RESEARCH ARTICLE

A REVIEW ON PHARMACOLOGICAL AND BIOLOGICAL PROPERTIES OF CALOTROPIS GIGANTEA

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INTRODUCTION

Herbs and plants have been in use as a source of therapeutic compounds in traditional medicinal system since ancient time. Plant-produced compounds are of interest as sources of safer or more effective substitutes for synthetically produced antimicrobial agents (Balandrin et al., 1985). Herbal medicines have been used from the earliest times to the present day. Herbal plants are effective source of traditional & modern medicines, useful for primary health care. From pre-historic times to the modern era in many parts of the world, plants, animals and other natural objects have profound influence on culture and civilization of man. Since the beginning of civilization, human beings have worshiped plants and such plants are conserved as a genetic resource and used as food, fodder, fibre, fertilizer, fuel and in every other way (Suresh Kumar et al., 2012). Since ancient times, plants have been a variable source of drugs; mantends to ignore the importance of herbal medicine (Sofowora et al., 1982). Calotropis species, belonging to the family of Asclepiadaceae in plant kingdom, are the well-known plants throughout the tropical world and they are native to the tropical and subtropical parts of Asia and Africa (Sharma, 1934). C. gigantea is a widely growing plant native to India, Indonesia, Malaysia, Philippines, Thailand, Sri Lanka and China. It is commonly known as milk weed or crown flower weed. C. gigantea is latex bearing plant and releases the latex after a tissue injury. Plant latex is a mixture of alkaloids, tannins, gum, sugars, starch, resins and protein (Abraham and Joshi, 1979). In ancient Ayurvedic medicine the plant Calotropis gigantea is known as “Sweta Arka”. Most recently C. gigantea is scientifically reported for several medicinal properties viz. the flowers are reported to possess analgesic activity, antimicrobial and cytotoxic activity.

Leaves and aerial parts of the plant are reported for anti-diarrhoeal activity, anti-Candida activity, antibacterial activity and antioxidant activity. Roots are reported to contain anti-pyretic activity and cytotoxic activity. All parts of the tree are considered to possess medicinal properties and used in the treatment of syphilis, boils, inflammation, epilepsy, hysteria, fever, muscular spasm, warts, leprosy, gout, snakebites, and cancer. In view of this the purpose of this article is to review the pharmacological and biological properties of this medicinal plant.
triangular measuring 10–15 mm × 5–8 mm; they are pale lilac and cream coloured towards the tips (Poonam., 2013). *Calotropis* is drought resistant, salt tolerant to a relatively high degree, grows wild up to 900 meters (msl) throughout the country (Sharma and Tripathi, 2009). It is one of the few plants not consumed by grazing animals (Oudhia ., 1997). It thrives on poor soils particularly where overgrazing has removed competition from native grasses (Smith, 2002). It is a native of India, China and Malaysia and distributed in the following countries: Afghanistan, Algeria, Burkina Faso, Cameroon, Chad, Cote d’Ivoire, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Gambia, Ghana, India, Iran, Iraq, Israel, Kenya, Kuwait, Lebanon, Libyan, Arab Jamahiriya, Mali, Mauritania, Morocco, Mozambique, Myanmar, Nepal, Niger, Nigeria, Oman, Pakistan, Saudi Arabia, Senegal, Somalia, Sudan, Syrian Arab Republic, Tanzania, Thailand, Uganda, United Arab emirates, Vietnam, Yemen, Exotic: Antigua and Barbuda, Argentina, Australia, Bahamas, Barbados, Bolivia, Brazil, Colombia, Cuba, Dominica, Dominican Republic, Ecuador, French Guina, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St Lucia, St Vincent, Surinam, Trinidad, Uruguay, and Venezuela (Gamble, 1935).

**Phytochemistry of Calotrops Gigantea**

Phytochemicals present in this plant is discussed in Table 1.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Compounds</th>
<th>Root</th>
<th>Plant parts</th>
<th>Buds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Alkaloids</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>2.</td>
<td>Amino acids</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>3.</td>
<td>Acid compounds</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>4.</td>
<td>Carbohydrate</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>5.</td>
<td>Flavonoids</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>6.</td>
<td>Glycosides</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>7.</td>
<td>Peroxides</td>
<td>Negative</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>8.</td>
<td>Sterols</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>9.</td>
<td>Saponins</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
</tbody>
</table>

**Chemical Composition**

*Calotrops gigantea* contains a- and b- amyrin, teraxasterol, gigantin (chemical) and gigantol. They are poisonous plants; calotropin, a compound in the latex, is more toxic than strychnine. Cardenolides contents in leaf (2.04 mg/gm) and in latex (162.0 mg/g), mostly caltoprogenin – derived cardenolides present from *Calotrops gigantea*, two triterpene esters–3 methylbutanoates of amyrin and taraxasterol are isolated from latex of *C. gigantea*. Calotrops D1 and D2 had been isolated from *C. gigantea* (Pal and Sinha, 1980). The new oxiopregnane- oligoglycosides named *Calotrops* A and B have been isolated from the root of *C. gigantea* and their chemical structure have been elucidated by chemical and spectroscopy methods (Kitagawa Isao., 1992). The cytotoxic principles of ‘*Akondmul*’ (Root of *C. gigantea*) cardenoloids glycosides, calotropin frugoside and 4-O-Beta-D-glucopyranosyl frugoside were obtained as the cytotoxic principles (Kiuchi ., 1998). Leaves contain active constituent’s like-nudarine resin, calotropin, uscharin and calotoxin. The latex contains a powerful bacteriolytic enzyme, a very toxic glycoside calactin (the concentration of which is increased following insect or grasshopper attack as a defense mechanism), calotropin D I, calotropin D II, calotropin F I, calotropin F II and a non-toxic proteolytic enzyme calotropin (2-3%).

**Medicinal Properties**

Different parts of the plant have immense potential to cure various diseases and disorders. It is used in various polyherbal preparations (Tenpe., 2007). More than hundred activities were described in detail by Duke (1992).

**Antibacterial and antifungal activity**

The phyto chemical analysis revealed the bioactive compounds which are responsible for the in vitro antibacterial activity of *C. gigantea* over *Bacillus cereus*, *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumonia*, *Staphylococcus aureus*, *Salmonella typhi* and *Micrococcus luteus* strains. All extracts could be alkaloids, cardiac glycoside, tannins, saponins, flavonoid, steriods, terpenoids reducing sugars and resins (Chandrabhan Seniya., 2011). The presence of antifungal and antibacterial activity in the shade dried extract of *Calotrops gigantea* were obtained against the human pathogenic organisms. The leaves extract (Ethanol, Methanol, Chloroform and n-Hexane extract) of *Calotrops gigantea* were screened for its antimicrobial activity. The extract was tested against fungal pathogens such as *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus fumigates*, *Candida tropicalis*, *Candida albicans*, and bacterial pathogens such as *Bacillus cereus*, *Salmonella typhi*, *Proteus mirabilis*, *Escherichia coli* and *Pseudomonas aeruginosa* (Senthil kumar ., 2012). The aqueous, methanol and ethanol extracts of *Calotrops gigantea* leaves, apical buds and flowers were prepared and used to study the effect of *Calotrops gigantea* extracts on growth & survival dynamics of *Escherichia coli*, *Staphylococcus aureus*, *Candida albicans* and *Xanthomonas campestris* (David., 2011). Well diffusion method was employed to determine the antibacterial activity against certain Gram positive bacteria like *B.subtilis* NCIM 2063, *Micrococcus luteus* NCIM 2704, *Staphylococcus aureus* NCIM 2079 and Gram negative bacteria namely, *K.pneumoniae* NCIM 2719, *P. vulgaris* NCIM 2027 and *E.coli* NCIM 2118. Ethyl acetate and dichloromethane extracts showed better and broader spectrum of activity when compared to other extracts. Ciprofloxacin (10 μg/well) was used as the standard antibacterial agent (Bharathii., 2011).The latex extract possesses potent fungicidal activity which may be due to the presence of biologically active ingredients with antimicrobial activity in the ethanolic extract of *C.gigantea* latex (Subramanian and Saratha, 2010).

**Antioxidant activity**

Chloroform extracts of *Calotrops gigantea* leaf and flower on free radical scavenging activity, and lipid profile in streptozotozin-induced diabetic rats was investigated. The lipid peroxidation, superoxide dismutase, and catalase were measured in liver homogenate. Serum glutamic pyruvic transaminase, serum glutamic oxaloacetic transaminase, alkaline phosphatase and lipid profile were measured in blood serum (Rathod., 2009).

**Antivenom activity**

Antivenom activity of *Calotrops gigantea* plant extract was evaluated against Vipera russelli snake venom. Required
concentrations were prepared by dissolving the lyophilized snake venom of *Viperarusselli* in saline. Lyophilized polyvalent snake venom antiserum was used as reference serum. The methanolic extract of *Calotropis gigantea* was evaluated for its efficacy to neutralize various actions of the venom like lethality, necrotizing activity, edema forming activity and haemorrhagic activity (Nimmy Chacko, 2012).

**Anti-diarrhoeal activity**

The anti-diarrhoeal effect of hydroalcoholic (50:50) extract of aerial part of *Calotropis gigantea* was studied against castor oil-induced-diarrhoea model in rats. Enteropooling method was used to determine the weight and volume of intestinal content induced by castor oil. Like atropine (3 mg/kg) there were significant reductions in fecal output and frequency of droppings when the plant extracts of 200 and 400 mg/kg doses were administered intraperitoneally compared with castor oil treated rats. All doses of the plant extracts also significantly retarded the castor-oil induced enteropooling and intestinal transit. The dose 100 (P<0.01), 200 and 400 mg/kg significantly inhibited (P<0.001) weight and volume of intestinal content. The remarkable anti-diarrhoeal effect of *C.gigantea* extract against castor oil-induced diarrhoea model in a wide range of diarrhoeal states was studied (Chitim, 2004).

**Wound healing activity**

Wound healing activity of this plant was studied in root bark. The effects of *Calotropis gigantea* root bark on wound healing activity in rats was investigated by excision, incision and dead space wound healing models. The percentage of wound closure; epithelization time, hydroxyproline content and scar area on complete epithelization were measured. Application of *Calotropis gigantea* in excision wound model increased the percentage of wound contraction. Scar area and epithelization time were found to be decreased. In incision wound and dead space wound breaking strength of wounds and hydroxyproline was increased (Deshmukh, 2009).

**Pharmacological Properties**

**Anti-inflammatory and Insecticidal activity**

Chloroform, n-butanol, ethanol and distilled water extracts of leaves of *Calotropis gigantea* (Linn.) was screened for anti-inflammatory activities. Anti-inflammatory activity was compared with standard drug Paracetamol for Carrageenan induced rat paw oedema method (Mahatma, 2010). The residual film toxicity, fumigant toxicity and repellent effect of methanol extract of root bark of *Calotropis gigantea* (Linn) and its chloroform and petroleum ether (40–60°C) soluble fractions were evaluated against several inster of larvae and adult of *Tribolium castaneum*. Methanol extract, chloroform and petroleum ether fractions showed insecticidal activity against *T. castaneum* (Asharaful Alam, 2009).

**Hepatoprotective activity**

 Ethanolic extract of *Calotropis gigantea* stem at doses of 250 and 500 mg kg⁻¹ were studied for hepatoprotective activity in male Wistar rats with liver damage induced using carbon tetrachloride, 2 mL kg⁻¹. The protective effect of *C. gigantea* extract was compared with the standard drug. Various biochemical parameters like aspartate amino transferase (AST), alanine amino transferase (ALT), glutathione (GSH), lipid peroxide (LPO), superoxidedismutase (SOD), glutathione peroxidase (GPx) and catalase (CAT) were evaluated (Gaurav Lodhi, 2009).

**Other Biological Properties**

*C.gigantea* is known to possess Antiviral activity (Rama and Pathak, 2006), Anthelmintic activity (Iqbal ,, 2005), Antitumor activity (Jayaweera, 1982), Removing anaemia (Blair, 1907), Fibrinolytic activity (Rajesh,, 2005), Biogas (Shilpkar., 2007), Paper manufacture, Latex collection (Ahmed., 2005), Mosquitoicidal activity (Neraliya and Srivastava, 1996) etc.

**Uses and Adverse Effect Of Calotropis Gigantea**

The leaves of *C.gigantea* are used for the treatment of poisonous snake bites, periodic fever, intestinal worms and ulcers. Roots of this plant are crushed well and applied well by rubbing firmly over the bitten area. Latex of this plant is used to cure dental problems, rat bite, swellings, gonococcal arthritis and other rheumatic complaints. Flowers are used to cure bronchial asthma (Kumar,2011). Fermented mixture of *Calotropis* and salt is used to remove the hair from goat skins and sheep skins to make leather which is much used for inexpensive book-binding. Allelopathic effects of *Calotropis* on different agricultural crops have not been well studied. Extracts of different plant parts viz. root, stem, leaf, and stem of *Calotropis* affect germination and seedling vigor of many agricultural crops have been reported (Baby Joseph ., 2013).The adverse effects of other *Calotropis* sp. consumption are reported to cause blisters, lesions and eruptions. Latex of *C. gigantea* causes irritation to mucosa (Poonam., 2013).

**CONCLUSION**

*Calotropis gigantea* is a potential plant with many curative principles and economic values. It is used as a traditional medicinal plant with unique properties. This review shows that it is a popular remedy in Ayurvedic and traditional practitioners for the treatment of a range of ailments. Though *Calotropis gigantea* has various medicinal applications, but still the phytochemicals of this plant needs to be standardized to explore its medicinal values with the help of various methods. Further research is necessary to elucidate the phytochemical and pharmacological aspects of this plant.

**References**


2. Ahamed M, Rana AC and Dixit VK.2005. Plant Review *Calotropis gigantea* was studied against castor oil induced diarrhea model in rats. Enteropooling method was used to determine the weight and volume of intestinal content induced by castor oil. Like atropine (3 mg/kg) there were significant reductions in fecal output and frequency of droppings when the plant extracts of 200 and 400 mg/kg doses were administered intraperitoneally compared with castor oil treated rats. All doses of the plant extracts also significantly retarded the castor-oil induced enteropooling and intestinal transit. The dose 100 (P<0.01), 200 and 400 mg/kg significantly inhibited (P<0.001) weight and volume of intestinal content. The remarkable anti-diarrhoeal effect of *C.gigantea* extract against castor oil-induced diarrhoea model in a wide range of diarrhoeal states was studied (Chitim, 2004).


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