A Review of *Calotropis gigantea* and *Calotropis procera*: Promising Sources for Antimicrobial and Antioxidant Therapies

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***Abstract*-- The antimicrobial properties of *Calotropis* species, particularly *Calotropis gigantea* and *Calotropis procera*, have been widely investigated due to their potential in treating various infectious diseases. Multiple studies have highlighted the plant's significant antibacterial and antifungal activities, supporting its traditional use in herbal medicine. Various parts of the plants, including leaves, flowers, latex, and roots, have been analyzed for their efficacy against both Gram-positive and Gram-negative bacteria, such as *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae*. These studies utilize methods such as the disc diffusion and well diffusion techniques to determine the inhibition zones produced by extracts obtained from different solvents like methanol, ethanol, and aqueous solutions. The results generally indicate that *Calotropis* extracts show varying degrees of antimicrobial activity, with some extracts outperforming standard antibiotics in inhibiting bacterial growth. Additionally, *Calotropis* plants have been found to possess strong antioxidant properties, which further support their medicinal value. The plants' phytochemical constituents, including glycosides, flavonoids, and terpenoids, contribute to their antimicrobial and anti-inflammatory properties, suggesting their therapeutic potential. The overall findings encourage further exploration and isolation of bioactive compounds from *Calotropis* for pharmaceutical applications, particularly in combating resistant bacterial strains and contributing to the development of new antimicrobial agents.**

***Index Terms*—Anti oxidant,Antibacterial, Phytochemical, Latex, Bioactive copounds.**

I. INTRODUCTION

The genus *Calotropis*, which includes species like *Calotropis gigantea* and *Calotropis procera*, has long been recognized for its wide-ranging medicinal properties, particularly in the treatment of infections. These plants are found abundantly in tropical and subtropical regions, often used in traditional medicine for their purported antimicrobial, antioxidant, and anti-inflammatory effects. The significant presence of bioactive compounds in the leaves, roots, flowers, and latex of *Calotropis* species has sparked interest in exploring their therapeutic potential. This paper reviews several studies focused on the antimicrobial and antioxidant properties of *Calotropis gigantea* and *Calotropis procera*, examining their efficacy against a range of bacterial pathogens and their potential as natural alternatives in the fight against drug-resistant microorganisms.

II. ANTIMICROBIAL ACTIVITY OF *Calotropis* SPECIES

Numerous studies have confirmed the antimicrobial efficacy of *Calotropis* species against both Gram-positive and Gram-negative bacteria. Gaurav Kumar et al. (2010) demonstrated that aqueous extracts of *C. gigantea* leaves exhibited significant antimicrobial activity against common clinical pathogens like *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. Similarly, Mst Nazma Yasmin et al. (2008) reported that methanol and aqueous extracts of *C. procera* leaves were effective

against both Gram-positive and Gram-negative bacteria, with results comparable to standard antibiotics such as Gentamycin. Kartini Hasballah's study (2008) further confirmed the antibacterial properties of methanol extracts from *C. gigantea* flowers against *Staphylococcus aureus* and *Escherichia coli*.

Kareem et al. (2010) expanded on this by studying different extracts (ethanol, aqueous, and chloroform) from both the leaf and latex of *C. procera*. Their research demonstrated that the ethanol extract provided the highest antimicrobial activity, particularly against *E. coli*, with the latex extract showing the broadest zones of inhibition. Furthermore, studies by Kori et al. (2014) investigated the root and latex of *C. gigantea*, providing further evidence of its antimicrobial activity against *Escherichia coli* and *Staphylococcus aureus*.

Hayat et.al (2020) reported that methanolic extract of leaves of Calotropis procera was used to check the antibacterial activity against Proteus mirabilis, Pseudomonas aeruginosa, Bacillus cereus, Escherichia coli, Klebsiella pneumonia, Salmonella typhi and Enterococcus faecalis using the disc diffusion method.

Irfan Ullah et al., (2024) investigated that the antibacterial activities of *C. procera* extract and latex was done using agar well diffusion method. The leaves extract of *C. procera* has antibacterial activity on pathogenic microorganisms. It was concluded that chloroform, ethanol and aqueous of *C. procera* leaf extract and latex have antibacterial as well as the ant-fungal potential against clinical strains and thus derive antimicrobial agents especially *M. morganii, E. coli, S. typhi* and *P. alcalifaciens.*

Mohammad Humayoon Amini et al., (2021) reported that antimicrobial activities of C. procera latex, different crude extracts and some isolated compounds which have been tested for antimicrobial property.

The root and latex of *Calotropis gigantea* were screened for its antimicrobial and phytochemical activities. The solvents used for the roots and latex extraction were n-hexane, benzene, acetone, ethanol, aqueous. The extract was tested against infectious disease causing bacterial such as *E.coli, Pseudomonas aeruginosa, Staphylococcus aureus* using the well diffusion method. In this study, bacterial extract showed a varying zone of inhibition of the growth of tested organism than n-hexane, benzene, ethanol, aqueous. Phytochemical properties of root and latex of *calotropis gigantea* obtained from n-hexane, benzene, ethanol and aqueous extract were investigated by Pramila kori et al.,(2014).

Shar S. Alghamdi et al., (2025) demonstrated that the remarkable cytotoxic and antibacterial effect of *C. procera* extracts prepared using ethyl acetate. These results pave the way for further in vitro studies to explore the full potential of these extracts and highlight the presence of chemically active metabolites in *C. procera,* which hold promise as lead molecules for the development of novel therapies targeting bacterial infections and cancer while minimizing potential side effects.

III. ANTIOXIDANT POTENTIAL OF *Calotropis* SPECIES

In addition to antimicrobial properties, the antioxidant potential of *Calotropis* species has been a major focus in recent research. Mst Nazma Yasmin et al. (2008) assessed the antioxidant properties of both methanol and aqueous extracts from *C. procera*, finding that the methanol extract exhibited strong antioxidant activity with a 50% inhibition concentration of 110.25 µg/ml. These results suggest that *C. procera* may be a valuable source of natural antioxidants, which can be used to mitigate oxidative stress in various diseases.

Ahmed Alafnan et al. (2021) also confirmed the antioxidant potential of *C. gigantea* in their studies, where the ethanolic leaf extract was found to be effective in scavenging free radicals. This supports the dual therapeutic potential of *Calotropis* species in both antimicrobial and oxidative damage-related diseases.

Ashish Dixit et al., (2023) investigated that antioxidant activity was determined in vitro by reducing power, DPPH and nitric acid method. Hydroalcoholic extract of *Calotropis procera* shown significant antioxidant activity. *Calotropis procera* (Asclepiadacea) commonly known as akado and wild growing tropical

plant, which process number of medicinal properties. It is reported to contain cardiac glycosides, beta sitosterol, madrine, saponins, alkaloids, tannins, trisecharoids and flavonols. The plant has been used for various disease condition, including leprosy, ulcer, tumors and piles.

Varsha G Shetty et al., (2015) suggested that since the leaves of *C. procera* process significant antibacterial properties and contain phytoconstituents, it can be potential exploited for the development novel chemotherapeutic agents.

Occurrence of more phenols in the naturally growing *Calotropis procera*pants as compared to the in vitro raised plants suggest that the plant synthesis phenolic compound under stress conditions in their natural habitat for defense purposes, Ramesh et.al., 2009.

IV. PHYTOCHEMICAL COMPOSITION AND FURTHER INVESTIGATIONS

The antimicrobial and antioxidant properties of *Calotropis* are attributed to the presence of various bioactive phytochemicals, including flavonoids, saponins, alkaloids, and glycosides. The latex of *C. procera*, for example, contains bioactive proteins such as lysozyme, which has shown promising antibacterial activity (Sakthivel Muthu et al., 2024).

Calotropis procera owes its therapeutic qualities to the secondary metabolites like tannins, alkaloids and phenols present in it. New synthetic drug are being formulated by using this secondary metabolites as a prototype. (Aisha et.al., 2024)

Phytochemical analysis of the leaf and latex extracts showed the presence of tannins, steroids, saponins and flavanoids while alkaloids were present in both extracts. Generally the anti bacterial effects of the plant parts revealed that the leaf extracts had the stronger activity in comparison with those of the latex. (Kawo et.al., 2009)

Further research should focus on isolating and characterizing these active compounds to determine their exact mechanisms of action. Studies on the safety, efficacy, and potential toxicity of these extracts will be crucial for advancing *Calotropis* species toward clinical applications.

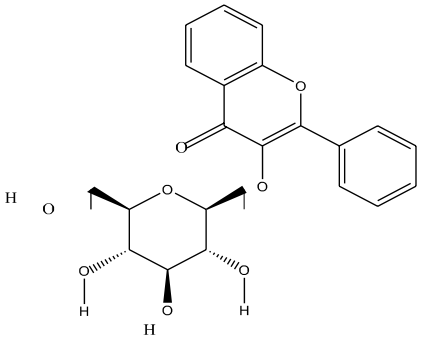

Fig.1. Structure of Flavonol

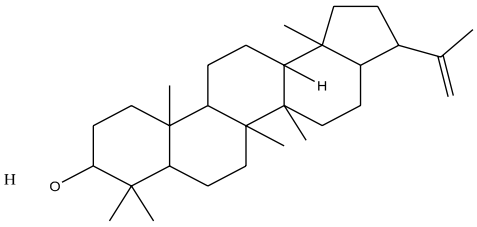

Fig.2.Structure of saponin

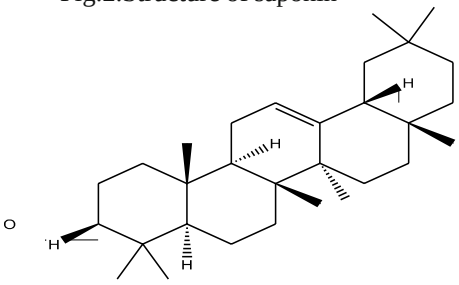

Fig.3.Structure of Terpenes

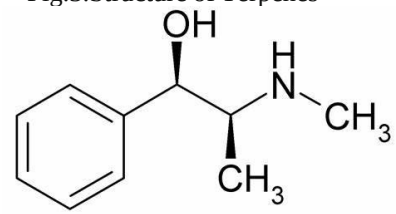

Fig.4.Structure of Alkaloid

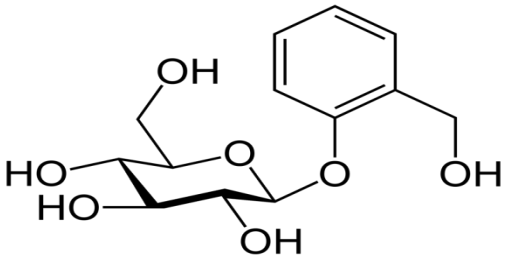

Fig.5.Structure of Glycocide

VI TOXICITY AND SAFETY CONSIDERATIONS

While the antimicrobial and antioxidant properties of *Calotropis* species are well-documented, the safety and toxicity profiles of these plants require further investigation. Studies on the toxicity of *Calotropis* species have reported mild to moderate toxicity, particularly in animals, and caution is advised in using them for medicinal purposes without proper dosage regulation. Md. Shaficur Rahman et al. (2013) highlighted the antimicrobial activity of the exudate from *C. gigantea*, but the safety and potential side effects of its prolonged use are still unclear.

VII. CONCLUSION

The findings from the studies reviewed highlight the significant antimicrobial potential of *Calotropis gigantea* and *Calotropis procera* against a broad spectrum of bacterial pathogens. These plants, commonly found in wastelands and tropical regions, demonstrate promising antibacterial activity through both aqueous and organic solvent extracts. Several researchers have found that the leaves, roots, latex, and flowers of *Calotropis* species exhibit varying degrees of effectiveness against Gram-positive and Gram-negative bacteria. For instance, *Calotropis gigantea* has shown activity against pathogens such as *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*, supporting its use in traditional medicine for treating infections.

Additionally, the antioxidant properties of *Calotropis* species further bolster their therapeutic potential. The methanolic and aqueous extracts of these plants have demonstrated notable antioxidant activity, suggesting their role in neutralizing free radicals and protecting cells from oxidative damage. This makes them potential candidates for inclusion in the development of natural remedies for diseases linked to oxidative stress, such as cancer and cardiovascular disorders. The ability of these plants to combat microbial growth while also offering antioxidant protection underscores their multifaceted pharmacological value.

While the antimicrobial and antioxidant activities are well-documented, there remains a need for more detailed studies on the active compounds responsible for these effects. Researchers have identified various phytochemicals such as flavonoids, alkaloids, saponins, and glycosides, but the precise mechanisms of action and their interactions require further investigation. Future studies should focus on isolating these compounds and assessing their efficacy in clinical trials to confirm their potential as alternative therapeutic agents. Moreover, the safety profile of these extracts needs to be thoroughly evaluated to ensure their suitability for long-term medicinal use.

The potential applications of *Calotropis* species are not limited to antimicrobial and antioxidant therapies. The latex from *Calotropis procera*, for instance, has been explored for its wound healing, anti-inflammatory, and analgesic properties. This broad spectrum of medicinal uses makes *Calotropis* a valuable resource for the development of natural-based treatments for various health conditions. Furthermore, their environmental adaptability and widespread availability position *Calotropis* as a cost-effective option for the production of medicinal compounds in low-resource settings.

In conclusion, *Calotropis gigantea* and *Calotropis procera* represent a promising avenue for further pharmacological research. Their established biological activities, combined with the diversity of active compounds, offer great potential for future drug development. However, continued research into their bioactive properties, coupled with clinical studies, is crucial to translating their traditional uses into modern therapeutic applications.

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