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A RIVIEW ON THERAPEUTIC ACTIVITY AND MEDICINAL USES OF LANTANA CAMARA 'LINN'

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ABSTRACT

India has a rich tradition of plant-based knowledge in healthcare, with numerous herbal medicines widely used across the country. Many of these have been extensively studied, providing insights into their therapeutic benefits. One such plant is *Lantana camara*, an evergreen species found throughout India. Traditionally, it has been used in treating various ailments, with its effectiveness supported by scientific data. *Lantana camara* is considered both a problematic weed and a valuable cosmetic plant, and it has been recognized as a source of medicinal compounds since ancient times. Various parts of the plant—leaves, flowers, roots, and stems—contain a range of phytochemicals, contributing to its medicinal properties. Studies on its phytoconstituents have shown it to be useful in the treatment of ailments like colds, headaches, asthma, chickenpox, eye injuries, and hypertension.Additionally, *Lantana camara* has demonstrated multiple therapeutic activities, including antibacterial, antioxidant, antipyretic, and antimicrobial effects. Its pharmacological potential is continuously explored in research, highlighting its role in both traditional and modern medicine. Despite being classified as a weed, *Lantana camara* remains a significant plant in India's herbal medicine, showing potential for further medicinal applications.

Keywords: *Lamtana Camara* Linn , Traditional Medicine , Phytoconstituents , Herbal Medicine , Cosmetic Plant.

I. INTRODUCTION

"Lantana camara" a member of the Verbenaceae family, is popular in India as an ornamental plant and has become well-established across the country. Commonly known as, *Surina Wild Sage m Tea Plant, Spanish Flag, and West Indian Lantana*, this flowering plant is native to tropical areas. It displays significant adaptability, with most varieties favoring nutrient-rich soils, though many can also thrive on sandy or sandstone- derived soils with sufficient moisture. L. camara exists in a variety of strains, each differing in appearance, and is recognized in traditional medicine, with recent research highlighting its potential for modern medicinal applications.[1]Historically, medicinal plants have been crucial in treating various health issues, as they contain bioactive compounds valuable for pharmaceutical development. Pharmacognosy, the study of natural sources of medicine, focuses on the identification, standardization, and scientific evaluation of plant-based remedies to support their therapeutic uses[7]Lantana camara derives its name from the Latin word "lento," meaning "to bend." It is a thorny, multi-stemmed shrub that typically grows up to 6 feet (2 meters) in height. Known for its resilient root system, L. camara can sprout new shoots even after repeated trimming. The stems are square in shape, covered in bristly hairs while young, and often bear small prickles. Its leaves, which are arranged opposite each other, are oval with long petioles, have a rough, hairy texture, and display toothed edges. When crushed, the leaves release a strong fragrance. The plant produces small, brightly colored flowers that form in dense, flat-topped clusters; these flower often change color as they mature. Recognized in traditional medicine,

L. camara has shown potential for use in modern therapeutic applications. This review explores the medicinal properties of L. camara and highlights the need for further research into its possible development as a source of medicinal compounds [2]

II. TAXONOMICAL CLASSIFICATION

The botanical name of Raimuniya is Lantana camara. It belongs to plant family Verbanaceae. The taxonomical classification is mentioned below.

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Table 1: Plant Taxonomy

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliopsida
Subclass	Asteridae
Order	Lamiales
Family	Verbenaceae
Genus	Lantana
Species	Lantana camara

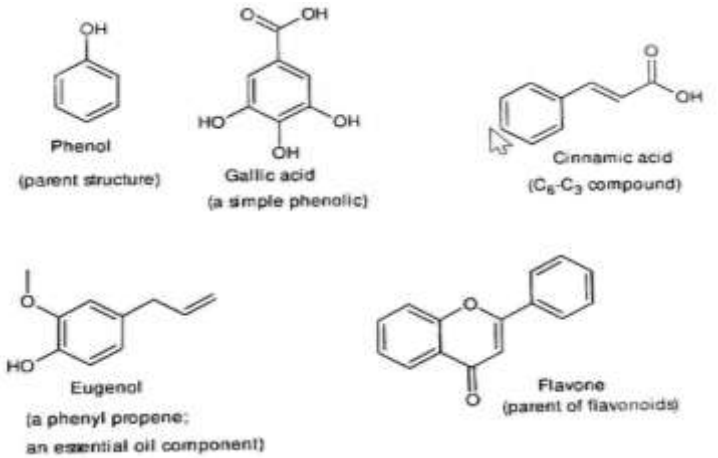
Figure 1: *Lantana Camara* Plant with flowers

Phytochemistry

The phytochemical composition of *Lantana camara* has been widely explored over recent decades. Studies reveal that various parts of *Lantana camara* contain essential oils, phenolic compounds, flavonoids, carbohydrates, proteins, alkaloids, glycosides, iridoid glycosides, phenyl ethanoids, oligosaccharides, quinines, saponins, steroids, triterpenes, sesquiterpenoids, and tannins as primary phytochemical categories. Each part of *Lantana camara* appears to house a diverse array of these compounds, contributing to the plant's broad biochemical profile and potential medicinal applications. [3],[4]

Chemical Constituents

- β-sitosterol, Betulonic acid, Betulinic acid, Campesterol, Hispidulin, Pectolinarigenin, Pectolinarin
- β-pinene, 1,8-Cineole, Cinnamic acid, Dipentene, Ferulic acid, Myristic acid, Palmitic acid
- Camaraside, Camarinic acid, Camaric acid, Lantanilic acid, Linaroside, Lantanoside, Linaroside, Oleanolic acid, Ursonic acid
- 8-epiloganin, Geniposide, Icterogenic acid, Isonuomioside A, Isoverbascoside, Lamiridoside, Lantadene A, B,C, Lantanolic acid, Lantic acid, Theveside, Ursolic acid, Verbascoside
- ρ-Coumaric acid, ρhydroxybenzoic acid, Vanillic acid [5],[6]



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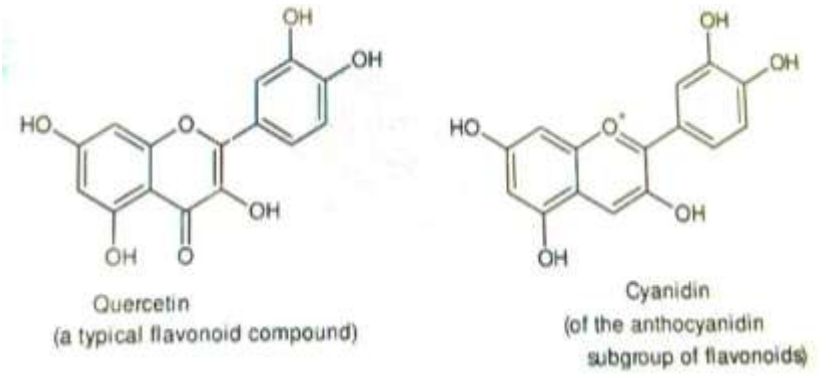

Figure 2: Chemical constituents of lantana camara

III. MEDICINAL AND THERAPEUTIC USES

Lantana camara is an important medicinal plant and in recent history this plant is reported for various medicinal properties

Antioxidant Activity

The leaves of "*Lantana camara"* have been widely recognized for their potent antioxidant properties, demonstrated through various in vitro and in vivo studies. Antioxidant activity in leaf extracts has been measured using assays such as reducing power and 'DPPH' "(1,1-diphenyl-2-picrylhydrazyl)" radical scavenging methods. These studies consistently reveal that *L. camara* leaves possess strong antioxidant effects, with younger leaves exhibiting higher activity compared to mature ones. This suggests a developmental variation in phytochemical composition that enhances the antioxidant potential of younger foliage.Ethanolic extracts of "*L. camara"* have shown promising results in in vivo experiments, particularly in studies involving urolithic rats. The extracts significantly reduced lipid peroxidation levels in the kidneys, highlighting their role in mitigating oxidative stress in biological systems. This protective effect against oxidative damage further supports their potential application in managing oxidative stress- related disorders.In vitro studies have corroborated these findings using DPPH and nitric oxide radical scavenging assays, which confirmed the high antioxidant potential of *L. camara* leaf extracts. The ability to neutralize free radicals effectively demonstrates the leaves' role as a natural source of antioxidants, potentially useful in pharmaceutical and nutraceutical formulations.The significant antioxidant activity of '*Lantana camara'* leaves underscores their therapeutic relevance, particularly in conditions associated with oxidative stress. This supports the plant's traditional use in herbal medicine and highlights the potential for further research into its phytochemicals for developing antioxidant-based therapies.[8]

Antibacterial Activity

Ethanolic extracts of "*Lantana camara"* leaves and roots have demonstrated significant antibacterial activity in vitro, as assessed through the 'microdilution method'. These extracts effectively inhibited the growth of various pathogenic bacteria, including "*Staphylococcus aureus"*, "*Proteus vulgaris"*, "*Pseudomonas aeruginosa"*, "*Vibrio cholerae"*, "*Escherichia coli"*, and multidrug-resistant strains of '*E. coli'* and '*S. aureus'*. This highlights their potential as a natural antimicrobial agent, particularly in combating antibiotic-resistant pathogens.Further studies on extracts from the leaves and flowers of four *L. camara* varieties, prepared in three different solvents, revealed notable antibacterial activity against '*E. coli'*, '*Bacillus subtilis'*, and '*P. aeruginosa'*. However, the activity was comparatively lower against '*Staphylococcus aureus'*. These findings suggest the antibacterial efficacy of *L. camara* varies based on the solvent used for extraction and the specific bacterial strain tested.Methanolic extracts from various parts of the plant have also been evaluated against 10 bacterial strains and five fungal species using disk diffusion and broth microdilution methods. Among the tested plant parts, the leaves exhibited strong antibacterial activity against '*Bacillus cereus'* (Gram-positive) and '*Salmonella typhi'* (Gram-negative).

These results indicate that different plant parts of *L. camara* possess bioactive compounds with antimicrobial properties, making the plant a promising candidate for developing natural antibacterial agents.The broad-

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spectrum antimicrobial activity of *Lantana camara* underscores its potential application in managing bacterial infections, particularly those involving resistant strains, and highlights its importance in further phytochemical and pharmacological studies [10],[11]

Hemolytic Activity

The hemolytic activity of "*Lantana camara"* extracts, including an aqueous extract and various solvent fractions, has been studied using a modified spectroscopic method at concentrations of 125, 250, 500, and 1000 µg/ml. These investigations aimed to evaluate the potential cytotoxic effects of the extracts on human erythrocytes. The results revealed that both the aqueous extract and the solvent fractions exhibited minimal hemolytic activity, suggesting a relatively safe profile for therapeutic application. Among the tested extracts, differences in hemolytic activity were observed, with the chloroform fraction displaying the highest activity. This was followed by the hexane and ethyl acetate fraction (50:50), which showed moderate hemolytic effects. The aqueous extract exhibited lower hemolytic activity, indicating its compatibility with erythrocytes. Ethanol and methanol fractions demonstrated the least hemolytic effects, ranking as the safest among the tested fractions.The observed order of hemolytic activity was as follows: chloroform fraction > hexane and ethyl acetate fraction (50:50) > aqueous extract > ethanol fraction > methanol fraction. These results suggest that the type of solvent used in the extraction process significantly influences the hemolytic potential of the resulting fractions, possibly due to the differential solubility and concentration of bioactive compounds.Overall, the study highlights the low cytotoxicity of *Lantana camara* extracts on human erythrocytes, particularly for ethanol and methanol fractions. This finding underscores the potential of these extracts for further development in pharmaceutical and therapeutic applications while emphasizing the need for careful selection of extraction methods to ensure safety. [12]

Wound Healing Activity

The wound healing properties of *Lantana camara* leaf extracts have been evaluated in several studies, particularly focusing on ethanol and aqueous extracts. In one study, an ethanol extract was applied directly to wound sites in adult male 'Wistar rats'. The treatment significantly promoted wound healing, as evidenced by improved tissue regeneration and histological analysis of the healed areas. This indicates that the bioactive compounds in the ethanol extract play a critical role in enhancing the wound repair process. Similarly, the topical application of an aqueous leaf extract of *L. camara* at a dose of 100 mg/kg/day demonstrated remarkable wound healing effects. The treatment facilitated wound contraction by up to 98%, indicating accelerated closure of the wound. Furthermore, the extract enhanced collagen synthesis, a crucial factor in strengthening the repaired tissue and ensuring proper wound healing. This treatment also significantly reduced the healing time, suggesting its potential for speeding up recovery in wound management.These findings collectively highlight the effectiveness of '*Lantana camara'* leaf extracts in promoting wound healing. The observed improvements can be attributed to the plant's bioactive compounds, which likely contribute to enhanced cellular activity, increased collagen production, and overall tissue repair. The studies suggest that *L. camara* extracts, particularly in ethanol and aqueous forms, hold significant promise for developing natural therapeutic agents for wound care, supporting the plant's traditional use in herbal medicine. Further research is warranted to explore their mechanisms of action and optimize their application in clinical settings [13]

Anti-Fungal Activity

The antifungal properties of "*Lantana camara"* have been studied extensively, demonstrating its potential as a natural antifungal agent. Ethanol and hot water extracts of *L. camara* were tested against wood- destroying fungi, specifically white rot and brown rot species. Both extracts showed significant antifungal activity, with the ethanol extract displaying particularly strong efficacy even at a low concentration of 0.01%. This suggests the presence of potent antifungal compounds in the ethanol extract that could inhibit fungal growth effectively at minimal doses.In another study, *L. camara* extracts were evaluated against '*Alternaria'* species, which are known pathogens causing diseases in various vegetables. The antifungal activity of the extracts was assessed using the food poison plate method at three concentrations: 10 mg/ml, 15 mg/ml, and 20 mg/ml. Results indicated that *L. camara* exhibited a dose- dependent antifungal effect, with the highest concentration (20 mg/ml) showing the most significant inhibition of '*Alternaria* growth'. This highlights the potential application

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of *L. camara* in managing fungal diseases in agriculture.The robust antifungal activity observed in these studies underscores the efficacy of *Lantana camara* extracts in combating fungal pathogens. Ethanol extracts, in particular, stand out due to their high potency even at low concentrations. These findings suggest the potential for *L. camara* to be developed into antifungal formulations for both agricultural and industrial applications, supporting its traditional use and encouraging further research into its active compounds and mechanisms of action [14]

Antimicrobial Activity

Dried extracts of *Lantana camara* were prepared for antimicrobial testing by dissolving them in acetone or methanol to a final concentration of 30 mg/ml. The solutions were sterilized using 0.45 µm Millipore filters to ensure sterility prior to testing. The disk diffusion method was employed to evaluate the antibacterial and antifungal activities of the extracts.Bacterial suspensions were prepared at a concentration of 10^8 CFU/ml, while yeast suspensions were set at 10^6 CFU/ml. These suspensions were evenly spread onto nutrient agar for bacteria and sabouraud dextrose agar for yeast. Sterile disks measuring 6 mm in diameter were infused with 10 µl of each extract, delivering a final concentration of 100 µg/ml per disk. These disks were then placed onto the prepared agar plates. Negative controls included the solvents (acetone and methanol) used to dissolve the extracts to rule out solvent-specific effects, while gentamycin sulfate (10 mg/ml disk) was used as a positive control to benchmark bacterial sensitivity.The plates were incubated at 35 ± 1°C for 24 hours for bacterial cultures and 48 hours for yeast cultures. This incubation period allowed sufficient time for microbial growth and for the extracts to exert their antimicrobial effects. The results demonstrated the efficacy of the *Lantana camara* extracts in inhibiting microbial growth, highlighting their potential as natural antimicrobial agents. The study provides a robust framework for exploring the therapeutic applications of these extracts in combating bacterial and fungal infections. [15]

Mosquito Controlling Activity

The methanol and ethanol extracts derived from the leaves and flowers of *Lantana camara* have demonstrated significant larvicidal activity against the third and fourth instar larvae of *Aedes aegypti* and *Culex quinquefasciatus* mosquitoes. Both extracts were particularly effective against "*Ae. Aegypti"*, exhibiting higher larvicidal potency at lower concentrations, such as 1 mg/ml, when compared to their activity against "*Cx. Quinquefasciatus"*. These findings suggest that the bioactive compounds in *L. camara* possess targeted efficacy against mosquito larvae, with potential for application in vector control.In addition to larvicidal effects, the essential oil extracted from *L. camara* leaves demonstrated strong adulticidal properties against various mosquito species, including *Ae. aegypti*," *Cx. Quinquefasciatus"*, "*Anopheles culicifacies"*, "*An. Fluviatilis"*, and "*An. Stephensi"*. The effectiveness of the essential oil was quantified using LD_{50} and LD_{90} values, which were in the range of 0.05–0.06 mg/cm^2 and 0.09–0.10 mg/cm^2, respectively, for these species. These low lethal doses highlight the potent adulticidal potential of the oil.The combined larvicidal and adulticidal properties of "*Lantana camara"* extracts and essential oils underscore its efficacy as a natural mosquito control agent. Its effectiveness against multiple species, including major vectors of diseases like dengue, malaria, and filariasis, makes it a promising candidate for integrated pest management strategies. Further research into formulation and field application could advance its use as a sustainable and eco-friendly alternative to synthetic pesticides [16]

Effect on Red Blood Cells

The effects of an aqueous extract of *Lantana camara* on red blood cell (RBC) osmotic fragility and morphology were investigated to understand its potential impact on cellular stability and structure. The study revealed a significant ($p < 0.05$) increase in "hemolysis", indicating that the extract compromises the integrity of RBC membranes under osmotic stress. This heightened fragility suggests the extract may interfere with membrane stability, potentially through interactions with 'lipid bilayers' or 'membrane- bound proteins'.In addition to increased hemolysis, morphological changes in RBCs were observed.

Alterations in cell shape may reflect the pharmacological activity of certain bioactive compounds within the extract, such as saponins, phenolics, or alkaloids, which are known to impact membrane properties. These changes could include "echinocytosis" or "spherocytosis", indicative of disruptions in cytoskeletal organization

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or membrane fluidity.The observed effects underscore the potential for the aqueous extract of "*L. camara"* to interact with cellular membranes, possibly contributing to its broader pharmacological or toxicological profile. While these findings highlight potential risks, they also provide insights into the mechanisms by which the plant's compounds exert biological effects.Further research is warranted to isolate and characterize the specific compounds responsible for these effects and to assess their implications for therapeutic applications. Understanding the balance between the extract's beneficial and adverse effects is essential for its safe use in medicinal or other applications [17]

Anticancer and Antiproliferative Activity

Various parts of *Lantana camara* have shown promising anticancer and antiproliferative properties, making it a subject of interest in cancer research. The leaves, in particular, demonstrated significant antiproliferative effects against 'HEp-2' "(laryngeal cancer)" and 'NCI-H292' "(lung cancer)" cell lines, as evaluated through the MTT assay. The methanol extract of the leaves exhibited potent activity against 'NCI-H292 cells', reducing cell viability to 25.8%, highlighting its potential efficacy in lung cancer treatment.In addition to its anticancer effects, the methanol leaf extract displayed cytotoxicity against the Vero cell line. At a concentration of 500 µg/ml, the extract inhibited cell growth, though its effect was approximately 2.5 times lower than that of Triton X-100 (1%), a standard cytotoxic agent. These results indicate the selective toxicity of *L. camara* extracts, which may be further optimized for therapeutic use.A key compound, oleanonic acid, isolated from *L. camara*, was also tested for anticancer activity. It demonstrated significant cytotoxic effects against Ehrlich ascites carcinoma, a murine tumor model, and three human cancer cell lines: A375 (malignant melanoma), 'HEp-2' "(laryngeal carcinoma)", and 'U937' "(lymphoma)". Among these, oleanonic acid was particularly effective against A375 melanoma cells, indicating its potential as a therapeutic agent for melanoma treatment.These findings underscore the potential of *Lantana camara* and its bioactive compounds in anticancer therapy. Further research is required to elucidate the mechanisms of action and develop safe, targeted treatments using these natural compounds [18,19]

Anti-Hyperglycemic Activity

The methanol extract of "*Lantana camara"* leaves has demonstrated notable antihyperglycemic effects in '*alloxan*-induced diabetic rats'. Oral administration of the extract at a dose of 400 mg/kg body weight resulted in a significant reduction in blood glucose levels, which dropped to 121.94 mg/dl. This suggests that the extract contains bioactive compounds capable of modulating glucose metabolism and potentially offering therapeutic benefits for managing diabetes.In addition to the effects of the leaf extract, studies on the hypoglycemic properties of *L. camara* fruit extract were conducted in '*streptozotocin*-induced diabetic Wistar albino rats'. The fruit extract exhibited a dosedependent reduction in blood glucose levels, with doses of 100 and 200 mg/kg body weight producing significant effects. These findings indicate that both the leaves and fruits of "*L. camara"* possess antidiabetic potential, though their activity may vary based on the dosage and part of the plant used.Treatment with the fruit extract also contributed to improvements in overall health markers. Notably, it led to an increase in body weight, a common challenge in diabetic conditions, and positively impacted the "HbA1c profile", suggesting better long-term blood glucose control. Furthermore, liver cell regeneration was observed, indicating a potential hepatoprotective effect of the extract, which could aid in reversing diabetes-related liver damage.These results highlight the therapeutic potential of "*Lantana camara"* in managing hyperglycemia and related complications, supporting its traditional use in herbal medicine. Further research is needed to isolate the active compounds and fully understand their mechanisms of action for diabetes treatment [20]

IV. CONCLUSION

Lantana camara is an intriguing medicinal plant with immense therapeutic potential. Despite being commonly regarded as an invasive weed, it has a long history of use in traditional and folk medicine across various cultures. Its rich phytochemical profile, including alkaloids, flavonoids, phenolics, and terpenoids, lends it diverse pharmacological properties. Different parts of the plant, such as the leaves, flowers, roots, and stems, are utilized in traditional healing systems for a range of health conditions. These include oxidative stress, fungal infections, fertility disorders, hemolytic conditions, wounds, and even cancer.One of the most notable uses of *L.*

camara is its application in treating skin-related conditions. The oil extracted from the plant is applied topically to alleviate skin irritations, serve as an antiseptic for wounds, and treat diseases such as leprosy and scabies. Its antioxidant properties help combat free radicals, reducing the risk of chronic illnesses. Additionally, preliminary studies suggest anti-fertility and anti-cancer properties, though the mechanisms remain poorly understood.However, despite its promising medicinal applications, most pharmacological studies on *L. camara* are in their early stages, often limited to animal models. While these studies offer valuable insights into the plant's therapeutic potential, they are insufficient for validating its use in modern medicine. Rigorous preclinical and clinical trials are essential to evaluate the efficacy and safety of *L. camara* in human health. Understanding the specific mechanisms of its bioactive compounds is also necessary for advancing its pharmaceutical applications.Another challenge lies in managing the invasive nature of *L. camara*. Its ability to spread rapidly and dominate ecosystems can disrupt native flora and fauna. However, this characteristic could be leveraged for sustainable utilization, turning an ecological concern into a medicinal resource.In conclusion, *Lantana camara* offers significant potential as a natural alternative to synthetic medicines. Its applications in treating infections, wounds, and other conditions make it a valuable candidate for further exploration. However, more robust scientific research is needed to fully understand its therapeutic actions and ensure its safety for human use. With focused efforts on sustainable management and comprehensive pharmacological studies, *L. camara* could transition from being viewed primarily as a weed to becoming an essential resource in herbal medicine. This approach not only promotes innovation in natural medicine but also addresses environmental concerns associated with the plant's invasive nature.

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