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Research Paper

Phytochemical and Pharmacological Characteristics of *Wrightiatinctoria*: A Review

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Abstract: *Medicinal plants have gained tremendous attention in recent years. The species Wrightiatinctoria (family Apocynaceae) is a wild medicinal tree contains many active phytoconstituents which are of aphrodisiac, anthelminthic, anti-inflammatory, analgesic as well as antipyretic importance and used to cure many human diseases. The phytochemicals of Wrightia is in major interest of pharmacological and pharmaceutical sectors due to their diverse function and biological activities by inhabitants for centuries. Therefore, the outcome of present review is to aid the understanding and concept of the researchers engaged in identification, characterization of phytochemical and diverse pharmacological attributes of the species.*

Keywords: *Wrightiatinctoria,* aphrodisiac, anthelminthic, anti-inflammatory, analgesic, pharmacological, phytochemical.

1. Introduction

Medicinal plants are well known for traditional uses with global therapeutic importance. They are considered best source to obtain variety of drugs. *Wrightiatinctoria* is available in wild habitats and has high medicinal value in Indian indigenous system of medicine. It used in modern medicine as raw material for important drugs as well as food and occupy a very significant place. Plant is rich source of ecologically developed secondary metabolites with potential remedies for different ailments. Studies have been performed on the species on various aspects.

W. tinctoria (family- Apocynaceae) is commonly known as 'Kudi', 'Dudhi', 'Indrajao' 'Easter tree' and 'Jaundice curative tree'. The species is a small to medium-size deciduous tree, reaching around 18

m height and up to 20 cm dbh. with green marks on the stem and produces milky-white resin (Fig.1). The bark of the plant is smooth, somewhat corky and pale grey (Joshi, 2000). Leaves are around 10 cm in length and 5 cm in width, simple, opposite, decussate and glabrous. Flowers are white with fragrance, while fruits are follicle and 0.5 cm in diameter and 50 cm in length. Seeds are linear, pointed at the ends with 1.2-1.8 mm in length and light yellowish-grey in color and dispersed by wind (Hocking, 1993). The flowering occurs during April to June, and fruiting in August. The species is suitable for arid, semi-arid and moist regions with a wide range of soil types, especially dry sandy sites or hillsides and valleys and tolerates moderate shading. However, the species is often found as undergrowth in deciduous forests. It is usually found up to altitude of 1200 meter, in area having 400-2500 mm mean annual rainfall and temperature 17-25 ˚C. Dry, sandy, gravely or rocky soils types support the growth of the species but it grows well in high uranium levels in soils (Arey and Jain, 1995). Species is native to India and Burma. It commonly occurs in Central India, Western Ghats, Coromondal coast, Coimbatore, Godavary district, Rajputana, Deccan, Konkan, Western Ghats of Madras presidency (Devi and Divakar, 2012).

2. Traditional Usage

The flowers, leaves, fruits and seeds of the species are used as vegetables. The timber obtained from the species is high in quality and valuable. The white wood, which is very fine, is used for turnery, carving, toy making, matchboxes, small boxes and furniture. The leaves, flowers, fruits and roots are sources of indigo yielding glycosides, which produce a blue dye or indigo like dye (Gadpandey et al., 1995). The local c ommunity uses different parts of *W. tinctoria* for various dietary needs. The juice extracted from fresh unripe fruits is used for coagulating milk. The seeds are reported to have aphrodisiac and anthelminthic properties (Shruti and Shwetha, 2010). The bark and leaves of the species are used to treat psoriasis, stomach pains, toothache, and dysentery. The leaves are used to relieve toothache while chewing with salt and milky juice is used to stop bleeding (Elumulai et al., 2012). Leaves and roots crushed in water are used for treatment of fever. In Indian traditional medicine, the bark and leaves are used as a poultice for mumps and herpes and also to treat psoriasis and other skin diseases, stomach pains, toothache, and dysentery (Jolly and Mechery, 1996). The species, reported to have analgesic, anti-inflammatory (Purohit and Kukda, 2004), antipyretic properties (Jain and Bari, 2010) and effective in the treatment of psoriasis. The mixture of Phyllanthusamarus (keezhanelli) and Vitexnegundo (nochi) with *Wrightia* milk is orally administered to women for improving fertility. Oil extracted from seeds has anti-inflammatory and anti-dandruff properties and used in hair oil preparations (Krishnamoorthy and Ranganathan, 2000). The oil emulsion of the pods, “777 Oil,” is used to treat psoriasis (GOI, 1987). The leaves are lopped as livestock fodder. The pods from species contain floss, which is used for stuffing cushions. The cream-coloured latex derived from species has a rubber content varying from 2 to 28% that can be exploited commercially (Rodgers, 1990). Many artisans in Chennapatna, Etikoppaka and Kondapally (India) depend on wood of *W. tinctoria* for earning their livelihood and it is used by the lacware handicraft industry generally in toy making ((Rodgers, 1990; GOI, 2000).

3. Phytochemical Studies

Secondary metabolites are complex organic compounds biosynthesized from primary plant metabolites in plant cells. Secondary metabolites are classified as: alkaloids, glycosides, tannins, phenolic compounds, volatile oils, terpenoids, saponins, steroids, resins etc. These are used as medicine, food, flavors, colours, dyes, poisons and perfumes etc. It is estimated that 1/4th of prescription drugs contains at least one chemical originally identified from plants (Ahmad, 2007). The plant medicinal property of is closely related to the different groups of phytoconstituents such as alkaloids, acids, steroids, tannins, essential oils, saponins etc. present in the plant, each of which would have a preferred effective method of extraction, facilitating maximum yield in preparation.

The aim of phytochemical studies is to identify the bioactive components in the plants, devise suitable methods for their extraction, help in standardization and quality control. Phytochemical studies help in

standardizing the herbal preparations so as to get the optimal concentrations of these active constituents, as well as in preserving their activities (Brijesh et al., 2006). The last decade is characterized by a growing interest in natural occurring phytochemicals.

The shade dried leaf powder in various solvent extracts such as methanol, ethanol, dichloromethane, chloroform, ethylacetate and petroleum ether, have been analyzed for their phytoconstituents and fluorescence characters by HPTLC suggests lupeol as a major triterpene(Devi and Divakar, 2012). Lignocellulose of the seed fibre of *Wrightia* has been characterized for textile implication (Subramanian et al., 2005). Investigation for the qualitative analysis of steroids, triterpenoids, phenolic compounds, tannins, alkaloids, saponins, flavanoids and reducing sugars as well as antimicrobial properties of different solvent crude extracts of *W. tinctoria* was performed against various bacterial pathogens (Jayachandra et al., 2010).

The bioactive compounds of *W. tinctoria* leaf have been evaluated using GC-MS revealed the presence of 3-O-methyl-d-glucose (51.44%), Squalene (16.52%), n-hexadecanoic acid (6.17%), Phytol (4.47%) and 9,12-Octadecadienoyl chloride (Z,Z)- (4.31%) in the ethanolic extract (Jayamathi et al., 2012).

A group of terpenes containing lupeol, β-amyrin and β-sitosterol from stem bark (Rangaswami and Nageswara, 1963), indurubin from leaves (Ponnusamy et al., 2010a; Ponnusamy et al 2010b) and wrightial, cycloartenone, cycloeucalenol, β- amyrin and β-sitosterol were isolated from methanolic extract of the immature seed pods of *Wrightia* (ramchandra et al., 1993) (Fig.2). Latex of the tree was investigated for isolation of writing from class of serine protease enzyme (Tomar and Jagannadham, 2008). Sterol 14α-methylzymosterol along with four uncommon sterol desmosterol, clerosterol, 24-methylene-25-methylcholesterol and 24-dehydropollinastanol were also isolated from the unsaponifiable lipid of W. tinctoria seed lipid (Akihisa et al., 1988). Tryptanthrin, isatin, anthranillate and rutin were isolated and identified as major constituents of *W. Tinctoria* (Muruganadam et al., 2000).

4. Pharmacological Studies

*W.tinctoria*have been widely used as a therapeutic agent to treat a number of ailments of folklore medicines in Indian indigenous treatment because of its *W. tinctoria*because of its diverse pharmacological profile (Table 1).

4.1. Anti- Inflammatory Activity

The bark of *W. tinctoria*was investigated for anti-inflammatory activity by carrageenan- induced rat paw oedema and cotton pellet induced granuloma method; the extract of the species showed inhibition of rat paw oedema and percent granuloma changes at dose of 200 mg/kg as compared to control group (Tharkar et al., 2010).

*Wrightiatinctoria*ethanolic and aqueous leaf extracts were investigated for its anti-inflammatory effects in rat and mice by Human Red Blood Cell (HRBC) membrane stabilization and carrageenan induced hind paw edema method was found to be effective (Aleykutty et al., 2011).

Petroleum ether and methanol wood stem extracts of the species was investigated for its anti-inflamatory effect on animal models using carrageenan- and histamine-induced paw edema test method. The extract was found to possess significant dose dependent anti-inflammatory activity (Jain and Bari, 2010).

Anti-inflamatory activity was tested by HRBC membrane method using ethyl alcohol and aqueous extract of *W. tinctoria*. The preventation of hypo tonicity induced HRBC membrane lysis was taken a

measure of anti-inflammatory activity and these extracts shows biphasic effects (Rajalakshmi and Harindran, 2012).

4.2. Anti-Diabetic Activity

Streptozotocin (STZ)-induced albino diabetic rats were investigated for anti diabetic activity of petroleum ether extract of *W. tinctoria*leaves (PWT) (Raj et al., 2010). PWT was orally administered to STZ-induced diabetic rats at 200 and 400 mg/kg, p.o doses for 14 days to determine anti hyperglycemic activity. The fasting blood sugar levels and serum biochemical analysis in STZ-induced diabetic rats were investigated. Oral administration of PWT for 14 days exhibited a significant reduction in serum glucose, total cholesterol and triglycerides in alloxan diabetic rats. The anti-diabetic and hypolipidemic activities of the petroleum ether extract of *W. tinctoriaL*. (PWT) were similar to those produced by glibenclamide at 600µg/kg. The results demonstrate that PWT possesses potent anti hyperglycemic and hypolipidemic activity in STZ-induced diabetic rats.

4. 3. Anti-Nociceptive Activity

The anti-nociceptive activity in ethyl acetate, acetone and methanol extracts of *W. tinctoria* bark on acetic acid-induced writhing test in mice was evaluated and their effects were found to be comparable to that of acetylsalicylic acid (Reddy et al., 2002).

4.4. Hepatoprotective Activity

A triterpene fraction containing lupeol, -amyrin and β-sitosterol isolated from the stem bark of *W. tinctoria* was investigated for its hepatoprotective effect on CCl4 induced hepatotoxicity in the rat (Bigoniya and Rana, 2010) (Fig.2).

4.5. Antibacterial Activity

Leaf extract was effective against Gram negative, Gram positive bacteria and drug-resistant *S. aureus*. Efflux pump inhibition of indirubin constituent of leaves of *Wrightia*synergistically increases the activity of ciprofloxacin against *Staphylococcus* (Ponnusamy et al., 2010b).

4.6. Antifungal Activity

Antifungal activity of indirubin isolated from leaf chloroform extract of *Wrightiatinctoria* against *Trichophytonrubrum*, *Epidermophytonfloccosum*, *Aspergillusniger* and *Scopulariopsisbrevicaulis*[21]. Moreover the anti-pityrosporum activity of herbal drug combination of *W. tinctoria* and *Hibiscus rosasinensis* was tested *in vitro* against the isolates of *Pityrosporumovale* recovered from dandruff. The drug combination exhibited fungicidal activity at a concentration ranging between 500 to 1000 µg/ ml (Krishnamoorthy and Ranganathan, 2000).

4.7. Antiviral Activity

Leaves of *W. Tinctoria*depicts antiviral activity of different extracts of in replication of HIV-1(IIIB) in MT-4 cells and HCV in Huh 5.2 cells. Choloroform extract of *W. tinctoria* exhibited a maximum protection of 48% against the cytopathic effect of HIV-1(IIIB) in MT-4 cells (Selvam et al., 2009).

4.8. Anti-PsoriaticActivity

The alcoholic leaves extract of the species was analyzed for anti-psoriatic activity by mouse tail test. Various parameters like degree of orthokeratosis, drug activity and the relative epidermal thicknesses were calculated and the extract of the species was also evaluated for its antioxidant potential by

DPPH, nitric oxide and hydrogen peroxide radical scavenging assays. Results indicated that extract produced significant degree of orthokeratosis compared to control and the drug activity was found to be 70.18%, which is more potent than the standard (57.43%). Further the extract showed prominent antioxidant activity in all the assays and conclude that the selected plant has antipsoriatic activity which can be used for psoriasis treatment (Dhanabal et al., 2012).

4.9. Anti Cancerous Activity

In-vitro cytotoxic activity of alcoholic extracts of the bark of five different plants, *Artocarpusheterophyllus*, *Alangiumsalvifolium*, *Buchananialanzan*, *Sesbaniagrandiflora*, and *Wrightiatinctoria*which are traditionally used in Chhattisgarh was studied against human breast cancer (MCF-7) and human leukemia (HL-60) tumor cell lines using the thiazolyl blue test (MTT) assay. *Wrightia*was found to be effective on MCF-7 and moderately effective on HL-60 cell line (Jain and Jain, 2011).

4.10. Anthelmintic Activity

Leaves of *Wrightiatinctoria* was investigated for its anthelmintic activity against *Raillietinaspiralis* and *Ascaridiagalli*. The extract exhibited significant dose dependent anthelmintic activitiy at time of paralysis and time of death of the worm (Rajalakshmi and Harindran, 2013).

Tables and Figures:

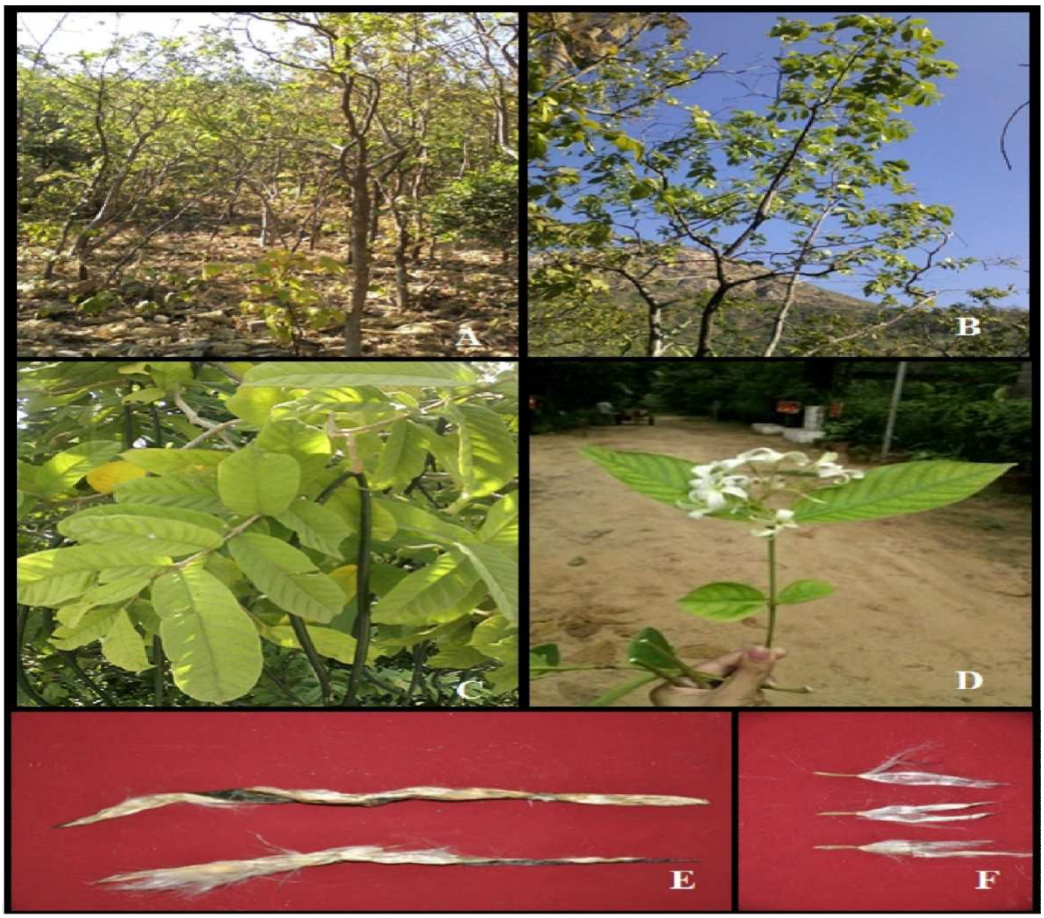

Figure 1:*W. tinctoria*plant(A) species under natural habitat; (B) Complete tree; (C) Leaves; (D) inflorescence; (E) fruit and (F) seeds

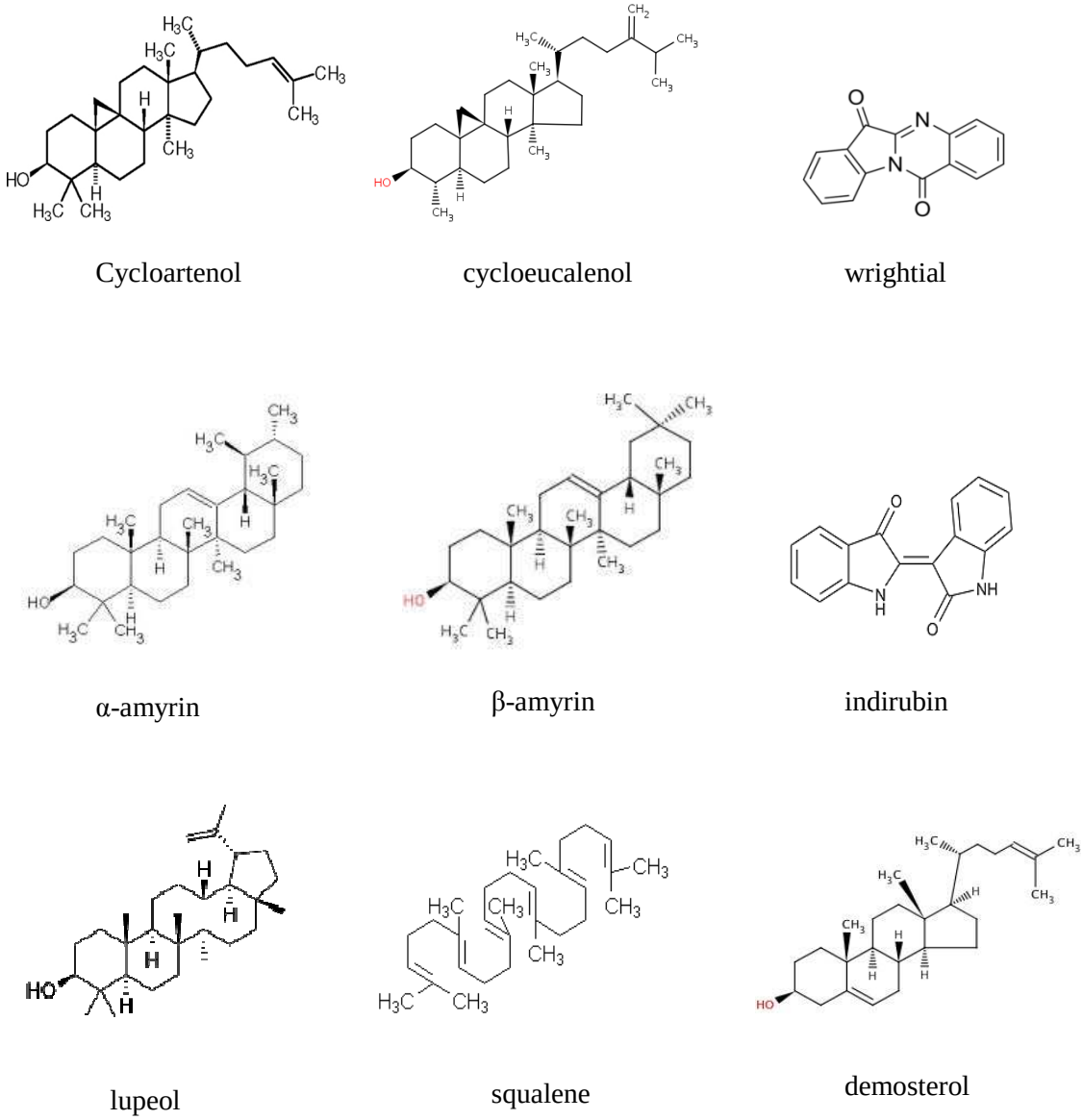

Fig.2: Structure of biocompounds present in *Wrightia tinctoria*

Table 1: Pharmacological activities of *W. tinctoria*

Activity studied	Plant part used	References
Anti-inflamatory	Stem bark	Tharkar et al., 2010
Anti-inflamatory	Stem bark	Jain and Bari, 2010
Anti-inflamatory	Leaf	Aleykutty et al., 2011
Anti-inflamatory	Leaf	Rajalakshmi and Harindran, 2012
Anti-diabetic	Leaf	Raj et al, 2010
Anti-nociceptive	Stem ark	Reddy et al., 2002
Hepatoprotective	Stem bark	Bigoniya and Rana, 2010
Analgesic	leaf	Aleykutty et al., 2011

Antibacterial	Leaf	Ponnusamy et al, 2010
Antifungal	Leaf	Ponnusamy et al, 2010
Anti-psoriatic	leaf	Dhanabal et a., 2012
Anthelmintic	Leaf	Rajalakshmi and Harindran, 2013
Anticancer	bark	Jain and Jain, 2011

5. Conclusion

Wrightiatinctoria is the species found in wild, having health beneficial effects due to presence of potential secondary compounds. The presence of high amount of active phytoconstituents such as phenolis, falvonols, alkaloids, steraol and several terpenes make the afore-mentioned plant extract a good candidate for more exploration in pharmacological activity. The outcome of present study suggests that the species of *Wrightiatinctoria* may prove to be quality product for the production of medicine and useful therpeutics provided thorough resource mapping and phytochemical investigation conducted.

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