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TAXONOMY, ETHNOBOTANY, AND PHARMACOLOGY OF *Alstonia scholaris* (L.) R. BR. -A ROADSIDE EVERGREEN TREE IN ROHILKHAND REGION (U.P.)

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***Abstract*:**

Alstonia scholaris (Devil tree) is reported as an ornamental tree with medicinal importance. This evergreen tree is native to the Indian subcontinent and Southeast Asian countries. It is planted extensively in Rohilkhand region as a roadside tree for beautiful flowers and amazing fragrance. It has long been investigated for its phytochemicals and pharmacological activities supporting its vast ethnobotanical and alternative medicinal use. Various parts of this tree are used in traditional, Ayurvedic, Unani, Homoeopathy and Sidhha types of alternative medicinal systems against different ailments such as asthma, malaria, fever, dysentery, diarrhoea, epilepsy, skin diseases, snakebite etc. Among the phytochemicals, alkaloids are mostly reported. *A. scholaris* has been reported as antimicrobial, anti-cancer, anti-inflammatory, analgesic, antioxidant, antifertility and wound healing activities.

Keywords: Devil tree, Ornamental, Ethnobotanical, Medicinal, Rohilkhand region.

1.INTRODUCTION

The genus *Alstonia* with 45 species occurs in Africa, Central America, Southeast Asia, Polynesia and Australia. Historically, the plant was scientifically named by Linnaeus as *Echites scholaris*. However, to commemorate the great botanist Professor C. Alston at Edinburgh University the generic name was changed to *Alstonia*, whereas the species name *scholaris* was retained to signify its use in schools in South East Asia, where the wood is traditionally used to make blackboards and wooden slates (Orwa et al. 2009). *A. scholaris* (L.) R.Br. (Family: Apocynaceae) is popularly known as "Saptaparni" or the "Devil tree" and one of the most versatile medicinal plants having a wide spectrum of biological activity. This is widely planted under afforestation programs and as an avenue or ornamental tree in urban centres in India. It is a beautiful foliage tree up to 3.0 meter in height, with a large canopy, and because of this, it has become a popular ornamental tree in roadsides (Fig 1). The species can be grown in a variety of climatic conditions in India, ranging from dry tropical to sub-temperate. According to references, the tree was first planted in Delhi in the late 1940s when Golf Links colony was coming up (it's still a good place to find the tree, along with Lodhi Gardens). It has slowly evolved as a prominent avenue tree, due to its hardy nature, high tolerance against pollution, and adaptability. The plant is used in Ayurvedic, Unani and Sidhha/Tamil types of alternative medicinal systems (Khare, 2007). Infection in the *A. scholaris* trees, planted across the Rohilkhand region, is spreading at an alarming stage.

Taxonomic arrangement of *A. Scholaris* (L.) R. Br.

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*
Species	*scholaris* (L.) R. Br.

Local Names Hindi (saitan-kijhad); Sanskrit (saptaparna); Tamil (palegaruda,pala); Bengali (chatium); Gujarati (satuparni); Urdu (chatiana); Burmese (lettok); English (white cheesewood, black board tree, devil's tree, dita bark); Kannada: AeleleHaale, Bantale, Doddapala, Malayalam: Daivappala, Marathi: Satvin, Nepali (chhatiwan,chhataun).

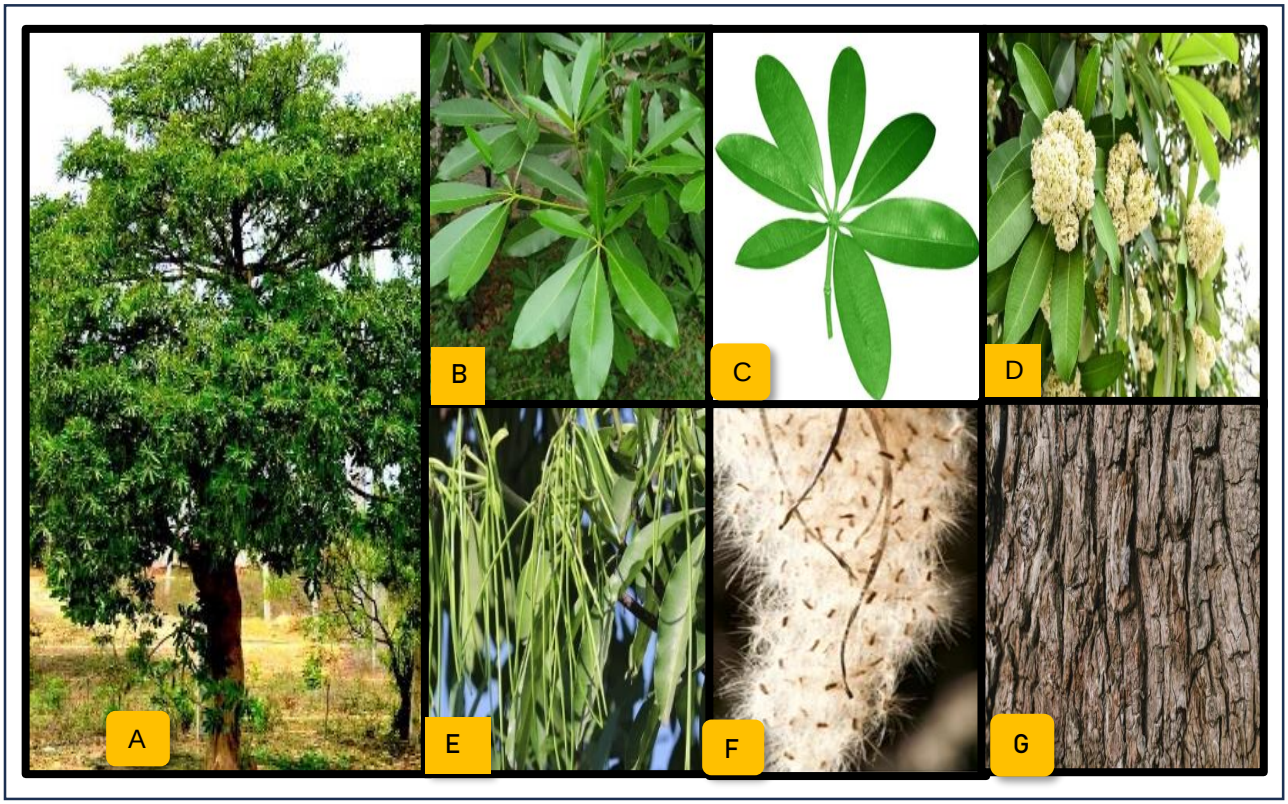

Fig.1 *Alstonia scholaris* and its various parts.

A- Full grown Tree, B-Foliage, C-Leaf, D-Inflorescence, E- Follicles, F-Seeds, G-Bark.

2. TAXONOMIC DESCRIPTION

Alstonia scholaris (L.) R. Br., Mem. Wern. Nat. Hist. Soc. 1: 76. 1811; Wight, Icon. pl. Ind. orient. 422. 1841; Beddome, Fl. sylv. S. India. t. 242. 1872; Hook. f. Fl. Brit. India 3: 642. 1882; Gamble, Fl. Pres. Madras 2: 810 (569). 1923; Duthie, Fl. Upp. Gang. Plain 1: 486. repr. ed. 1960; Maheswari Fl. Delhi. 215.1963; Huber in Abeyw. Rev. Handb. Fl. Ceylon 1 (1): 12. 1973; Markgraf, Blumea 22: 23. 1974; Matthew, Fl. Tamilnadu Carnatic 3: 257. 1981–1983; Ramch. & Nair, Fl. Cannanore 274. 1988; Sasi. & Sivar. Fl. Pl. Thrissur For. 277. 1996; Saini, J. Econ. Taxon. Bot. 29 (3): 609. 2005; Maliya & Datt, J. Econ. Taxon. Bot. 34 (1): 56. 2010; syn- *Echites scholaris* L., Mant. Pl. 1:53. 1767.-*Alstonia scholaris* var. *velutina* Monach., Pacific Sci. 3: 150. 1949.

A tree up to 30 m tall, bark 10-15 mm thick, surface grey-brown, irregularly cracked and shallowly fissured, corky, white milky latex; branchlets whorled. Branches whorled; branchlets terete, glabrous. Leaves simple, whorled with 4-7 unequal leaves; petiole 0.4-1.5 cm long; lamina 6-20 x 2.5-7 cm, narrow elliptic-oblanceolate, apex rounded or emarginate, base cuneate to decurrent, coriaceous or sub-coriaceous, shining above, glaucous beneath; secondary nerves many, closely parallel with intramarginal vein; tertiary nerves obscure. Flower bisexual, 10-12 mm long, greenish-white in terminal umbellate cymes; calyx cupular, lobes 5, ovate, unequal, obtuse, puberulous, eglandular; corolla salver shaped, 4 mm across, lobes 5, obovate to orbicular, creamy yellow, spreading; stamens 5, included; anthers narrowly cordate; disc obscure; carpels 2, free, ovules many; style filiform; stigma obconic. Follicles, linear 20-50 cm long; seeds many, linear-oblong, flat with a fringe of long hairs at both ends. Flowering and Fruiting: December to May.

Citation--ALSTONIA SCHOLARIS (Linnaeus) R. Brown, Asclepiadeae 75. 1810.
Basionym--Echites scholaris Linnaeus 1767.
Type--INDIA: Without data (lectotype: LINN 302.2). Lectotypified by H. Huber, in Dassanayake et al., Fl. Ceylon 4: 55. 1983.
Documented Species Distribution Native- Australia, Bangladesh, Brunei, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Thailand, Vietnam. Exotic-Taiwan, Province of China, USA.

3. ETHNOBOTANY

The bark of *Alstonia scholaris* is useful in malarial fevers, abdominal disorders, dyspepsia and in skin diseases11. The bark is bitter, astringent, digestive, laxative, anthelmintic, antipyretic, stomachic, cardiotonic and tonic (Bhandary,2020). The bark extract has been reported to possess antiplasmodial, immunostimulant, anticancer effect and is also hepatoprotective (Shrivastava et al., 2016). In Ayurveda it is reported that the bark of the plant when soaked in water overnight, can reduce the blood glucose level after oral administration. Bark is also used as febrifuge, depurative and galactogogue. It is effective in leprosy, skin diseases (Mollik et al., 2010; Bhogayata et al.,2016), pruritis, chronic and foul ulcers, asthma (Saikia, 2006; Vikneshwaran et al., 2008), bronchitis, agalactia and debility (Nadkarni 1976; Rahmatullah et al., 2009), dental or gum problem (Sen et al, 2011). In folklore medicine, milky juice is applied on wounds (Bharadwaj and Gakhar, 2005), ulcers and rheumatic pains; mixed with oil and dropped into ear, it relieves ear ache (Arulmozhi et al., 2011). The leaves have been used traditionally as folk remedies for the treatment of many diseases including diarrhea, dysentery, and malaria and snake bites (Kirtikar and Basu,1935). Juice of the leaves acts in certain cases as a powerful galactogogue (Arulmozhi et al., 2011). Leaves used in beriberi, dropsy and congested liver. Latex applied to sores, ulcers, tumours and rheumatic swellings (Yusuf et al., 2006). The ripe fruits of the plant are used in syphilis and epilepsy. It is also used as a tonic, antiperiodic, and anthelmintic (Pawan et al.,2011). Reports are available on its ethnoveterinary use such as fever in cattle (Harsha et al., 2005; Bharati and Sharma, 2010).

Miscellaneous uses and as herbal formulations *A. scholaris* as an antimalarial drug, used in many marketed Ayurveda preparations. The methanolic extract of this plant was found to exhibit pronounced anti-plasmodial activity (Pagariya et al., 2020). The plant is reported to have anti-mutagenic effect (Pawan, et al.,2011). The drug is reported to cause paralyzing effect on the motor nerves and consequent fall in blood pressure. The plant has hepatoprotective activity on liver injury (Oktavia et al., 2020). Saptaparni has been reported to be used in the management of hypertension by tribal people of Sikkim. It is used in various Ayurvedic preparations like Saptaparnasatvadi vati, Saptachadadi vati, Saptacchadadivati, Saptacchadadi taila, Saptacchadadi kvatha and saptaparna ghanasara (Khatele and More,2016; Pagariya et al., 2020). Ayurvedic use is found in phosphaturia and as a blood purifier also (Khare, 2007).

4. ECONOMIC IMPORTANCE

The wood is used for manufacturing packing cases and boxes for packing tea, writing boards and lamina boards. Wood charcoal is used for gun powder. It can be peeled easily and accepted as suitable for 3rd class commercial plywood after necessary treatment. It is good enough for making both match boxes and splints, also fairly suitable for second grade pencil and paper industry. Bark which is bitter in taste is used as an astringent, tonic and useful for diarrhoea and dysentery. The milky juice of bark is applied to sores and ulcers. Bark also yields a fibre. Flowers yield an alkaloid 'Picrinine' which acts as a depressant on the central nervous system.

5. PHYTOCHEMISTRY

Analysis of phytochemical constituents (Chakravarti et al., 1955, 1956; Talapatra et al., 1967, 1968; Banerji and Banerji, 1975; Dhar et al., 1977; Banerji and Chakrabarti, 1984; Banerjee et al., 1984; Arambewela and Ratnayake, 1991; Varshney and Goyal, 1995; Mahajan and Badgujar, 2008; Deepthi et al., 2008; Khyade and Vaikos, 2009a Thenmozhi et al., 2010; Dutta et al., 2010; Thankamani, 2011) and pharmacognosy (Datta and Datta, 1984; Upadhye et al., 2006; Ansari et al., 2006; Hemalatha et al., 2008; Dutta and Laskar, 2009; Khyade and Vaikos, 2009b, Kaushik et al., 2011; Dhruti et al., 2016) of the species have been reported by many authors.

Stem bark-It having echitamine, new glycosiderenoterpine, glucoside triterpenes, aamyring acetate, echitamidine, echitenine, Ditamine.

Root- It contains akuammigine, tubaitowine, akuammigine, Hydroxyl-19.

Leaves- It contains an indole alkaloid- picrinine, botalin, ursolic acid, β-sitosterol, new alkaloid Scholarin.

Flowers- Picrinine, strictamine are present in flowers.

Fruits- Fruit contains Akuammidine (rhazine).

6. PHARMACOLOGY

The plant has been reported for anticancerous (Kamarajan et al., 1991; Saraswathi et al., 1997,; Keawpradub et al., 1997; Jagetia et al., 2004; Jagetia and Baliga, 2004; Nersesyan et al., 2004; Baliga, 2010; Jahan et al., 2009a; Jain et al., 2009c); anti-tussive, anti-asthmatic and expectorant (Shang et al., 2010a); anti-inflammatory and analgesic (Karawya et al., 2010; Shang et al., 2010b; Arulmozhi et al., 2012); antipyretic (Surwase et al., 2009); anti-ulcerogenic (Arulmozhi et al., 2012); antipsychotic (Campos et al., 1999, 2004a; de Moura Linck et al., 2008); anxiolytic (Costall and Naylor, 1995; Campos et al., 2004b; Arulmozhi et al., 2008); antioxidant and free radical scavenging (Arulmozhi et al., 2007a; 2010a; Ravi Shankar et al., 2008; Kumar et al., 2010; Bellah et al., 2017); immunostimulating (Iwo et al., 2000); hepatoprotective (Lin et al., 1996); wound healing (Arulmozhi et al., 2007b); antinociceptive (Arulmozhi et al., 2007c); antidiabetic and antihyperlipidemic (Jong-Anurakkun et al., 2007;Arulmozhi et al., 2010b; Bandawane et al., 2011); hypoglycaemic (Akhtar and Bano, 2002; Sonawane and Lohar, 2011); antiarthritic (Arulmozhi et al., 2011); antidiarrhoeal (Patil et al., 1999; Shah et al., 2010) and spasmolytic (Shah et al., 2010), anti-stress (adaptogenic) and nootropic (Kulkarni and Juvekar, 2009); antifertility (Choudhary et al., 1991; Gupta et al., 2002, 2005); broncho-vasodilatory (Channa et al., 2005); nitric oxide scavenging (Jagetia and Baliga, 2004); radioprotective (Gupta et al., 2008, 2010a,b; Jahan et al.,

2009b; Jahan and Goyal, 2010); Nephro-protection (Bhattacharya et al., 1979; Verma et al., 2019); αGlucosidase inhibitory (Jong-Anurakkun et al., 2007); antibacterial (Khan et al., 2003; Deepthi et al., 2008; Khyade and Vaikos, 2009a; Patel, 2010; Hussain et al., 2010; Dutta et al., 2010; Dash and Murthy, 2011; Gami and parabia, 2011a); antimycobacterial (Macabeo et al., 2008); antimicrobial (Versha et al., 2003; Sirohi et al., 2009; Thankamani, 2011; Singh and Sangwan, 2011; Mohammad and Sarwar (2019)); antifungal (Riaz et al., 2010); antiplasmodial (Keawpradub et al., 1999); antimalarial (Gandhi and Vinayak, 1990); larvicidal (Kaushik and Saini, 2009); schizonticidal (Patel et al., 2010; Gami and parabia, 2011b); antileishmanial (Singha et al., 1992); molluscicidal (Singh and Singh, 2003a,b; 2005; Singh et al., 2010; Chauhan and Singh, 2010); anti-cholinesterase (Singh et al., 2003b); antiparasitic (Monzon, 1995); phytotoxic (Javaid et al., 2010); piscicidal (Singh and Singh, 2010); Antivenom Activity (Sumana and Rituparna, 2017); antihypertensive (Bhogayata et al., 2009); aphrodisiac (Dweck, 2007) activities. Alstonine, the alkaloid, (Elisabetsky and Campos, 2006) is reported to have anticancerous property (Beljanski and Beljanski, 1982, 1986; Jagetia & Baliga,2006; Abdul Malick and Karunakar, 2018; Pratyush et al,2021).

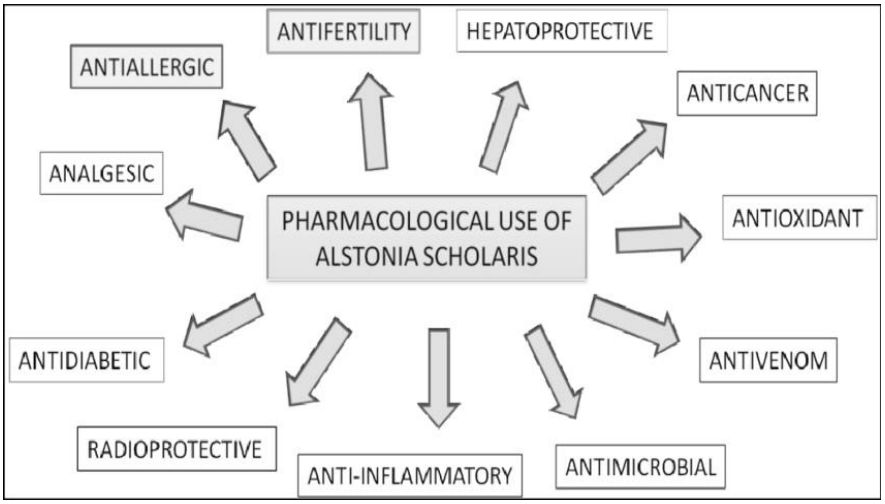

Fig.2 Various uses of Saptaparni in pharmacology

The plant was also reported for some negative pharmacological aspects such as teratogenic (Jagetia and Baliga, 2003c); toxic (Baliga et al., 2004); irritant and allergenic (Pasricha and Agarwal, 1990) properties. Antimicrobial activity of endophytic fungi from the plant was reported (Mahapatra and Banerjee, 2010).

7. CONCULSION

A. scholaris (Saptaparni) is a beautiful foliage tree with a large canopy. It has been used in traditional systems of medicines for treating various ailments such as antibacterial, antimicrobial. It is one of the ingredients of antimalarial drug Ayush-64, prepared by CCRAS. The plant has long been investigated for its phytochemicals and pharmacological activities supporting its vast ethnobotanical and alternative medicinal use. Traditional use of this plant has been validated by several pharmacological investigations. The recently developed isolation, characterization techniques and pharmacological testing have led to interest in plants as a source of new drugs. The pharmacological activity of *Alstonia scholaris*, which will substantiate the use of this tree over centuries for medicinal purposes.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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