Pharmacognostic Review 0n Alstonia Scholaris

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***Abstract*—Alstonia scholaris, commonly known as the devil's terror blackboard tree, is an evergreen tree belonging to the family Apocynaceae. Native to south and southeast Asia, it has significant medicinal, ecological and economic importance. this fast-growing tree can reach heights of up to 40 meters and is characterized by whorled leaves, milky latex, and fragrant white flowers. Chemical constituents of alstonia scholaris is echitamine, echitenine, alstonine, Picrinine, dita nine, kaempferol, quercetin, rutin, lupeol, oleanolic acid, garlic acid etc. The plant is used in traditional, ayurvedic, Unani, homeopathy, and siddha types of alternative medicinal system against different illness such as asthma, malaria, fever, dysentery, diarrhoea, skin disease, snake bites, jaundice, antioxidant, antifungal, antibacterial etc. Among the phytochemicals alkaloids are mostly reported. since ancient times, medicinal plants performing a very essential role as a source of medicine and their medicinal properties have been well documented in the various traditional systems of medicine including Indian, Chinese, and Korean medicine for the management of chronic inflammatory disorder. Complimentary therapies based on herbal medicines are the world's oldest form of medicine and recent report suggest that such therapies still enjoy vast popularity, especially in developing countries where most of the population does not have easy access to modern medicine. The plant Alstonia Scholaris has ethnobotanical uses which has been validated in few pharmacological investigations. therefore, the aim of this review is compilation of phytochemistry, ethnobotanical and pharmacological use of Alstonia Scholaris so as to provide better scope for the use of this plant in pharmacological related studies.**

***Index Terms*—Alstonia Scholaris, Apocynaceae, Phytochemistry, Novel drug delivery system, Alkaloids.**

I. INTRODUCTION

In order to maintain and secure wellbeing as well as to treat, mitigate, identify, and manage physical or mental illnesses, traditional medicine is a collection of knowledge, skills (the ability to apply learned knowledge), and performances based on theories, viewpoints, and understanding of various ethnic groups, whether or not they are understandable. In most countries, conventional medicine is used extensively to treat a variety of disorders due to its safety, affordability, and pharmacological effectiveness (Mahavir Chhajed1, 2023), (PC) Alstonia is a well-known medicinal plant that belongs to the Apocynaceae family. People all throughout the world utilize this medicinal plant extensively to cure a range of illnesses. Numerous inflammatory chronic skin conditions, rheumatic pain, general tonic, antidysentery, vulnerary, anti-fever, anti-choleric, malaria fever, irregular menstruation, hepatic disorders, diabetes, anthelmintic, upset stomach, bone fracture, skin disorders, aphrodisiac, emmenagogue, inflammation, and urinary infections have all been effectively treated by A. scholaris. (India, 1988), (The wealth of India, 2001), (AK, Indian materia medica, 1976), (Kirtikar KR B. B., 2005), (DP, 2008) It possesses analgesic, anti-inflammatory, anti-diabetic, and astringent qualities. In addition, it possesses cytotoxic, anti-cancer, antioxidant, anti-malarial, and radioprotective CNS and anti-arthritic qualities. (Khyade, 153).

Taxonomical Classification of Alstonia scholaris Linn.

Taxonomy	*Alstonia scholaris*
Kingdom	Planta, Vegetal, Plants
Subkingdom	Tracheobionta, Vascular Plants
Division	Mangoliophyta, Flowering Plant
Class	Mangoliopsida, Dicotyledon
Subclass	Asteridae

Order	Gentianales
Family	Apocynaceae
Tribe	Plumeriae
Subtribe	Alstoniinae
Genus	Alstonia

The Devils tree is known by several local and common names (India, 1988) (The wealth of India, 2001), (AK, Indian materia medica, 1976), (Kirtikar KR B. B., 2005) (DP, 2008), (Khyade, 153), (Kaushik D, 2011).

Language	Vernacular Names of Saptaparna
English	Dita; Devils tree; White Cheese wood
Sanskrit	Saptaparna
Hindi	Chatiun; chitvan; saitan ka jhad; Saptaparni
Gujarati	Saptaparni
Malayalam	Daivapala
Kannada	Doddapala
Tamil	MukumPalai; Elilaippala
Telugu	Edakulapala
Marathi	Saptaparni
Bengali	Chattin
Unani	Kashim

II. BOTANICAL DESCRIPTION

(Meena AK, 2001) (A, 2011), (Kaushik P, 2011)

The size of the huge, evergreen Alstonia scholaris tree ranges from 6 to 10 meters.

Bark:

When injured, its hard bark releases a yellowish, bitter latex and has an interior color that ranges from greyish white to pale.

Leaves:

The thick, dark green, whorled leaves are oblong to oblanceolate, thin at the base, whole, rounded or bluntly acuminate at the apex, with petioles that range in length from 6 to 12 mm.

Flowers:

Little greenish white flowers with umbellate branches. They are 1.5–4 mm long, with the left borders overlapping, strongly scented, and 7–10 mm long. The tube is hairy, and the lobes are either sparsely or densely pubescent. India's blossoming season lasts from December to March.

Fruit:

The fruits consist of two linear follicles that are 20–50 cm long, globous, and have narrow wings on a single suture. The fruiting season in India is from May to July.

Seeds: The rectangular, 6–8 mm long seeds are flattened and have a brownish fur tuft at each end.

(Leave)

(Whole Plant)

Fig 1: Plant of Alstonia scholaris

III. PHYTOCHEMISTRY:

Alkaloids, coumarins, flavonoids, leucoanthocyanins, reducing sugars, simple phenolics, steroids, saponins, and tannins are all commonly found in A. scholaris plants. Cu, Zn, Fe, Ca, Cr, Mn, and Cd are among the eight elements found in leaf extract (Ye YQ, 2009). Methanolic leaf extract contains the first seco-uleine alkaloids, whereas ethanolic leaf extract contains four picrin type monoterpenoids: indole alkaloids, 5βmethoxyaspidophylline, picrinine, picralinal, and 5-methoxystrictamine. (Cai XH, 2008). Nmethoxymethyl picrine, an indole alkaloid, as well as 2, 3 secofernane triterpenoids and astonic acids A and B are present in the hydroalcoholic extract of leaves (Wang F, 2009).

IV. TRADITIONAL USES

- Bark: Alstonia scholaris bark helps with skin conditions, dyspepsia, stomach issues, and malarial fever. The bark has digestive, laxative, anthelmintic, antipyretic, stomachic, cardiotonic, tonic, astringent, and bitter properties. (AK, Indian Materia Medica, 1976) According to reports, the bark extract contains hepatoprotective, immunostimulant, antiplasmodial, and anticancer properties. (Lin SC, 1996). According to Ayurvedic reports, soaking the plant's bark in water for the entire night will lower blood glucose levels following oral ingestion. (Deepti B, 2011). Bark is also used as a galactogogue, depurative, and febrifuge. (Arulmozhi S, 2010). Leprosy, skin conditions, agalactia, bronchitis, pruritic, chronic, and nasty ulcers, as well as debility, respond well to it12. Milky juice is used in traditional medicine to treat wounds, ulcers, and rheumatic aches; when combined with oil and injected into the ear, it improves ear pain (Arulmozhi S, 2010).
- Leaves The leaves have been used traditionally as folk remedies for the treatment of many diseases including diarrhoea, dysentery, and malaria and snake bites (Kirtikar KR B. B., 1935). In some situations, the leaf juice has strong galactogogue properties.
- (Arulmozhi S, 2010). Leaves are utilized for liver congestion, dropsy, and beriberi. Latex is applied to rheumatic swellings, tumors, ulcers, and wounds.
- Fruits The plant's mature fruits are used to treat epilepsy and syphilis. Additionally, it has anthelmintic, antiperiodic, and tonic properties. (Pawan K, 2011).

Miscellaneous uses and as herbal formulations

Numerous commercially available Ayurvedic medicines contain the antimalarial medication Alstonia scholaris. It was discovered that this plant's methanolic extract had strong antiplasmodial properties. (Kirtikar KR B. B., 1999). The plant is reported to have anti-mutagenic effect (Lim-Sylianco CY, 1990). According to reports, the medication paralyzes the motor nerves, which lowers blood pressure. When it comes to liver damage, the plant has hepatoprotective properties.

(Arulmozhi S, 2010). There have been reports of Sikkim tribal people using saptaparna to treat hypertension. (Bhogayata K, 2009). Saptaparnasatvadi vati, Saptachadadi vati, Saptacchadadi vati, Saptacchadadi taila, Saptacchadadi kvatha, and Saptaparna ghanasara are among the Ayurvedic remedies that use it.

V. PHARMACOLOGICAL ACTIVITIES

- Immunomodulatory activity:

Combining the alkaloids and triterpenes of A. scholaris (Linn.) R Br leaves has two effects: it increases immunomodulatory activity in C57BL/6 mice and induces apoptosis in the A549 Cell Line. These results provide preliminary evidence that both triterpenes and alkaloids have the ability to modulate the immune system and induce apoptosis, and that their combined action is more powerful than that of either type alone. (Salim AA, 2004), (Chakravarti D, 1957)Bark extracts from pulses (A. scholaris) stimulate the immune system. In this study, the aqueous extract had no effect on the quantity of primary antibodies at dosages of 50 and 100 mg/kg body weight. At a dose of 50 mg/kg body weight, the aqueous extract boosted cellular immunity, but at a dose of 100 mg/kg b.w., it inhibited the delayed form of hypersensitive reaction. (Iwo MI, 2000)

- Anti asthmatic activity:

Bronchodilatory action of the ethanol extract of Alstonia scholaris leaves in anaesthetized rats was reported by Channa et al This feature was not

confirmed by in vitro preparations of guinea-pig trachea, suggesting that bronchodilation is not caused by direct relaxation of the tracheal smooth muscle. According to reports, the extract's vasodilatory action was primarily caused by nitric oxide, a relaxing agent derived from endothelium, and was not dependent on prostaglandins, adrenergic or muscarinic receptors, or either. Acetylcholine and histamine's contractile effects on the guinea-pig ileum were reduced by the extract, as were the spontaneous movements of the rabbit jejunum. Furthermore, the extract significantly decreased the contraction that was elicited by barium chloride, potassium chloride, and calcium chloride on the guinea-pig ileum and pulmonary artery, suggesting that the plant extract directly interfered with the entry of calcium ions into cells. Nevertheless, there was no discernible impact of the extract on intracellular calcium mobilization. These findings, along with the effects of ethanol extract in vivo, demonstrate that the leaves of Alstonia scholaris exhibit broncho-vasodilatory activity, likely due to prostaglandins, calcium antagonists, and endothelium-derived relaxing factors.

- Wound healing activity: Alstonia scholaris ethanol and aqueous extracts were investigated for their ability to cure wounds using excision, incision, and dead space wound models (S. Arulmozhi V. R., 2007). Rate of wound contraction, epithelialization period, skin breaking strength, granulation strength, dry granulation tissue weight, hydroxyproline, collagen, and granulation tissue histology were used to evaluate the wound healing process. To assess the degree of lipid peroxidation, the malondialdehyde level was also calculated. In every wound model examined, the extracts markedly accelerated wound healing. The extract-treated groups showed enhanced collagenation in the histological section, decreased epithelialization time, and higher rates of wound contraction, skin breaking strength, granulation strength, dry granulation tissue weight, hydroxyproline, and collagen. Additionally, the extracts markedly reduced the lipid peroxidation levels.

- Analgesic and anti-inflammatory activities: The acetic acid-induced writhing, hot-plate, and formalin tests in mice were used to examine the plant's analgesic properties. Both in vivo and in vitro anti-inflammatory activities were performed, including inhibiting COX-1, -2, and 5-LOX and causing xylene-induced ear edema and carrageenan-induced air pouch formation in mice. It has been demonstrated that the alkaloid components considerably lessened the writhing reaction that mice experienced when exposed to acetic acid. Alkaloids clearly did not lengthen the mice's latency period in the hot-plate test. Alkaloids considerably reduced the licking time of mice in the second part of the formalin test, but they did not affect the licking time in the first phase. In an air pouch mouse model, the alkaloid fractions dramatically reduced NO, PGE2, and MDA levels, enhanced SOD activity, and dramatically prevented xylene-induced ear edema. Additionally, in vitro anti-inflammatory assays showed that some alkaloids inhibited COX-1, COX-2, and 5-LOX, supporting alkaloids as the bioactive fraction. Therefore, it was determined that the alkaloids fraction of Alstonia scholaris leaves, which contains the three primary alkaloids of picrinine, Valles amine, and scholaricine, may have a peripheral analgesic and anti-inflammatory effect. Alkaloids demonstrated suppression of inflammatory mediators (COX-1, COX-2, and 5-LOX) in in vitro experiments, which is consistent with findings in animal models. s (Jian-Hua Shang, 2010).

- Anti-ulcer activity: The anti-ulcer properties of Alstonia scholaris leaf ethanolic extract were assessed. (S. Arulmozhi V. R., 2007) through the pyloric ligation technique. While rats given diclofenac sodium had a noticeably higher ulcer score, the animals treated with the extract did not exhibit any ulcers.

- Anthelmintic activity: Ascardia galli was used to test the anthelmintic properties of *Alstonia scholaris'* alcoholic extract. Following incubation, measurements were made of the worms' acetylcholine esterase (AchE) activity, glucose absorption, glycogen content, lactic acid generation, and gross motility. The worms with Alstonia scholaris showed a considerable reduction in glycogen content and a severe inhibition of glucose uptake. Significant increases in lactic acid concentration and decreases in gross

motility suggest that the extract has an impact on the parasite's energy-generating system. The marked rise in lactic acid level points to either lactic acid buildup or ATP generation inhibition. The extract exhibited strong anthelmintic properties, and its potential mode of action could involve blocking energy metabolism (linn., 2007).

- Antioxidant activity: Antony et al. reported on the phytochemical analysis and antioxidant properties of A. scholaris. When compared to butanoic and ethyl acetate extracts, the study discovered that aqueous bark extracts exhibited the best antioxidant activity in DPPH and ABTS experiments (Antony M, 2011).
- Anticancer activity: Methanol extracts of root barks of Alstonia macrophylla, A. glaucescens, and A. scholaris, collected from Thailand, have been assessed for cytotoxic activity against two human lung cancer cell lines, MOR-P (adenocarcinoma) and COR-L23 (large cell carcinoma), using the SRB assay. Pleiocarpamine, O-methylmacralstonine and macralstonine were all considerably less active than villalstonine (N. Keawpradub, 1997)
- Antibacterial activity: It was shown that a methanolic extract of the bark of A. scholaris was effective against both gram-negative bacteria, such as Escherichia coli, and gram-positive bacteria, such as Bacillus coagulans. (Khan MR, 2003).

VI. CONCLUSION

The plant Alstonia Scholaris is an evergreen tree. Many parts of this plant have been used in traditional system of medicine for treating various ailments such as antibacterial, antimicrobial, astringent, asthma etc. The plant contains various chemical constituents mostly alkaloids, coumarin, flavonoids, leucoanthocyanins, reducing sugar, simple phenolics, steroids, saponins and tannins. A part from these many researches has been done on this plant and proven that the plant is having many pharmacological activities supporting its vast ethanobotanicals and alternative medicinal use. Many of the disease treated indigenously using the plant have not been confirmed in the laboratory. This leaves and opportunity to explore the species both phytochemically and pharmacologically. Therefore, ethanopharmacology and bridge between the folklore use and actual pharmacological efficacy of the medicinal plant. In this way it may be used in novel drug discovery programs in the future.

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