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A COMPREHENSIVE REVIEW ON PLANT *CALOTROPIS GIGANTEA*

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ABSTRACT

Many drugs commonly used today are of herbal origin. Indeed, about 25 percent of the prescription drugs dispensed in the United States contain at least one active ingredient derived from plant material. Some are made from plant extracts; others are synthesized to mimic a natural plant compound. *Calotropis gigantea* (Crown flower) is a species of *Calotropis* native to Cambodia, Indonesia, Malaysia, Philippines, Thailand, Sri Lanka, India and China. Belongs to family Asclepiadaceae. *Calotropis* is a genus of plants that produce milky sap hence also commonly called milkweed. The milky white endogenous latex, produced by the plant in appreciable amount, exhibits a variety of effects in various animal models. On oral administration, the latex produces potent anti-inflammatory, analgesic, and weak antipyretic effects, while on local administration it induces an intense inflammatory response in animal models. Traditionally the dried root is powdered and effectively used to cure bronchitis, asthma, leprosy, eczema and elephantiasis. Its milky latex is rich in lupeol, calotropin, calatoxin and uscharin. Latex also contains cardiac glycosides, calotopin, uscharin, calotoxin, calactin, gigantin and uscharidin.

INTRODUCTION TO FAMILY ASCLEPIADACEAE[1 to 3]:

Asclepiadaceae is the milkweed family of the flowering-plant order Gentianales, including more than 280 genera and about 2,000 species of tropical herbs or shrubby climbers, rarely shrubs or trees. Most members of the family have milky juice, flowers with five united petals, podlike fruits, and, usually, tufted seeds. The silky-haired seeds are drawn out of their pods by the wind and are carried off. Male and female parts of each flower are united in a single structure. The pollen is massed in bundles called pollinia, pairs of which are linked by a yokelike bar of tissue contributed by the stigma of the pistil. Parts of the pollinia stick to visiting insects, which then carry them to other flowers. In some species the fertility is low, and many-flowered plants often produce few fruits.

INTRODUCTION TO GENUS *CALOTROPIS*[4,5]*:*

Calotropis is a genus of plants that produce milky sap hence also commonly called milkweed. It is considered a common weed in some parts of the world. The flowers are fragrant and are often used in making 'floral tassels' in some mainland Southeast Asian cultures. Fibers of these plants are called mudar or mader. The plant is known as aak in Ayurveda. The latex is said to have a mercury-like effects on the human body, and is sometimes referred to as vegetable mercury and is used in place of mercury in aphrodisiacs. It is used variously but sometimes leaves are fried in oil for medicinal purposes. The calotropis plant is usually found in abandoned farmland. Cattle often stay away from the plant because of its unpleasant taste and due to presence of Cardiac Glucosides in its sap. Root bark has Digitalis like effect on the heart, but was earlier used as a substitute of ipecacuanha. It is a poisonous plant; calotropin, a compound in the latex, is more toxic than strychnine. Calotropin is similar in structure to two cardiac glycosides which are responsible for the cytotoxicity of *Apocynum cannabinum* L. Extracts of flower of Calotropis procera has shown a strong cytotoxic activity in the patients of colorectal cancer. They are harmful to the eyes.

Propagation: "Seeds spread by wind and water over large distances. Local stands increased in size by suckering. Also spread as an ornamental plant."

Native range: Sri Lanka, India, China and Malesia.

Plant reproduction is the production of new individuals or offspring in plants, which can be accomplished by both sexual and asexual means. Sexual reproduction produces offspring by the fusion of gametes, resulting in offspring genetically different from the parent or parents. Asexual reproduction produces new individuals without the fusion of gametes, genetically

identical to the parent plants and each other, except when mutations occur. In seed plants, the offspring can be packaged in a protective seed, which is used as an agent of dispersal.

The genus *Calotropis* have following four species:

1. *Calotropis gigantea*
2. *Asclepias tuberose*
3. *Asclepias syriaca*
4. *Calotropis procera*

INTRODUCTION TO SPECIES *CALOTROPIS GIGANTEA*[6,7,8]*:*

Calotropis gigantea (Crown flower) is a species of *Calotropis* native to Cambodia, Indonesia, Malaysia, Philippines, Thailand, Sri Lanka, India and China. This species is a large shrub or small tree, about 3-4(-10) m tall. Its stems are erect, up to 20 cm in diametre. The leaves are broadly elliptical to oblong-obovate in shape, with the size of 9-20 cm x 6-12.5 cm but subsessile. The cymes are 5-12.5 cm in diameter. The inflorescence stalk is between 5-12 cm long, the stalk of an individual flower is 2.5-4 cm long. Sepal lobes are broadly egg-shaped with a size of 4-6 mm x 2-3 mm. Petal is 2.5-4 cm in diameter. It has clusters of waxy flowers that are either white or lavender in colour. Each flower consists of five pointed petals and a small, elegant "crown" rising from the centre, which holds the stamens. The plant has oval, light green leaves and milky stem.

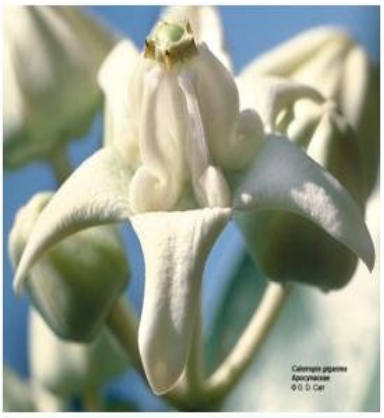
The petal lobes are broadly triangular measuring 10-15 mm x 5-8 mm; they are pale lilac and cream coloured towards the tips. The outgrown like structure from the petal (corona) has 5 narrow fleshy scales, connected to and shorter than the staminal column, forming an upturned horn with 2 obtuse auricles on either side, cream coloured or lilac to purple, with a dense longitudinal dorsal row of short white hairs. The egg-shaped or boat-shaped fruits are mostly in pairs, inflated, 6.5-10 cm x 3-5 cm. The flowers last long, and in Thailand they are used in various floral arrangements. They were also supposed to be popular with the Hawaiian Queen Liliuokalani, who considered them as symbol of royalty and wore them strung into leis. In India, the plant is common in the compounds of temples and is known as Madar. While in Cambodia, they are used in funerals to decorate the urn or sarcophagus and the interior of the house holding the funeral. The fruit is a follicle and when dry, seed dispersal is by wind. This plant plays host to a variety of insects and butterflies. In Indonesia its flowers is called widuri.

Calotropis gigantea is a common weed in open waste ground, roadsides and railway lines, as well as village surroundings. It grows especially on littoral sandy soils and dry uncultivated land, with periodic dry periods.

Ecology[1,8]**:-**

"Crownflower grows anywhere, but it truly thrives in hot, sunny, dry environments, including areas near the coast that receive salt exposure" In Australia, "Found on roadsides, disturbed areas, watercourses, river flats and coastal dunes. Thrives on poor soils particularly where overgrazing has removed competition from native grasses."

Photographs of plant[9]**:**



Scintific classification[1,10]**:-**

Kingdom:	Planatae
Subkingdom:	*Tracheobionta*
Superdivision:	*Spermatophyta*
Division:	*Magnoliophyta*
Class:	Dicotyledones
Sub class:	*Asteridae*
Series:	Bicarpellatae
Order:	Gentianales
Family:	Apocynaceae
Subfamily:	Asclepidiaceae
Genus:	*Calotropis*
Species:	*Calotropis gigantea*

Vernacular Names[11]**:-**

Common names:	Giant Milkweed, Crown Flower, Swallow Wort.
Hindi:	Safed aak, Aak, Alarkh, Madar, Sveta Arka, Akanda, Bara Akand.
Gujarati:	Aakando
English:	Crown flower, giant Indian milkweed. Bowstring hemp, crownplant, madar

Malaysia:	Remiga, rembega, kemengu.
Indonesia:	Bidhuri (Sundanese, Madurese), sidaguri (Javanese), rubik (Aceh).
Philippines:	Kapal-kapal (Tagalog).
Laos:	Kok may, dok kap, dok hak.
Thailand:	Po thuean, paan thuean (northern), rak (central).
Vietnam:	B[oot]ng b[oot]ng, l[as] hen, nam t[it] b[at].
French:	Faux arbre de soie, mercure vegetal.

Parts used [1, 11]:

Root, root-bark, leaves and flowers

Chemical Constituents[11,12]:

Active principle appears to be a yellow, bitter resin. Root bark contains two substances closely resembling alban and fluavil found in gutta-percha. Alkaloids are not present in this plant. Early studies of latex yielded an amorphous, bitter principle, calotropin, identical to mundarin. Latex contains cardiac glycosides, calotopin, uscharin, calotoxin, calactin and uscharidin; gigantin. Also contains the protease calotropin DI and DII and calotropin FI and FII. Study isolated stigmasterol and ß-sitosterol from the dried root bark powder extracts. Its milky latex is rich in lupeol, calotropin, calatoxin and uscharin.

Four new chemical constituents including one naphthalene derivative, named calotropnaphthalene, two terpene derivatives, namely calotropises juiterpenol and calotropisesterterpenol and an aromatic product designated as calotropbenzofuranone along with a known compound, sucrose, have been isolated from the roots of the Calotropis gigantea. The structures of these chemical constituents have been established as 1-methoxy-4-ethyl naphthalene, 6-(2-methyl-2, 3-dihydroxypenty1)-11, 11-dimethyl cyclohex-8-ene-10-one-7-oic isopentenyl ester, 14-(15, 15-dimethyl cyclohexanyl-14, 19, 25-tricyclo)- 3,7,11-trihydroxymethylene-tridecane and 8,15-dihydro benzofuranyl-18-hepta-7,15-dione-16-oic acid, respectively, on the basis of the spectral data analyses and chemical reactions.

Uses[12 to 20]:

Root bark considered emetic, used as substitute for ipecac. Latex is considered bitter, heating, purgative, caustic, acrid, expectorant, depilatory, anthelmintic. The latex calotropin, gigantin and uscharin have digitalis-like action on the heart. Latex used to induce abortion and infanticide. Flowers are considered digestive, stomachic, tonic. In Java, the central part of the flower used to make sweetmeat. Inner part of the flower used for flavoring. Bark in small doses, dried and powdered, used as alterative and tonic; in larger doses, an emetic. The leaves are

useful in the treatment of paralysis, arthralegia, swellings, and intermittent fevers. The powdered root used in asthama, bronchitis, and dyspepsia.Root-bark reported to promote secretions and used for skin diseases, enlargement of the abdominal viscera, intestinal worms, coughs, ascites, anasarca. In India, pulverized root made into ointment, used in the treatment of old ulcers. Root bark and inspissated juiced used for leprosy, syphilis, cachexia, idiopathic ulcerations, dysentery, diarrhea, and chronic rheumatism. Leaves, warmed and moistened with oil, used as dry fomentation for abdominal pains; also, as rubifacient. In India, the acrid milky juice from bruised leaves and stems used for skin affections and as depilatory. Fresh or dried juice from the root-bark taken internally as alterative or purgative. Juice taken internally or locally as abortifacient. A stick smeared with the juice is pushed into the os uteri and left there until uterine contractions are induced. For toothaches, milky juice mixed with salt used for toothache; or juiced cotton inserted in the decayed tooth. Juice of young buds used for earache. Milky juice used for ringworm of the scalp, sinus problems and anal fistula; also used for pile, and mixed with honey for aphthae of the mouth. Flowers used for coughs, asthma, catarrh, and loss of appetite. Flowers are strung into rosaries.

Fiber from inner bark once used in the manufacture of cloth for the nobility. The durable fiber commercially known for bowstrings. Seed hair said to have been used in making thread in Borneo. Gunpowder charcoal made from young branches. Stems yield a durable fiber for products for underwater use: nets, halters, lines, ropes and for making sewing threads. Floss of seeds used for stuffing mattresses. Salted acrid milky juice used to remove hair from hides. Root makes a good tooth cleanser. Root utilized in making charcoal and gunpowder. Infanticide**:** As poison, the juice, forced down the throat of infants, was a reported method of infanticide employed by castes, with the purpose of putting the girl babies to death.

PHYTOCHEMICAL & PHARMACOLOGICAL STUDIES[18 to 22]:

Anti-Diarrheal: Study of the hydroalcoholic extract of the aerial part of *Calotropis gigantea* on castor oil-induced diarrhea model in rats showed remarkable anti-diarrheal effect. **Latex / Wound Healing:** Study using an excision and incision wound model showed to latex to have significant wound healing activity, similar to standard FSC (Framycetin sulphate cream). **Antibacterial:** Study showed the latex to possess potent bactericidal activity attributed to the presence of biologically active ingredients with antimicrobial activity of the ethanolic extract. **Anti-Inflammatory:** Anti-inflammatory studies of extracts of T procumbens and *Calotropis gigantea* showed greater anti-inflammatory action with the combined effect of CG and TP with ibuprofen than ibuprofen alone, probably through release of various inflammatory mediators.

Vasodilation: Effect of latex from *Calotropis gigantea* in the green frog R hexadactyla showed a significant increase in cardiac output. Evidence suggests the prime action of latex on the cardiovascular system involves changes in the cation (Ca, Na) permeability, with consequent excitation of Ca channels in the heart muscle and an increase coronary flow. Therefore, dilatation property is likely responsible for the pharmacologic actions of the latex.
Hepatoprotective: Preliminary screening yielded triterpenoids, steroids, flavonoids and glycosides. Study showed *Calotropis gigantea* stem extract reduced lipid peroxidation and significantly improved biochemical parameters in CCL4-treated rats.
Cytotoxic / Pregnanone: Study yielded a new pregnanone, named calotropone, together with a known glycoside, from the ethanolic extract of the roots of *Calotropis gigantea*. The compounds exhibited inhibitory effects toward chronic myelogenous leukemia K562 and human gastric cancer SGC-7901 cell lines.
Antipyretic: Study showed the extract of *Calotropis gigantea* to have potent antipyretic activity against both yeast-induced and TAB-vaccine induced fever, suggesting a potential source for a cheaper and potent antipyretic agent.
Insecticidal: Study of extracts of *Calotropis gigantea* showed insecticidal activity against T castaneum.

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