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Review Paper

Wrightia Tinctoria: A Review of Phytochemicals and Pharmacological Activities

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ABSTRACT

Wrightia tinctoria is a medicinal plant belonging to the family Apocynaceae, which is widely distributed in India and other parts of Asia. Traditionally, it is known as a valuable medicinal plant and is commonly used for the treatment of various health problems especially skin disorders, psoriasis, jaundice, wounds, headache, toothache and dandruff. Different parts of the plant are used in traditional medicine like leaves, bark, roots, flowers, and seeds. Studies on the phytochemicals have reported the presence of important bioactive compounds like alkaloids, flavonoids, phenolic compounds, terpenoids, triterpenoids, steroids and other constituents. The pharmacological properties of Wrightia tinctoria have been proved in various studies such as anti-inflammatory, antioxidant, antimicrobial, analgesia, antidiabetic, antiulcer, hepatoprotective, wound healing and anti-psoriatic activities. The anti-inflammatory and antioxidant activities of the plant may participate in the beneficial effects of the plant on skin diseases. The plant has also shown potential in reducing inflammation and other symptoms associated with psoriasis. Therefore, Wrightia tinctoria is considered as a promising medicinal plant with important therapeutic potential. The review summarizes the botanical characteristics, traditional uses, phytochemicals constituents and pharmacological activities of this plant, paying special attention to its potential anti-psoriatic activity and future therapeutic applications.

INTRODUCTION

Wrightia tinctoria is a medicinal plant belonging to the family Apocynaceae and is widely distributed in India and other parts of South and South-East Asia. [13,8] It is traditionally important

for medicinal uses, particularly in relation to skin disorders and other health conditions. [13,8] Different plant parts, including leaves, bark, roots, flowers and seeds, are used in traditional medicine. [13] The therapeutic potential of *w. tinctoria* is associated with its diverse phytochemical

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constituents, including alkaloids, flavonoids, phenolic compounds, terpenoids, and steroids. [13,15,8] Recent studies have investigated its antioxidant, antibacterial, antifungal/anti-dandruff, anti-inflammatory, wound healing and anti-psoriatic activities. [10,11,9,15,6,14] The present review summarizes the botanical characteristics, traditional uses, phytochemical constituents and pharmacological activities of *w. tinctoria* with emphasis on recent findings and its potential medicinal applications.

Recent experimental studies have provided evidence for several biological activities of *W. tinctoria*. [10,11,9,15,6,14] Leaf and bark extracts have demonstrated antioxidant and anti-dandruff activity. [10,15] Leaf extracts have been investigated for antibacterial activity and wound-dressing applications. [11] Seedpod extracts have shown anti-inflammatory potential, and fresh-leaf methanolic extract has demonstrated wound-healing activity. [14] Leaf extracts have also been investigated in experimental models of psoriasis. [6] These findings provide a basis for further investigation of the plant's bioactive constituents, mechanisms and therapeutic potential. [10,11,9,15,6,14]

TAXONOMY AND BOTANICAL DESCRIPTION

Wrightia tinctoria is a small, deciduous tree belonging to the family Apocynaceae. [13,3] The bark is smooth and scaly, while young parts are glabrous or puberulous. [13,3] The leaves are variable, elliptic to lanceolate, with an acuminate apex and an acute or rounded base. [13,3] The flowers are white and fragrant and occur in terminal cymes. [13,3] The fruits are cylindrical and pointed at both ends, and the seeds are elongated with a pointed apex. [13,3]

TAXONOMIC CLASSIFICATION

Kingdom: Plants

Order: Gentianales

Family: Apocynaceae

Genus: *Wrightia*

Species: *Wrightia tinctoria*

TRADITIONAL USES

Wrightia tinctoria has been used in traditional systems of medicine, including Ayurveda, siddha and Unani practices. [13,7,8] Different parts of the plant, especially the leaves, bark, seeds and fruits, have been traditionally used for various health conditions. [13,7,8] Traditional uses include applications related to skin disorders, psoriasis, wounds, dandruff, jaundice, headache and toothache. [13,7,8] Ethnomedicinal observations have also documented the use of *w. tinctoria* in traditional communities. [7,8] These traditional uses have encouraged further phytochemical and pharmacological investigation of the plant. [13,8]

PHYTOCHEMICAL PROFILE AND BIOACTIVE CONSTITUENTS

Wrightia tinctoria contains a variety of phytochemical constituents that may contribute to its medicinal properties. [13,15,8] Different parts of the plant have been reported to contain bioactive compounds belonging to groups such as alkaloids, flavonoids phenolic compounds, terpenoids, triterpenoids, steroids, glycosides, tannins and saponins. [13,15,8] The phytochemical composition may vary depending on the plant part and the solvent used for extraction. [15] These constituents are considered important because they may be associated with the antioxidant, antibacterial, antifungal, anti-inflammatory and other biological activities reported for the plant. [10,11,9,15,8]



Qualitative Phytochemical Screening

Qualitative phytochemical screening of *W. tinctoria* is used as a preliminary method to identify major classes of secondary metabolites present in different plant parts and extracts. [15] In a reported study, leaf and bark extracts prepared using ethanol and acetone were subjected to tests for alkaloids, flavonoids, phenolic compounds, glycosides, steroids, terpenoids, saponins and tannins. [15] The screening showed Variation in phytochemical composition according to the plant part and extraction solvent. [15]

Alkaloids were detected using Dragendorff's test and were prominent in the ethanol extracts of both leaf and bark. Flavonoids were examined using the shinoda test and were not detected in the tested extracts. [15]

Phenolic compounds were identified using the ferric chloride test and were particularly abundant in the acetone leaf extract. [15] Tannins were also detected, with notable levels in the acetone leaf extract. These findings indicate variation in phytochemical composition according to plant part and extraction solvent. [15]

Glycosides were evaluated using the keller-kiliani test and were detected in the acetone bark extract. [15] Steroids were examined using the Liebermann-Burchard test and were detected in the ethanol bark extract. [15] Terpenoids were identified using the Salkowski test and were found in both ethanol and acetone extracts. [15]

Saponins were screened by the foam test and were not detected in the tested extracts. [15] Overall, the qualitative screening demonstrated the presence of several phytochemical groups, particularly alkaloids, phenolic compounds, glycosides, steroids, terpenoids, and tannins, with variation between plant parts and extraction solvents. [15]

Quantitative Phytochemical Analysis

Quantitative Phytochemical analysis is used to estimate the amount of bioactive phytochemical constituents present in *Wrightia tinctoria* extracts. [10] GC-MS analysis of the metabolic leaf extract identified several bioactive constituents, including terpenoids -related compounds, fatty acid derivatives, sterol -related compounds, flavonoids derivatives and other secondary metabolites. [10] This analysis provides information about the chemical composition of the plant extract and helps in understanding the possible relationship between its phytochemical constituents and biological activities. [10]

Chromatographic and Marker Identification

GC-MS is an important analytical technique used for the identification and characterization of phytochemical constituents in *Wrightia tinctoria*. [10] The methanolic leaf extract was subjected to GC-MS analysis, which identified several compounds, including beta-caryophyllene, myo-inositol, neophytadiene, phytol, squalene, flavonoids derivatives and other compounds. [10] Such chromatographic profiling helps characterize the chemical composition of the extract and identify compounds that may contribute to its reported biological activities. [10]

PHARMACOLOGICAL ACTIVITIES

Wrightia tinctoria has been investigated for several pharmacological activities due to the presence of diverse bioactive phytochemicals. [10,11,9,15,6,14] Recent studies have reported antioxidant, antibacterial, antifungal/anti-dandruff, anti-inflammatory, wound-healing and anti-psoriatic activities in different plant parts and extracts. [10,11,9,15,6,14] Experimental studies have evaluated these properties using different in vitro and in vivo models, supporting further



investigation of the plant's bioactive constituents and potential therapeutic applications.

Antioxidant Activity

Wrightia tinctoria exhibits antioxidant activity in its leaf and bark extracts. [10,15] Methanolic leaf extract showed free-radical scavenging activity in the DPPH assay, while GC-MS analysis identified several bioactive constituents that may contribute to this activity. [10] Ethanolic and acetone extracts of the bark and leaves also showed antioxidant activity in phosphomolybdenum and metal-chelating assays. [15] Antioxidant activity has also been investigated in phytochemical-capped silver nanoparticles prepared using *W. tinctoria*. [2]

Antibacterial Activity

Wrightia tinctoria exhibits antibacterial potential in different experimental studies. [11,12,2,1,5] Leaf extracts have been investigated for possible application in wound-dressing materials, and the ethanol extract showed promising antibacterial activity. [11] Antibacterial activity has also been reported for hydroxyapatite nanoparticles and silver nanoparticles prepared using *W. tinctoria*. [12,2] Zirconium oxide nanoparticles synthesized using its leaf extracts. [1] Silver nanoparticles synthesized from *W. tinctoria* fruit extracts have also been evaluated for antimicrobial activity. [5]

Antifungal/Anti-dandruff Activity

Leaf and bark extracts of *Wrightia tinctoria* showed anti-dandruff activity against *Malassezia furfur*. [15] Ethanolic and acetone extracts were evaluated by the disc diffusion method and showed inhibitory activity against the fungus. [15] Antifungal efficacy of *W. tinctoria* has also been investigated against candida species isolated from the oral cavity. [4]

Anti-inflammatory Activity

Wrightia tinctoria shows anti-inflammatory potential in experimental cell models. [9] The seedpod extract was found to reduce inflammation induced by lipopolysaccharide and palmitate in RAW 264.7 macrophages and HepG2 cells. [9] GC-MS and NMR analysis also identified several chemical constituents in the active fraction. [9]

Wound-Healing Activity

Methanolic extract of fresh *Wrightia tinctoria* leaves showed promising wound-healing Activity. [14] The extract exhibited antioxidant, anti-inflammatory and antibacterial properties and promoted wound healing in experimental studies. [14] These combined activities may contribute to the wound-healing potential of the plant. [14]

Anti-psoriatic Activity

Wrightia tinctoria leaf extracts demonstrated anti-psoriatic Activity in experimental models. [6] Treatment with the extracts reduced erythema, scaling and epidermal thickening and also decreased acanthosis, parakeratosis and inflammatory infiltration. [6] These findings indicate the potential of *W. tinctoria* leaf extracts in reducing the major skin changes associated with psoriasis. [6]

THERAPEUTIC APPLICATIONS

Wrightia tinctoria has several traditional medicinal and potential pharmaceutical applications. [13,7,8] Different parts of the plant, such as leaves, bark, roots, flowers and seeds, are used in traditional medicine. [13] Its applications are mainly related to skin care, wound management and other traditional therapeutic uses. [13,7,8]



Skin Disorders

Wrightia tinctoria is traditionally used for the management of various skin Disorders. [13,8] Preparations made from the plant, particularly its leaves and bark, have been used in traditional systems of medicine for skin-related conditions. [13,8] The reported phytochemical constituents and Pharmacological properties support further investigation of the plant for skin -related applications. [13,8]

Psoriasis

The plant has attracted attention for its potential application in psoriasis management. [6] Leaf extracts have been investigated using experimental models of psoriasis. [6] In these studies, treatment with *W.tinctoria* leaf extracts reduced visible skin changes such as erythema, scaling and epidermal thickening, along with histological changes associated with psoriasis. [6]

Wound Healing

Wrightia tinctoria leaves have a traditional history of use in wound treatment. [13] Recent experimental research on methanolic fresh-leaf extract demonstrated wound-healing potential. [14] The extract showed antioxidant, anti-inflammatory and antibacterial properties and promoted wound healing in experimental models. [14] These findings support its possible application in herbal wound-healing preparation and topical formulations. [14]

Wound-Dressing Applications

Wrightia tinctoria has potential applications in the development of plant-based wound-dressing materials. [11] Leaf extracts of the plant have demonstrated antibacterial activity, and ethanol leaf extract showed promising potential in a study of Wound-dressing materials. [11] The reported

wound-healing and related biological properties provide a basis for further investigation of *W. tinctoria* in wound-care materials. [11,14] Further studies are required to optimize formulations and evaluate their safety and effectiveness.

Anti-dandruff and Scalp Care

Wrightia tinctoria has potential application in herbal anti-dandruff and scalp-care preparations. [15] Leaf and bark extracts have shown inhibitory activity against *Malassezia furfur*, indicating potential for further investigation as natural ingredients in anti-dandruff formulations. [15] Further research is needed to standardize the extracts and evaluate their safety, stability and effectiveness in suitable topical formulations.

Traditional Medicine

Traditionally, different parts of *W.tinctoria* have been used for conditions such as jaundice, toothache, headache, wounds, skin diseases and dandruff. [13,7,8] Ethnomedicinal documentation and recent reviews highlight the continued traditional importance of the plant. [13,7,8]

Herbal and Pharmaceutical Research

The phytochemicals present in *W.tinctoria*, including alkaloids, flavonoids, phenolic compounds, terpenoids, triterpenoids and steroids, have increased interest in its development as a source of bioactive compounds. [10,8] GC-MS has been used to characterize compounds present in plant extracts. [10] Research on endophytic fungi associated with *W.tinctoria* has also expanded interest in microbial secondary metabolites and their **potential** bioactive properties. [16]

ENDOPHYTIC PHYTOCHEMISTRY

Endophytic fungi associated with *Wrightia tinctoria* have also been investigated as sources of



secondary metabolites with potential bioactive properties. [16] Studies on endophytic fungi such as *Xylaria rohrensii* highlight the potential contribution of associated microorganisms to phytochemical and biotechnological research related to *W. tinctoria*. [16]

FUTURE PERSPECTIVES

Wrightia tinctoria has considerable therapeutic potential because of its reported antioxidant, antibacterial, antifungal, anti-inflammatory, wound-healing and anti-psoriatic activities. [10,11,9,15,6,14] The presence of different bioactive compounds may contribute to these beneficial effects. [10,15] Its anti-psoriatic potential is particularly important for the development of plant-based approaches for skin disorders. [6] Future studies should focus on the identification and isolation of active compounds, standardization of plant extracts, and understanding their biological mechanisms. Further toxicity, safety and Pharmacological studies are also required to confirm its therapeutic effectiveness. Clinical studies may help to establish the safety and efficacy of *W. tinctoria* before wider therapeutic application.

CONCLUSION

Wrightia tinctoria is an important medicinal plant with a wide range of traditional uses and pharmacological properties. The plant contains various bioactive compounds, including alkaloids, flavonoids, phenolic compounds, terpenoids, triterpenoids and steroids. Reported studies have demonstrated antioxidant, antibacterial, antifungal/anti-dandruff, anti-inflammatory, wound-healing and anti-psoriatic activities. These properties support the potential use of *W. tinctoria* in herbal and pharmaceutical research, particularly for skin disorders and wound management. However, further research is needed to identify the

specific active compounds and understand their mechanisms of action. More studies on safety, toxicity, standardization and clinical effectiveness are necessary to support its future therapeutic application. Overall, *W. tinctoria* represents a promising medicinal plant and a potential source of bioactive compounds for future drug and herbal formulation development.

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