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Unlocking The Nutritional and Medicinal Value of Lantana Camara Linee.

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Abstract: Lantana is valued for its rich nutritional and powerful healing properties. It contains Beneficial compounds such as triterpenoid, flavonoids, phenolic acids, iridoid Glycosides, alkaloids, saponins, tannins, steroids, and essential oil components. These Compounds provide antioxidant, antimicrobial antifungal, anti-inflammatory Wound healing, and anticancer/cytotoxic activity this review highlights the key Phytochemicals, extraction methods like maceration and sonication improve the quality or bioactive compounds. While adding lantana leaves to the extraction process is Generally safe at moderate doses, very high amounts may cause side effect.

Overall, Lantana camara holds great promise as a natural source of nutrition and medicine. With more research, standardization, and safe formulation, it can play a Major role in improving global health.

Keywords: Phytochemistry, Antioxidants Anti- inflammatory, wound healing Insecticidal agent, essential oils.

I. INTRODUCTION

Lantana camara L, a perennial shrub of the Verbenaceae family Occupies a paradoxical position in contemporary research: long valued for its ornamental and ethnos medicinal uses, it is simultaneously one of the world's most Aggressive invasive plants. Modern phytochemical profiling has revealed a complex Mixture of bioactive classes in leaves, flowers and roots – including terpenoids, Flavonoids, alkaloids, tannins and glycosides –which help explain the species' broad Spectrum of reported biological activities (antimicrobial, antioxidant, insecticidal and Cytotoxic). These chemically diverse extracts are now the subject off targeted Pharmacological studies and formulation efforts that aim to convert traditional Knowledge into standardized, reproducible products.

Contemporary experimental work has begun to separate promising therapeutic leads from ecological risk. For example, recent investigations into essential oils and flowers extracts report selective antiproliferative effects against certain cancer cell lines and support for topical wound- healing formulations, indicating specific molecular activities (e.g., modulation of inflammatory markers promotion of tissue repair) that warrants deeper mechanistic study and safety evaluation. At the same time, ecological and agronomic studies demonstrate that L. camara's allopathic compounds and aggressive growth habit alternative plant communities, suppress crop germination, and reduce biodiversity in invaded landscape – a reminder that any pharmaceutical or commercial exploitations must consider containment, sustainable sourcing, and post –harvest processing to avoid spreading this weed

Taken together, recent research frames lantana camara s a high – value, high-risk species: it is rich source of structurally varied metabolites with demonstrable Bioactivity, yet its ecological footprint demands integrated strategies that pair drug discovery and formulation science with conservation – minded management and bioprocessing. This review synthesizes up-to-date phytochemical characterization preclinical pharmacology, standardized extraction and toxicity profiling.

Fig 2 Lantana Camara.

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II. TAXONOMICAL CLASSIFICATION

Kingdom: plantae
Division: magnoliophyte
Class: magnoliopsid
Order: lamiae's
Family: Verbenaceae

Genus: lantana
Species: lantana camara Linn **Common** name: shrub verbena
Synonyms:
Botanical name: Lantana camara Linn
English: lantana camara Linn
Hindi: Raimuniya
Marathi: Ghaderi, Tantani
Sanskrit: Chaturanga, Vanacched
Tamil: Unni chedi

III. MATERIAL AND METHODS

Plant Material Collection: Fresh leaves and flowers of Lantana Camara Linn were collected, washed with tap and distilled water, and shade – dried at room temperature until constant weight. The dried material was ground into a fine powdered and sieved.
Extraction Procedure: The powered plant material was subjected to extraction using the Soxhlet extraction method and cold maceration technique, depending on the solvent system used.
Soxhlet Extraction: About 50g of dried Lantana camara leaf powdered was extracted success Ly with solvent of increasing polarity – petroleum ether, chloroform, methanol, distilled water. Each extraction was carried out for 6-8hrs at 60-70°C, the extracts were filtered through Whatman no1 filter paper and concentrated under reduced pressure using a rotary evaporator to obtained solid residues. The extracts were stored 4°C in air tight container until further phytochemical and pharmacological analysis.
Cold Maceration: Foe a more thermolabile compound profile ,50gof powdered leaves were macerated with a solvent mixture of dichloromethane: methanol: distilled water(1:1:1v/v) for 72hrs with octennialstirring. the mixture was filtered and the filtrate was concentrated at low temp under reduced pressure to a semisolid extract. the extract was then dried and stored in desiccators for subsequence analysis.
Yield (%) = weight of dried extract \ weight of plant powder× 100
Storage: The concentrated extract was stored in amber –coloured bottle at 4°C t prevent photodegradation and contamination until further use in phytochemical or pharmacological evaluation.

IV. PROCEDURE

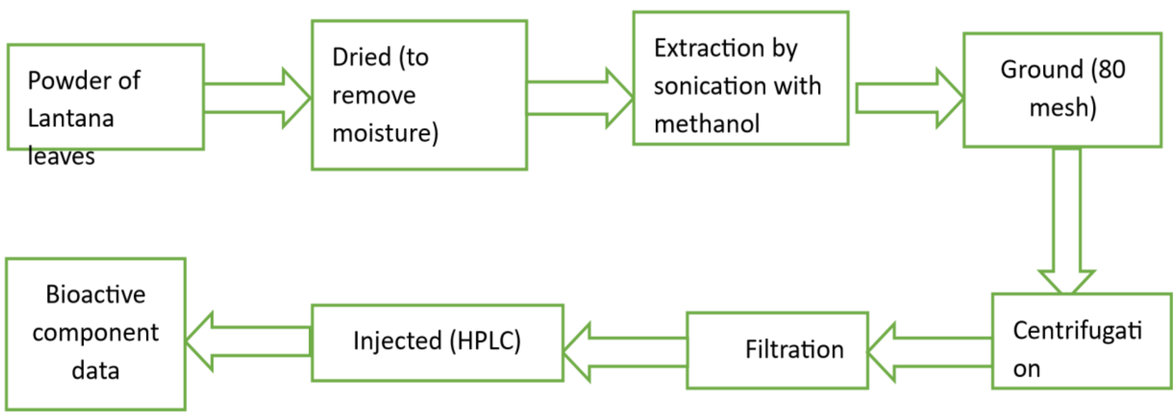

Fig.2 research procedure.

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PHYTOCHEMISTRY:

Part of plant	Phytochemical component
1.Leaves	Lanta Dene A & B, ursolic acid, Oleanolic acid, Flavonoids (quercetin, kaempferol) , saponins, Tannins, alkaloids, glycoside, essential oils.
2.Flowers	Flavonoids, phenolic acids, anthocyanins, essential oils, saponins, glycosides
3.Stems	Triterpenoids, steroids, phenolic compounds, alkaloids, tannins.
4.Fruits	Ursolic acid, oleanolic acid, carotenoids, anthocyanins, organic acids
5.Roots	Triterpenoids, alkaloids, saponins, phenolic acids, glycosides.
6.Whole plant Extract	Flavonoids, Terpenoids, alkaloids, saponins , tannins, glycosides, essential oils.

PHARMACOLOGICAL ACTIVITIES:

Parts of plant	Pharmacological activity
Leaves	Anti-oxidant, antimicrobial, antiinflammatory, analgesic and antipyretic, wound healings, cytotoxic / anticancer, antibiotics / hypoglycaemic,
	insecticidal & larvicidal, antiparasitic / antimalarial, Hepatoprotective, Antileishmanial, Antioxidant enzyme activation.
Flowers	Antioxidant, Antimicrobial, Cytotoxic / anticancer, Wound-healing, Antidiabetic, Antiviral .
Stems	Antimicrobial, Antioxidant, anti-inflammatory, Cytotoxic / anticancer, Analgesic.
Fruits	Antioxidant, Antimicrobial, Anticancer, Anti-inflammatory, Cytoprotective
Roots	Antimicrobial, antiinflammatory, Analgesic, Anthelmintic, Cytotoxic / anticancer, Hepatoprotective, Antiparasitic.

V. TOXICOLOGICAL PROFILE

Lantana Camara is known to contain toxic pentacyclic triterpenoids, particularlylamtidine A and B which cause hepatotoxicity, photosensitization, and cholestasis in rodents indicates safe use of ethanolic and aqueous extracts below 300mg/kg body weight, while higher lesions, Standardization, detoxification and selection of safe extraction solvents are therefore essential before medicinal use.**(Reference: Journal of Veterinary Toxicological,2023; Phytochemical Reports, 2024).**

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Future Prospectives of Lantana Camara:

The future of lantana camara research lies in exploring its therapeutic potential through advanced scientific, pharmacological and technological approaches. Although the plant has been extensively studied for its phytochemical richness and pharmacological diversity, there remains a significant scope for translational and applied research.

Clinical Evaluation and Therapeutic Validation: Focus on Establishing dose-response relationships and long-term safety profiles. And understanding pharmacokinetic and pharmacodynamics mechanisms of major bioactive compounds such as lantadeneA, oleanolic acid and urosolic acid.

.**Safe Formulation Development and Toxicity Reduction**: Designing selective detoxification techniques to remove or neutralize toxic triterpenoids. And exploring biotechnological approaches for developing non-toxic chemotypes.

Nanotechnology and Novel Drug Delivery Systems: Future studies may focus on targeted and controlled-release formulations to optimize therapeutic outcomes.

Biotechnological and Environmental Application's: Applications in Bioremediation and Phytoremediation, as L. Camara is capable of accumulating heavy metals and improving soil quality. And integration into sustainable agricultural systems to reduce dependents on synthetic chemicals.

Molecular and Omics –based research: Transcriptomic and proteomic studies can identify enzymes responsible for bioactive compound biosynthesis, and metabolite profiling can help in selecting chemotype's with desired pharmacological activity. Genetic modification and metabolic engineering could improve yield and purity of therapeutic metabolites.

VI. CONCLUSION

Lantana camara is a potent medicinal plant rich in bioactive phytochemicals that exhibit diverse pharmacological activities such as anti-oxidant, anti-microbial, antiinflammatory and anti-cancer effect. Modern research highlights its potential for developing safe and effective herbal formulations. However, standardization, toxicity control, and clinical validation are essential before large scale therapeutic application. With advance biotechnological and pharmaceutical approaches, L. camara holds great promise as a future phytopharmaceutical resource.

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