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A Review on Phytochemical and Biological Properties of Calotropis Gigantea

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ABSTRACT

Calotropis gigantea (L.) Dry and (Giant milkweed; Asclepiadaceae family) has been used historically to cure bronchitis, asthma, leprosy, dermatitis, and elephantiasis. The ethnopharmacology, chemical components, and pharmacology of C. gigantea are highlighted in this review. C. gigantea material was gathered by an internet search of major scientific resources. According to a review of the literature, cardenolides, flavonoids, terpenoids, glycosides, steroids, and nonprotein amino acids are key classes of chemical ingredients in C. gigantea. Analgesic, antimicrobial, antioxidant, antipyretic, anti-inflammatory, insecticidal, cytotoxic, hepatoprotective, pregnancy interceptive, procoagulant, and wound healing actions have all been found for the plant. Furthermore, a careful review of the literature revealed the shocking reality that clinical data on the plant are not available. The pharmacological research conductedon plant's traditional claims have not been validated since crude extracts utilised in experimental research have not been defined. It is concluded that C. gigantea is a medicinally promising plant that should be utilised more thoroughly. The plant may contain therapeutically active elements that might be turned into clinically viable medications.

Keyword: Calotropis Gigantea, Biological Properties, Phytochemicals, Anti-Inflammatory Properties

INTRODUCTION

In India, medicinal plants constitute a key source of traditional medicine. India is recognized as the "Botanical Garden of the World". A huge portion of the Indian people relies on medicinal plants to maintain their health. India contains 15 agroclimatic zones and 17000-18000 blooming plant species, of which 6000-7000 are thought to have medicinal use in traditional medical systems (Anonymous, 2015). Medicinal and aromatic plants include a significant variety of chemical elements that are the primary source of therapeutic medicines used to treat human suffering. The World Health Organization has also acknowledged the importance of traditional medical systems, which rely heavily on medicinal herbs. The global usage of Medicinal and Aromatic Plants is expanding at a pace of 7-15% each year. Calotropisgigantea (L.) Dry and is one such plant with a lengthy history of usage in numerous medical systems. As a result, a review of C. gigantea's ethnopharmacological applications, chemical components, and pharmacology has been prepared. The review is organized into three parts: ethnopharmacology, chemical ingredients, and pharmacological studies. The traditional applications of C. gigantea have been documented under the section on ethnopharmacology. The available information on traditional applications of C. gigantea in folk medicine has been compiled from old medical textbooks, novels, and original articles that chronicle the therapeutic uses of the plant. In the chemical components section, many classes of chemical constituents (with structures) extracted from C. gigantea have been listed. Section pharmacological reports describe work on C that has been scientifically published. gigantea for a variety of pharmacological actions. The phytochemical and pharmacological reports on C. gigantea were gathered from a variety of major databases, including Google Scholar, Science Direct, PubMed, SciFinder, AGRICOLA, MEDLINE, Directory of Open Access Journal (DOAJ), Scientific Commons, Open J-Gate, Medicinal and Aromatic Plants Abstract (MAPA), The Wealth of India, Glossary of Indian Medicinal Plants, Flora of Different States, World Cats, US Dispensatory, King

Kadiyala et al. (2013) collated reports on C. gigantea phytochemical and pharmacological investigations. However, a careful examination of the existing literature suggests that the aforementioned review on C. gigantea should be updated by integrating ethnopharmacological, phytochemical, and pharmacological data that have not been addressed. The sources used by this article do not mention Kadiyala et al. (2013). There were 109 references in this review article. The current project was performed with the following goals in mind:

- To determine whether traditional C. gigantea claims have been scientifically confirmed via preclinical and clinical investigations.
- To see if reasonable procedures were used to separate bioactive chemical compounds from C. gigantea after bioactivity-directed fractionation.
- To determine whether the method of action of C. gigantea bioactive extract or fraction has been developed.
- To determine whether any structure-activity connection studies on chemical compounds extracted from C. gigantea have been conducted.

Calotropis gigantea L. [Synonym: Giant milkweed; Asclepiadaceae Family]: Milkweed, Akand, Bowstring Hemp, Akado, Ark, Arka, Erukku, LalAkra, Akondo, Moto-aak, and Verukku are some of the common names for the plant.

Activity in wound healing

In albino rats, Calotropis gigantea latex demonstrated wound healing efficacy in excision and incision wound models. When compared to controls, latex-treated animals had an 83.42% reduction in wound area. As a control, 1% w/w framycetinsulfate cream was utilized. When compared to controls, wounds treated with extract epithelized more quicker. Granuloma breaking strength increased significantly (p 0.001). 26

Under anesthesia, 2 cm diameter excision wounds were generated in streptozotocin (50 mg/kg) caused diabetic rats. Calotropis gigantea latex extract ointment (2%) was used as a therapy for 14 days. In test drug-treated rats, the rate of wound contraction increased while the period of epithelisation reduced considerably (p 0.05). The density of volume Collagenfiber density, fibroblast numerical density, and vessel length density were all considerably (p 0.05) enhanced. Calotropis gigantea enhances diabetic wound healing by boosting collagen production and improving histological processes essential to proper wound healing, according to this study. 27

Anti-asthmatic properties

Calotropis gigantea demonstrated anti-asthmatic efficacy in OVA-induced asthma. Rats were sensitized and then exposed to OVA. Calotropis gigantea was tested at doses of 100, 200, and 400 mg/kg p.o. on various bodily cells, enzymes, and histopathological alterations. Calotropis gigantea at 200 and 400 mg/kg inhibited eosinophils, neutrophils, lymphocytes, and total leukocyte counts in bronchoalveolar lavage fluid significantly (p 0.05). Because of its anti-inflammatory, antilipoxygenase, and antioxidant properties, this plant may prove to be a promising medicinal medication for the treatment of asthma. 28

Anticancer properties

Treatment with anhydrosophoradiol-3-acetate (A3A) derived from the flower of Calotropis gigantea reduced viable tumor cells and body weight increase, as well as changed hematological (Hb, RBC, and WBC) and biochemical parameters.

Plant components

Chemical components

Stem and Bark

Giganteol and calotropeol, as well as -amyrin.

Calotropnaphthalene [naphthalenederivative], calotropisesquiterpenol, calotropisesterterterpenol [terpene derivatives], calotropbenzofuranone [aromatic product], and sucrose are all components of **Root.**

Palmitic, oleic, linoleic, and linolenic acid are all found in seed oil. Phytosterol, stigmasterol, melissyl alcohol, and Lauren are all found in the unsaponifiable fraction. Flower ester of - and -calotropeols.

Leaves

Sapogenins, holarrhetine, cyanidin-3-rhamnoglucoside, and taraxasterol isovalerate are all ingredients. Marine, as well as three glycosides, calotropin, uscharin, calotoxin, and phenol. 4\sLatexCaoutchouc (0.6-1.9%) with water and water-soluble material (86-95.5%). Caoutchouc (5.1-18.6), resin (73.6-87.8), and insoluble materials (4.5-13.8%) make up the coagulam. 18- and -calotropeols (also known as latex-protease, calotropains FI & FII, flower-amyrin, and stigmasterol are all found in latex. 17 Calotoxin, uscharin, and calactin are all examples of carcinogens. 23

Two novelTriterpenee ester-3'-methyl butanoates of -amyrin and taraxasterol from latex have been identified.

Bark of the Root

-amyrin and two isomeric crystalline alcohols, giganteol and isogiganteol, are found in the root bark.

20 to a normal level, extending the longevity of Ehrlich's ascites carcinoma (EAC)-bearing mice. According to the findings of this investigation, A3A was efficient in preventing the growth of EAC in vivo while alleviating cancer-related comorbidities. 25

It has antilipoxygenase and antioxidant properties. 28

Viricide activity

Calotropis gigantea leaves, stem, flower, roots, and whole pleasurewere examined for ovicidal action on Helicoverpaarmigera at 2, 4, 6, 8, and 10% concentrations. The leaf extract completely inhibited egg hatchability, followed by the floral extract (90%). It was also discovered that as the dose grew, the percentage of inhibition in egg hatchability increased, and that the early-stage of eggs (24-48 h old eggs) were extremely vulnerable at all concentrations. These findings suggest that the milkweed plant has ovicidal action and might be utilized to regulate Helicoverpaarmigera. 29

Hair development activity

The effects of Calotropis gigantea with Hibiscus rosa Sinensis (HRSF) and polyherbal formulation (HCF) containing both plants on hair growth initiation and promotion in albino rats were investigated. The findings and observations from the study were compared to Minoxidil. Calotropis gigantea demonstrated potential hair growth activity, however, it was less than other treatments. 30

Antibacterial properties

The well plate technique was used on Calotropis gigantea leaf extract against Gram positive (B. subtilis, M. luteus, S. aureus) and Gram negative (K. pneumoniae, P. vulgar, and E. coli) bacteria. When compared to other extracts, ethyl acetate and dichloromethane extracts demonstrated a greater and broader range of activities. 31

The in vitro antibacterial activity of aqueous extract of leaves was investigated using the goodwell diffusion technique on MH agar. The extract has the highest zone of inhibition against E. coli and the lowest against K. pneumonia. Crude extract had the highest relative percentage inhibition against B. cereus and the lowest relative percentage inhibition against M. luteus. The modified agar well diffusion technique was used to determine the minimum inhibitory concentration (MIC). Extract concentrations were 50, 25, 6.25, 3.1, 1.5, and 12.5 mg/ml. S. aureus, K. pneumoniae, B. subtilis, P. aeruginosa, M. luteus, and E. coli MIC values. 32

The leaves were extracted in n-hexane, ethanol, methanol, chloroform, water, and ethyl acetate and evaluated for antibacterial activity against B. cereus, B. subtilis, E. coli, K. pneumonia, S. aureus, S. Typhi, and M. luteus. The most effective extract was found to be ethyl acetate extract, with MIC values

ranging from 0.25 to 1.0 mg/ml. The bactericidal activity of aqueous leaf extract was poor. 33 The crude n-hexane, carbon tetrachloride, chloroform, ethanol, and water extracts of leaves were tested for antimicrobial activity against 16 bacteria, including Gram-positive, Gram-negative, and fungi. The antibacterial activity of carbon tetrachloride and ethanolic fractions was low, with average zones of inhibition of 9.5 mm and 8.4 mm, respectively. 400 g/disc. The antibacterial activity was compared to doxycycline (30 g/disc), which had a zone of inhibition of 40 mm on average. 34

Calotropis gigantea latex was tested for antibacterial activity against six bacterial species and two fungus species. The results indicated that S aureus, B. cereus, and E. coli were the most vulnerable bacteria, with C. krusei being moderately susceptible and M. luteus, K. pneumonia, P. aeruginosa, and A. niger showing no impact. 35

Antioxidant properties

The antioxidant activity of Calotropis gigantea root extract in vitro was studied using the 2, 2-diphenyl-1-picrylhydrazyl and fluorescence recovery after photobleaching methods. Because of the presence of both methods, the extract has considerable antioxidant activity when compared to ordinary ascorbic acid. high concentration of different phytochemicals. 36

Anti-inflammatory properties

Calotropis gigantea's anti-inflammatory effect was demonstrated using the albumin denaturation procedure. The percentage inhibition of denaturation caused by the test medication was comparable to that produced by Ibuprofen (85.71%), indicating that the test drug had anti-inflammatory effects. 37

Cytotoxic action

The cytotoxic capability of C. gigantea root extract was evaluated using the Brine shrimp lethality bioassay (BSLB) and Allium cepa root meristem (ACRM) models. After 48 hours of incubation, the ethanolic root extract inhibited ACRM growth the most (p 0.01). The extract inhibited growth in a dosage and time-dependent manner. Calotropis gigantea has cytotoxic properties equivalent to conventional drugs. 38

Hypoglycemic activity

In Streptozotocin-induced diabetic rats, the hypoglycemic effect of chloroform extracts of Calotropis gigantea leaf and flower at 10, 20, and 50 mg/kg were studied and compared to glibenclamide. Normal rats' serum glucose levels were reduced by extracts of the leaves and flowers. Treatment with the test medication improved oral glucose tolerance as well. The administration of leaf and flower extracts to streptozotocin-induced diabetic rats reduced blood glucose levels signify

Analgesic action

The analgesic effect of an alcoholic extract of Calotropis gigantea flowers was investigated in chemical and thermal models in mice. In the acetic acid induced writhing test, dosages of 250 and 500 mg/kg reduced the number of writhes by 20.97% and 43.0%, respectively. The paw licking time was delayed using the hot plate approach. The analgesic effect was noticed after 30 minutes after dosage administration and peaked after 90 minutes. 44

Antidiarrheal action

The antidiarrheal activity of a hydroalcoholic extract of Calotropis gigantea aerial portion was tested in a castor oil-induced diarrhoea model. The enteropooling method was used to investigate the weight and volume of intestinal content caused by castor oil. The plant extracts of 200 and 400 mg/kg IP significantly (P 0.001) suppressed weight and volume of intestinal content in the same way as atropine (3 mg/kg IP), and there were significant decreases in faecal output and frequency of droppings when compared to control rats. 45 Another research was conducted utilising an aqueous extract of the root bark of Calotropis gigantea in two groups

Antiviral action

(+)-pinoresinol 4-O-[60-Ovanilloyl] is a novel lignan glycoside isolated from the latex of Calotropis gigantea.

-b-D-glucopyranoside (1), two known phenolic compounds, 69-O-vanilloyltachioside (2) and 69-O-vanilloylisotachioside (3), and one genuine compound, (+)-pinoresinol 4-O-b-Dglucopyranoside, were tested on MDCK cells for A/PR/8/34 (H1N1) inhibitory activity. Compound 1 inhibited the action of A/PR/8/34 (H1N1). The CPE inhibition assay was used to test this for in vitro inhibitory effects against a panel of human and avian influenza viruses. It inhibited human influenza viruses in both subtypes A and B while having no impact on avian influenza viruses. Furthermore, plaque reduction assay revealed its efficacy against human influenza virus subtype A. The assay-determined time course.indicated that chemical 1 had antiviral efficacy early in the viral replication process. Compound 1 effectively reduced influenza virus-induced activation of the NF-kB pathway in a dose-dependent manner, but had no effect on virus-induced activation of the Raf/MEK/ERK pathway, according to a mechanistic analysis. Further research revealed that 1 substantially reduced nuclear translocation of the transcription factor NF-kB triggered by influenza virus, as well as nuclear export of viral ribonucleoproteins. 50

Conclusion

Calotropis gigantea Linn. plant components such as root, root bark, leaves, flower, and milk are utilised ethnomedicinally to treat a variety of human ailments. The current review attempts to compile the plant's morphological description, therapeutic applications stated in Unani medicine, ethnopharmacological reports, and all pharmacological investigations undertaken on it, as well as its phytochemistry. These findings support the plant's use in traditional medicine and offer a foundation for further research into the plant's pharmacological and therapeutic potential.

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