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Ethnomedicine, Phytochemistry and pharmacology of *Alstonia scholaris* R.Br. (Apocynaceae): A review

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Abstract: ***Ascholaris*** **is a traditionally important medicinal plant. Herbal medicine has become an in-tegral part of standard healthcare, based on a combination of time-honored traditional us-age and ongoing scientific research. Herbal medicine contains natural substances that can promote health and reduce illness. This evergreen tree is native to the Indian subcontinent and Southeast Asian countries. The plant is used in traditional, ethnomedicinal, Ayurvedic types of alternative medicinal systems against different ailments such as asthma, malaria, fever, dysentery, diarrhea, epilepsy, skin diseases, snakebite etc. Among the phytochemicals, alkaloids are mostly reported. The present review attempt to detailed introduction of its pharmacological profile, ethanomedical use, chemical constituents, as a medicinal**

Keywords: **Ethnobotany, Phytochemistry, Pharmacology, Phytochemistry.**

1. INTRODUCTION

The botanical name of *Saptaparna* is Alstonia scholaris R. Br.; Family: Apocynaceae. It is also known as ‘’Devil’s tree’’, ‘’Dita bark’’. The Apoc-ynaceae family consists of about 250 genera and 2000 species of tropical trees, shrubs and vive. *Alstonia scholaris* R.Br. is com-mon tree, growing up to 17 to 20 meter in height, distributed throughout the sub Himalayana belt, west Bengal, Southeast Asia (Psteve Thomas et al., 2008). The wood has been used for school black-boards, hence the name ‘Scholaris’(Pawan K, et al., 2011) .[4] A great poet of Sanskrit literature from 5 th Century AD has written *Raghuwansha Mahakavya*, which contains a poetic description of *Saptaparna* with regards to the *Madagandha* of its *Pushpa* and *Ksheera* (Kalidas). The plant grows throughout the humid regions of India, especially in West Bengal and west-coast forests of south India. The plant is used in Ayurvedic, Unani and Sidhha/Tamil types of alternative medicinal systems (Khare, 2007).

SYSTEMATIC POSITION

Kingdom: Plantae

Order: Gentianales

Family: Apocynaceae

Tribe: Plumeriae

Subtribe: Alstoniinae

Genus: *Alstonia*

Species: *Alstonia scholaris*

Local / vernacular names:

Sanskrit : Saptacchada, Saptaparni

Assamese : Chatiyan

Bengali : Chatin Chatwan,

English : Devil tree, Dita

Gujrati : Saptaparna, Satvana

Hindi : Chhativan, Satawana, Shaitan ka jad

Kannada : Maddale, Hale, Eleyalaga,

Kashmiri : Kath

Malayalam : Daivaphal, Ezilampala,

Marathi : Satveen

Oriya : Chbatiana, Chatiana

Punjabi : Sathi, Satanna

Tamil : Ezilampalai, Mukkampalai

Telugu : Edaakula Ponna

French: Arbre à lait

Burma (Myanmar): lettok, taung meok

China: tang jiao shu, xiang pi mu

Indonesia: njau lutungpulai, pule, rite

Lepcha: Pur vok koong

Malayan names: basong, geceh, kacau gitik, petai agong, pulai, pulai basong, rutih

Nepal: chatiwan, chhatiwan, chition, palimara

Papua New Guinea: Budo, herina, hibom, jijima, katung, puto, sipuel, watsil, zopang

Philippines: alipauen, andarayan, dalipaoen, dilupaon, dirita, dita, lipauen, tanitan

Sarawak: gite, pelai

Thailand: gah bo, hassaban, sattaban, tin pet

Tibet: Lo ma bdun

Vietnam: co tin pat, may man, mo cua, m[of] cua, mua cua, sura, s[uwx]a, Hoa sữa

Propagation and cultivation: The tree is sometimes planted in gardens for ornamental purpose. It is easily raised through seeds and prefers fairly moist conditions.

Necessary Altitude: 0-900 M

Mean Annual rainfall: 1200-1400 mm

Soil type: Soil including alluvia, basaltic red earth, yellow earth with grey brown top soil, sandy grey earth. (The wealth of India, 2004 and The Ayurvedic pharmacopoeia of India, 1990- 2001)

Diseases affecting: Diseases caused by col-lectotrichum glocosporioides (Penz) sacc. Sordaria humana (Fuckel) wint and other fungi have been reported on this tree.

Substitute and Adulterants: Trachelo-spermum fragrant Hook. F. (Apocyna-ceae)H.

Trachelospermum lucidom (Don) schum. syn. (The wealth of India, 2004 and The Ayurvedic pharmacopoeia of India, 1990- 2001)

Used in Ayurveda, Unani and Sidha:

Indole alkaloids from the leaves, stem and bark. Molluscicidal, anthelmintic, cytotoxic, antiseptic, tonic, antibacterial, bronchodilatory, emmenagogue, antidysenteric, astringent, anticholeric and vulnerary. Raw leaf juice applied to kill head lice; roots insect repellent. Bark and leaves used to treat headache, influenza, diarrhea, dysentery, bronchitis, arthritis, fever and pneumonia; leaves and bark decoction given in dysentery. Bark bitter, febrifuge, tonic, antidote, antiperiodic, used in malaria and diarrhea, dysentery, rheumatism, snakebite, cold and bronchitis; dry powdered bark with bark of Tabernaemontana divaricata given in consumptive fever; bark paste applied for skin diseases and chest pain; bark extract with Cuscuta reflexa and bark of Rhamnus napalensis given to kill intestinal worms; bark decoction drunk to treat genital troubles in men; bark decoction with bark of Flacourtia jangomas, seeds of Luffa aegyptiaca and rootstock of Momordica cochinchinensis given in asthma; powdered stem bark with cow milk given in gonorrhea; infusion of bark and leaves of Mallotus roxburghianus with bark of Alstonia scholaris drunk for hypertension. Latex applied to ulcers, ulceration of mouth, open sores, rheumatic pains; gum taken with sugar for dysentery. Bark sap said to induce abortion; sap mixed with hot water and the suspension drunk to treat malaria; leaves chewed as an oral contraceptive. Seeds pounded with ginger and applied on painful swelling of scrotum. Ceremonial, plant very sacred, worship tree, abode of spirits, stone-gods consecrate on the bottom of the trunks; rain-making through sacrifices in the sacred forest; leafy branch held in hand at the time of religious ceremonies; the souls of forefathers supposed to take rest on this tree after the death. Veterinary medicine, crushed leaves juice applied or dropped on wounds and sores, leaves and bark decoction given in dysentery; crushed stem bark given to cure diarrhea. [CRC World Dictionary of Medicinal and Poisonous Plants] The bark is useful in fevers, malaria fever, diarrhoea, dyspepsia, leprosy, skin diseases, foul ulcer and asthma.

Bark in colic pain; Some Parts of India plant is used in the treatment of leprosy; Twig: hung in the room of the newly confined woman to lessen the activities of evil spirit on the new born. Atharva Veda: preventive and curative of diseases caused by change of season. Charaka Samhita and Sushruta Samhita: good for headache, sores, and some other diseases; Ayurveda: the following uses are recommended:

Bark dermal sores, ragging fever, discharge of sperm with urine, hiccup, insufficiency in breast milk, gout, cold congestion, dyspepsia; 2. Latex: caries, pimple, pyorrhoea; 3. Flower: asthma, respiratory troubles. Unani: Ingredient of 'Kashim'. Homoeopathy: Malarial fever, anaemia, indigestion, general debility and other stomach ailments. Modern Use: Bark: known in commerce as Dita Bark and is used in medicine as bitter, febrifuge and astringent, in treatment of malarial fever, chronic dysentery, diarrhoea and in snake bite; Milky juice: applied to ulcers.

In Cambodia, the bark is used to promote menses and to treat chronic paludism with the enlargement of the spleen and liver discomfort. In Indonesia, the plant is used to stop diarrhea, treat diabetes and heal haemorrhoids. An infusion of the young leaves is drunk to treat beriberi. The leaf tips roasted with coconut are used to treat stomatitis. In Malaysia, the plant is used to treat malaria. The latex is used to assuage toothache. A decoction of the bark is drunk to combat fever, invigorate the body, stimulate appetite, and treat yaws. In Burma, the latex is used to heal ulcers. In India, the bark is used to promote milk secretion and to treat cancer. In the Philippines, the plant is used internally to combat fever, stop dysentry, heal wounds, and treat epilepsy. In Vietnam, the bark is used to treat chronic malaria with enlarged spleen, while the leaves are used to promote milk secretion. The bark of *Alstonia scholaris* (L.) R. Br. has been used in Western medicine (British Pharmacopoeia, 1914) as an antimalarial drug. [Medicinal Plants: Drugs For The Future]

Dita is used in many Asian countries as a folk remedy for malaria and fever. Reports conflict on the value of the plant as an anti-malarial, with some researchers churning that an extract from the bark does not have any effect on malaria parasites in vitro. It is possible that reports of cures for malaria were made on the basis of temporary recovery from fever since dita's alkaloids do have a depressant action on medullary centers - tins action can bring down fever. [Philipnine Medicinal Plants in Common use: Their Phytochemistry & Pharmacology].

2. ETHNOBOTANY

The plant is traditionally being used in debility (Rahmatullah et al., 2009), arthritis (Yusuf et al., 2006), impotence (Zashim Uddin et al., 2006), wounds and earache (Bharadwaj and Gakhar, 2005), asthma (Saikia, 2006; Vikneshwaran et al., 2008), leucorrhoea (Bhandary et al, 1995), dog bite (Prusti and Behera, 2007), fever (Rajakumar and Shivanna, 2010), cancer, tumour, jaundice, hepatitis, malaria, skin diseases (Mollik et al., 2010), diarrhea (Dash and Padhy, 2006), agalactia (Singh and Sangwan, 2011), hypertension (Bhogayata et al., 2009), dental or gum problem (Sen et al, 2011),

abdominal pain after delivery (Deb et al, 2009; Sharma and Kumar, 2011) and swelling (Deb et al, 2009). It is also used as aphrodisiac (Zashim Uddin et al., 2006), antidote to poison (Mollik et al., 2010), abortifacient (Ayyanar and Ignacimuthu, 2005), astringent, thermogenic, cardiotonic (Singh and Sangwan, 2011), stomachic and expectorant (Sen et al, 2011). Reports are available on its ethnoveterinary use such as fever in cattle (Harsha et al., 2005; Bharati and Sharma, 2010). Ayurvedic use is found in phosphaturia and as a blood purifier (Khare, 2007).

3. PHYTOCHEMISTRY

The plant enriched with wide range of chemical compounds. It is known to be rich source of alkaloids which are useful for medicinal purposes. Alkaloids stand as a class of major importance in developing new drugs because alkaloids own a great variety of chemical structure and have been identified as being responsible for the pharmacological proper-ties of medicinal plants.

Stem bark- It having echitamine, new glyco-side-renoterpine, glucoside triterpenes, a-amyring acetate, echitamidine, echitenine, Ditamine.

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

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

Flowers- Picrinine, strictamine are present in flowers.

Fruits- Fruit contains Akuammidine (rhazine).

Physical contents: (The Ayurvedic pharmacopoeia of India, 2001**)**

Foreign matter - Not more than 2%

Total Ash - Not more than 11%

Acid insoluble ash - Not more than 3%

Water soluble extractives - Not less than 12%

Alcohol soluble extractives - Not less than 4%

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) of the species have been reported by many authors.

Alkaloids are one of the major constituents of the species (Dutt, 1944; Boonchuay and Court, 1976a; Rahman and Alvi, 1987; Kam et al., 1997; Hadi and Bremmer, 2001; Mahidol et al., 2002; Dai et al, 2008; Cai et al., 2010; Jain et al., 2009a,b). Among different alkaloids, Echitamine (Govindachari and Rajappa, 1961; Manohar and Ramaseshan, 1961; Fritz and Fischer, 1964); Echitamine chloride (Kamarajan et al., 1991; Saraswathi et al., 1997, 1998,1999); Rhazine (Chatterjee et al., 1969); Nareline (Morita et al., 1977); Pseudo Akuammigine (Banerji and Banerje, 1977); Scholarine (Banerji and Siddhanta, 1981); Scholaricine (Banerji, 1981; Rahman et al., 1985); Dihydrocondylocarpine, (Rahman et al., 1986); 19, 20-Z-Vallesamine and 19, 20-EVallesamine (Rahman et al., 1987); Picrinine (Ghosh et al., 1988); Alschomine and Isoalschomine, (Abe et al., 1989); Mataranine A and B (Hadi, 2009); monoterpenoid indole alkaloids (Cai et al., 2007; 2008a; Feng et al., 2009); Picralinal of picralima group (Rastogi et al., 1970); Picrinine-type alkaloids (Cai et al., 2008b); N1-methoxymethyl Picrinine (Wang et al., 2009) etc. have been reported. Constituents have been reported from different parts of the plant such as bark (Manohar and Ramaseshan, 1961; Yamauchi et al., 1990b; Gupta et al., 2002; Salim et al., 2004; Feng et al., 2009); leaves (Chatterjee et al., 1965; Banerji and Banerje, 1977; Rahman et al., 1986; Yamauchi et al., 1990a,b; Zhou et al., 2005; Macabeo et al., 2005; Cai et al., 2008b; Hirasawa et al., 2009); roots (Boonchuay and Court, 1976b); flowers (Dutta et al., 1976) and fruits (Wongseripipatana et al., 2004). Among the other constituents, Isookanin-7-o-alpha-lrhamnopyranoside, a new flavanone glycoside (Chauhan et al., 1985) and Alstonoside, a secoiridoid glucoside (Thomas et al., 2008) have been recorded. Iridoids, coumarins, flavonoids, leucoanthocyanins, reducing sugars, simple phenolics, steroids, saponins and tannins were also found in the plant (Khyade and Vaikos,

2009a). Presence of agr-amyrin, bgr-amyrin, lupeol acetate, venenative, rhazine and yohimbine have been noted (Gupta et al., 2002), Linalool, cis- and trans-linalool oxides (furanoid and pyranoid), alpha-terpineol, 2-phenylethyl acetate and terpinen-4-ol (Dung et al., 2001) and steroids (Singh et al., 2010b) are among the other phytoconstituents of the species.

In another investigation, unusual 2,3-secofernane triterpenoids, Alstonic acids A and B were found (Wang et al., 2009). Three new triterpenoids, two of the ursane type, 3β -acetate- 24-nor-urs-4,12-diene ester triterpene and 3β -hydroxy-24-nor-urs- 4,12,28-triene triterpene , and one of the oleanane type, 3,28-β - diacetoxy-5-olea-triterpene and two triterpenes, α-amyrin acetate and ursolic acid have also been recorded (Sultana and Saleem, 2010). Ursolic acid (pentacyclic triterpene acid) (Shetty et al., 2007), lupeol acetate (Gupta et al., 2005), flavonoids (Hui et al., 2009); monoterpene (Datta and Mathur, 1987), triterpene (Chakravarti et al., 1957, 1960; Wang et al., 2009; Singh et al., 2010b); iridoids (Feng et al., 2008) have been reported from the plant. Apart from those, two C13-norisoprenoids namely megastigmane-3*β*, 4*α*, 9-triol, 7-megastigmene-3,6,9-triol (Xu et al., 2009); C13-norisoprenoid (Xu et al., 2009) have been found. The plant has been investigated as a source of biocrude and solid fuel (Sharma and Prasad, 1986), alternative energy (Augustus et al., 2003) and isoprene emission (Padhy and Varshney, 2005).

4. PHARMACOLOGY

Alstonia scholaris also been reported to inhibited liver injuries induced by carbon tetrachloride, β- galactosamine, acetaminoo-hen, ethanol as remarked by the reduced el-evation of levels of serum transamiases and histopathologic changes such as necrosis and inflammatory cell infiltration (Lin, S. C, 1996). Ayur-veda recommends Alstonia scholaris for bowel complaints. The herb is given to lac-tating mothers to increased lactation, helps post-delivery weakness and digestion. Al-most all parts of plant are used in medicine.

Bark: The bark is most intensively used part of the plant. It is a bitter, astringent, an-tipyretic, digestive, laxative, anthelmintic, cardiotonic, useful in skin diseases, chronic ulcers, asthama (Warrier, P. K, 1996).

Leaves: Leaves are used to cure Male-ria, snake bite, diarrhea, dysentery, beriberi, Congested liver, antimicrobial (Kirtikar K R, Basu B D, 1935).

Fruits: Fruits are used in epilepsy, syph-ilis, antiperiodic, anthelmintic. Alstonia scholaris is used in various Ayurvedic for-mulations like Saptaparnasatvadi vati, Sap-tacchadadi tail, Saptacchadadi kwath, Sattaparna ghanasara (Pawan, K., 2011).

Alsonia scholaris is one of the ingredient of an antimalerial drug Ayush-64, prepared by CCRAS, India which proved to be quite effective incombacting malaria and it was also found effective in clearance of parasitaemia (The wealth of India, Raw materials,2004).

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).

The plant has been reported for anticancerous (Kamarajan et al., 1991; Saraswathi et al., 1997,1998,1999; Keawpradub et al., 1997; Jagetia et al., 2003; 2005; Jagetia and Baliga, 2003a,b; 2004; 2005; 2006; 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); immunostimulating (Iwo et al., 2000); hepatoprotective (Lin et al., 1996); wound healing (Arulmozhi et al., 2007b); antinociceptive (Arulmozhi et al., 2007c); antidiabetic and antihyperlipidemic (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); neuropharmacological (Bhattacharya et al., 1979); α- Glucosidase 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); 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); anti hypertensive (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).

5. CONCLUSION

The plant Saptaparna (Alstonia scholaris R.Br.) is a beautiful foliage tree with a large canopy. Alstonia scholaris R. Br. has been used in traditional systems of medicines for treating various ailments such as antibacterial, antimicrobial. The plant contains various chemical constituents most-ly alkaloids that can promote health and re-duce illness. It is one of the ingredient of antimalerial drug Ayush-64, prepared by CCRAS.

The plant has long being 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 plant has been reported extensively as anticancerous, antimicrobial, molluscicidal, anxiolytic and antipsychotic agent. However, many of the diseases treated indigenously using the plant have not been confirmed in the laboratory. This leaves an opportunity to explore the species both phytochemically and pharmacologically. Therefore, ethnopharmacology can 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.

REFERENCES

[1] Abe F., Chen R.F., Yamauchi T., Marubayashi N., Ueda I. Thakurdesai P.A. *In vitro* antioxidant and free radical scavenging activity Alschomine and Isoalschomine, New Alkaloids from the Leaves of *Alstonia scholaris*. Chem. Pharmaceut. Bull. 1989; 37(4): 887-890.

[2] Akhtar S.M., Bano H. Hypoglycemic effect of powdered *Alstonia scholaris*(Satona). Prof. Med. J. 2002; 9: 208-271.

[3] Ansari M.M., Khan S.A., Ahmad J., Ansari S.H. Pharmacognostical studies on the bark of *Alstonia scholaris* R.Br.(Chatiun). Hamdard Med. 2006; 49: 95-103.

[4] Arambewela L.S.R., Ratnayake C. Constituents of *Alstoniascholaris*. Fitoterapia 1991; 62(4): 357.

[5] Arulmozhi S., Mazumder P.M., Kangralkar V.A., NarayananL.S., Thakurdesai P. Anti-Anxiety activity of Alstonia scholaris Linn.R.Br. Pharmacologyonline. 2008; 3: 761-775.

[6] Arulmozhi S., Mazumder P.M., Lohidasan S., Thakurdesai P.Antidiabetic and antihyperlipidemic activity of leaves of *Alstoniascholaris* Linn. R.Br. Eur. J. Integrative. Med. 2010b; 2(1): 23-32.

[7] Arulmozhi S., Mazumder P.M., Sathiyanarayanan L., Thakurdesai P.A. Analgesic, anti-inflammatory and anti-ulcerogenicactivities of fractions from *Alstonia scholaris*. Pharmacologia 2012; 3(5):132-137.

[8] Arulmozhi S., Mitra Mazumder P., Ashok P., Hulkoti B.,Narayanan L.S. Antinociceptive and anti-inflammatory activities of*Alstonia scholaris* Linn. R.br. Phcog. Mag. 2007c; 3(10): 106-111.

[9] Arulmozhi S., Mitra Mazumder P., Ashok P., Sathiya NarayananL. *In vitro* antioxidant and free radical scavenging activity of *Alstoniascholaris* Linn. R.Br. Iranian Journal of Pharmacology and Therapeutics2007a; 6(2): 191-196.

[10] Arulmozhi S., Mitra Mazumder P., Sathiya Narayanan L., of fractions from *Alstonia scholaris* Linn. R.Br. International Journal of PharmTech Research 2010a; 2(1): 18-25.

[11] Arulmozhi S.L., Rasal V.P., Sathiyanarayanan L., Ashok P.Screening of *Alstonia scholaris* Linn. R. Br., for wound healing activity.Oriental Pharmacy and Experimental Medicine 2007b; 7(3): 254-260.

[12] Arulmozhi, S., Mazumder P.M., Ashok P., Sathiyanarayanan L. Antiarthritic and antioxidant activity of leaves of Alstonia scholaris Linn.R.Br. Eur. J. Integr. Med. 2011 [In press].

[13] Augustus G. D. P. S., Jayabalan M., Seiler G. J. Alternativeenergy sources from plants of Western Ghats (Tamil Nadu, India).Biomass and Bioenergy 2003; 24(6): 437-444.

[14] Ayyanar M., Ignacimuthu S. Traditional knowledge of Kanitribals in Kouthalai of Tirunelveli hills, Tamil Nadu, India. J.Ethnopharmacol. 2005; 102: 245-255.

[15] Baliga M.S. *Alstonia scholaris* Linn R Br in the treatment andprevention of cancer: past, present, and future. Integr. Cancer Ther. 2010;9(3): 261-269.

[16] Baliga M.S., Jagetia G.C., Ulloor J.N., Baliga M.P., VenkateshP., Reddy R., Rao K.V., Baliga B.S., Devi S., Raju S.K., VeereshV., Reddy T.K., Bairy K.L. The evaluation of the acute toxicity and longterm safety of hydroalcoholic extract of Sapthaparna (*Alstonia scholaris*)in mice and rats. Toxicol. Lett. 2004; 151(2): 317-326.

[17] Bandawane D., Juvekar A., Juvekar M. Antidiabetic andAntihyperlipidemic Effect of *Alstonia scholaris Linn* Bark inStreptozotocin Induced Diabetic Rats. Indian Journal of PharmaceuticalEducation and Research Ind. J. Pharm. Edu. Res. 2011; 45(2): 114-120.

[18] Banerji A. Scholaricine, an alkaloid from *Alstonia scholaris*.Phytochemistry 1981; 20(3): 2771-2773.

[19] Banerji A., Banerji J. Constituents of *Alstonia scholaris*. Indian Science Congress Association Proceedings 1975; 62.

[20] Banerji A., Banerji J. Isolation of Pseudo Akuammigine fromthe leaves of *Alstonia scholaris*. Indian J. Chem. B Org. 1977; 15: 390-391.

[21] Banerji A., Siddhanta A.K. Scholarine: An indole alkaloidof *Alstonia scholaris.* Phytochemistry 1981; 20: 540-542.

[22] Banerji J., Chakrabarti R. Constituents of *Alstonia scholaris*conversion of Picrinine into Strictamine and to a Pyrrolidinoindoleninesystem. Indian Journal of Chemistry Section B Organic Chemistry Including Medicinal Chemistry 1984; 23: 453-454.

[23] Banerji J., Mustafi R., Roy D.J. Levo scholarine and dextrolochneridine, constituents of *Alstonia scholaris* Apocynaceae. Indian .JChem. B. Org. 1984; 23: 455.

[24] Beljanski M., Beljanski M.S. Selective inhibition of *in vitro*synthesis of cancer DNA by alkaloids of beta-carboline class. Exp. Cell.Biol. 1982; 50: 79-87.

[25] Beljanski M., Beljanski M.S. Three alkaloids as selectivedestroyers of cancer cells in mice. Synergy with classic anticancer drugs.Oncology 1986; 43: 198-203.

[26] Bhandary M.J., Chandrashekar K.R., Kaveriappa K.M. Medicalethnobotany of the Siddis of Uttara Kannada district, Karnataka, India. J. Ethnopharmacol. 1995; 47(3): 149-158.

[27] Bharati K.A., Sharma B.L. Some ethnoveterinary plant recordsfor Sikkim Himalaya. Indian Journal of Traditional Knowledge 2010; 9(2):244-346.

[28] Bhardwaj S., Gakhar S.K. Ethnomedicinal plants used by the tribals of Mizoram to cure cuts & wounds. Indian Journal of Traditional Knowledge 2005; 4(1): 75-80.

[29] Bhattacharya S.K., Bose R., Dutta S.C., Ray A.B., Guha S.R. Neuropharmacological studies on strictamine isolated from *Alstoniascholaris*. Indian J. Exp. Biol. 1979; 17(6): 598-600.

[30] Bhogayata K., Sharma P.P., Patel B.R. A clinical evaluation ofsaptaparna (*Alstonia scholaris* l., r. Br.) on essential hypertension. Ayu.2009; 30(3): 318-322.

[31] Boonchuay W., Court W.E. Alkaloids of *Alstonia scholaris* from Thailand. Planta Med. 1976a; 29(4): 380-390.

[32] Boonchuay W., Court W.E. Minor alkaloids of *Alstoniascholaris* Root. Phytochemistry 1976b; 15.

[33] Cai X.H., Du Z.Z., Luo X.D. Unique Monoterpenoid Indole Alkaloids from *Alstonia scholaris*. Org. Lett. 2007; 9(9): 1817-1820.

[34] Cai X.H., Liu Y.P., Feng T., Luo X.D. Picrinine-type alkaloidsfrom the leaves of *Alstonia scholaris.* Chin. J. Nat. Med. 2008b; 6: 20-22.

[35] Cai X.H., Shang J.H., Feng T., Luoa X.D. Novel alkaloidsfrom *Alstonia scholaris* Z. Naturforsch. B Chem. Sci. 2010; 65: 1164-1168.

[36] Cai X.H., Tan Q.G., Liu Y.P., Feng T., Du Z.Z., Li W.Q., Luo X.D. A cage-monoterpene indole alkaloid from *Alstonia scholaris*. Org. Lett. 2008a; 10(4): 577-580.

[37] Campos L.C., Dassoler S.C., Rigo A.P., Iwu M., Elisabetsky E.Anxiolytic properties of the antipsychotic alkaloid alstonine. Pharmacol. Biochem. Behav. 2004b; 77(3): 481-489.

[38] Campos L.C., Elisabetsky E., Lara D.R., Carlson T.J., King S.R., Ubillas R., Nunes D.S., Iwu M.M., Nkemjika C.O., Ozioko A., Agwu C.O. Antipsychotic profile of alstonine: ethnopharmacology of atraditional Nigerian botanical remedy. An. Acad. Bras. Cienc. 1999; 71(2):189-201.

[39] Campos L.C., Iwu M., Elisabetsky E. Lack of pro-convulsantactivity of the antipsychotic alkaloid alstonine. J. Ethnopharmacol. 2004a; 93(2-3): 307-310.

[40] Chakravarti D., Chakravarti R.N., Ghose R. Triterpenes of*Alstonia scholaris* R. Br. J. Indian Chem. Soc. 1960; 37: 637-639.

[41] Chakravarti D., Chakravarti R.N., Ghose R. Triterpenesof *Alstonia scholaris* (dita-bark). Experientia 1957; 13(7): 277.

[42] Chakravarti R.N., Chakravarti D., Ghose R. Chemical examination of Dita-bark *Alstonia scholaris*. II. Bull. Calcutta Sch. Trop. Med. 1955; 3: 165-166.Chakravarti R.N., Chakravarti D., Ghose R. Chemical examination of Pita bark. III. Bull. Calcutta Sch. Trop. Med. 1956; 4: 166-167.

[43] Channa S., Dar A., Ahmed S., Rahman A.U. Evaluation of *Alstonia scholaris* leaves for broncho-vasodilatory activity. J. Ethnopharmacol. 2005; 97(3): 469-476.

[44] Chatterjee A., Mukherjee B., Ghosal S., Banerjee P.K. Occurrence of Rhazine in *Alstonia scholaris* R. Br.: biogenetic and chemotaxonomic significance of the co occurrence of several indole alkaloidshaving a common structural pattern. J. Indian Chem. Soc. 1969; 46: 635-638.

[45] Chatterjee A., Mukherjee B., Ray A.B., Das B. The alkaloid of the leaves of *Alstonia scholaris* R. Br. Tetrahedron Lett. 1965; (41): 3633-3637.

[46] Chauhan J.S., Chaturvedi R., Kumar S. Isookanin-7-O-Alpha-LRhamnopyranoside a new flavanone glycoside from the Roots of *Alstonia scholaris*. Indian J. Chem. B Org. 1985; 24(2): 219.

[47] Chauhan S., Singh A. Molluscicidal potential of *Lantana indica* and *Alstonia scholaris* plants against freshwater snail *Lymnaea acuminata*. Internet J. Toxicol. 2010; 7(2) [Cited from: http://www.ispub.com/journal/the_internet_journal_of_toxicology/volume_7_number_2_29/article/molluscicidal-potential-of-lantana-indica-andalstonia-scholaris-plants-against-freshwater-snail-lymnaea-acuminata.html].

[48] Choudhary D.N., Singh J.N., Singh B.P. Effect of somemedicinal plants on fertility of albino rats. Indian J. Pharmacol. 1991;23(4): 253-257.

[49] Costall B., Naylor R.J. Behavioural interactions between 5-hydroxytryptophan, neuroleptic agents and 5-HT receptor antagonists inmodifying rodent responding to aversive situations. Br. J. Pharmacol. 1995; 116: 2989-2999.

[50] Dai Y.Y., Yang W., He R., Zhou F.L., Mao Y.L. Resourcestatus, seed germination characteristics and alkaloids contents of *Alstonia scholaris* in Yunnan. Journal of West China Forestry Science 2008; 1(1): 73-76.

[51] Dash G.K., Murthy P.N. Antimicrobial activity of few selectedmedicinal plants. International Research Journal of Pharmacy 2011; 2(1):146-152.

[52] Dash S.K., Padhy S. Review on ethnomedicines for diarrhoea diseases from Orissa: prevalence versus culture. J. Hum. Ecol. 2006; 20(1): 59-64.

[53] Datta S.C., Mathur R.K. Monoterpene from *Alstonia scholaris*. Indian Drugs 1987; 24(6): 321.

[54] Datta S.K., Datta P.C. Pharmacognosy of *Alstonia scholaris* bark drugs. Pharmaceut. Biol. 1984; 22(4): 151-160.

[55] de Moura Linck V., Herrmann A.P., Goerck G.C., Iwu M.M., Okunji C.O., Leal M.B., Elisabetsky E. The putative antipsychotic Alstonine reverses social interaction withdrawal in mice. Prog. Neuropsychopharmacol. Biol. Psychiatry 2008; 32(6): 1449-1452.

[56] Deb S., Arunachalam A., Das A.K. Indigenous knowledge of Nyishi tribes on traditional agroforestry systems. Indian Journal of Traditional Knowledge 2009; 8(1): 41-46.

[57] Deepthi S.R., Remya R., Thankamani V. Antibacterial activity studies and phytochemical screening on the methanol extract of *Alstonia scholaris* R. Br. Res. J. Biotechnol. 2008; 3: 40-43.

[58] Dhar D.N., Suri S.C., Dwivedi. Chemical examination of the flowers of *Alstonia scholaris*. Planta Med. 1977; 31(1): 33-34.

[59] Dung N.X., Ngoc R.H., Rang D.D., Nhan N.T., Klinkby N.,Leclercq P.A. Chemical composition of the volatile concentrate from the flowers of Vietnamese *Alstonia scholaris* (L.) R.Br., Apocynaceae. J. Essent. Oil Res. 2001; 13(6): 424-426.

[60] Dutt A.T. Total alkaloids in *Alstonia scholaris*. Sci. Cult. 1944; 9: 555-556.

[61] Dutta M., Laskar S. Hydrocarbons in the surface wax of the leaves of *Alstonia scholaris* (Linn.) R.Br. Orient. J. Chem. 2009; 25: 437- 439.

[62] Dutta M., Senn S., Laskar S. Fatty acid composition of *Alstonia scholaris* (Linn.) R. Br. seed oil having some antibacterial principles. Biosci. Biotechnol. Res. Asia 2010; 7: 481-484.

[63] Dutta S.C., Bhattacharya S.K., Ray A.B. Flower alkaloids of *Alstonia scholaris*. Planta Med. 1976; 30(1): 86-90.

[64] Dweck A.C. Impotence - evaluating traditional remedies. Personal Care Magazine 2007; 8(3): 1-8.

[65] Elisabetsky E., Campos L.C. The Alkaloid Alstonine: A Review of Its Pharmacological properties. Evid. Based Complement. Alternat.Med. 2006; 3(1): 39- 48.

[66] Feng T., Cai X.H., Du Z.Z., Luo X.D. Iridoids from the Barkof *Alstonia scholaris*. Helv. Chim. Acta 2008; 91: 2247-2251.

[67] Feng T., Cai X.H., Zhao P.J., Du Z.Z., Li W.Q., Luo X.D. Monoterpenoid indole alkaloids from the bark of *Alstonia scholaris*. Planta Med. 2009; 75(14): 1537-1541.

[68] Fritz H., Fischer O. Neighboring group effect in the formation of ring-chain tautomers of o-analogues of echibolin. Contribution to the chemistry of echitamine *Alstonia scholaris*. Tetrahedron 1967; 20: 2047-2053.

[69] Gami B., Parabia F. Evaluation of acetone extract of three Indian medicinal plants for schizonticidal properties in *Plasmodium falciparum*. Int. J. Pharm. Tech. 2011b; 3(1): 1373-1384.

[70] Gami B., Parabia F. Screening of methanol and acetone extract for antimicrobial activity of some medicinal plants species of Indian folklore. Int. J. Res. Pharm. Sci. 2011a; 2(1): 69-75.

[71] Gandhi M., Vinayak V.K. Preliminary evaluation of extracts of *Alstonia scholaris* bark for *in vivo* antimalarial activity in mice. J. Ethnopharmacol. 1990; 29(1): 51-57.

[72] Ghosh R., Roychowdhury P., Chattopadhyay D., Iitaka Y. The structure of an alkaloid, picrinine, from *Alstonia scholaris*. Acta Cryst. 1988; 44: 2151-2154.

[73] Govindachari T. R., Rajappa S. Echitamine Tetrahedron 1961; 15(1-4): 132-143.

[74] Gupta R.S., Bhatnager A.K., Joshi Y.C., Sharma M.C., Khushalani V., Kachhawa J.B. Induction of antifertility with lupeolacetate in male albino rats. Pharmacology 2005; 75(2): 57-62.

[75] Gupta R.S., Sharma R., Sharma A., Bhatnager A.K., Dobhal M.P., Joshi Y.C., Sharma M.C. Effect of *Alstonia scholaris* bark extract on testicular function of Wistar rats. Asian J. Androl. 2002; 4(3): 175-178.

[76] Gupta U., Chaudhary R., Goyal P.K. Alterations in phosphatises activity in blood of mice by *Alstonia scholaris* extract after gamma irradiation. Pharmacol. Online 2010a; 2: 752-760.

[77] Gupta U., Chaudhary R., Goyal P.K. Post-treatment effects of *Alstonia scholaris* extract against radiation-induced biochemical alterations in Swiss albino mice. Iran. J. Radiat. Res. 2010b; 8: 169-177.

[78] Gupta U., Jahan S., Chaudhary R., Goyal P.K. Amelioration of radiation-induced hematological and biochemical alterations by *Alstonia scholaris* (a medicinal plant) extract. Integr. Cancer Ther. 2008; 7(3): 155-161.

[79] Hadi S. Mataranine a and b: a new diastomeric indole alkaloid from *Alstonia scholaris* R.BR. of Lombok Island. Indonesian J. Chem. 2009; 9(3): 466-469.

[80] Hadi S., Bremner J.B. Initial studies on alkaloids from Lombok medicinal plants. Molecules 2001; 6: 117-129.

[81] Harsha V.H., Shripathi V., Hegde G.R. Ethnoveterinary practices in Uttara Kannada district of Karnataka. Indian Journal of Traditional Knowledge 2005; 4(3): 253-258.

[82] Hemalatha K., Satyanarayana D., Subrahmanyam E.V. Phytochemical constituents of root bark of *Alstonia scholaris*. R. Br. Asian J. Chem. 2008; 20: 5405-5408.

[83] Hirasawa Y., Miyama S., Kawahara N., Goda Y., Rahman A., Ekasari W., *et al*. Indole alkaloids from the leaves of *Alstonia scholaris.* Heterocycles 2009; 79: 1107-1112.

[84] http://ayurveda.ygoy.com/2010/08/19/medicinal uses. of Alstonia scholaris.

[85] Hui T. Sun Y., Zhu L., Guo W., Rao G. Flavonoids in leaves of*Alstonia scholaris*. Zhongguo Zhong Yao Za Zhi 2009; 34(9): 1111-1113.

[86] Hussain A., Zaman M.K., Ramteke A.M. Antibacterial activity of trunk bark of *Alstonia scholaris*. Asian J. Pharmaceut. Clin. Res. 2010; 3(4): 46-47.

[87] Iwo M.I., Soemardji A.A., Retnoningrum D.S., Sukrasno U.U.M. Immunostimulating effect of pule (*Alstonia scholaris* L. R.Br., Apocynaceae) bark extracts. Clin. Hemorheol. Microcirc. 2000; 23(2-4): 177-183.

[88] Jagetia G.C., Baliga M.S. Effect of *Alstonia scholaris* in enhancing the anticancer activity of berberine in the Ehrlich ascites carcinoma-bearing mice. J. Med. Food 2004; 7(2): 235-244.

[89] Jagetia G.C., Baliga M.S. Evaluation of anticancer activity of the alkaloid fraction of *Alstonia scholaris* (Sapthaparna) *in vitro* and *in vivo*. Phytother. Res. 2006; 20(2): 103-109.

[90] Jagetia G.C., Baliga M.S. Induction of developmental toxicity in mice treated with *Alstonia scholaris* (Sapthaparna) in utero. Birth Defects Res. B Dev. Reprod. Toxicol. 2003c; 68(6): 472-478.

[91] Jagetia G.C., Baliga M.S. Modulation of antineoplastic activity of cyclophosphamide by *Alstonia scholaris* in the Ehrlich ascites carcinoma-bearing mice. J. Exp. Ther. Oncol. 2003a; 3(5): 272-282.

[92] Jagetia G.C., Baliga M.S. The effect of seasonal variation on the antineoplastic activity of *Alstonia scholaris* R. Br. in HeLa cells. J. Ethnopharmacol. 2005; 96(1-2): 37-42.

[93] Jagetia G.C., Baliga M.S. The evaluation of nitric oxide scavenging activity of certain Indian medicinal plants in vitro: a preliminary study. J. Med. Food 2004; 7(3): 343-348.

[94] Jagetia G.C., Baliga M.S. Treatment with *Alstonia scholaris* enhances radiosensitivity *in vitro* and *in vivo*. Cancer Biother.

[95] Jagetia G.C., Baliga M.S., Venkatesh P. Effect of Sapthaparna (*Alstonia scholaris* Linn) in modulating the benzo(a)pyrene-induced forestomach carcinogenesis in mice. Toxicol. Lett. 2003; 144(2): 183-193.

[96] Jagetia G.C., Baliga M.S., Venkatesh P., Ulloor J.N., Mantena S.K., Genebriera J., Mathuram V. Evaluation of the cytotoxic effect of the monoterpene indole alkaloid echitamine *in-vitro* and in tumour-bearing mice. J. Pharm. Pharmacol. 2005; 57(9): 1213-1219.

[97] Jahan S., Chaudhary R., Goyal P.K. Anticancer activity of an Indian medicinal plant, *Alstonia scholaris*, on skin carcinogenesis in mice. Integr. Cancer Ther. 2009a; 8(3): 273-279.

[98] Jahan S., Goyal P.K. Protective effect of *Alstonia scholaris* against radiation-induced clastogenic and biochemical alterations in mice. J. Environ. Pathol. Toxicol. Oncol. 2010; 29(2): 101-111.

[99] Jahan S., Gupta U., Chaundhary R., Goyal P.K. Prophylactic use of *Alstonia scholaris* (Sapthaparna) against gamma irradiation. Pharmacol. Online 2009b; 1: 160-175.

[100] Jain L., Pandey M.B., Singh S., Singh A.K., Pandey V.B. A new indole alkaloid from *Alstonia scholaris*. Nat. Prod. Res. 2009a; 23(17): 1599-1602.

[101] Jain L., Singh S., Pandey M.B., Pandey V.B. Alkaloids of *Alstonia scholaris.* J. Indian Chem. Soc. 2009b; 86: 758-760.

[102] Jain S., Gill V., Vasudeva N., Singla N. Ayurvedic medicines in treatment of cancer. J. Chin. Int. Med. 2009c; 7(11): 1096-1099.

[103] Javaid A., Shafique S., Bajwa R., Shafique S. Parthenium management through aqueous extracts of *Alstonia scholaris*. Pak. J. Bot. 2010; 42(5): 3651-3657.

[104] Jong-Anurakkun N., Bhandari M.R., Kawabata J. α-Glucosidase inhibitors from Devil tree (*Alstonia scholaris*). Food Chem. 2007; 103: 1319–1323.

[105] Kalidas, Raghuwansha Mahakavya, 4123.

[106] Kam T.S., Nyeoh K.T., Sim K.M., Yoganathyan K. Alkaloids from *Alstonia scholaris*. Phytochemistry 1995; 45: 1303-1305.

[107] Kamarajan P., Sekar N., Mathuram V., Govindasamy S. Antitumor effect of echitamine chloride on methylcholonthrene induced fibrosarcoma in rats. Biochem. Int. 1991; 25(3): 491-498.

[108] Karawya M.S., Ammar N.M., Hifnawy M.S., Al-okbi S.Y., Doha A.M., El-Anssary A.A. Phytochemical study and evaluation of the anti-inflammatory activity of some medicinal plants growing in Egypt. Med. J. Islamic World Acad. Sci. 2010; 18(4): 139-150.

[109] Kaushik R., Saini P. Screening of some semi-arid region plants for larvicidal activity against *Aedes aegypti* mosquitoes. J. Vector Borne Dis. 2009; 46: 244-246.

[110] Keawpradub N., Houghton P.J., Eno-Amooquaye E., Burke P.J. Activity of extracts and alkaloids of Thai *Alstonia scholaris* against human lung cancer cell lines. Planta Med. 1997; 63(2): 97-101.

[111] Keawpradub N., Kirby G.C., Steele J.C, Houghton P.J. Antiplasmodial activity of extracts and alkaloids of three *Alstonia* species from Thailand. Planta Med.1999; 65(8): 690-694.

[112] Khan M.R., Omoloso A.D., Kihara M. Antibacterial activity of *Alstonia scholaris* and *Leea tetramera*. Fitoterapia 2003; 74(7-8): 736-740.

[113] Khare C.P. Indian Medicinal Plants: An Illustrated Dictionary. Springer-Verlag Berlin/ Heidelberg (2007) 38-39.

[114] Khare C.P. Indian Medicinal Plants: An Illustrated Dictionary. Springer-Verlag Berlin/Heidelberg (2007) 38-39.

[115] Khyade M.S., Vaikos N.P. Pharmacognostical studies on the leaves of *Alstonia scholaris* R. Br. J. Pharm. Res. 2009b; 2(5): 858-861.

[116] Khyade M.S., Vaikos N.P. Phytochemical and antibacterial properties of leaves of *Alstonia scholaris* R. Br. Afr. J. Biotech. 2009a; 8 (22): 6434-6436.

[117] Kirtikar K R, Basu B D. Indian medici-nal plants, Allahaad: LM Basu publica-tion; 1935, Vol. I.

[118] Kulkarni M.P., Juvekar A.R. Effect of *Alstonia scholaris* (Linn.) R. Br. on stress and cognition in mice. Indian J. Exp. Biol. 2009; 47(1): 47-52.

[119] Kumar A., Kaur R., Arora S. Free radical scavenging potential of some Indian medicinal plants. J. Med. Plants Res. 2010; 4(19): 2034-2042.

[120] Lin S.C., Lin C.C., Lin Y.H., Supriyatna S., Pan S.L. The protective effect of *Alstonia scholaris* R. Br. on hepatotoxin-induced acute liver damage. Am. J. Chin. Med. 1996; 24(2): 153-164.

[121] Lin, S. C., Lincc, Lin YH. Supriyatha S, Pan SL. The protective effect of Alstonia scholaris on hepatotoxin. Induced acute liver damage. Am J Chin Med 1996;34:153-64.

[122] Macabeo A.P, Krohn K., Gehle D., Read R.W., Brophy J.J., Cordell G.A., Franzblau S.G., Aguinaldo A.M. Indole alkaloids from the leaves of Philippine *Alstonia scholaris*. Phytochemistry 2005; 66: 1158–1162.

[123] Macabeo A.P, Krohn K., Gehle D., Read R.W., Brophy J.J., Franzblau S.G., Aguinaldo A.M. Activity of the extracts and indole alkaloids from *Alstonia scholaris* against *Mycobacterium tuberculosis* H37Rv. Philippine Agr. Sci. 2008; 91(3): 348-351.

[124] Mahajan R.T., Badgujar S.B. Phytochemical Investigations of some laticiferous plants belonging to Khandesh Region of Maharashtra. Ethnobotanical Leaflets 2008; 12: 1145-1152.

[125] Mahapatra S., Banerjee D. Diversity and screening for antimicrobial activity of endophytic fungi from *Alstonia scholaris.* Acta Microbiol. Immunol. Hung. 2010; 57(3): 215-223.

[126] Mahidol C., Prawat H., Prachyawarakorn V., Ruchirawat S. Investigation of some bioactive Thai medicinal plants. Phytochem. Rev. 2002; (1)3: 287-297.

[127] Manohar H., Ramaseshan S. The structure of echitamine iodide major alkaloid from bark of *Alstonia scholaris*. Curr. Sci. 1961; 30: 5-7.

[128] Mollik M.A.H., Hossan M.S., Paul A.K., Taufiq-Ur-Rahman M., Jahan R., Rahmatullah M. a comparative analysis of medicinal plants used by folk medicinal healers in three districts of Bangladesh and inquiry as to mode of selection of medicinal plants. Ethnobotany Research & Applications 2010; 8:195-218.

[129] Monzon R.B. Traditional medicine in the treatment of parasitic diseases in the Philippines. Southeast Asian J. Trop. Med. Publ. Health 1995; 26(3): 421-428.

[130] Morita Y., Hesse M., Schmid H., Banerji A., Banerji J., Chatterjee A., Oberhänsli W.E. *Alstonia scholaris*: the structure of the indole alkaloid nareline. Helv. Chim. Acta 1977; 60(4): 1419-1432.

[131] Nersesyan A.K. Modification of benzo(a)pyrene-(BaP)-induced forestomach carcinogenesis in mice by means od extract of the bark of *Astonia scholaris* (ASE). Toxicol. Lett. 2004; 154(1-2): 159-160.

[132] Padhy P.K., Varshney C.K. Isoprene emission from tropical tree species. Environ. Pollut. 2005; 135(1): 101-109.

[133] Pasricha J.S., Agarwal U. Irritant and allergenic potential of some latex producing Indian plants. Indian Journal of Dermatology, Venereology and Leprology 1990; 56(4): 293-295.

[134] Patel J.P. Antibacterial activity of methanolic and acetone extract of some medicinal plants used in Indian folklore medicine. PRAJÑĀ - Journal of Pure and Applied Sciences 2010; 18: 54 – 58

[135] Patel J.P., Gami B., Patel K. Evaluation of in vitro Schizonticidal Properties of Acetone Extract of Some Indian Medicinal Plants. Adv. Biol. Res. 2010; 4(5): 253-258.

[136] Patil R.S., Juvekar A.R., Joglekar S.N., Shamkuwar P.B.,Nimbkar S.R. Study of antidiarrhoeal activity of *Alstonia scholaris* bark. Indian Drugs 1999; 36: 463-465.

[137] Pawan K, Dhirender k, Neha S, Ranas. Alstonia scholaris: It's phytochemistry and pharmacology Chron Young Sci. 2011:2:71-8.

[138] Pawan K, Dhirendra K, Neha S, Ranaj. Alstonia scholaris:It's phytochemistry and pharmacology. Chrom Young sci. 2011;2:71-8.

[139] Prusti A.B., Behera K.K. Ethnobotanical exploration of Malkangiri district of Orissa, India. Ethnobotanical Leaflets 2007; 11: 122-140.

[140] Psteve Thomas, Anil K, Dipankar G, Rajiv D and Chandrakanta K. Alstoside: A secoiridoid glucoside from Alstonia scholaris. Ind J CHEM 2008;47:1298-1302.

[141] Radiopharm. 2003b; 18(6): 917-929.

[142] Rahman A.U., Alvi K.A. Indole Alkaloids from *Alstonia scholaris*. Phytochemistry 1987; 26: 2139-2142.

[143] Rahman A.U., Alvi K.A., Abbas S.A., Voelter W. Isolation of 19, 20-Z Vallesamine and 19, 20-E Vallesamine from *Alstonia scholaris*. Heterocycles 1987; 26: 413-420.

[144] Rahman A.U., Alvi K.A., Muzaffar A. Isolation and 1H/13CNMR Studies on 19,20-Dihydrocondylocarpine: An alkaloid from the leaves of *Ervatamia coronaria* and *Alstonia scholaris*. Planta Med. 1986; (4): 325-326.

[145] Rahman A.U., Asif M., Ghazala M., Fatima J., Alvi K.A. Scholaricine an alkaloid from *Alstonia scholaris*. Phytochemistry 1985; 24: 2771-2773.

[146] Rahmatullah M., Mollik M.A.H., Ali Azam A.T.M., Islam M.R., Chowdhury M.A.M., Jahan R., Chowdhury M.H., Rahman T. Ethnobotanical survey of the Santal tribe residing in Thakurgaon district, Bangladesh. American-Eurasian Journal of Sustainable Agriculture 2009; 3(4): 889-898.

[147] Rajakumar N., Shivanna M.B. Traditional herbal medicinal knowledge in Sagar taluk of Shimoga district, Karnataka, India. Indian Journal of Natural Products and Resources 2010; 1(1): 102-108.

[148] Rastogi R.C., Kapil R.S., Popli S.P. Picralinal--a key alkaloid of picralima group from *Alstonia scholaris* R. Br. Experientia 1970; 26(10): 1056.

[149] Ravi Shankar K., Ramesh K.V., Naveena P. Free radical scavenging activity of the flower and fruit extracts of *Alstonia scholaris*. Biosci. Biotechnol. Res. Asia 2008; 5: 493-494.

[150] Riaz T., Khan N.S., Javaid A. Management of corm-rot disease of Gladiolus by plant extracts. Nat. Prod. Res. 2010; 24(12): 1131-1138.

[151] Saikia B. Ethnomedicinal plants from Gohpur of Sonitpur district, Assam. Indian Journal of Traditional Knowledge 2006; 5(4): 529- 530.

[152] Salim A.A., Garson M.J., Craik D.J. New indole alkaloids from the bark of *Alstonia scholaris*. J. Nat. Prod. 2004; 67(9): 1591-1594.

[153] Saraswathi V., Mathuram V., Subramanian S., Govindasamy S. Modulation of the impaired drug metabolism in sarcoma-180-bearing mice by echitamine chloride. Cancer Biochem. Biophys. 1999; 17(1-2): 79-88.

[154] Saraswathi V., Ramamoorthy N., Subramaniam S., Mathuram V., Gunasekaran P., Govindasamy S. Inhibition of glycolysis and respiration of sarcoma-180 cells by echitamine chloride. Chemotherapy 1998; 44(3): 198-205.

[155] Saraswathi V., Ramamurthy N., Subramanian S., Mathuram V., Govindasamy S. Enhancement of the cytotoxic effects of Echitamine chloride by vitamin A: An *in vitro* study on Ehrlich ascites carcinoma cell culture. Indian J. Pharmacol. 1997; 29: 244-249.

[156] Sen S., Chakraborty R., De B., Devanna N. An ethnobotanical survey of medicinal plants used by ethnic people in West and South district of Tripura, India. Journal of Forestry Research 2011; 22(3): 417- 426.

[157] Shah A. J., Gowani S.A., Zuberi A.J., Ghayur M.N., Gilani A.H. Antidiarrhoeal and spasmolytic activities of the methanolic crude extract of *Alstonia scholaris* L. are mediated through calcium channel blockade. Phytother. Res. 2010; 24(1): 28-32.

[158] Shang J.H., Cai X.H., Feng T., Zhao Y.L., Wang J.K., Zhang L.Y., Yan M., Luo X.D. Pharmacological evaluation of *Alstonia scholaris*: anti-inflammatory and analgesic effects. J. Ethnopharmacol. 2010b; 129(2): 174-181.

[159] Shang J.H., Cai X.H., Zhao Y.L., Feng T., Luo X.D. Pharmacological evaluation of *Alstonia scholaris*: anti-tussive, antiasthmatic and expectorant activities. J. Ethnopharmacol. 2010a; 129(3): 293-298.

[160] Sharma D.K., Prasad R. Biocrude and solid fuel from laticiferous plants. Biomass 1986; 11: 75-79.

[161] Sharma H., Kumar A. Ethnobotanical studies on medicinal plants of Rajasthan (India): A review. J. Med. Plants Res. 2011; 5(7): 1107-1112.

[162] Shetty P., Mangaonkar K., Sane R.T. HPTLC determination of ursolic acid in *Alstonia scholaris* R. Br. Journal of Planar Chromatography. Modern TLC 2007; 20(1): 65-68.

[163] Singh A., Singh S.K. Molluscicidal evaluation of three common plants from India. Fitoterapia 2005; 76(7-8): 747-751.

[164] Singh B., Sangwan P. Taxonomy, ethnobotany and antimicrobial activity of *Alstonia scholaris* (L.) R. Br., *Carissa carandas* L. And *Catharanthus roseus* (L.) G. Don. Int. J.Biotech & Biosci. 2011; 1(1): 102-112.

[165] Singh S.K., Singh A. Molluscicidal and anti-cholinesterase activity of *Alstonia scholaris* plant against freshwater snail *Lymnaea acuminata*. Pak. J. Biol. Sci. 2003b; 6(16): 1442-1446.

[166] Singh S.K., Singh A. Toxic effect of *Alstonia scholaris* plant to fingerlings of *Labeo rohita* (Hamilton) in different conditions. World J. Zool. 2010; 5: 41-46.

[167] Singh S.K., Singh A. Toxic effect of *Thevetia peruviana* and *Alstonia scholaris* latices on the freshwater snail *Lymnaea acuminata*. Iberus 2003a; 22: 19-27.

[168] Singh S.K., Yadav R.P., Singh A. Molluscicides from some common medicinal plants of eastern Uttar Pradesh, India. J. Appl. Toxicol. 2010; 30(1): 1-7.

[169] Singha U. K., Guru P. Y., Sen A. B., Tandon J. S. Antileishmanial Activity of Traditional Plants against *Leishmania donovani* in Golden Hamsters. Pharmaceut. Biol. 1992; 30(4): 289-295.

[170] Sirohi S.K., Pandey N., Goel N., Singh B., Mohini M., Pandey P., Chaudhry P.P. Microbial activity and ruminal methanogenesis as affected by plant secondary metabolites in different plant extracts. Int. J. Environ. Sci. Eng. 2009; 1(1): 52-58.

[171] Sonawane J.M., Lohar P.S. Evaluation of hypoglycaemic activity of some medicinal plants of Satpuda forest on alloxan induced diabetes in rats. J. Ecobiotech. 2011; 2(6): 30-33.

[172] Sultana N., Saleem M. Phytochemical Studies on *Alstoniascholar*is. Z. Naturforsch. 2010; 65(b): 203-210.

[173] Surwase U.S., Shaikh G.H., Patil S.M., Hunsnalkar S.G., Chaudhary R.Y. Phytochemical investigation and preliminary pharmacological screening of *Alstonia scholaris* R. Br. as an antipyretic. Asian J. Res. Chem. 2009; 2(3): 304-305.

[174] Talapatra S.K, Sengupta S, Banerjee S, Talapatra B. The Neutral Constituents of the Root and Root Bark of *Alstonia scholaris* R. Br. J. Indian Chem. Soc. 1968; 45: 1183-1185.

[175] Talapatra S.K., Talapatra B. Isolation of echitamine chloride from the root and root-bark of *Alstonia scholaris* R. Br. alkaloid. J. Indian Chem. Soc. 1967; 44: 639-640. Thankamani V.I. Phytochemical screening and antimicrobial activity of *Alstonia scholaris* flowers (L.) BR. FAM: Apocynaceae. Int. J. Pharmaceut. Res. Dev. 2011; 3(4): 172-178.

[176] The Ayurvedic pharmacopoeia of India, Govt. of India, Ministry of health and family welfare dpt., The controller of publication, Delhi, part-I, Vol.-3(1990-2001).

[177] The Ayurvedic pharmacopoeia of India, Govt. of India, Ministry of health and family welfare dpt., The controller of publication, Delhi, part-I, Vol.-3(1990- 2001).

[178] The wealth of India, Raw materials, Vol- I,CSIR, New Delhi, 50-51(2004).

[179] Thenmozhi M., Rajeshwari S., Yadav H. Comparative phytochemical analysis of *Alstonia scholaris, Lawsonia inermis, Ervatamia divaricata* and *Asparagus racemosus*. Int. J. Pharmaceut. Res. Dev. 2010; 9: 86-91.

[180] Thomas P.S., Kanaujia A., Ghosh D., Duggar R., Katiyar C.K. Alstonoside, a secoiridoid glucoside from *Alstonia scholaris* Indian J. Chem. B Org. 2008; 47: 1298-1302.

[181] Upadhye A.S., Khatoon S., Melhotra S. Seasonal variation studies and pharmacognostic evaluation of *Alstonia scholaris* R.Br. bark. Nat. Prod. Sci. 2006; 12(4): 241-246.

[182] Varshney A., Goyal M.M. Phytochemical study on the leaves of *Alstonia scholaris* and their effects on pathogenic organisms. Ancient Science of Life 1995; 15(1): 30-34.

[183] Versha P., Ghosh B., Anroop B., Ramanjit M. Antimicrobial activity of *Alstonia scholaris* leaf extracts. Indian Drugs 2003; 40(7): 412- 413.

[184] Vikneshwaran D., Viji M., Raja Lakshmi K. A survey of the ethnomedicinal flora of the Sirumalai hills, Dindugul district, India. Ethnobotanical Leaflets 2008; 12: 948-953.

[185] Wang F., Ren F.C., Liu J.K. Alstonic acids A and B, unusual 2,3-secofernane triterpenoids from *Alstonia scholaris*. Phytochemistry 2009; 70: 650–654.

[186] Warrier P K, Nambiar VPK, Raman Kutty C. Indian medicinal plants. Hy-derabad India: Orient Longman; 1996.

[187] Wiart C. Medicinal plants of the Asia-Pacific Drugs for the Future? World Scientific Publishing Co. Pte. Ltd., Singapore (2006) 447- 450.

[188] Wongseripipatana S., Chaisri L., Sritularak B., Likhitwitayawuid K. Indole alkaloids from the fruits of *Alstonia scholaris*. Thai J. Pharm. Sci. 2004; 28: 173-180.

[189] Xu Y., Feng T., Cai X.H., Luo X.D. A New C13-Norisoprenoid from leaves of *Alstonia scholaris*. Chin. J. Nat. Med. 2009; 7(1): 21-23.

[190] Yamauchi T., Abe F., Chen R.F., Nonaka G.I., Santisuk T., Padolina W.G. Alkaloids from the leaves of *Alstonia scholaris* in Taiwan, Thailand, Indonesia and the Philippines. Phytochemistry 1990a; 29(11): 3547-3552.

[191] Yamauchi T., Abe F., Padolina W.G., Dayrit F.M. Alkaloids from Leaves and Bark of *Alstonia scholaris* in the Philippines. Phytochemistry 1990b; 29(10): 3321-3326.

[192] Yusuf M., Wahab M.A., Chowdhury J.A., Begum J. Ethnomedico- botanical knowledge from Kaukhali proper and Betbunia of Rangamati district. Bangladesh J. Plant Taxon. 2006; 13(1): 55-61.

[193] Zashim Uddin, M., Hassan M.A., Sultan M. Ethnobotanical survey of medicinal plants in Phulbari upazila of Dinajpur district, Bangladesh. Bangladesh J. Plant Taxon. 2006; 13(1): 63-68.

[194] Zhou H., He H.P., Luo X.D., Wang Y.H., Yang X.W., Di Y.T., Hao X.J. Three new indole alkaloids from the leaves of *Alstonia scholaris*. Helv. Chim. Acta 2005; 88(9): 2508-2512.