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A REVIEW ON THE MEDICINAL PROPERTIES OF *Wrightia tinctoria* AND ITS USES IN DENTISTRY

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ABSTRACT

Wrightia tinctoria has played a significant role for ages in the realms of traditional medicine. Its renaissance into the evidence based modern medicine is aided by the identification and isolation of various chemically potent and pharmaceutically beneficial phytochemicals extracted from the different parts of the plant. The plant is native to the Indian subcontinent and is cheaply available in India. The extracts yield various properties such as antibacterial, antifungal, antioxidant, anti-cancer, immunomodulatory and wound healing properties. With literature backing various medicinal uses of this plant the dental prospectus of this plant is still an inconclusive ordeal. The article highlights the newer horizons of dental research that would unfold with further studies on the applications of *Wrightia tinctoria* in dentistry.

Keywords: Herbal dentistry, *Wrightia tinctoria*, Anti- oral cancer, Antioxidant, Antimicrobial, Phytochemicals

INTRODUCTION

The use of plants in medicine is as old as the art and science of medicine **[1]**. Crude plant extracts have been a part of various ramifications of medicine such as ayurvedic, homeopathic and allopathic medicine **[2]**. Plants have special chemical compounds called phytochemicals which have been extracted and used extensively in modern medicine. Plants have always been an easily procurable and cost effective source for new drugs and formulations. Herbal medicine is a booming research field where the opportunities are limitless **[3]**.

Oral ailments are ubiquitous and cause a huge impact on human health and economics **[4]**. The most common oral ailments are dental caries and gingivitis **[5]**. These diseases are multi-factorial and often become a challenge to treat **[6]**. Besides the prevalence of oral cancer have increased manifolds with the increasing number of tobacco users **[7]**. Oral cancer is the most debilitating cancer. The 5 year survival rate for oral cancer has been estimated to be only about 50% **[8]**. With a deafening increase in the antimicrobial resistance as well as the strong demeaning side effects of the oral cancer medication the search for a new sustainable and safe cure for these diseases has been a priority in the pharmaceutical research for ages.

Wrightia tinctoria is also called Pala Indigo Plant or Dyer's Oleander. *Wrightia tinctoria* is a plant, very commonly used in traditional medicine and as a grandmother's home remedy for various ailments such as psoriasis, toothache, headache, abdominal pain, breast cancer. The various parts of the plant such as its leaves, young stem, bark and seeds have been used traditionally **[9]**. The age old use of *Wrightia tinctoria* in dental ailments is in the form of; chewing the leaves with salt, using the milk from the plant for gingivitis or the young stems could be used as an alternative for brush **[10]**. The crude nature of extraction and insufficient evidence for its use in humans has resulted in the failure to absorb this plant in modern medicine. This earnest review on the plant should throw highlights on the spectrum of the applications that this wonder plant offers for modern medicine.

PLANT DESCRIPTION

Taxonomical Classification: **[11]**

Kingdom : Plantae
Order : Gentianales
Family : Apocyanaceae
Genus : *Wrightia*
Species : *tinctoria*

Wrightia tinctoria is an ever green tree. It is a medium sized tree and it produces milky white latex. The species is identified by leaves which are simple with leaves across from each other and they are 10-20 cm long and 5cm wide. The bark is yellowish-brown colored, smooth and about 10 mm thick with the production of a milky-white latex **[12]**. The inflorescence is terminal and flowers are white and bisexual. The flowering season is from March to May. Flowers have ovoid petals which are rounded at the tip. Fruits develop in august. The fruit is cylindrical and blackish-green in colour. The seeds are brownish with white hairs at chalazal end and are flat. The seeds get dispersed by wind. Propogation is done by seeds and stem cuttings. *Wrightiatinctoria* grows in a variety of soil types. They are commonly found as undergrowth in forest and plantations **[13]**.

DISTRIBUTION OF *WRIGHTIA TINCTORIA*

The plant is native to the Indian sub-continent. It is widely distributed in India, Bangladesh and Myanmar. The plant is doubted to exist in the Lesser SundaIslands **[14]**.

PHYTOCHEMICALS ISOLATED FROM *WRIGHTIA TINCTORIA*

Wrightia tinctoria has been extensively studied for the presence of certain specific phytochemicals and alkaloids. Various extraction methods and solvents were used in the different parts of the plants. The soxhlet extraction of the compounds has been carried out using different solvents such as ethanol, methanol, chloroform, ethyl acetate and ether. The compounds extracted have been identified by comparing the unknown to the known compound in the National Institute Standard and Technology (NIST) library or using Gas Chromatography- Mass Spectroscopy (GC-MS) analysis. The various chemicals identified from the bark include: Lupeol, α-, β-amyrin, Benzene 1, 2, 4, 5-tetramethyl, 1-decanol 2, 2-dimethyl, Phenol 2, 4-bis (1, 1-dimethyl ethyl), Heptadecane, 3-hexadecanol, i-Propyl tetradecanol, Octadecanoic acid methyl ester, Pentadecane and Phytane **[15]**.

The leaf extracts revealed the presence of Pentadecanoic acid, 8-Octadecanoic acid, eptadecanoic acid, Eicosadienoic acid, Hexadecadienoic acid, 10-Octadecadienoic acid, Nonadecatriene and Lupeol, α- and β- amyrin, Indigotin, Indirubin, tryptanthrin, Isatin, Rutin, βsitosterol, Triacontanol, Myristic acid, Palmitoleic acid, Palmetic acid, Stearic acid,

Behenic acid, Arachidic acid. The seed extracts provided Lupeol, Chlorogenic acid, Dihydrocanaric acid, Glycerol, Erythritol, Thritol, Dgalactose, D-mannose, α-methyl zymosterol, Desmosterol, Clerosterol, methylene-25-methyl cholesterol, dehydro-pollinastanol, methylcholesterol, methylene cholesterol, ethyl cholesterol, ethyledehy-drocholesterol, Isofucosterol, cholesterol, Palmetic acid, stearic acid, Behenic acid, Arachidic acid. The fruits of the plant has phytochemicals such as carbohydrates, sugar, Tannins, Phenols, Phytosterols, Steroids, Flavonoids, Terpen-oids, Alkaloid, Cumarine, Phlo-batinins, Chalcones, Saponins, Ursolic acid, Oleanolic acid, Isoricinolic acid, βsitosterol, Cycloeucalenol, Wrightial and β-sitosterol **[16]**.

PHARMACOLOGICAL EFFECTS

Antibacterial Property

The presence of flavonoids, terpenoids and phenols instigate the innate nature of antimicrobial activity present in the various parts of *Wrightia tinctoria.* The extracts from the plant have proved effective zone of clearance with a spectrum of bacteria ranging from gram positive to gram negative, aerobic to anaerobic organisms. *Bacillus subtilis*, *Bacillus cereus, Enterobacter faecalis, Salmonella paratyphi, Staphylococcus aureus, Escherichia coli, Proteus vulgaris, Klebsiella pneumoniae, Pseudomonas aeruginosa* and *Serratia marcescens* were few pathogenic bacteria which were inhibited by extracts from this plant **[17]**. Among the solvents used ethanol, methanol, acetone and chloroform showed increased antibacterial property. The antibacterial property was comparable to commercially available antibiotics such as tobramycin. Predominant oral diseases are multibacterial in nature. The most common oral disease dental caries is hypothesized to be initiated by *Streptococcus mutans*. Moderate antibacterial effect has been elicited from the ethyl acetate and methanolic extract against *Streptococcus mutans* giving the plant an anti-cariogenic potential **[18]**.

Antifungal Property

Fungal organisms like *Candida, Aspergillus and Cryptococcus sp.* are considered commensals in the oral cavity. Notwithstanding various noxious diseases such as candidiasis, aspergillosis, cryptococcosis, blastomycosis and histoplasmosis occur as opportunistic infections in immunocompromised patients **[19]**. *Wrightia tinctoria* as methanolic extracts has shown moderate activity against dermatophytes causing skin diseases and few non dermatophytes, with their aqueous extracts proving futile antifungal effects.

However the antifungal activity against oral pathogens is a fairly unexplored area and requires further investigation to provide conclusive evidence. Nevertheless the antifungal activity of the plant on skin fungi is significant **[20]**.

Antioxidant

The presence of free radicals and an increased oxidative stress has been identified as the cause of various ailments in the human body. Oral diseases such as gingivitis and periodontitis could develop or progress due to increase in the oxidative stress. The presence of oxygen metabolites could cause the microorganisms causing these diseases such as *Porphyromonas gingivalis* and *Aggregatebactor actinomycetecomitans* to thrive causing further breakdown of the periodontium. These free radicals are scavenged by the antioxidants and thereby reducing the amount of free radicals. Various compounds in *Wrightia tinctoria* possess antioxidant activity of which dihydrocanaric acid is a powerful anti-oxidant agent **[21]**. This throws highlight on the plant as a natural source of antioxidant to reduce the burden of free radical mediated diseases.

Anti-cancer properties

Cancer is one of the life threatening diseases affecting man. It is intensely complex in that it includes dysfunction of the apoptosis, with increased growth, proliferation of new blood vessels and metastasis culminating to death. Oral cancer is the most common cancer among men in India following lung cancer. Oral cancer has the abuse of tobacco and tobacco products as its chief etiology. The effects of oral cancer are both physical and psychological. The survival rate for oral cancer is also very less as it has a 50 % mortality rate in 5 years. Oral cancers causes' grotesque facial deformation, difficulty in speaking, eating, chewing, breathing and expressing while also metastasizing to various parts of the body causing systemic derangement and ultimately yielding to death. Cancer therapy for oral cancer could be surgical excision of the lesion, radiotherapy or cancer chemotherapy. Chemotherapeutic agents often are associated with a high potential to cause side effects. *Wrightia tinctoria* has shown promise in treating breast cancer in traditional use. Modern medicine has sought evidence and found anti-tumor activity of the extracts from the plant against breast cancer cells MDA-MB-231, MCF-7 cells and the colony forming nature of these cells has been diminished by the *Wrightia tinctoria* extracts. The bark extracts have shown activity against the DLA cells and reduce the cancer cell growth rate **[22]**. Sufficient information for

the anti- cancer property against oral cancer is unavailable opening opportunities for further research in this field.

Immunomodulatory Activity

The periodontal destruction due to periodontitis has a unique facet in which the bacterial toxins modulate the host immune system causing the host immune cells to cause more damage than the toxins themselves. This has highlighted the importance of host modulatory aspect of periodontal therapy. *Wrightia tinctoria* through its various extracts has shown promising immunomodulatory activity. This is demonstrated by the rat paw oedema test or a macrophage clearance phagocytic index. This potential could be harnessed to provide the adequate immunomodulatory response required for treating periodontal diseases **[23]**.

Wound healing property

The antioxidant property, together with immunomodulatory and antibiotic activity of the *Wrightia tinctoria* extracts deems a positive influence on the wound healing nature proved as an increase in the tensile strength of the wound in both wound healing by primary and secondary intention. The enhancement of wound healing could be as a result of the presence of terpenoids, flavonoids and steroids This property of the plant could be employed in the rapid healing of extraction socket wounds. The plant could be used in the dressing material used to cover the area where a periodontal surgery has been done augmenting the wound healing capacity **[24]**.

CONCLUSION

The traditional medicinal plant *Wrightia tinctoria* has many phytochemicals throwing it in the spotlight for new, sustainable, herbal, modern medicine development. The various extracts from *Wrightia tinctoria* can be harnessed for the plethora of medicinal properties it showcases such as antibacterial, antifungal, antioxidant, anti-cancer, immuno-modulatory and wound healing properties. Various dental diseases such as aphtous ulcers, oral cancers, dental caries can be cured with the use of antioxidant and anti-bacterial property of the plant. The scope into the dental field is a relatively unexplored area with very promising practical applications.

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