20 cm in length and 3.8–10 cm in width, featuring a thick, pale green color and acute tips. Its spongy fruits contain light brown seeds measuring approximately 6 × 5 mm. (Al-Snafi *et al.*,1999)

Kingdom	Plantae
Sub kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyte
Class	Magnoliopsida
Subclass	Asteriidae
Order	Gentianales
Family	Asclepiadaceae
Genus	<i>Calotropis</i>
Species	<i>Calotropis procera</i>

Table 1: Taxonomic classification



Fig: *Calotropis procera*

2. Unique Characteristics of *Calotropis procera*

2.1 Toxicity of *Calotropis procera*

The plant secretes a milky, toxic latex known as "vegetable mercury" due to its mercury-like effects on the human body. While all parts of the plant are toxic, the latex in the stem and roots is particularly poisonous (Gupta *et al.*, 2012). Contact with the latex can cause keratoconjunctivitis, corneal edema, and blurred vision without associated pain if it enters the eyes. Additionally, this

latex can lead to hepatocellular degeneration in the liver, brain congestion, dilation of central veins, underdeveloped kidneys, and sinusoidal dilation (Meena *et al.*, 2011).

2.2 Defense Mechanism

The glycosides calactin and uscharin, found in the plant's latex and leaves, are naturally toxic. When the plant is attacked by grasshoppers or insects, the concentration of calactin increases as a defense mechanism. This toxicity deters cattle and other grazing animals from consuming the plant (Akhkhaetal., 2009).

2.3 Adaptation for Survival in Arid Conditions

An intriguing feature of this plant is its capacity to withstand challenging environmental conditions, such as water scarcity, arid climates, and other harsh weather, as noted in the research article by (Misra *et al.*, 1993).

Plant part	Disease	Preparation/administration	References
Root	Jaundice	Taken with rice in grounded form	Anonymous 1956
	Snakebite	Powder orally taken. Paste applied on wounds and internally taken with ghee	Garg <i>et al.</i> , 1986 and dastur 1970
	Amoebic dysentery	Paste with/without opium taken orally	Misra <i>et al.</i> , 1993
Latex	Boils	Applied externally	Jain <i>et al.</i> , 1973
	Leprosy	Applied on the affected area	Garg <i>et al.</i> , 1986
	Migraine	Applied on the affected side vein of forehead	Misra <i>et al.</i> , 1993

Leaf	Cold,cough,as thma and bronchitis	Warmed along with ghee and bandaged on the chest of infants	Misra <i>et al.</i> ,1993
Flowers	Cough	Burnttoproduceash,thentakenwithhoney	Misra <i>et al.</i> ,1993
	Epilepsy	Oraladministrationofpastewithblackpepper	Jain <i>et al.</i> , 1973
Fruit	Anemia	Mixedwithsamequantityofredchilli,mineralsaltandtak en with milk	Jain <i>et al.</i> , 1973
Whole plant	rheumatic pain and hyperacidity	Aste directly taken	Misra <i>et al.</i> ,1993

Table 2: Ethnomedicinal Uses of *Calotropis procera*

2.4 Cytotoxic Effects of *Calotropis procera*

2.4.1 Antiproliferative Effects of *Calotropis procera* Stem Extracts The cytotoxic potential of *Calotropis procera* stem organic extracts was initially assessed against cancer cell lines using the MTT assay by Hemerson *et al.* (2010). Extracts found to be cytotoxic were further tested for antimitotic activity on sea urchin egg development and in vivo antiproliferative effects in mice with Sarcoma 180 tumors. Among the five extracts (hexane, dichloromethane, ethyl acetate, acetone, and methanol), ethyl acetate and acetone showed the highest cytotoxicity against tumor cells, with IC₅₀ values ranging from 0.8 to 4.4 µg/mL, while the methanol extract displayed weaker cytotoxicity. Ethyl acetate extracts also demonstrated the ability to inhibit cell division in the antimitotic assay, with IC₅₀ values below 5 µg/mL.

2.4.2 Cytotoxic activity of root bark of *Calotropis procera*

A study found that the methanolic extracts of *Calotropis procera* root bark contain a novel cardenolide, 2-Oxovoruscharin, which demonstrates in vitro anti-tumor activity against a panel of 57 human cancer cell lines, similar to the effects of Taxol. Additionally, the root bark has shown significant in vivo tolerance to tumor growth and extended survival in human xenograft models using nude mice (Quaquebeke *et al.*, 2005).

2.4.3 Anti-tumor activity of root extract of *Calotropis procera*

Mathur *et al.* (2009) investigated the anti-tumor potential of *Calotropis procera* root extracts against Hep 2 cancer cells. They tested methanolic, hexane, ethyl acetate, and aqueous root extracts, assessing cellular proliferation using tetrazolium bromide (MTT) colorimetry. The study concluded that the root extracts of *Calotropis procera* inhibit Hep 2 cell proliferation through mechanisms involving apoptosis and disruption of the cell cycle.

2.4.4 Cytotoxic Effects of *Calotropis procera* on Human Skin Melanoma Cells (sk-MEL-2)

Aparna L. Joshi *et al.*, 2015 reported that the cardiac glycosides in *Calotropis procera* are cytotoxic to human skin melanoma cells (sk-MEL-2). When SK-MEL-2 cells were treated with *C. procera* methanolic extract (CPME), growth inhibition and apoptosis were observed. Cell cycle analysis revealed that CPME-treated cells were arrested at the G₂/M phase. The significant cytotoxic activity of CPME against SK-MEL-2 cells is likely due to its high content of cardenolides.

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