



AMERICAN JOURNAL OF PHARMTECH RESEARCH

Journal home page: <http://www.ajptr.com/>

A Review on Phyto-pharmacological Profile of *Alstonia venenata* R.Br.

Sreelakshmi S. S, S. Venkatesh,*

Department of Pharmacology, Devaki Amma Memorial College of Pharmacy, Malappuram-
673634

ABSTRACT

The genus *Alstonia* finds a promising place in Indian systems of medicine. The different ethnic communities in India have used different species of *Alstonia*, mainly *Alstonia scholaris* in the treatment of various human ailments. *Alstonia venenata* R.Br. is an important ethnobotanical plant of the Apocynaceae family which is having many medicinal values. Stem bark, root bark, fruits and leaves are used by many tribal communities and also used in Ayurveda. Roots and fruits are believed to be useful for skin diseases, leprosy, cobra and other venomous bites, epilepsy, fatigue, fever, syphilis, insanity, helmenthiasis, as remedy for impure blood. The plant reported to have anti-epileptic, anti-depressant, anti-cancer, anti-fungal, and anti-bacterial activities. The phytochemical analysis revealed that the presence of secondary metabolites such as alkaloids, coumarins, tannins, saponins, flavonoids, phenols, anthraquinones, quinones, carbohydrates, glycosides and starch. The present review includes the updated information on medicinal values of *Alstonia venenata*. R. Br.

Keywords: *Alstonia venenata* R. Br., Apocynaceae, Cobra and other venomous bites.

*Corresponding Author Email: svenkatpharma@rediffmail.com

Received 25 February 2018, Accepted 04 March 2019

Please cite this article as: Venkatesh S *et al.*, A Review on Phyto-pharmacological Profile of *Alstonia venenata* R.Br.. American Journal of PharmTech Research 2019.

INTRODUCTION

Medicinal plants are considered as rich sources of ingredients which can be used in drug development pharmacopoeial or non- pharmacopoeial or synthetic drugs. ^[1] Complementary therapies based on the herbal medicines are the world's oldest form of medicine and recent reports suggest that such therapies still enjoy vast popularity, especially in developing countries where most of the population does not have easy access to modern medicines and treatments. The traditional Indian system of medicine, Ayurveda, which means the science of life, is one of the world's oldest systems of medicines. Ayurveda mainly uses plant based formulas developed through the experimentation and many experiences done by the physicians.

The Apocynaceae family consists of about 250 genera and 2500 species of tropical trees, shrubs and vines. This family is known for plants that having very high biological activities and medicinal properties. The genus *Alstonia* finds a prominent place in different Indian systems of medicine for their pharmacological activities.^[2] The different ethnic communities in India have used different species of *Alstonia* in the treatment of various human ailments as they have proved their pharmacological activities.^[3] The important plants of genus *Alstonia* includes *Alstonia scholaris*, *Alstonia boonei*, *Alstonia congensis* and *Alstonia macrophylla* which have proved to be useful in various diseases.^[4] *Alstonia venenata* R.Br is an important ethnobotanical plant of the Apocynaceae family which is having many pharmacological activities. It is a tall evergreen shrub growing in warm climates is a member of the family Apocynaceae. It is a small sized about two meters high, evergreen tree, approximately ten to fifteen years old. It is about six to eight metres in height, spreading and flowering in summer and requires moist humus rich soil throughout. It is distributed throughout Peninsular India mainly seen in Northern Circars (Costal regions of Andhra Pradesh and Orissa), Hills of Ganjam & Godavari up to 2000 feet, in Western Ghats, Hills of Coimbatore, Nilgiris, sparsely distributed on the Ponmudi and Annamalai Hills, Pulneys and Hills of Thirunelveli up to 4000 feet.^[5] *Alstonia venenata* R.Br are highly effective in Snake bite, Ascaris, Blood impurity and Cough. They are mainly used as Anthelmintic, Antibacterial, Blood purifier, Stimulant, Aphrodisiac, and Tonic.^[6]

Habitat and distribution

General habitat

Moist deciduous and dry deciduous forests, often in forests clearings.

Distribution

Alstonia venenata R.Br. is a rare species mainly found in Maharashtra in Konkan area, Karnataka in the district of Chikmagalur, Mysore. In Kerala it is mostly found in Idukki, Kollam, Malappuram, Palakkad, Thiruvananthapuram, Thrissur, and Wyanad. In Tamil nadu it is mainly available in Coimbatore, Theni, Thirunelveli, Dindigul, Nilgiris, Kanyakumari, and Viluppuram.

Cyclicality

Flowering and fruiting in the month of February and August.^[7]

Climate and soil

Trees only flower after marked periods of dry weather. The species can be grown in a variety of climatic conditions in India, ranging from dry tropical to sub temperate. However, it blooms well in areas where annual rainfall is about 100–150 cm, as it prefers a fairly moist habitat. The species grows well in the red alluvial soil having proper aeration. It can bloom in black cotton soils as well, but the growth is slow due to prevailing moist soil conditions during rainy seasons.^[8]

Morphological characters

Bark

Bark of *Alstonia venenata* R.Br is highly medicinal values. Investigation into the constituents of the bark and fruits of this plant revealed that the major compounds present in the bark are venenatine, veneserpine, venoterpine, venalstonidine etc. Bark is light ash coloured to slate greyish in colour, hard, somewhat rough and lenticellate, exuding latex when ruptured.

Leaves

Whorls of 3-6, membranous, 10-20 by 2-4.5cm oblong to lanceolate, very finely acuminate, base much tapered; main nerves numerous, very close, parallel, slender, uniting in an intra- marginal nerve, midrib strong; petioles 1.3-2.3 cm long, but obscure owing to the decurrent leaf- blade.

Flowers

Flowers are white in colour, bisexual, regular, actinomorphic, hypogynous, pentamerous often racemose on the branches. Calyx small triangular, ovate gamosepalous; corolla funnel shaped, tube swollen at the top, corona hairy. Stamens are five in numbers, filaments very short, epipetalous and included in the corolla tube; disc of two ligulate glands alternating with carpels. Carpels two, semi apocarpous; fruit follicle three to five inches long, tapering at both ends. Seeds numerous, oblong with a tuft of hairs at both ends. (Plate - 3: 7).

Fruits

Fusiform, stalked and beaked follicles, tapering both ends.

Seed

Flat with tufts of hair in each ends.^[9]

Microscopic features

Midrib

The midrib has wide and short adaxial hump and broadly hemispherical abaxial part. About three or four layers of sub-epidermal cells are collenchymatous. Mainly it consists of several radial parallel lines of thick walled angular xylem elements.

Lamina

The leaf has even, smooth adaxial and abaxial surfaces with prominent midrib and lateral veins. Mesophyll consists of narrow zone of palisade cells and aerenchymatous spongy parenchyma cells. The spongy parenchyma cells present in them are lobed and interconnected with each other with wide air chambers. The later vein consists of a few vertical files of xylem elements and a small arc of phloem. The marginal part of the lamina is slightly curved abaxially and the margin is semicircular with palisade and spongy tissues in them.

Epidermal tissues

The adaxial epidermis is apostoamatic. The epidermal cells are slightly amoeboid in shape. The stomata are predominantly with two, equal or unequal subsidiary cells lying parallel to the guard cells.^[8]

Vernacular names

The plant is known by different vernacular names as ‘Poison devil tree’ (English) ‘Analivegam’ (Malayalam), ‘Addasarpa’ (Kannada), ‘Theepala’, ‘Anadana’, ‘Rajaadana’, ‘Visaghni’ (Sanskrit), ‘Palamunnipalai’, ‘Sinnappalai’ (Tamil), ‘Edaakula pala’ (Telugu).^[10]

Table: 1 Vernacular names of *Alstonia venenata*

Language	Vernacular names
English	Poison devil tree
Malayalam	Analivegam, Theepala, Kuttipala
Kannada	Adda sarpa
Sanskrit	Anadana, raja-adana, Vishagni
Tamil	Sinnappalai
Telugu	Edaakula pala

Synonyms

Alstonia venenata Var. Pubescens Monach

Blaberopus Venenatus (R.Br.) A.DC.

Echites venenatus Roxb.ex. A. Dc.^[7]



Figure: 1. *Alstonia venenata* leaves

Figure: 2. *Alstonia venenata* plant

Taxonomic classification

Taxonomical classification of *Alstonia venenata* is given in the Table 2.^[11]

Table: 2. Taxonomic classification of *Alstonia venenata*

Kingdom	Plantae
Division	Magnoliophyta
Class	Eudicots
Order	Gentianates
Family	Apocyanaceae
Sub family	Rauvolfioideae
Tribe	Plumeriae
Sub tribe	Alstoniiae
Genus	<i>Alstonia</i>
Species	<i>Alstonia venenata</i>
Binomial name	<i>Alstonia venenata</i> R.Br

Traditional uses

This medicinal plant is an inevitable ingredient in tri health Ayurvedic formulations for treating gastrointestinal ailments, neurological disorders, brain and nerve functions, joint pain etc. Stem bark, root bark, fruits and leaves of the plant are medicinally important. The riped fruits find used in the treatment of syphilis, insanity and epilepsy in Indian medicine.^[10]

Chemical constituents

The various species of *Alstonia* are highly rich in alkaloids, steroids, triterpenoids and phenolic compounds. Various alkaloids that have been reported in the *Alstonia venenata* R.Br. are minovincinine, 19-Epi(+)-echitoveniline, echitovenidine, echitoveniline, echitoserpidine, echitovenaldine, 11-methoxyechitoveniline, 11-methoxy echitovenidine, echitoserpine, alstovenine, 16-epialstovenine, venenatine, venoxidine, 16-epivenenatine, stigmasterol, reserpine, venenatine picrate, isovenenatine, kopsinine, venenatic acid, norvenenatic acid, venenatyl alcohol, tetrahydrovenenatine chloride, 7-chloro-7H-venenatine.^[12]

Phytochemistry

V.R.Mohan *et al.*, reported the presence of different chemical compounds such as alkaloids, terpenoids, steroids, coumarins, tannins, saponins, flavonoids, quinines, anthraquinones, phenols and glycosides were detected in *Alstonia venenata* R.Br. which could make the plant useful for treating different ailments as having a potential of providing useful drugs of human use.^[8] The components present in the ethanol extract of leaves of *Alstonia venenata* R.Br. were identified by using GC-MS analysis. The active principles with their retention time (RT), molecular formula, molecular weight (MW) and concentration (%) in the ethanol extract of leaves of *Alstonia venenata* R.Br. are measured. Twenty three compounds were identified in ethanol extracts of *Alstonia venenata* R.Br. leaf. The prevailing compounds were 3-0-methyl D glucose (87.64%), hexanedioic acid, bis (2-ethylhexyl) ester (1.87%), n-Hexadecanoic acid (1.70%), Vitamin E (1.70%), dl- glyceraldehyde dimer (0.26%), 2-butanone , 3- methoxy-3- methoxy-3-methyl (0.092%), glycerine (0.04%), 2-propenal (0.13%), 2-propen-1-ol (0.132%), thymine (0.09%), 2,4-dihydroxy-2,5-dimethyl-3(2H)- furan-3-one (traces), tetrahydropyran-Z-10-dodecenoate (0.13%), phenol,4-propyl- (0.70%), pentanoic acid, 2-hydroxy (0.04%), methyl β -D- arabinopyranoside (0.09%), myo-inositol,4-C- methyl (0.78%), Z-2-dodecenol (1.31%), didodecyl phthalate (0.22%), decanoic acid-2-methyl- (0.30%), 4-docecanol (0.26%), 1-cyclohexylnoene (1.48%), 1,2-benzenedicarboxylic acid, mono (2-ethylhexyl) ester (0.70%).^[13]

Bioactivity

Anti-epileptic activity

C.Pradeep kumar *et al.*, reported the ethanolic extract of *Alstonia venenata* R.Br. stem bark have anti-epileptic activity. It was subjected for phytochemical investigation and LD₅₀. It was found that ethanolic extract contained reducing sugars, proteins, amino acids, flavonoids, phenolic compounds and tannins. Phenolic compounds and flavonoids were responsible for anti-epileptic activities. Significantly (P< 0.05- 0.01) produced anti-epileptic effect in mice at 100mg/kg compared to 50mg/kg by oral administration by using the method pentylenetetrazole induced model. It was concluded that, the ethanolic extract of stem bark of *Alstonia venenata* R.Br. Possessed anti-epileptic activities. During acute toxicity study, no mortality was observed up to high dose of 1000mg/kg body weight. It was not possible to elucidate the actual mechanism through which *Alstonia venenata* R.Br. exerts its effects.^[14]

Anti-depressant activity

C. Pradeep Kumar *et al.*, subjected the ethanolic extract of *Alstonia venenata* R.Br. stem bark for phytochemical investigation and LD₅₀. It was found that ethanolic extract contained reducing sugars, proteins, amino acids, flavonoids, phenolic compounds and tannins. Phenolic compounds

and flavonoids were responsible for anti-depressant activities. The extract was tested for their lethal effect up to the dose level of 1000 mg/kg and no mortality was observed in mice. The administration of extract at doses of 50 mg/kg, 100 mg/kg, by oral administration, produced a significant ($P < 0.05-0.01$) anti-depressant effect in mice by tail suspension test and forced swim test of 50 mg/kg by oral administration.^[15]

Phytochemical screening and TLC profile

Thankamani V.I. *et al.*, studied the phytochemical analysis and has done the TLC profile of the fruits and flowers of *Alstonia venenata* R.Br. Phytochemical composition of fruits and flowers are determined in hexane, butanol, methanol and water extracts. The phytochemical analysis revealed the presence of secondary metabolites such as alkaloids, steroids, tannins, terpenoids, saponins, flavonoids and phenolic compounds. Methanolic extracts showed more phytoconstituents. TLC profile of hexane extracts of fruits and flowers were developed using anisaldehyde sulphuric acid or ceric sulphate (steroids or terpenoids) and Dragendroff's spray reagents (alkaloids). Petroleum ether: Chloroform: Methanol (5: 4.5: 0.5) showed good resolution for the hexane extracts of fruit and flower when treated with Dragendroff's spray reagent. Petroleum ether: Chloroform (1:1) was best for the hexane extracts of flowers and fruits when sprayed with ceric sulphate spray reagent.^[15]

Anti-fungal activity

T. Vaidyanatha iyer *et al.*, reported the anti-fungal activity of *Alstonia venenata* R.Br. Various plant parts like leaves, stem-bark, root-bark, flowers and fruits were extracted with a variety of solvents ranging from non-polar to polar and screened for bioactivity. Butanol and methanol extracts of all the parts alone were selected for anti-fungal testing. The tested organisms included human pathogens and laboratory contaminants or opportunistic fungi. They were *Penicillium marniffi*, *Cryptococcus* sp., *Candida* sp., *Epidermophyton* sp., *Microsporum* sp., *Fusarium* sp., *Penicillium* sp., *Aspergillus flavus*, *Aspergillus niger* and *Rhizopus* sp. Different concentrations of the extracts dissolved in DMSO were incorporated in Sabouraud Dextrose Agar (SDA) and a final concentration of 50 mg, 100 mg and 125 mg per ml of SDA was obtained for testing. The drug control used was Imidazole at a concentration of 100 µg/ml of SDA. Butanol extracts of stem and root bark inhibited all the tested strains of fungi at a concentration of 50 mg and 100 mg respectively. Methanol extract of stem bark and root bark either showed complete or partial inhibition at a concentration of 125 mg/ml. Butanol and methanol extracts of fruits, flowers and leaves showed complete or partial inhibition of most of the fungi tested at 125 mg/ml concentration. Anti-fungal activity of the fruits and flowers of *Alstonia venenata* R.Br. are reported for the first time.^[16]

Anti-bacterial activity

V. Thankamani *et al.*, reported the antimicrobial efficacy of butanol and methanol solvent extracts. It was evaluated by agar well diffusion against selected pathogenic bacterial strains. Gram negative strains like *Pseudomonas aeruginosa*, *Proteus vulgaris*, *Escherichia coli*, *Klebsiella pneumonia*, *Salmonella enteric typhimurium*, *Salmonella typhi*, *Salmonella paratyphi A*, *Shigella sp.* were tested. Gram positive strains tested were *Micrococcus luteus* and *Staphylococcus aureus*. Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were determined using macro broth dilution method against clinical isolate of *Staphylococcus aureus*. Streptomycin 0.125 mg/ml was used as positive control and Dimethyl sulfoxide (DMSO) as the solvent control. Butanol and methanol extracts of all the plant parts are highly effective against Gram positive strains and show moderate inhibition against Gram negative strains. Stem bark and root bark butanol were the most effective fractions followed by fruits, flowers and leaves extracts. The inhibition zones of *Micrococcus luteus* and *Staphylococcus aureus* were 24-26 mm and 18-20 mm respectively. The observed zone size was equal to or greater than the positive control used. The MIC value for stem bark butanol and root bark butanol were 0.98 mg/ml and the MBC values were 7.8 mg/ml and 3.9 mg/ml respectively. For fruits, flowers and leaves butanol the MIC values were 15.6, 31.25 and 125 mg. The extracts were highly active against Gram positive strains than Gram negative strains. The butanol extracts were the most active fraction followed by the methanol extracts. Highest activity was observed for root bark and stem bark followed by fruits, flowers and leaves extracts.^[17]

Anti-cancer activity

Abdul Malik V.M *et al.*, reported that the ethanolic extract of *Alstonia venenata* R.Br. (Poison devil tree) leaves have anti-cancer activity. *In vitro* cytotoxicity analysis of the leaf extract on DLA cells, EAC cells and the Normal splenocytes were studied. Tumour bearing animals treated with lower dose of 100 mg/kg, 250 mg/kg and higher dose of 500 mg/kg individually, showed a significant increase in survival. The average life spans of animals treated with plant leaf Extract was observed for 100 mg dose 16.37 ± 4.60 days, 250 mg dose 20.62 ± 5.42 & 500 mg dose 23.12 ± 5.56 days. Finally, the change in body weights of the animals suggested the tumor growth inhibiting property. The percentage increase in life span of the treated animals was found to be 30.79% for high dose (500 mg) when compared to untreated control.^[18]

CONCLUSION

One of the valuable gifts the nature can provides to human health is medicinal plants. The plant

Alstonia venenata R.Br. has many medicinal properties which are revealed in the literature surveys. As it is one of the rare medicinally used plants, its pharmacological action is yet to be explored which will be a promising development of a drug in the future.

ACKNOWLEDGEMENT

The author thank to Department of Pharmacology, Devaki Amma Memorial College of Pharmacy, Malappuram for the survey of review literatures.

REFERENCES

1. https://www.nhp.gov.in/introduction-and-importance-of-medicinal-plants-and-herbs_mtl.
2. Kalaria Pankti, Gheewala Payal, Chakraborty Manodeep, Kamath Jagadish. A Phytopharmacological review on *Alstonia scholaris*: A panoramic herbal medicine. International Journal of Research and Ayurveda Pharmacy. 2012;3(3):367-371.
3. Sutha S, Kalpana Devi V, Mohan V.R. GC-MS determination of bioactive components of *Alstonia venenata* R.Br. Research Journal of Pharmaceutical, Biological and Chemical sciences. 2012;3(2)291-296.
4. Kumar Pratyush, Chandra Sekhar Misra, Joel James, Lipin Dev M.S., Arun Kumarthaliyil veettil, Thankamani V. Ethnobotanical and Pharmacological study of *Alstonia* (Apocynaceae)- A review. Journal of Pharmaceutical Sciences and Research. 2011;3(8):1394-1403.
5. Thomas S.K, George R.E., Kunjumon M, Thankamani V.I. Phytochemical screening and TLC profile of fruits and flowers of *Alstonia venenata* R.Br. International Journal of Pharmaceutical Sciences and Drug research. 2016;8(2):117-120.
6. <https://herbpathy.com/uses-and-benefits-of-Alstonia-venenata-cid4818>.
7. <https://indiabiodiversity.org/species/show/261048>.
8. S. Sutha, V. KalpanaDevi, P.Tresina Soris, A.Maruthupandian, V.R.Mohan. Pharmacognostical studies on *Alstonia venenata* R.Br.-an ethnomedicinal plant. International Journal of PharmTech Research.2011;3(3):1697-1704.
9. Shodhganga.inflibnet.ac.in/bitstream/10603/145271/0/09_chapter%205.pdf.
10. <https://www.flowers of India.net/catalog/slides/poison%20devil%20tree.html>.
11. https://en.m.wikipedia.org/wiki/Alstonia_venenata.
12. Govindachari T.R, Viswanathan N, Pai B.R, Savitri T.S. Chemical constituents of *Alstonia venenata* R.Br. Tetrahedron. 1965;21(10):2951-6.

13. Sutha S, Kalpana Devi V, Mohan V.R. GC-MS determination of bioactive components of *Alstonia venenata* R.Br. Research Journal of Pharmaceutical, Biological and Chemical sciences. 2012;3(2):291-296.
14. C. Pradeep Kumar, T.Sravanthi, Dr. Vijaya Kuchana, C.H. Maheswara Reddy. Pharmacological screening for antiepileptic activity of *Alstonia venenata* R.Br. stem bark extracts In-vivo methods. International Journal of Current Trends in Pharmaceutical Research. 2015;3(1):733-738.
15. C.Pradeep Kumar, T.Sravanthi, Dr.Vijaya Kuchana, C.H.Maheswara Reddy. Anti-Depressant activity of *Alstonia venenata* R.Br.stem bark extracts in In-vivo methods. Journal of Pharmaceutical and Biomedical Analysis Letters. 2015;3(1):218-223.
16. K. Thomas, M. Kunjumon, R.E. George, T. Vaidyanatha Iyer. A comparative study of antifungal activity of *Alstonia venenata* R.Br.International Journal of Pharmaceutical sciences and Research.2015;6(4):1741-1745.
17. Shirly K. Thomas, Roshin Elizabeth George, Manesh Kunjumon, V. Thankamani. In-vitro antibacterial profile of *Alstonia venenata* R.Br.-a comparative study. International Journal of Current Pharmaceutical Research.2015;7(4):86-88.
18. Abdul Malick VM, Karunakar Hedge. Evaluation of anti-cancer activity of the extract of *Alstonia venenata* (Poison devil tree) leaves. International Journal of Pharma and Chemical Research. 2018;4(2):125-130.

AJPTR is

- Peer-reviewed
- bimonthly
- Rapid publication

Submit your manuscript at: editor@ajptr.com

