

## Pharmacological activities of *Alstonia scholaris*: A review

Arora, Anubha

Received: October 2, 2010 | Accepted: January 3, 2011 | Online: July 20, 2011

### Abstract

The plant *Alstonia scholaris* has been used in different system of traditional medication for the treatment of diseases and ailments of human beings. It is reported to contain various types of alkaloids, flavonoids and phenolic acids. *Alstonia scholaris* has been reported as antimicrobial, anti-cancer, anti-inflammatory, analgesic, antioxidant, anti-fertility and wound healing activities. In this review recorded the pharmacological activities of *A. scholaris*.

**Keywords:** *Alstonia scholaris* |

*Pharmacology* |

### Introduction

Plants have played a significant role in maintaining human health. In recent times, focus on plant research has increased all over the world. One such plant, *Alstonia scholaris*, invites attention of the researcher's worldwide for its pharmacological activities. It belongs to family Apocynaceae grows throughout in India. This plant is an evergreen and a common medicinal plant of India that can grow to a height of hundred meters, with white and strongly perfumed flowers and cultivated in Pakistan as an ornamental. It has wide occurrence also in the Asia Pacific region from India, Sri Lanka through mainland South East Asia and Southern China, throughout Malaysia to northern Australia and Solomon Islands. The wood has been used for school black boards, hence the name "scholaris".

The plant is a large evergreen tree up to 17 to 20 m in height about 110cm in diameter. Bark is grayish brown, rough, abounding in bitter, white milky latex; leaves 4-7 in a whorl, flowers small greenish white numerous in umbellate panicles, corolla tube short, very strongly scented; fruit follicles, 30-60 cm long; seeds papillose with brownish hair at each end. (Kirtikar et al. 1980 and Nadkarni et al. (1976).

**For Correspondence:**



Department of Botany, D.N. College. Meerut, India

**Email:** [anubha.arora@yahoo.co.in](mailto:anubha.arora@yahoo.co.in)

## Phytochemistry

*Alstonia scholaris* (Linn) is known to be a rich source of alkaloids (about 180 alkaloids) isolated, so far only few have been assessed for biological activities. (Versha et al 2003) The bark of this plant contains alkaloid ditamine and echitamine, echitenine, echicaoutchin, an amorphous yellow mass, echicerin in acicular crystals, echitin in crystallized scales, echitein in rhombic prisms, resembling an alkaloid, a fatty acid and fatty resinous substance. Steve Thomas et al (2007) reported the isolation of a new secoiridoid glucoside alstonoside, together with two known isoflavone apioflavones, formononetin 7-O-Beta-D-apiofuranosyl(1-6)-Beta-D-glucopyranoside and biochanin A 7-O-Beta-D apiofuranosyl -(1-6)-Beta-D-glucopyranoside are reported. Atta-ur-Rahman et al (1985) 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-dihydrocondylo carpinalkloid from the leaves of *Alstonia scholaris* (Atta-ur-Rahman et al 1986). In 1987 they also isolated 19-20-Z-Vallesamine and 19,20-E-Vallesamine from *Alstonia scholaris*. Yamauchi et al (1990). 17-O-Acetylechitamine was isolated from the bark of the plant along with echitamine. In 1990 they also isolated several alkaloids from the leaves of *A. scholaris*. They reported that the leaves of plants from Taiwan and Thailand showed similar alkaloids patterns, with picrinine, nareline and alschomine as the major alkaloids.

## Pharmacology

The bark, stem, roots and the leaves have been used traditionally as folk remedies for the treatment of many diseases. The bark is

bitter, astringent, acrid, digestive, febrifuge, stomachic, cardiostimulant and tonic. It is useful in fever, malarial fever, diarrhoea, dysentery, skin diseases, ulcers, asthma, bronchitis, cardiopathy, agalactia and debility. The milky exudate is bitter and is good for ulcers. (Kirtikar et al., 1980 and Nadkarni et al., 1976). The ripe fruits are used to treat insanity due to syphilis and epilepsy. The most extensively used part of the plant is the bark which is a component of many compound herbal formulations. The bark extract of the powdered stem bark is a bitter tonic and febrifuge, useful for the treatment of malaria, diarrhea and dysentery. (Baliga et al., 2004).

## Antimicrobial activity

The leaf extract has antimicrobial properties while the alcoholic extract from the stem bark showed anticancer activity in HSI human sarcoma in embryonated egg. (Baliga et al., 2004). The antimicrobial property of the plant constitutes of *A. scholaris* (alkanes, alkanols and sterols) (Goyal et al., 1995). Evaluated the antibacterial activity of the petrol, dichloromethane, ethyl acetate, butanol fractions of crude methanolic extracts of the leaves, stem and root barks of *Alstonia scholaris* and reported that butanol fractions exhibited broader spectrum of antibacterial activity. (Khan et al., 2003).

## Anti-Cancer activity

An 85% ethanolic bark extract of *A. scholaris* showed antitumor and radiation sensitizing activity against a mouse transplantable tumor and is cytotoxic to human tumor cell lines. (Baliga et al., 2004). 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. (Keawpradub *et al.*, 1997).

### **Antimalarial activity**

Corialstonine and corialstonidine, alkaloids of *Alstonia scholaris*, are against *P.falciparum*. (Jagetia *et al.*, 2005).

### **Antifertility activity**

*A. scholaris* bark extract (200 mg/day for 60 days, orally) showed significant antifertility effects in male rats as evidenced by marked reductions in the weight of testes, epididymides, seminal vesicle and ventral prostate (Gupta *et al.*, 2002). Step-19 spermatids production was reduced by 79.6% while the population of preleptotene and pachytene spermatocytes was decreased 61.9% and 60.1%, respectively. Spermatogonia, sertoli cell population and areas of the seminiferous tubule and Leydig cell nuclear, were significantly as were other indicators of male fertility. (Gupta *et al.*, 2002.)

### **Broncho-Vasodilatory activity**

The ethanolic extract of the leaves of *A. scholaris* showed broncho - vasodilatory activity. Administration of the plant extract (25, 37 and 50 mg/kg, via the jugular vein) to anaesthetised rats at 5 min before the administration of carbachol (10 µm/kg) led to a transient decrease in the normal blood pressure by  $54 \pm 13\%$  and  $81 \pm 7\%$  at doses of 25 and 37 mg/kg respectively. In contrast the inspiratory pressure was increased by  $50 \pm 13\%$  and  $83 \pm 12\%$ , respectively, while the expiratory pressure and heart rate remained

unchanged. Isoprenaline and salbutamol were the positive controls for the effects of the leaf extract on the carbachol-induced changes. The highest dose of the leaf extract (50 mg/kg) caused a severe decrease in the blood pressure and disturbed the respiratory rhythm. (Channa *et al.*, 2005).

### **Teratogenic effects**

The hydroalcoholic extract of *Alstonia scholaris* extract produced teratogenic effects in mice at doses greater than 240 mg/kg (>20% of the LD<sub>50</sub>) when exposure occurred at day 11 of gestation. The extract at doses of 60, 120, 180 and 240 mg/kg did not cause mortality, congenital malformations, or alter the normal growth patterns. Doses of 360 or 480 mg/kg caused a dose-dependent increase in mortality, growth retardation and congenital malformations, characterized mainly by bent tails and syndactyly. These doses also significantly delayed fur development, eye opening, pinna detachment and vaginal opening. Doses of 240-480 mg/kg also delayed incisor eruption and testes descent (Jagetia *et al.*, 2003).

### **Immunomodulatory activity**

The immunostimulating effect of *Alstonia scholaris* bark extracts was studied in BALB/c mouse by (Iwo *et al.*, 2000). The aqueous extract at 100 mg/kg b.w. increased lytic activity of peritoneal exudate cells against *Escherichia coli*. At the doses of 50 and 100 mg/kg b.w., the aqueous extract had no effect on primary antibody level.

The aqueous extract at 50 mg/kg b.w. induced the cellular immune response while at 100 mg/kg b.w. inhibited the delayed type of hypersensitivity reaction. (Iwo *et al.*, 2000)

## Wound healing activity

Wound healing activity of the ethanol and aqueous extracts of *Alstonia scholaris* was tested against excision, incision and dead space wound models (Arulmozhi et.al. 2007). The wound healing was assessed by the rate of wound contraction, period of epithelialisation, skin breaking strength, granulation strength, dry granulation tissue weight, hydroxyproline, collagen and histopathology of granulation tissue. Malondialdehyde level was also estimated to evaluate the extent of lipid peroxidation. The extracts promoted wound healing significantly in all the wound models studied. Increased rate of wound contraction, skin breaking strength, granulation strength, dry granulation tissue weight, hydroxyproline and collagen, decrease in the period for epithelialisation and increased collagenation in histopathological section were observed with extracts treated groups. The extracts also significantly decreased the levels of lipid peroxidation.

## Analgesic and anti-inflammatory activities

The effect of ethanolic extract of leaves of *Alstonia scholaris* was evaluated in experimental models of pain and inflammation (Arulmozhi et al., 2007). The leaf extract at 200 and 400 mg/kg showed significant decrease in acetic acid induced writhings in mice with a maximum of 65.76% at 400 mg/kg. in hot plate method, the percentage of pain inhibition was found to be 73.90% and 79.56% with 200,400 mg/kg of extract. There was a significant inhibition in carrageenan induced paw edema with 200 and 400 mg/kg of the extract.

## Conclusion

The plant *Alstonia scholaris* has a wide array of pharmacological activities and many isolated compounds. Plants, which are used in traditional medicine, require detailed investigation with ethnopharmacological approach. 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 plant over centuries for medicinal purposes. In this study Pharmacological activity we observed the *A. scholaris* is medicinally important plant and this study help the traditional knowledge of plants.

## Acknowledgements

The author presents heartiest thankfulness to Mr. Manish Arora for his valuable suggestion and inspirations.

## References

- Arulmozhi .S, V.P. Rasal, L. Sathiya Narayanan and Purnima Ashok. (2007). Screening of *A.scholaris* Linn. R.Br. for wound healing activity. *Oriental Pharmacy and Experimental Medicine* **7(3)**.
- Arulmozhi, S., Papiya Mitra Mazumder, Purnima Ashok and L. Sathiya Narayanan. (2007). Anti-nociceptive and anti-inflammatory activities of *Alstonia scholaris* Linn. R. Br., *Pharmacognosy Magazine* **3(10)**.
- Atta-Ur-Rahman, M. Asif, Ghazala, J. Fatima and Alvi, K. A. (1985). Scholaricine, alkaloid from *Alstonia scholaris*. *Phytochemistry*. **24(11)**: 2771-73.

Atta-ur-Rahman (1986). Isolation, structural

- and synthetic studies on the chemical Constituents of medicinal plants of Pakistan. *Pure and Appl. Chem.* **58(5)**: 663 – 73.
- Atta-ur-Rahman, A. Muzaffar and N. Doulatabadi (1986). Isolation and <sup>1</sup>H/<sup>13</sup>C-NMR studies on 19, 20-dihydrocondylocarpine-an alkaloid from the leaves of *Ervatamia coronaria*. *Phytochemistry* **25(7)**: 1781 – 83.
- Atta-ur-Rahman, K.A. Alvi, S.A. Abbas and W. Voelter (1987). Isolation of 19, 20-Z.
- Vallesamine and 19, 20 – E – Vallesamine from *Alstonia scholaris*. *Heterocycles* **26(2)**: 413 – 419.
- Baliga, M.S., Jagetia, G.C., Ullor, J.N., Baliga, M.P., Venkatesh, P., Reddy, R., Rao, K.V.N.M., Baliga, B.S., Devi, S. Raju, S.K., Veeresh, V., Reddy, T.K. and Bairy, K.L. (2004). The evaluation of the acute toxicity and long term safety of hydroalcoholic extract of *Alstonia scholaris* in mice and rats. *Toxicology Letters*. **151**:317-326.
- Channa, S., Dar, A., Ahmed, S., Atta –ur – Rahman (2005). Evaluation of *Alstonia scholaris* leaves for broncho-vasodilatory activity. *Journal Ethnopharmacology*. 97:469-476.
- Gupta, R. S, R. Sharma, A. Sharma, A.K. Bhatnager, M.P. Dobhal, Y.C. Joshi and Sharma, M.C. (2002). Effect of *Alstonia scholaris* bark extract on testicular function of Wistar rats. *Asian J. Androl.* **4(3)**:175-78
- Goyal, M.M. and Varshney, A. (1995). Effects of natural products isolated from three species of *Alstonia* on some gram-positive and gram-negative bacteria. *Indian Drugs* **32(2)**:69-72.
- Iwo, M. I., Soemardji, A.A., Retnoningrum, D.S. and Sukrasno, U.M. (2000). Immunostimulating effect of pule (*Alstonia scholaris* L.R.Br., Apocynaceae) bark extracts. *Clin Hemorheol Microcirc.* **23(2-4)**: 177-83.
- Jagetia, G.C. and Baliga, M.S. (2005). Induction of development toxicity in mice treated with *Alstonia scholaris* (Sapthaparna) In utero . *Repro Toxicol* 68 (6):472-8.
- Keawpradub, N., Houghton, P.J., Eno-Amooquaye, E. and Burke, P.J. (1997). Activity of extracts and alkaloids of Thai *Alstonia* species against human lung cancer cell lines. *Planta Med.* **63(2)**: 97-101.
- Khan, M. R., Omoloso, A.D. and Kihara, M. (2003). Antibacterial activity of *Alstoniascholaris* and *Leea tetramera*. *Fitoterpia* **74(7- 8)**: 736-40.
- Kirtikar. K.R. and B.D. Basu, Indian Medicinal Plants (1980). Vol. II, Bhushen Singh and Mahendra Pal Singh, Dehradun, 111-14.
- Nadkarni, A.K. (1976). K.M. Nadkarni's Indian Material Medica, Vol. I, Popular Prakashan, Bombay, 80-83.
- Tatsuo Yamauchi, Fumiko Abe, William G. Padolina and Fabian M. Dayrit (1990). Alkaloids from leaves and bark of *Alstonia scholaris* in the



- Philippines. *Phytochemistry* **29(10)**: 3321-25
- Steve Thomas, P., Kanaujia, A., Ghosh, D., Dugger, R. and Katiyar, C.K. (2008). Alstonoside, a secoiridoid glucoside from *Alstonia scholaris*. *Indian Journal of Chemistry*. Vol **47 B**: 1298 - 1302.
- Tatsuo Yamauchi, Fumiko Abe, Rong-Fu Chen, Gen-Ichiro Nonaka, ThawatchaiSantisuk and William G. Padolina (1990). Alkaloids from leaves of *Alstonia scholaris* in Taiwan, Thailand, Indonesia and Philippines. *Phytochemistry* **29(11)**: 3547- 52.
- Versha, P., Ghosh, B., Anroop, B., and Ramanjit M. (2003). Antimicrobial activity of *Alstonia scholaris* leaf extracts. *Indian drugs* **40 (7)**: 412-13.

