Review Article
IASR Journal of Medical and Pharmaceutical Science
Website: https://iasrpublication.com/ijmps
ISSN(*online*): 2582-9343

A Review On *Calotropis Gigantea* And *Calotropis Procera*: Chemical Constituents And Pharmacological Activities

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A B S T R A C T
Calotropis procera and *C. gigantea*, two soft-wooded, xerophytic shrubs of the family Apocynaceae, are used both historically and currently. Their uses are examined in light of the chemical makeup and biological characteristics of the plants. The use of plants as building materials, organic insecticides, animal feed, and for bioremediation are the main topics of discussion. Milkweed known as "Madar" or Calotropis gigantea (Crown Flower) is a plant that grows in Bangladesh, Sri Lanka, and India. The plant is a member of the Apocynaceae family, which also includes plants that produce latex. It is a significant medicinal herb that is used frequently in Ayurveda to control a variety of health risks. The objective of the current study is to identify the phytoconstituents that are present in the plant. The plant was found to mostly include phenolics, terpenoids, and flavonoids. The plant exhibited antibacterial properties as well. The plant's flavonoids were also tested for their potential to provide photoprotection. By utilising a UV visible spectrophotometer, it was discovered that the methanolic extract of leaves effectively absorbs ultraviolet light at wavelengths between 200 and 400 nm. The development of anti-UV dermatological applications may benefit from this.

Keywords*:* *Calotropis gigantea, Biomass, Petrocrop, Natural pesticides, Bioremediation, Calotropis procera*

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INTRODUCTION
Plants have been utilised for the treatment of many diseases from the beginning of time. The Arka species (Calotropis gigantea and Calotropis procera), which were both used interchangeably and had related properties, are significant according to Ayurveda. Numerous ailments, including tumours, leucoderma, ulcers, piles, leprosy, dysentery, asthma, spleen, and liver, were treated with the help of the plants in Ayurveda, Unani, and Afghan medicine [1,2]. The Calotropis species are evergreen perennial shrubs that grow to a height of 2.4–3 m. Their branches are robust, terete, and less or more heavily covered in fine-grained cottony pubescence. The bark is yellowish white, furrowed, rough, and corky. The leaves are opposite-decussate, sessile, elliptic oblong or obviate-oblong, acute, thick, and pale green. They measure between 10 and 20 by 3.8 and 10 cm, with a narrow base. Regular, bisexual, 3.8–5 cm dia., purple or light greenish yellow flowers with a mild odour. In umbellate lateral cymes, the pedicels are covered in cottony wool, the periodicals are much longer than the flowers, the buds are ovoid, the calyx is divided to the base, the corolla is 2 cm long, the lobes of the corona are 1.3 cm long, broadly in 5mm at the middle, smaller than the column, the margin is slightly thickened, and the apex is rounded with two obtuse auricles Follicles are plentiful, wide, plump ventricose, and green, measuring 9–10 cm in length. Green, spongy fruits with light brown, 6 x 5 mm seeds make up the fruit. Brown, flattened, arrow-margined ovary with a 2.5–3.2 cm long coma and hairs on one end. The roots have less lateral roots close to the surface and are deep, hefty taproots. Leucoderma, tumours, expectorant, analgesic, anticonvulsant, anti-inflammatory, piles, leprosy, asthma, enlargement of spleen and liver, and joint swelling are only a few of the disorders for which latex is utilised [4,5]. Numerous uses of several Calotropis species components have been documented, including the treatment of jaundice, lice, headaches, sore lips and gums, ulcers, abortives, anthelmintics, cough, and dysentery. Presented are [6] and its taxonomy[7, 8].

Figure.1; *Calotropis procera*

Figure.2; *Calotropis gigantea*

Geographic Distribution:

The species of Calotropis are moderately salt-tolerant, drought-tolerant, and drought-resistant. In general, both animals and the air are used to pollinate flowers. Such species are easily spread as weeds along roadways, at the border of lagoons, and in overgrazed native meadows. Additionally, it thrives in sandy soil with little rainfall. India, Nepal, Pakistan, Iran, Iraq, Oman, Yemen, Vietnam, Afghanistan, and Zimbabwe are all home to the Calotropis species [9,10].

Traditional Uses:

Treatments for bronchitis, pain, asthma, leprosy, ulcers, piles, spleen, tumours, liver, abdomen, and dyspepsia are all possible with Calotropis species. It is also frequently used for colds, fever, diarrhoea, rheumatism, indigestion, eczema, and jaundice. For example, the stem was used to treat skin conditions, intestinal worms, leprosy, and leucoderma; the roots were used to treat leprosy, asthma, cough, elephantiasis, rheumatism, and diarrhoea; the latex and leaves were used to treat swelling and joint pain; oil massage could be used to treat paralysed limbs; and the juice of the Calotropis plant was used for purgation [11].

PHARMACOLOGICAL ACTIVITY

Antibacterial and Antifungal Potentials:

Anhydrosophoradiol-3-acetate and 1Di-(2-ethylhexyl) phthalate (compound 1) were isolated from Calotropis gigantea ethyl acetate extract (compound 2). Isolated substance, Kanamycin, and Nystatin disc were employed as the study's positive controls for anti-bacterial activity. With 30, 60, and 90 g/disc for testing antibacterial activity and 100, 200, and 400 g/disc for testing antifungal activity on the sample. When compared to gramme positive and gramme negative bacteria, such as Bacillus subtilis, Staphylococcus aureus, and Sarcina lutea, the 1Di-(2-ethylhexyl) phthalate (Compound 1) shown superior efficacy (Shigella sonnei, Escherchia coli, Shigella shiga and Shigella dysenteriae). Compound 1 had no effect on B. megaterium, while compound 2 had a moderate effect on S. aureus, S. lutea, and E. coli. Compound 1 displayed the lowest MIC against B. subtilis and S. lutea at 32 g/ml, but compound 2 displayed the lowest MIC when used against S. aureus at 64 g/ml. While compound 1 shows action against A. fumigates and A. flavus, the test extract for antifungal activity produces a zone of inhibition between 7 and 15 mm. Compound 2 is completely inactive. [12] However, when tested against E. coli, Salmonella typhi, Pseudomonas aeruginosa, Vibrio cholerae, and Staphylococcus aureus, the ethanolic extract of C. gigantea had strong antibacterial action in the 8–11 mm range. [13] Calotropis procera-silver nanoparticles were made by combining 3% latex extract with 3% silver nitrate solution. X-ray diffraction, UV-visible spectrophotometer, transmission electron microscopy, and fourier transform infrared spectroscopy were used to characterise the silver nanoparticles. The effectiveness of the silver nanoparticles against pathogenic fungus and bacteria (including Pseudomonas aeruginosa, Escherichia coli, and Serratia sp (Aspergillus terreus, Candida albicans and Trichophyton rubrum). Strong antibacterial and antifungal action is exhibited by the silver

nanoparticles. By decreasing the silver ions (Ag+ to Ag0), the silver nanoparticle demonstrates its significant antibacterial properties [14].

Anti-Diarrheal Effect:

In rats administered with 80% castor oil, dried latex that was comparable to phenylbutazone and atropine significantly reduced the frequency and severity of faeces. Different criteria, including as intestinal transit time, castor oil-induced fluid build up (enteropooling), and electrolyte content in intestinal fluid, were employed to evaluate the anti-diarrheal activity of C. procera latex in further detail. When compared to castor oil-treated and untreated animals, the intestinal transit of the dried latex exhibited a reduction of 27–37%. Contrary to atropine, castor oil significantly prevents enteropooling caused by dried latex from C. Procera. In contrast to rats treated with castor oil, the dry latex did not affect the electrolyte balance in the intestinal fluid [15]. While the anti-diarrheal efficacy of C. gigantea's ethanolic root extract was studied. Extract dosages of 100 mg/kg, 200 mg/kg, and 400 mg/kg were employed. There was noticeable anti-diarrheal action at the 200 and 400 mg/kg doses. [16] For the study's castor oil-induced diarrhoea model, the leaves of C. procera (CP) and C. gigantea (CG) were hydroethanolically extracted at a 70% concentration. The extract relieved the severity of the diarrhoea condition and decreased the amount of faecal boluses. Increase in latent period that is dose dependent was also noted. Regarding loperamide, the CP displayed a more noticeable impact than the CG extract [17].

Hepato protective Activity:

For the investigation, C. gigantea stem extract in 50% ethanol was used. Wistar rats were given extract doses of 250 and 500 mg/kg along with a dose of 2 mg/kg carbon tetrachloride. Aspartate transaminase (AST), Alanine aminotransferase (ALT), Glutathione (GSH), Lipid peroxidation (LPO), Superoxide dismutase (SOD), Catalase (CAT), and Glutathione peroxidase (GPx) changes in biochemical parameters were assessed. Rats given extract experience a considerable reduction in ALT and AST levels. Thiobarbituric acid reactive substances (TBARS) level was dramatically lowered by extract and silymarin, while GSH, SOD, CAT, GPx, and catalase level significantly raised in rats treated with extract and silymarin. The histological study showed fatty changes, tissue necrosis and infiltration of lymphocytes and kupffer cells near to central vein and cellular damage in CCl4 treated rats. Whereas animals pretreated with extract and subsequently given CCl4 showed the normal architecture of the liver [18]. A 70 % aqueous ethanolic extract of C. procera flowers used to study hepato-protection against paracetamol-induced hepatitis model. Biochemical changes in markers of hepatic damage, like Serum glutamic oxaloacetic transaminase (SGOT), Serum glutamic pyruvic transaminase (SGPT), bilirubin, Alkaline phosphatase (ALP), cholesterol, High density lipoprotein (HDL), and tissue glutathione (GSH), were evaluated in both treated and untreated groups. The biochemical markers SGOT, SGPT, bilirubin, ALP, and cholesterol levels were reported to be enhanced by paracetamol (2 gm/kg), while HDL serum levels were reported to decrease. The extract-treated group demonstrated tissue levels of GSH and also dose-dependently restored the altered levels of biochemical markers to nearly normal levels [19]. Catfish were tested for antioxidant and anti-apoptotic properties using latex from Calotropis procera. Catfish were exposed to the chemical contaminant 4-nonylphenol. Catalase, acetylcholinesterase, super oxide dismutase, glutathione S-transferase, and cortisol levels were all dramatically increased in apoptotic cells while being significantly decreased in latex-treated cells. When compared to the 4-nonylphenol treated group, the latex treated group demonstrated considerably higher total phenol content, reducing power, and overall antioxidant capacity. It demonstrated the presence of Calotropis procera latex [20].

Antitumor studies:

Swiss albino mice were utilised as the Ehrlich's as cites carcinoma (EAC) model to examine the anti-tumor efficacy of the isolated substance anhydrosophoradiol-3-acetate (A3A) from C. gigantea flowers. Mass and NMR spectrum data are used to characterise the isolated and purified molecule. According to research on the effects of A3A at doses of 10 and 20 mg/kg on body weight changes, viable cell counts, and survival times, the treated mice had much less viable tumour cells and lived noticeably longer [21]. Swiss albino mice were utilised to evaluate the anti-tumor efficacy of the methanolic root extract of C. gigantea using the Ehrlich's as cites carcinoma (EAC) model. The petroleum ether fraction, chloroform fraction, and methanolic extract were all used. Significantly less viable cells were seen in samples of methanolic extract at 10 and 20 mg/kg, petroleum ether extract at 80 mg/kg, and chloroform extract at 20 and 40 mg/kg. When compared to the control group, the highest life expectancy enhanced by chloroform extract (40 mg/kg) was 57.70%, but it was 96.97% in the case of conventional bleomycin. When compared to the control, extract-treated mice had significantly lower levels of ALP and SGOT. Comparing methanolic extract to tumor-bearing animals led to an increase in SGPT [22]. The HepG2 cancer cells were tested for anti-cancer activity using several extracts from the root of C. procera, including methanolic, hexane, aqueous, and ethylacetate. The cellular growth activities were studied using tetrazolium bromide (MTT) calorimetry. Different extract dosages of 1.0, 5.0, 10.0, and 25.0 g/ml revealed that CM, CH, and CE displayed cytotoxicity, however CW did not. The cells treated with the extract display the expected morphological alterations associated with apoptosis. The plant extract prevents the HepG2 cell from progressing to the G2/M phase and starts the apoptotic process by arresting it in the S phase [23].

Anthelmintic Activity:

Levamisole was compared to the Calotropis procera flower extract for its in-vivo and in-vitro anthelmintic activities. The crude aqueous extract (CAE) and crude methanolic extract (CME) of flowers had a noticeable impact on Indian earthworms, according to an in-vitro investigation. The anthelmintic activity of the extract was assessed at concentrations of 10.0, 15.0, and 20.0 mg/ml. When compared to albendazole, the dose of 20.0 mg/ml had the maximum activity [24-25].

Anti-Hyperglycemic Effect:

In order to study the hypoglycemic action of C. gigantea leaves extract, diabetes was induced using the common medication streptozotocin. The extract, which was given orally to treated rats for 21 days, decreased their levels of total cholesterol (TC), triglycerides (TG), very low density lipoprotein (VLDL), low density lipoprotein (LDL), and heart-protective high density lipoprotein (HDL). While animals treated with extract showed declines in kidney weight that were close to normal values, animals treated with STZ showed increases in kidney weight because of glomerular cell growth. In animals treated with extract and STZ, the levels of urea and creatinine were dramatically lowered. Animals treated with extracts stop diabetic animals' tissue lipid levels from rising. When compared to control groups, a histopathological study of the extract-treated animals revealed pronounced effects. [26] For the investigation, Calotropis procera leaves were hydro alcoholic extracted. Rats with diabetes caused by streptozotocin were given extract at doses of 300 and 600 mg/kg/day, insulin (6U, s.c.), or metformin (500 mg/kg/day) for four weeks. Intake of food significantly lowered in the group receiving the extract (300 mg/kg/day), according to the results. When compared to the diabetic control group, the 600 mg/kg/day group only displayed declines in food intake during the first week of the trial. When compared to the diabetic control group, the animals given with extract at 300 and 600 mg/kg showed significantly lower levels of uric acid, ALT, and AST and higher levels of creatinine, total cholesterol, and triglycerides. When compared to the diabetic control group, the extract considerably raised the relative mass of adipose tissue and the soleus muscle while dramatically decreasing the relative mass of the kidney[27].

Anti-Ulcer Activity:

Calotropis procera stem bark hydro alcoholic and chloroform extract was utilised to test the anti-ulcer and anti-inflammatory properties. The carrageenan-induced paw oedema paradigm was used to test the anti-inflammatory and ulcer-prevention effects of ethanol and aspirin in albino rats. When compared to normal medications, the mice treated with the extract exhibited notable activity. The extract's anti-ulcer properties were demonstrated by histological analysis [28]. Calotropis gigantea flower extracts in chloroform and ethanol were tested for their ability to reduce inflammation and ulcers. For the research of anti-inflammatory action, cotton pellets and carrageenan were utilised to produce granulomas on the paws. For the investigation of anti-ulcer activity, aspirin and ranitidine were utilised. The extract considerably decreased the oedema in the rat paws and the dry weight granuloma, and it also significantly protected both groups from the pyloric ligation and aspirin-induced stomach ulcers [29].

Anti-Convulsant and Sedative Activity:

The latex proteins of Calotropis procera were utilised to evaluate the anti-convulsant and sedative activities in mice. Pentylenetetrazol, Pilocarpine, and strychnine were used to cause convulsions in order to test the anti-convulsant drug's effectiveness, while the pentobarbital-induced sleep model was utilised to assess the sedative drug's potential. When compared to standards, the plant extract has no discernible impact on convulsions caused by strychnine and pilocarpine. The plant extract shown a significant impact in a model of pentylenetetrazol-induced seizures when used at high doses (50 or 100 mg/kg). The extract's proteins also demonstrated central depressive properties [30]. The ethanol extract of Calotropis gigantea was given orally to the experimental animal to assess its anticonvulsant, sedative, and muscle relaxant effects. The study used maximal electroshock and strychnine-induced convulsion models. The investigation of sedative effects used an actophotometer and a Rota rod instrument. Animals treated with the extract exhibited notable anticonvulsant action against the most severe electroshock-induced convulsion, but no discernible effects were seen in the strychnine paradigm. The extract dramatically reduced the mice's motor coordination and activity as a muscle relaxant [31].

Anti-malarial activity:

Calotropis procera leaf ethanolic extracts were fractionated using petroleum ether, chloroform, and ethyl acetate, respectively. The extract underwent a bioassay for anti-malarial parasites and was tested for aversion to brine shrimp larvae. There was anti-malarial action in the extract [32]. A floral extract from Calotropis gigantea was tested for its ability to repel mosquitoes. For the study against the female Culex quinquefasciatus mosquito that had been blood-starved for three days, various plant extracts were used. In comparison to the petroleum ether and chloroform extracts, the ethanolic extract demonstrated high mosquito repellent effect against the female Culex quinquefasciatus mosquito. The extract's dose-dependent ability to repel mosquitoes was discovered [33].

Wound healing activity:

A bark extract from the C. gigantea root was utilised to measure the effectiveness of the healing process. For the study, various models including a dead space wound, an excision, and an incision were used. In an excision model, the extract was made into an ointment and applied topically to albino rats. In the incision model and the dead space wound models, oral administration of C. gigantea ethanol extract at various doses was used. Excision model demonstrated a higher proportion of wound contraction and a lower level of fibrosis. Incision and dead space wound models demonstrated enhanced breaking strength [34]. The wound healing investigation made use of C. procera latex. An excision was performed on the guinea pig's back. For seven days, two applications of a sterile latex preparation were made each day. The wound region began to heal in the latex-treated animal thanks to growing collagen fibres, DNA, and protein production [35].

CONCLUSION

According to estimates from the World Health Organization, 80% of people in underdeveloped nations rely on herbal remedies for their basic medical needs. Due to their effectiveness and safety for human consumption, traditional and botanical uses of organic compounds, especially those derived from plants, have recently gained more popularity. A thorough analysis of the information that has been published on Calotropis procera and Calotropis gigantea reveals how widely used they are as treatments for various diseases by traditional healers, Ayurveda, and cultural groups. Since the Calotropis species is thought to have far greater therapeutic potential than is currently understood, many researchers are primarily concentrating on it.

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