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CALOTROPIS PROCERA: AN PHARMACOLOGICAL REVIEW

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ABSTRACT

Calotropis procera, commonly known as the Apple of Sodom or Milkweed, is a versatile medicinal plant with a rich history in traditional medicine. This comprehensive review synthesizes the existing literature on the pharmacological properties of Calotropis procera, shedding light on its diverse therapeutic potentials and associated mechanisms of action.

The paper encompasses an exploration of Calotropis procera's bioactive compounds, highlighting the presence of cardenolides, alkaloids, flavonoids, and other secondary metabolites that contribute to its pharmacological activities. The plant has demonstrated promising anti-inflammatory effects, attributed to its ability to modulate various inflammatory pathways. Furthermore, Calotropis procera exhibits significant antioxidant properties, potentially conferring protection against oxidative stress-related diseases.

The review delves into the plant's antimicrobial properties, showcasing its efficacy against a range of pathogens. Calotropis procera also demonstrates notable wound healing attributes, making it a subject of interest for the development of novel therapeutic agents. Additionally, the potential anti-cancer properties of Calotropis procera are explored, emphasizing its impact on cell proliferation, apoptosis, and angiogenesis in various cancer models.

Moreover, the paper provides insights into the plant's effects on the cardiovascular system, neuroprotective properties, and its influence on reproductive health. The review critically assesses the existing evidence, highlighting gaps in knowledge and suggesting avenues for future research.

Keywords: Calotropis Procera, Medicinal Plant, Pharmacological Properties, Bioactive Compounds, Antioxidant.

I. INTRODUCTION

Major pharmaceutical corporations have made plants a source of new pharmaceuticals, and they are now performing considerable research on plant materials to launch new drugs in medical practice [1]. Procera Calotropis Linn. Family Asclepiadaecae is a plant used in Ayurveda that has significant therapeutic qualities [2]. From the earliest stages of civilization to the present, people have used plants and/or plant-derived products as efficient medicinal agents to cure illnesses and wounds [3]. The reason the plant is well-known is because it generates a lot of latex, which is readily extracted from its green sections when it is injured. The large amount of latex found in the plant's green sections supports the theory that it is created and stored as a defence mechanism against creatures including viruses, fungi, and insects [4]. The traditional medical system has made extensive use of the plant in treating a wide range of illnesses. It is an antidote for snakebites and has been used as a purgative, anthelmintic, digestive, stomachic, emetic, expectorant, sedative, blood purifier, ulcer healer, tumour, leprosy, asthma, boils, dysentery, dermatitis, piles, liver and spleen problems [5]. This genus has four species, however only Calotropis procera and Calotropis gigantea are widely known for their therapeutic qualities [6].

The main reason Calotropis is gathered is because of its unique therapeutic qualities. It is widely found as wasteland plant in Indonesia, Malaysia, China, and the Indian subcontinent and is generally known as ark, swallow-wart, or milkweed [7]. Native to North Africa, Calotropis procera is a tropical plant that reaches heights of around 1050 metres. Since it especially likes warm climates, Rajasthan is where it is most widely dispersed [8]. Procera Calotropis In the ancient medical systems of Sudan, Unani, Arabic, and India, linn is commonly used to treat a variety of illnesses, including leprosy, ulcers, piles, and disorders affecting the spleen, liver, and abdomen. [9]. Calotropis has several ethanomedicinal applications that are documented in Ayurveda and are referred to as Raktha Arka. Numerous biologically active chemical groups, such as cardenolides,

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steroids, tannins, glycosides, phenols, terpenoids, sugars, flavonoids, alkaloids, and saponins, were present in Calotropis procera. Numerous pharmacological actions were exhibited by it, including antibacterial, anthelmintic, anti-inflammatory, analgesic, and antipyretic properties, as well as anticancer properties. It was formerly used to cure dyspepsia, cholera, and guinea worm extraction [10].

II. MORPHOLOGY OF PLANT

Flower:

Bisexual, regular, 5-merous flowers with pedicel in shades of white, cream, lilac, or purple 2.5–7.5 cm in length, with 6 mm long, highly woolly, hairy lateral pedicles. Calyx split to base, glabrous; sepals ovate-acute, 5-2.5 mm. The glabrous corolla measures around 2.5 centimetres in diameter and is split into two thirds of that length. The lobes of the corona are typically upright, elliptical, acute, and measure 1 centimetre. The bark is almost straight or slightly curved away from the column above the subacute spur that is upcurved [11]. The flavonoids, polysaccharides containing D-arabinose, glucose, glucosamine, and L-rhamnose, sterol, calactin, calotoxin, calotropagenin, and calotropin are all present in the flower. Enzymes 3-proteinase and calotropain (protease) are also found in flowers. [12].

Fruits:

Follicles, or green, spongy, ovoid fruits, can measure up to 15 cm in length and 10 cm in width. When they break open, light brown, plumed seeds with a pappus of up to six centimeter-long white filaments on one side are released [13].

Barks:

Triterpenes are present in the root bark of Calotropis procera, along with two unidentified pentacyclic triterpinoids, calotropursenyl acetate and calotropfriedelenyl acetate, akundarol isovalerate, mundarol isovalerate, and quercetin -3-rutinoside [14].

Apex:

Nearly sharp, short hairy below. A thick, secondary branch up to 2 cm long, peduncle 6–12 cm long, and an axillary, umbellate to almost corymbose cyme up to 12.5 cm in diameter make up the inflorescence [15].

Taxonomic classification:

Kingdom	:	Plantae,
Subkingdom	:	Tracheobionta,
Superdivision	:	Spermatophyta,
Division	:	Magnoliophyta,
Class	:	Magnoliopsida,
Subclass	:	Asteridae,
Order	:	Gentianales,
Family	:	Asclepiadaceae,
Genus	:	Calotropis,
Species	:	Calotropis procera.

Pharmacological Activities:

Analgesic Activity:

Acetic acid-induced writhing was significantly reduced by a single oral dosage of DL, which ranged from 165 to 830 mg/kg [16]. Compared to an oral aspirin dosage of 100 mg/kg, the effects of DL at a dose of 415 mg/kg were more noticeable. However, in a tail-flick model, DL (830 mg/kg) very slightly reduced pain, similar to aspirin. Naloxone, at a dosage of 0.5 mg/kg, totally prevented the analgesic action of morphine (10 mg/kg), delaying the analgesic impact of DL by one hour. Naloxone, however, had no influence on aspirin's effects. The LD50 of DL was determined to be 3 g/kg, and an oral dosage of 830 mg/kg did not cause any harmful effects in mice [17].

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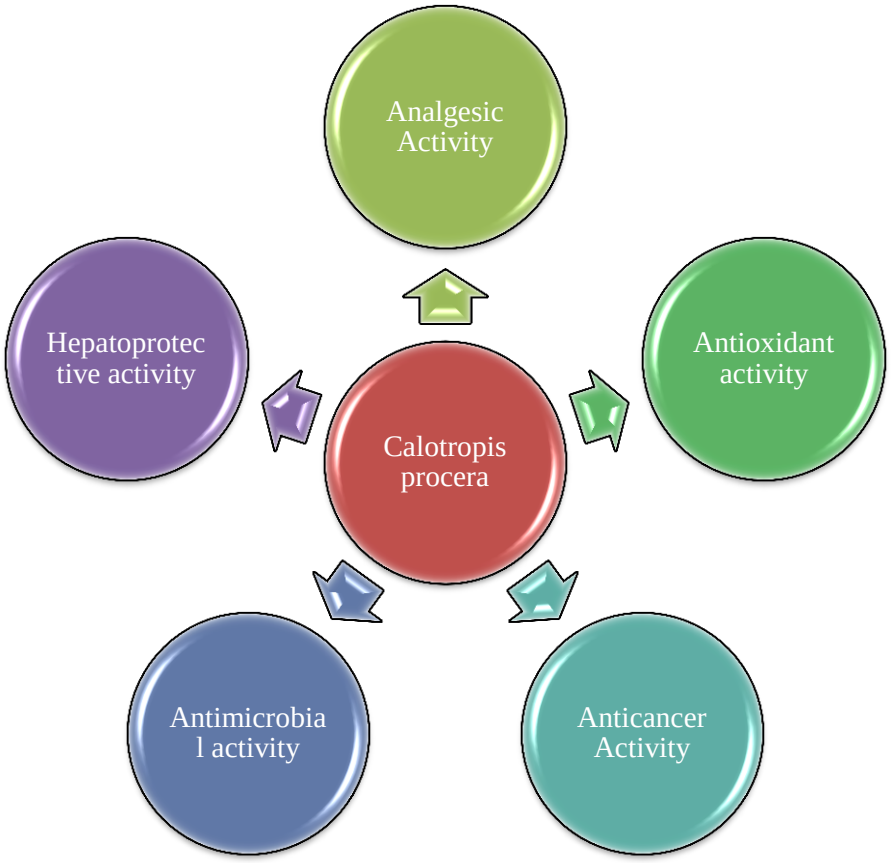

Anti-Oxidant Activity:

According to scientific data, biological systems create oxygen radicals such superoxide anion ($O2^-$), hydroxyl radical (-OH), and peroxyl radical (H2O2) when they are subjected to oxidative stress. Reactive oxygen species (ROS) are these oxygen radicals that may cause oxidative damage to lipids, proteins, and DNA in cells [18]. Rats with alloxan-induced diabetes were tested for the antioxidant and anti-hyperglycemic properties of Calotropis procera dry latex, which has strong anti-inflammatory action. In addition, DL stopped the diabetic rats from losing weight and reduced their daily water intake to levels similar to those of healthy rats. In addition, DL decreased the levels of thiobarbituric acid-reactive substances (TBARS) in rats with alloxan-induced diabetes while increasing the hepatic levels of endogenous antioxidants such as glutathione, catalase, and superoxide dismutase (SOD). Comparable to the typical anti-diabetic medication, DL's antioxidant and anti-diabetic agent effectiveness had a notable impact [19].

Anti-Cancer Activity:

Globally, the prevalence of cancer is rising, and it is the leading cause of death in both developed and developing nations. Nonetheless, traditional herbal medicine and complementary and alternative medicine (CAM) are growing in popularity among cancer patients in affluent nations due to the adverse effects of medications used in the treatment of various diseases [20]. It has been discovered that COLO 320 tumour cells are significantly cytotoxically affected by the root extract of C. procera. In the X15-myc transgenic mouse model of hepatocellular carcinoma, the anticancer ability of C. procera's dried latex (DL) was assessed, and its mechanism of action was clarified in cell culture. Mice treated with DL demonstrated complete protection against hepatocarcinogenesis [21].

Hep2 cancer cells were used in anti-tumor experiments with C. procera root extracts, and the results suggested that the plant's root extracts may have reduced the growth of the cancer cells by apoptotic and cell cycle disruption mechanisms [22].

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Hepatoprotective Activity:

The plant is a rich source of phytoconstituents, however its root bark may not be a hepatoprotective agent due to a lack of scientific support or reports in current literature. This led us to investigate the plant's root bark for potential hepatoprotective action. A 70% aqueous ethanolic extract of Calotropis procera flowers was made, and its ability to protect rats' livers against paracetamol-induced hepatitis was examined. In both the treated and untreated groups, alterations in the levels of biochemical indicators of liver damage, such as SGPT, SGOT, ALP, bilirubin, cholesterol, HDL, and tissue GSH, were examined [23].

Anti-Microbial Activity:

The antibacterial properties of Calotropis procera leaf and latex extracts in ethanol, water, and chloroform on six bacteria, three fungi, and one yeast Using paper disc and agar well diffusion techniques, the presence of Candida albicans was assessed [24]. The findings showed that ethanol was the most effective extractive solvent for the antibacterial qualities of C. procera leaves and latex, with chloroform and water coming in second and third, respectively ($p<0.05$) [25].

III. CONCLUSION

In conclusion, this comprehensive review illuminates the multifaceted pharmacological profile of Calotropis procera, underscoring its potential as a valuable resource in the realm of traditional medicine. The diverse range of bioactive compounds present in the plant, including cardenolides, alkaloids, and flavonoids, contribute to its remarkable therapeutic properties. The demonstrated anti-inflammatory effects, antioxidant capabilities, and antimicrobial prowess of Calotropis procera position it as a promising candidate for addressing a variety of health concerns.

Notably, the plant's role in wound healing and its potential anti-cancer properties add further layers to its medicinal significance. The exploration of Calotropis procera's effects on the cardiovascular system, neuroprotection, and reproductive health broadens its potential applications in various medical contexts.

However, this review also underscores the necessity for continued research to bridge existing knowledge gaps and further validate the plant's efficacy and safety. By critically assessing the current evidence, the paper highlights areas where additional investigation is warranted, presenting a roadmap for future research endeavors. Overall, Calotropis procera emerges as a versatile medicinal plant with a rich pharmacological profile, offering a compelling foundation for ongoing exploration and potential integration into modern therapeutic practices.

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