IJBPAS, April, 2020, 9(4): 828-838

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

SAPTAPARNI A TRADITIONAL MEDICINAL PLANT-A CONCISE REVIEW

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Received 5th Oct. 2019; Revised 4th Nov. 2019; Accepted 20th Dec. 2019; Available online 1st April 2020

https://doi.org/10.31032/IJBPAS/2020/9.4.5038

ABSTRACT

Saptaparni (Alstonia scholaris, family- Apocynaceae) is a medium-sized evergreen tree from the very moist forest of the Himalaya. The tree's natural range shows a broad belt in the sub-Himalayan tract east of the Yamuna and is also found in the moist forest of the Western and Esatern Ghats in Peninsualr India. In addition to this it also grows naturally from Sri Lanka to Myanmar and South China and from Malay Peninsula to Autralia. Present review deals to explore Phyto-chemicals present in Saptaparni, its pharmacological activities.

Keywords: Saptaparni, Himalaya, A. *scholaris,* Phyto-chemicals, pharmacological activities

INTRODUCTION

Saptaparni (Alstonia scholaris, family- Apocynaceae) is a medium-sized evergreen tree from the very moist forest of the Himalaya. The tree's natural range shows a broad belt in the sub- Himalayan tract east of the Yamuna and is also found in the moist forest of the Western and Esatern Ghats in Peninsualr India. In addition to this it also grows naturally from Sri Lanka to Myanmar and South China and from Malay Peninsula to Autralia. A. *scholaris* (L) R Br, belonging to the family *Apocynaceae*, is an important medicinal plant for the treatment of malaria in the Ayurveda and various folk systems of medicines **[1, 2]**.

It is a beautiful foliage tree with a large canopy, and because of this, it has become a popular ornamental tree in the landscapes and gardens in the warm and temperate regions of Florida, Texas, and California in the United States **[1]**.

Historically, the plant was scientifically named by Linnaeus as *Echites scholaris*. However, to commemorate the great botanist Professor C. Alston, 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 **[1, 2]**.

The Saptaparni is of great cultutral significance in the intellectual circle, as traditionally its leaves were awarded to scholars and teachers during convocation ceremonies by the Viswa Bharti University. This tradition was started by Rabindranath Tagore in Gurudeb University. Due to environmental degradation, the practice has been reduced to handing over a single leaf to the Vice Chancellor of the University **(The Hindu, Oct 2019)**.

In Sanskrit the plant is referred to as *sapthaparna* and *saptaparni* (*sapta* means seven and *parna* or *parni* means leaves) because the leaves are found in whorls of seven **[1, 2, 3- 7]**. This plant is also known by some common names such as Devil Tree, Shaitan ka jat, Black-board tree, dita bark **[1, 2, 3- 7]**.

The infusion prepared from the bark is used as astringent, thermogenic, digestive, bitter tonic laxative, anthelmintic, antipyretic, depurative, galactogogue, febrifuge stomachic, and cardio-tonic. It is also useful in treating malarial fever, abdominal disorders, diarrhea, dysentery, dyspepsia, leprosy, skin diseases, pruritus, asthma, bronchitis, cardiopathy, helminthiasis, agalactia, and debility **[1, 2, 3- 7]**.

In Ayurveda, the bark is a part of ayurvedic formulations (polyherbal preparations) such as *saptaparnaghana vati*, *saptachchhadadi kvatha*, *saptachchhadadi taila*, *saptaparnasatvadi vati*, and *mahatikta ghrita* **[2, 3, 8]**.

The Central Council of Ayurveda & Siddha, Ministry of AYUSH developed a new formulation, prepared using four different types of indigenously available herbs, which has been found to be very effective in the safe treatment of malaria and Saptaparni is one of the herb used in this formulation. Saptparni is also a constituent of an ayurvedic proprietary medicine 'Maltrex V' (Veer Health Care Ltd) indicated in malaria of any origin (veerhealthcare.net).

Figure 1: Saptaparni Plant

Figure 2: Saptaparni Leaves

Table 1: Taxonomical Classification

Saptaparni- Systematic Position		
1.	Kingdom	Plantae
2.	Order	Gentianales
3.	Family	Apocynaceae
4.	Tribe	Plumeriae
5.	Sub-tribe	Alstoniinae
6.	Genus	Alstonia
7.	Species	scholaris

Table 2: Saptaparni- Regional/ Vernacular Name

Saptaparni- Regional/ Vernacular Name			
Sanskrit	Saptaparni, Saptacchada	Kannada	Maddale, Hale, Eleyalaga
Assamese	Chatiyan	Kashmiri	Kath
Bengali	Chatin, Chatwan	Malayalam	Daivaphal, Ezilampala
English	Devils tree, Dita	Marathi	Satveen
Gujarati	Saptaparna, Satvava	Oriya	Chbatiana, Chatiana
Hindi	Chhativan, Satawana, Shaitan ka jad	Tamil	Ezilampalai, Mukkampalai

Phyto-chemicals in Saptaparni

Almost all the parts of plant (bark, flower, root, leaves) are found to contain active principles. The *Alstonia* species are rich in alkaloids, steroids, triterpenoids, and flavonoids **[1, 3, 5-7, 10-12]**.

Alstonia scholaris (Saptaparni) is known to be a rich source of alkaloids and about 180 alkaloids isolated, so far only few have been assessed for biological activities **[13]**.

Some of the most important alkaloids reported to be present are alstonidine, alstonine, alstovenine, chlorogenic acid, chlorogenine, ditain, ditaine, ditamine, echicaoutchin, echicerin, echiretin, echitamine, echitein, echitenin, echitin, porphyrine, porphyrosine, reserpine, venenatine, villalstonine pleiocarpamine, *O*-methylmacralstonine, macralstonine, *O*-acetylmacralstonine, villalstonine, macro-carpamine, corialstonine. corialstonidine, nareline, scholaricine, metylburnamine, and vallesamine **[1, 6, 7, 10-12]**.

Steve Thomas *et.al* (2007) reported the isolation of a new secoiridoid glucoside alstonoside, together with two know isoflavone apioglucosides, formononetin 7-0-β- D- apiofuranosyl (1-6) – β - D-glucopyranoside and biochanin A 7 - 0 – β - D apiofuranosy – (1-6)-β-D- glucopyranoside are reported **[14]**.

Atta-ur-Rahman *et.al* (1985) **[15]** reported the isolation of an anilinoacrylate alkaloid, scholaricine, from the leaves of *Alstonia scholaris* to which structure 2-(demethylschoarine) has been suggested. They also reported the isolation of 19, 20-dihydrocondylocarpinalkloid from the leaves of *Alstonia scholaris* (Atta-ur-Rahman *et.al* 1986) **[16]**.

The triterpenoids lupeol linoleate, lupeol palmitate, and α-amyrin linoleate are present in the stem bark **[3, 5- 7, 10-12]**.

Dung et al extracted the fresh plant material with hexane, hydrodistilled the combined extracts in slight and wet residue and analyzed by a high-resolution GC and GC/MS. The principal constituents were reported to be linalool (35.7 %), cis and trans linalool oxides, alpha-terpineol and terpinen-4- ol **[17]**.

The seeds contain hallucinogenic indole alkaloids, which are alstovenine, venenatine, chlorogenine, reserpine, ditamine, echitamine, and chlorogenic acid **[12]**. The leaves contains flavonoids such as kaempferol, kaempferol - 3- 0- β- D-galactopyranoside, kaempferol- 3- 0- β- D-xylopyranosyl - (2-1)- 0- β- D- galacto pyranoside, quercetin, Quercetin - 3 -0- β - D-galactopyranoside, quercetin - 3- 0- β- D-xylopyranosyl- (2-1) - 0 – β - D- galacto

pyranoside, isorhamnetin, and isorhamnetin-3-0-β-D-galactopyranoside **[11]**.

The presence of these pharmacologically potent compounds is supposed to be responsible for the various pharmacological activities **[1, 3, 5- 7]**.

Scientifically reported pharmacological Activities

Alstonia scholaris in treating cancer

The alcoholic extract of the bark has been reported to possess anticancer activity in HS1 human sarcoma in the embryonated egg **[7]**. Further studies by Keawpradub *et al* **[18]** have also shown that the methanolic extracts of the root bark of *A macrophylla*, *A glaucescens*, and *A scholaris* possess cytotoxic activity against human lung cancer cell lines, MOR-P (adenocarcinoma), and COR-L23 (largecell carcinoma). These results confirm that *A scholaris* as well as its sister species possess antineoplastic effects.

Alstonine, another indole alkaloid present in *A scholaris*, is reported to possess antineoplastic effects in transplantable YC8 lymphoma ascites–bearing mice (BALB/C mice) and in Ehrlich ascites carcinoma–bearing Swiss mice. Alstonine's cytotoxic effect was selective only to the tumor cells, and it inhibited DNA synthesis in vitro by forming an alkaloid–DNA complex **[19]**. However, alstonine was only partially effective in solid tumors because it could only moderately alter the growth kinetics **[20]**.

Radioprotection:

It is observed that oral administration (25, 50, 75, 100, 150, and 200 mg/kg body weight) of the ethanolic extract of the bark for five consecutive days before exposure to a lethal dose of γ-radiation (7.5 Gy) prevented radiation-induced sickness and mortality **[21]**.

Chemopreventive Effect

The chemopreventive effects of various doses of hydroalcoholic extract of *A scholaris* were studied on benzo (a) pyrene [b (a) p]-induced forestomach carcinogenesis in mice. Treatment of mice with 1, 2, and 4 mg/mL extract (0.1%, 0.2%, and 0.4%) in drinking water before, during, and after the treatment with b(a)p, resulted in chemopreventive activity. The highest effect was observed for the 4 mg/mL extract, where the tumor incidence and multiplicity were reduced **[22]**.

Anti-inflammatory Effect

Studies by Arulmozhi *et al* **[23]** have shown that the ethanolic extract of leaves at 200 and 400 mg/kg significantly inhibited chemically induced (carrageenan-induced) inflammation in the rat paw edema study model.

Immunomodulatory Activity

The investigators observed that the aqueous extract of *A scholaris* was able to stimulate nonspecific immune response, increase the phagocytic activity, restore the reduction of phagocytic action induced by the immunotoxin prednisole, and protect the body from opportunistic infections **[24]**.

Antidiabetic Potential

The powder of *A. scholaris* leaves exerts a consistent hypoglycemic effect in patients suffering from non-insulin-dependent diabetes mellitus. The hypoglycemic effect *A. scholaris* leaves powder in patients suffering from non-insulin-dependent diabetes mellitus was ascribed to their insulin triggering and direct insulin-like actions **[25]**.

Hepatoprotective Activity

The hepatoprotective effect of *Alstonia scholaris* on carbon tetrachloride (CCl4), HDgalactosamine, acetaminophen and ethanol induced liver injuries was investigated by Lin *et al* by serum-biochemical and histopathological examinations. All serological and histopathological effects of A. scholaris were comparative with those of Bupleurum chinense, which has been reported previously as treatment criteria of hepatitis. A tendency was also shown to inhibit cell necrosis and inflammatory cell infiltration caused by H-Dgalactosamine in histopathological examination **[26]**.

Anti-ulcer activity

The ethanolic extract of leaves of Alstonia scholaris was evaluated for anti-ulcer activity **[27]** by pyloric ligation method. The animals treated with the extract did not show ulcer, whereas the ulcer score was found to be significantly high in rats administered diclofenac sodium.

Antioxidant Effect

The antioxidant effect of different extracts of Astonia scholaris were evaluated using various in-vitro models such as DPPH,free radical scavenging, metal ion chelating, hydrogen peroxide scavenging, supreroxide anion radical scavenging and and ferric thiocyanate reducing ability. Dicholoromethane and ethyl acetate fractions found to have significant free radical scavenging and metal ion chelating properties whereas anti-oxidant properties were absent in the petroleum ether and n-butanol fractions by in vitro models **[9]**.

Antioxidant activity of *A. scholaris* has been studied within *in vitro* study models. **[28]** reported that the methanol extracts of flower had higher antioxidant activity than the fruit. The observed radical scavenging and antioxidant potential of leaves were attributed to its phenolic and flavonoid

content, and flower & fruit extracts to their flavonoid content **[29, 30]**.

Antidiarrhoeal activity

Aqueous and alcoholic bark extract of *A. scholaris* exhibit significant antidiarrhoeal effects in mice as reported by **[30]**.

Antimicrobial activity

Goyal *et al.*, 1995, **[31]** reported the antimicrobial property of the plant constituents of *A. scholaris* (alkanes, alkanols, and sterols). Khan *et al.,* 2003, **[32]** evaluated the antibacterial activity of the pet ether, dichloromethane, ethyl acetate, and butanol fractions of crude methanolic extracts of the leaves, stem, and root barks of *A. scholaris* and reported that butanol fraction exhibited broad spectrum of antibacterial activity.

Antiasthamatic Activity

Bronchodilatory activity of the ethanol extract of *Alstonia scholaris* leaves in anaesthetized rats was reported by Channa *et al*., 2005, **[33]**. The extract inhibited the spontaneous movements of rabbit jejunum and contractile effects of acetylcholine and histamine on guinea-pig ileum. Additionally, the extract caused marked reduction of barium chloride-, potassium chloride- and calcium chloride-induced contraction on guinea-pig ileum and pulmonary artery, implying a direct interference of plant extract with the influx of calcium ions into cells.

Antiplasmodial Activity

Keawpradub N and *et al*., 1999, **[34]** reported methanolic extracts prepared from various parts of Alstonia scholaris, A. macrophylla and A. glaucescens have been assessed for antiplasmodial activity against multidrug-resistant K1 strain of Plasmodium falciparum cultured in human erythrocytes. Significant antiplasmodial activity was exhibited by methanol extract of the root bark of A. macrophylla with an IC50 value of 5.7 micrograms/ml. Thirteen indole alkaloids were isolated from the active extract. These alkaloids and a semisynthetic bisindole O-acetyl macralstonine were subsequently tested against the K1 strain of P. falciparum. Significant antiplasmodial activity was observed mainly among the bisindole alkaloids, particularly villalstonine and macrocarpamine with IC50 values of 0.27 and 0.36 microM, respectively. The potent alkaloids were further tested against T9-96, the chloroquine-sensitive strain of P. falciparum. It has been found that the active alkaloids, in contrast to chloroquine, have significantly higher affinity to the K1 strain than to the T9-96 strain.

Anti-tussive, anti-asthmatic and expectorant activities

Shang JH and *et al.,*2010, **[35]** evaluates the anti-tussive and anti-asthmatic activities of the leaf ethanolic extract, fractions and main alkaloids of *Alstonia scholaris*. The leaf of *Alstonia scholaris* was extracted with ethanol and then separated into various fractions. Alkaloids were isolated by phytochemical method. The anti-tussive activity was evaluated using three different models including ammonia or sulfur dioxide induced mice coughing, and citric acid induced guinea pigs coughing. The anti-asthmatic activity was investigated on guinea pigs bronchoconstraction induced by histamine. The expectorant activity was evaluated by volume of phenol red in mice's tracheas. The alkaloids fraction significantly inhibited mice's frequency of cough induced by ammonia, increased mice's latent period of cough induced by sulfur dioxide, and increased guinea pigs' latent period of cough and inhibited frequency of cough. The alkaloids fraction increase delitescence of convulsion and tumble of guinea pigs in anti-asthmatic test and enhanced tracheal phenol red output in expectorant evaluation. Moreover, the main alkaloid, picrinine exhibited anti-tussive and anti-asthmatic activities in vivo. The alkaloids fraction had anti-tussive, anti-asthmatic and expectorant activities.

Antiaging effects

Lee SJ *et al*., 2012, **[36]** reported ethanolic bark extract of Alstonia scholaris can significantly inhibit all-trans retinoic acid-induced inflammation in human HaCat keratinocyte cells. Furthermore, two representative retinoidinduced proinflammatory cytokines, monocyte chemoattractant protein-1 and interleukin-8, were significantly suppressed by A. scholaris extract (by 82.1% and 26.3% at 100 ppm, and dose-dependently across the tested concentrations) in vitro. In a cumulative irritation patch test, A. scholaris extract decreased retinol-induced skin irritation, while strengthening the ability of retinoids to inhibit matrix metalloproteinase-1 expression, which is strongly associated with aging effects.

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