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Review Article

Phytochemical and Therapeutic Potential of *Wrightia tinctoria* R. Br: A Comprehensive Review

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ABSTRACT

Wrightia tinctoria, also referred to as vettpalai/indrajava, is an evergreen herbal tree belonging to the Apocynaceae family, found in India and the Southeast Asian region. Revered in ancient medical systems such as Ayurveda along with Siddha, it has been employed for millennia to treat many maladies, including dermatological and gastrointestinal issues. This study systematically aggregates scholarly information on *Wrighita tinctoria*, highlighting its phytochemical composition, pharmacological characteristics, and therapeutic prospects. The plant has many bioactive components, including flavonoids, alkaloids, triterpenoids, and phenolic substances, which enhance its various therapeutic properties. Research underscores *Wrighita tintoria*'s significant antibacterial efficacy against several pathogens, encompassing viruses, Molds, and bacteria. The anti-inflammatory and antioxidant qualities indicate its effectiveness in treating chronic inflammatory disorders such as dermatitis, with emulgel formulations exhibiting remarkable drug diffusion rates. The plant exhibits considerable anticancer potential, especially targeting oral and breast carcinoma cell lines, causing apoptosis via unique biological pathways. In addition to these qualities, *Wrighita tinctoria* demonstrates advantages for metabolic and mental disorders, exhibiting antidiabetic actions akin to recognized medicines and neuroprotective properties. Toxicological investigations confirm its safety, demonstrating little mortality in healthy cells while efficiently targeting cancer cells. Notwithstanding these encouraging results, the analysis highlights a deficiency in medical verification and the necessity for further human studies. Subsequent investigations ought to concentrate on isolating active constituents, refining extraction techniques, and formulating standardized preparations. In summary, *Wrighita tinctoria* is a multifaceted plant with considerable therapeutic potential, integrating traditional and contemporary medicine, but necessitating more study to properly use its capabilities in healthcare.

Keywords: *Wrighita tinctoria*, Phytochemical composition, Pharmacological characteristics, Toxicological investigations.

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INTRODUCTION

In the verdant landscapes of India and its adjacent regions, a little yet tenacious tree thrives, known internationally as *Wrighita tinctoria R.Br* or vettpalai. This unassuming deciduous tree, belonging to the Apocynaceae family, has traditionally been a crucial component of herbal medicine, valued for its remarkable medicinal properties. For decades, it has functioned as a dependable remedy for several ailments, including chronic skin conditions, gastrointestinal illnesses such as intestinal disorders and diarrhoea, and other hair irregularities. The diverse assortment of compounds-steroids, alkaloids, volatile chemicals, and flavonoids each augmenting its considerable therapeutic value.[1,2] Imagine a natural healer skilled in reducing inflammation, fighting bacterial and fungal infections, and offering defence against oxidative stress. Vettpalai executes everything this and more. Its antioxidant properties counteract free radicals, while its antimicrobial and antidiabetic effects offer potential benefits for patients with chronic conditions. Nevertheless, the tale does not terminate at that juncture. Recent scientific studies have uncovered even more extraordinary attributes of this unpretentious tree. Researchers have recognized its potential in modern medicine, particularly in the treatment of psoriasis. Researchers have enhanced the oil's potency by transforming it into emulgels, preserving its anti-proliferative properties and offering a possible novel treatment for this challenging skin condition.[1] The ethanol-based isolate of *Wrighita tinctoria* has considerable promise in hindering oral cancer cell lines by inducing apoptosis and suppressing the proliferation of malignant cells. This discovery positions the plant as a potent, natural candidate for the creation of innovative anticancer

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therapies, providing optimism in the ongoing battle against tumours.[3] Furthermore, vettpalai has become a prominent entity in the care of psoriatic arthritis. Rich in phenolics and flavonoids, its extracts possess significant antioxidant and anti-inflammatory properties, providing therapeutic benefits to those suffering from this severe condition.[4]

The account of *Wrightia tinctoria* illustrates resilience, adaptability, and untapped potential. This tree, from ancient herbal remedies to modern medical research, continuously reveals its secrets, bridging traditional knowledge with contemporary science. As researchers investigate its pharmacological properties, the possibilities seem boundless (Tables 1 and 2).[1,4,5-7]

BOTANICAL DESCRIPTION

Wrightia tinctoria is a little deciduous tree, attaining heights of 5-8 m, distinguished by its scaly, smooth bark. The leaves range in dimensions from 6 to 15 cm in length and 3 to 6 cm in width, exhibiting an elliptic-lanceolate form with acuminate apices. The tree yields aromatic white blossoms in loose terminal cymes, accompanied by little ovate bracts. The calyx is devoid of hair and possesses glands and glandular but the corolla features a small tube with lobes measuring 6-8 mm. The corona encompasses many linear scales linked to the filaments and some on the corolla-lobes. Stamen are located at the apex of the corolla tubes, characterised by short filament and protruding anthers that arc and attach to the stigma. The ovary comprises two carpels, which may be either separate or fused, carrying many ovules. The resultant fruits are two separate pendulous follicles, ranging from 20 to 40 cm in length, cylindrical in shape, and slightly tapered at both extremities. Initially, they attach at the apex. Seeds range in length from 1.2 to 2.0 cm and possess a pointed tip. They possess a deciduous coma that generally (Figure 1).[8]

Leaves

The leaves of *Wrightia tinctoria* display distinctive anatomical and micromorphological characteristics,[2,9,10] with paracytic and anomocytic stomata that enhance gas exchange and water retention. The foliar cuticle exhibits variability in thickness, signifying environmental adaptability. The abaxial surface possesses multicellular trichomes that serve as a defence mechanism against herbivory. The dorsiventral leaf features a uniseriate epidermis or a collenchymatous hypodermis, together with a specialised mesophyll for optimal photosynthesis. The midrib comprises a crescent-like vascular bundle featuring endarch xylem. Quantitative microscopy indicates a stomatal index of 21 and a relatively thick venation structure, while histochemical analyses demonstrate the presence of lignin and starch, corroborating the stability of structure and carbohydrate storage (Figure 2).

Flowers

Wrightia tinctoria is distinguished by its aromatic, jasmine-scented blooms,[11-14] which exhibit a colour that varies between white to yellow to light brown. The plant possesses actinomorphic, bisexual, hypogynous flowers which emerge in terminal corymb-like cymes, ranging from 5 to 15 cm in diameter, characterised by rectangular petals with rounded tips. In India, flowering transpires periodically from March to May. The pharmacological importance has prompted comprehensive pharmacognostic investigations to develop quality control measures, such as ash and extractive levels, along with phytochemical analysis. These initiatives guarantee the authenticity and uniformity of herbal formulations, underscoring the plant's scientific and therapeutic significance (Figure 3).

Bark

Vettpalai is a moderate-sized deciduous tree notable for its importance in traditional medicine. The smooth,[12,15,16] greyish bark has been improperly misused as a substitute for *Holarrhena antidysenterica*, necessitating comprehensive pharmacognostic investigations to ascertain genuine *Wrightia tinctoria* bark. Microscopic examination uncovers distinctive anatomical characteristics, such as multiple layers of cork cells, phellogen, and stone cells, thereby are essential for differentiating it from adulterants. A comprehensive pharmacognostic assessment, encompassing combined macroscopic and microscopic traits, facilitates quality control for herbal formulations, assuring precise identification and preserving the integrity of therapeutic products sourced from this significant species (Figure 3).

Seeds

A pharmacognostic assessment has distinguished *Wrightia tinctoria* seedlings versus *H. antidysenterica* pods,[12,13,17] both employed in the treatment of dysentery. Prominent morphological indicators consist of the presence of trichomes near the chalazal extremity of Vettpalai pods, in contrast to the micropylar trichomes of *H. antidysenterica*. Further differentiating characteristics are cotyledon folding patterns and spermodermal decorations. *Wrightia tinctoria* demonstrates considerable pharmacological promise, exhibiting verified analgesic, anti-inflammatory, a parasitic agent and anticancer effects, in addition to a favourable safety profile. The results underscore the necessity for more investigation into the planting, the field of phytochemistry and clinical applications of *Wrightia tinctoria* to improve the standardisation of herbal formulations and to discover novel therapeutic uses (Figure 3).

Root

The root system of *Wrightia tinctoria* has distinctive morphological characteristics that facilitate its identification and underscore its medicinal potential.[9,11,12,18] The root possesses a thick epidermis, a robust periderm, a multitude of cell cork,

and a specialised cortex that contained starch along with oxalate crystals, signifying secondary growth. The vascular architecture has diverse xylem vessel components and slender medullary rays linking vascular tissues. The cortex uniquely integrates water-storage cells including sclereids, distinguishing it apart from *Wrightia indica*. These changes, together with the altered amphicribral vascular configuration, function as diagnostic indicators and imply the plant's ethnomedicinal importance, necessitating more investigation into its therapeutic use.

Geographical distribution

Wrightia tinctoria demonstrates exceptional ecological flexibility across Asia,[2,6,19,20] flourishing in a variety of environments ranging from dry plains to trees, especially in peninsular India. It demonstrates dual proliferation by seeds and stem cuttings, hence augmenting its ecological success. The species bears a karyotype characterised by intraspecific polyploidy, enhancing genetic flexibility. Its lightweight wood and robust root system let it to thrive in well-draining sandy soils. This adaptability affects its phytochemical composition, underscoring its medicinal potential. The capacity of *Wrighita tinctoria* to flourish in several environments renders it important within both natural and agricultural forestry, indicating prospects for ethical harvesting and more investigation in habitat preservation and pharmacology (Figure 4).

PRELIMINARY STUDIES

Previously researchers found phytochemical constituents in different extract of *Wrightia tinctoria* the observations are summarized in Table 3.

Chemical constituents

Various phytochemical constituents found on *Wrightia tinctoria* are reported by previously reported researchers summarized in Table 4.

TRADITIONAL USES

Wrightia tinctoria,[7,11,21,22] often known as the jaundice cure tree, is an essential element in traditional Indian medicine, celebrated for its various medicinal attributes. Abundant in bioactive chemicals such as alkaloids and flavonoids, it demonstrates significant pharmacological benefits, including pain relieving, anti-inflammatory, and antidiabetic properties. Plant-derived latex is particularly useful for treating skin problems like psoriasis when applied to irritated regions. Diverse components of *Wrightia tinctoria* are employed to treat conditions such as jaundice, malaria, and diarrhoea. Despite clinical trials demonstrating its promise, further study is necessary to identify the active molecules responsible for its therapeutic advantages.

THERAPEUTIC APPLICATION

The reported pharmacological activities of *Wrighita tinctoria* are represented in Figure 4.

Antimicrobial property

Research demonstrates that AgNPs derived from *Wrighita tinctoria* successfully suppress the proliferation of bacterial species that are both Gram-positive and Gram-negative,[1,3,23,26] which includes *S. aureus* and *E. coli*, exhibiting significant zones of inhibition. The environmentally sustainable green production of these nanoparticles enhances their antibacterial efficacy and establishes them as promising candidates for medicinal uses, underscoring the potential of *W. tinctoria*.

Antibacterial property

Research demonstrates that AgNPs obtained from its seeds and fruit successfully inhibit numerous bacterial strains,[23,24,27,29] encompassing the two types of bacteria, as seen by zones of inhibition in agar diffusion assays. Moreover, extracts of leaves from *Wrighita tinctoria* demonstrate considerable antibacterial efficacy associated with active metabolites. The herb has antioxidant capabilities, augmenting its medicinal uses in traditional medicine. *Wrighita tinctoria* is an exciting source for the development of eco-friendly antibacterial compounds.

Antifungal activity

Studies demonstrate that methanol-based extracts from the leaves and bark successfully suppress infections such as yeast infections like *Candida albicans* along with *Cryptococcus neoformans*, with a Minimal Inhibitory Concentration (MIC) of 512 µg/mL.[28-32] Moreover, these extracts suppress *Aphanomyces invadans*, the pathogen responsible for Epizootic Ulcerated Condition in fish, by 85-90%. Phytochemical investigations indicate the existence of flavonoids along with phenolic substances, which presumably

Figure 1: *Wrightia tinctoria.*

enhance its antifungal properties. These findings underscore *Wrighita tinctoria* ability as a natural anti-fungal agent, indicating the need for future exploration of its medicinal applications.

Anti-leishmanial/plasmodial activity

Research has identified several bioactive components,[2,20,22-39] including flavonoids, alkaloids, saponins, and phenol compounds, which augment its therapeutic effectiveness against malaria as well as leishmaniasis. Furthermore, extracts made from ethanol of *Wrightia tinctoria* have cytotoxic properties against cancer cell lines, indicating possible use in cancer therapy and parasitic diseases. Their ancient role in the practice of Ayurvedic medicine for the treatment of jaundice and malaria underscores their significance, necessitating additional study to isolate particular components for medicinal purposes.

Antiviral activity

Studies demonstrate that its extract of chloroform may suppress HIV-1 multiplication by as much as 48% in the case of MT-4 cells as well as has an 50% Effective Dose (EC_{50})[28,29,32,40,41] at 10 µg/mL vs HCV within Huh 5-2 cells. The methanolic extracts of its leaves and bark have significant antioxidant properties, ascribed to diverse phytochemicals such as flavonoids and terpenes. Furthermore, extracts of *Wrightia tinctoria* have antibacterial properties akin to conventional antibiotics, underscoring its prospective medicinal uses. Its many biological actions underscore its importance in pharmaceutical investigation and traditional medicine.

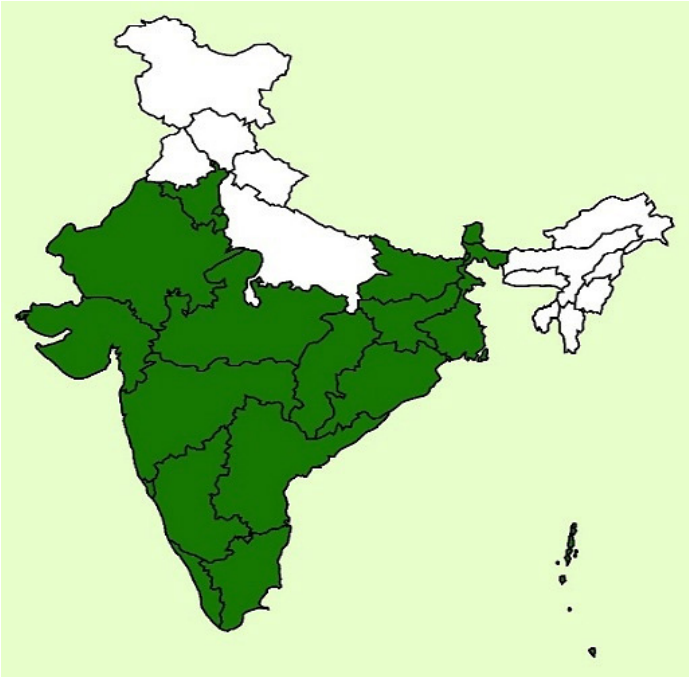


Figure 2: Geographical distributions of *Wrightia tinctoria*.[6]

Anti-psoriatic activity

Research demonstrates that an emulgel formulation that contains its oil markedly enhances its efficacy,[1,4,28,29,42,43] exhibiting an increased drug release rate while preserving anti-proliferative action *in vitro*. The herb's extracts are abundant in phenol and flavonoid components, augmenting its anti-inflammatory and antioxidant qualities that are crucial for the management of psoriasis and arthritis caused by psoriasis. Bioactive chemicals such as β-caryophyllene enhance its therapeutic efficacy by diminishing keratinocyte excessive proliferation and inflammation. Ongoing study is crucial to comprehensively elucidate its mechanisms effectiveness and medicinal applications.

Anthelmintic Activity

Wrighita tinctoria, demonstrated by research on its methanol-based leaf extract.[28,29,32,44] Studies indicate that this extract is efficacious against helminthic infections, comparable to the conventional medication piperazine citrate at doses ranging from 5 to 50 µg/mL. In addition to its anthelmintic properties, *Wrighita tinctoria* is acknowledged for its antibacterial, anti-inflammatory, and antifungal actions, hence supporting its traditional therapeutic uses. The phytochemical profile of the plant, determined using

Table 1: **Scientific classification of *Wrightia tinctoria* R. Br.**[6]

Kingdom	Plantae
Family	Apocynaceae
Genus	Wrightia
Species	*Wrightia tinctoria*
Order	Gentianales
Phylum	Tracheophyta
Class	Equisetopsida
Subclass	Magnoliidae

Figure 3: different parts of *Wrightia tinctoria*.

gas chromatography-mass spectrometry, indicates the presence of many bioactive chemicals that might augment its therapeutic potential, warranting more investigation in contemporary medicine.

Anticancer potential

Wrightia tinctoria was discovered as a prospective option for cancer therapy,[1,3,24,39] demonstrating substantial anticancer effects in several trials. The ethanol-based extract of the plant exhibited a significant the IC_{50} of 48.89 µg/mL vs the KB oral tumour cell line, exhibiting pronounced mortality and lethal effects, as validated by fragmentation of DNA and caspase-3 activation tests. The phytochemical constituents, including flavonoids and alkaloids, augment its pharmacological efficacy. The production of silver nanoparticles was done from *W. tinctoria* shown promising efficacy vs MCF-7 cell lines. The fraction composed of ethyl acetate demonstrated significant cytotoxicity, underscoring *Wrightia tinctoria* possibility in the development of effective anticancer treatments.

Anti-inflammatory activity

The leaf extracts are rich in phytochemicals, particularly flavonoids and phenolic components,[1,4,28,29,42,45] which enhance their anti-inflammatory activities. Studies suggest that the ethanolic extracts significantly suppresses inflammatory mediators, as evidenced by *in vitro* experiments assessing nitric oxide depletion and protein denaturation. Moreover, *Wrighita tinctoria* has promise in addressing disorders such as arthritis with psoriasis by targeting essential inflammatory pathways. The antioxidant activity of *Wrightia tinctoria*, attributed to its many phytoconstituents, bolsters its capacity to mitigate inflammation, indicating that its inclusion in treatment protocols may assist the management of inflammatory illnesses.

Anti-diabetic activity

Wrighita tinctoria Methanolic preparations of the plant have demonstrated efficacy in reducing fasting blood glucose and serum lipid levels in alloxan-induced diabetic mice,[28,29,32,46,47] comparable to the conventional medication glibenclamide. Phytochemical investigations indicate a substantial abundance of bioactive components, such as flavonoids and aromatic

Table 2: Vernacular names for *Wrightia tinctoria R.Br.*[7]

Languages	Vernacular names
Telugu	Akupala, Amkudu
Tamil	Erukkalam, Nilambalai
Sanskrit	Svetakuja, Madhuindrajava
Marathi	Gode indrajava
Kannada	Veppale
Malayalam	Ayyapala, Dantappala
Urdu	Indearjao shireen
Hindi	Indrajava

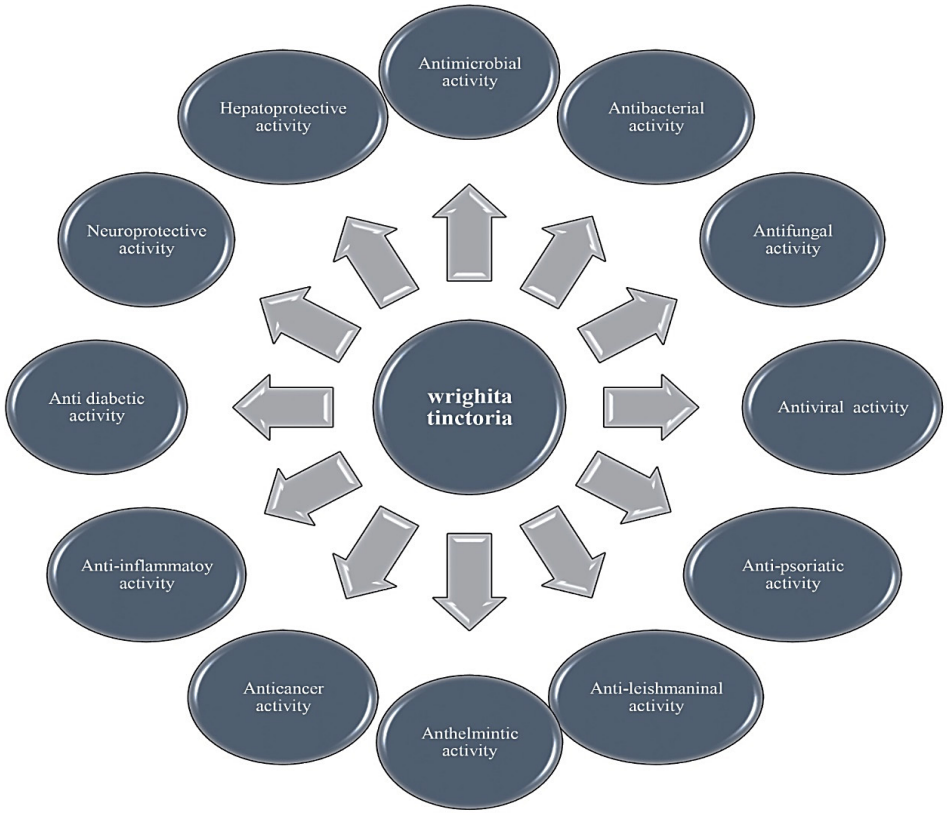


Figure 4: Different activities of *Wrightia tinctoria*.

compounds which augment its therapeutic efficacy. *Wrightia tinctoria*, traditionally employed in Indian medicine treating diabetes treatment, exhibits a diverse pharmacological profile that underscores its significance as an indigenous therapeutic agent for diabetes and associated consequences.

Neuroprotective activity

Wrighita tinctoria studies demonstrate this methanolic extract efficiently neutralises radicals that exist,[14,28,48,49] which is crucial for addressing oxidative stress associated with neurodegenerative disorders. Research indicates that bark extract enhances the function of antioxidant enzymes in rat models, providing defence from oxidative damage in essential organs such as the kidneys and liver. Furthermore, *Wrighita tinctoria* demonstrates specific cytotoxicity against cancer cells while safeguarding healthy cells, hence enhancing its therapeutic potential. These findings corroborate its historical therapeutic application and underscore its potential in the treatment of neurological diseases.

Hepatoprotective activity

Wrightia tinctoria studies demonstrate that extracts made from methanol possess significant antioxidant properties,[28,29,48,50] crucial for mitigating oxidative stress associated with liver damage. The triterpenoidal fraction from its bark, containing substances such as lupeol and β-amyrin, has demonstrated efficacy towards carbon tetrachloride-induced liver toxicity in rat trials, as indicated by reduced liver enzyme markers and enhanced histology. Moreover, its elevated concentrations of phenolic substances and flavonoids augment its therapeutic efficacy in the treatment of liver illnesses, highlighting its importance in herbal therapy.

TOXICITY AND SAFETY

Wrighita tinctoria an herbal remedy,[2,38,39,49,51,52] *In vitro* investigations utilising Vero cell lines demonstrate an IC_{50} over 100, suggesting safety to normal cells. Extracts from the stem bark exhibit specific cytotoxicity towards cancer cell lines, including MCF-7 and HeLa, while preserving non-cancerous fibroblast cells. These encouraging results underscore the potential of *Wrightia tinctoria* as a therapeutic agent, warranting additional investigation into its pharmacological uses.

Dose-dependent effects and potential side effects

Wrightia tinctoria has demonstrated potential therapeutic advantages along with a commendable safety profile in many investigations.[38,48,53-55] The ethanolic extract exhibited little toxic effects, with an IC_{50} level above 100 µg/mL in lethality experiments done with Vero cell lines. Standardised extracts efficiently regulated immuno-inflammatory responses by suppressing cytokines that promote inflammation in a dose-dependent manner. *In vivo* investigations demonstrated aqueous methanolic extracts reduced arterial pressure and enhanced lipid profiles without deleterious effects at dosages of up to 10 mg/kg. The bark extract had notable antiproliferative effects on cancer cells, especially MCF-7, and long-term dosing in mice validated its safety for extended usage.

Review of *in vivo* and *in vitro* studies

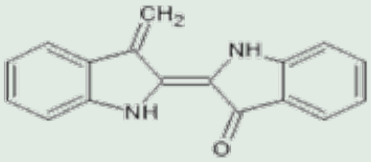
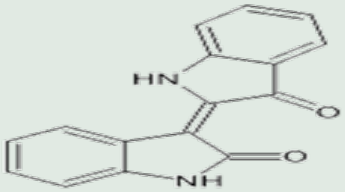
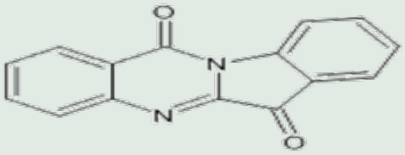
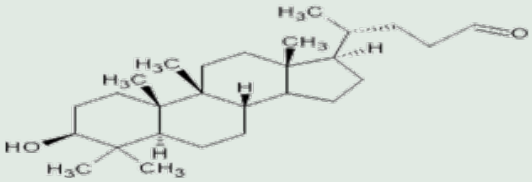
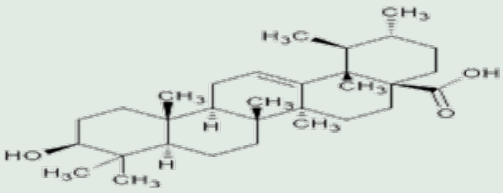
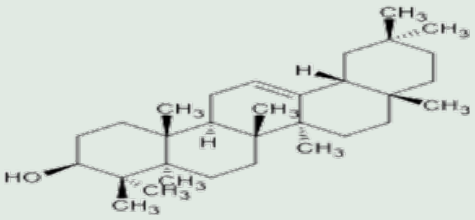
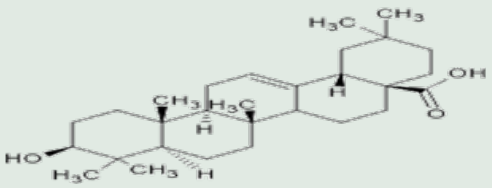
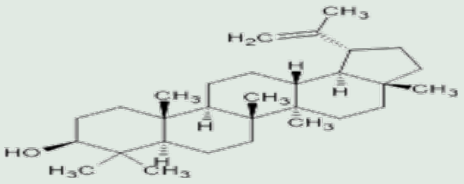
Wrighita tinctoria, a plant used as a remedy,[1,4,38,43] has attracted interest for its therapeutic qualities due to significant *in vivo* and *in vitro* studies. *In vitro* studies underscore its effectiveness in treating dermatitis and oral tumours, with the emulgel formulation exhibiting an impressive 98.87% drug diffusion rate over 10 hr. The extracts of the plant have encouraging anti-cancer properties, especially versus oral malignancies, with an IC_{50} level of 48.89 µg/mL. Phytochemical investigations identify bioactive components such as flavonoids and phenolics, which augment

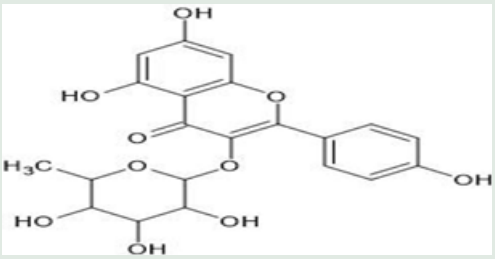
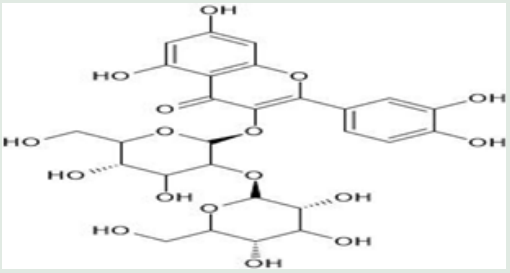
Table 3: Preliminary phytochemical studies on *Wrightia tinctoria* in various solvents.[33]

Sl. No.	Constituents	Acetone	Butyl alcohol	Chloroform
1	Alkaloids	-	+	+
2	Flavonoids	+	+	+
3	Saponins	+	-	-
4	Tannins	+	+	-
5	Amino acid	-	-	-
6	Terpenoids	-	+	+
7	Protein	-	-	-
8	Reducing sugar	-	-	+
9	Cardiac glycoside	+	+	+
10	Anthraquinones	+	-	+
11	Steroids	+	-	+

(+) indicates=presence; (-) indicates=negative.

Table 4: Different chemical constituents isolated from *Wrightia tinctoria*.[34-37]

Sl. No.	Chemical constituent	Chemical unit	Molecular formula	Chemical structure
1	Alkaloids	Indigotin	$C_{16}H_{10}N_2O_2$	
		Indirubin	$C_{16}H_{10}N_2O_2$	
		Tryptanthrin	$C_{15}H_8N_2O_2$	
		Wrightial	$C_{27}H_{44}O$	
2	Triterpenoids	Urosolic acid	$C_{30}H_{48}O_3$	
		Beta amyrin	$C_{30}H_{50}O$	
		Oleanolic acid	$C_{30}H_{48}O_3$	
		Lupeol	$C_{30}H_{50}O$	

Sl. No.	Chemical constituent	Chemical unit	Molecular formula	Chemical structure
3	Flavonoids	Kaempferol 3 - o - rhamonoside	$C_{21}H_{20}O_{10}$	
		Quercetin 3 - o - sophoroside	$C_{27}H_{30}O_{17}$	

its antioxidant and anti-inflammatory effects. Chemical profiling indicates possible uses in arthritis caused by psoriasis, highlighting the substantial pharmacological potential of *Wrightia tinctoria* in contemporary medicine.

Overview of clinical trials involving *Wrightia tinctoria*

Wrightia tinctoria recognised as a promising medicinal agent,[1,38,43,56] especially in clinical studies for psoriasis, hair loss, and malignancy. Recent research shown that an emulgel version of its oil efficiently cures psoriasis, attaining an impressive *in vitro* clearance rate of 98.87% after 10 hr. Moreover, its extracts exhibited notable anti-cancer properties with oral tumour cell types, with an IC_{50} concentration of 48.89 µg/mL, signifying substantial cytotoxicity. *In vivo* investigations shown that *Wrightia tinctoria* might promote hair growth, exceeding the efficacy of conventional therapies such as minoxidil. Its extensive phytochemical composition, rich in flavonoids, highlights its potential for many medicinal uses.

EFFICACY AND SAFETY APPLICATIONS

Wrightia tinctoria,[1,8,38,39,43] demonstrates considerable therapeutic promise and an admirable safety profile for consumption by humans. The phytochemicals, such as flavonoids, also alkaloids, and phenolics, have anti-cancer, anti-inflammatory, and anti-microbial properties. Research underscores its efficacy in managing psoriasis, especially with improved formulations such as emulgels. *In vitro* investigations utilising Vero cell lines demonstrate that its ethanol extract exhibits a robust tolerability characteristic, with an IC_{50} above 100. Furthermore, it exhibits encouraging antitumor attributes, triggering apoptosis in many cancer tumour cell lines while safeguarding normal cells. Consequently, *Wrightia tinctoria* provides a viable subject for therapeutic investigation.

CONCLUSION

In conclusion, *Wrightia tinctoria* is a notable entity in medicinal botany, demonstrating substantial therapeutic promise that connects traditional knowledge with contemporary scientific research. The varied range of bioactive chemicals has been associated with several health advantages, including antibacterial and anti-inflammatory qualities, as well as potential uses in the treatment of severe illnesses like as dermatitis and oral cancer. The herb's safety profile, supported by extensive study, establishes it as a credible natural option in modern medicine. Nevertheless, to completely realize its potential, there is an urgent requirement for more research into its active components and standardization of methods for extracting it. Future study should focus on clarifying the processes behind its benefits while also emphasizing sustainable farming techniques and the creation of standardized formulations. Consequently, *Wrightia tinctoria* might be seamlessly incorporated into healthcare systems, providing unique therapeutic alternatives that are both safe and efficacious. As we further investigate this extraordinary plant, it serves as a symbol of optimism for utilizing nature's therapeutic capabilities in our endeavour's.

CONFLICT OF INTEREST

The author declare that there is no conflict of interest

ABBREVIATIONS

W. tinctoria: *Wrightia tinctoria*; ***H. antidysenterica***: *Holarrhena antidysenterica*; ***S. aureus***: *Staphylococcus aureus*; ***E. coli***: *Escherichia coli*; **AgNPs:** silver nanoparticles; **MIC:** minimum inhibitory concentration; **EC_{50}:** Effective Concentration Producing In 50%; **HIV-1:** Human Immunodeficiency Virus; **HCV:** Hepatitis C Virus; **Huh 5-2:** Human hepatoma cell line; **MT-4:** Human T lymphoblastoid cell line; **IC_{50}:** Initial Concentration Producing In 50%; **KB:** Keratin-Forming Tumor Cell Line; **DNA:** Deoxyribonucleic acid; **MCF-7:** Michigan Cancer Foundation-7; **HeLa:** Henrietta Lacks cell lines.

SUMMARY

Wrightia tinctoria comprises several bioactive components, including flavonoids, alkaloids, triterpenoids, and phenolic substances, which augment its therapeutic qualities. These chemicals demonstrate pharmacological actions such as anti-fungal, anti-inflammatory, Anti-psoriatic activity, Hepatoprotective, and anti-cancer activity. Esteemed in traditional medicine for its ecological and therapeutic importance, further study is required to comprehensively elucidate its processes and prospective uses.

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