Comprehensive Review on Pharmacological Profile of *Alangium salvifolium*: A Medicinal Plant

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Abstract

Now a day’s world population moves towards herbal remedies for treatment of various ailments. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions. In India, medicinal plants are widely used by people as folk remedies and pharmaceutical preparations. *Alangium salvifolium* is a deciduous shrub belongs to family Alangiaceae with a long history of traditional medicinal uses in many countries, especially in India, China and Phillipines. The herb exhibits a broad range of therapeutic effects as an effective natural remedy for rheumatism, leprosy, hemorrhoid, burning sensation, constipation and antidote for several poisons. A wide range of chemical compounds including alkaloids, steroids, terpenoids, flavonoids, and saponins have been isolated from the species. Its extracts have been found to possess various pharmacological activities. In this paper, we give a comprehensive review of its habitat, taxonomy, distribution, identification ethnomedical uses, chemical constituents, and pharmacological profile of this medicinal plant.

Keywords: *Alangium salvifolium*, Pharmacological profile, Chemical constituents

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1 Introduction

Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions, and to defend against attack from predators such as insects, fungi and herbivorous mammals. The use of plants as medicine predates written human history. *Alangium salvifolium* belongs to genus *Alangium*, family Alangiaceae. This family consists of twenty-two species out of which *Alangium salvifolium* is mainly used as medicine in India, China and Phillipines. It is a deciduous rambling shrub or tall thorny tree and commonly known as Sage Leaved Alangium, stone mango, hill sack tree and ancolah.

*Alangium salvifolium* is the most versatile medicinal plants having a wide spectrum of biological activity. *Alangium salvifolium* showed potent antidiabetic, anticancer, diuretic, anti-inflammatory, antimicrobial, laxative, astringent, emollient, anthelmintic and antiepileptic activities. The plant was also reported for its anti fungal activity, anti microbial activity, cardiac activity and anti fertility activity.

In Ayurveda almost all parts of the tree use for medicinal purposes. The roots and the fruits are used for the treatment of rheumatism, leprosy and hemorrhoid. Externally, it is used for the treatment of bites by rabbits, rats, and dogs. Root bark is an antidote for several poisons. Fruits are sweet, cooling and purgative and used as a poultice for treating burning sensation and haemorrhage. However, there were not enough scientific investigations on the anti-inflammatory and analgesic activities conferred to these plants.

2 Taxonomical classification of *Alangium salvifolium*

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3 Vernacular Name of Alangium salvifolium

Hindi : Aankol, akola, Ankol
Kannada : Ankolemara, ankota, ankotha
Malayalam : Alinnil, angolam, ankolam
Marathi : Akel, akola, ankol
Sanskrit : Ankolah, ankolla
Telugu : Ankolamu, urgu, uru
Urdu : Ankula

4 Geographical Distribution of Alangium salvifolium

It is native to tropical Australia, Madagascar, Western Africa Southern and western Pacific Ocean islands Eastern Asia (China, Malaysia, Indonesia, India, and Philippines) and New Caledonia. In India, it is found throughout the Hyderabad forests and Sitamata wildlife sanctuary, Dhaka, Rajasthan, Chittoor district of Andhra Pradesh like Tirupati, Talakona, Chandragiri and Aragonda.

5 Botanical description of Alangium salvifolium

Alangium salvifolium is a deciduous shrub or small tree grows upto 3 to 10m height, with more or less spinescent branches and pale brown bark with rough surface and trunk with numerous holes. Leaves 7.6-15.2 cm long, alternate, simple, without stipules, narrowly oblong or ovate-lanceolate, glabrous, petiole up to 1.5 cm long, hairy. Flowers bisexual, regular, 5–10-merous, white, few in axillary fascicles. Fruits are small, nearly globular, purplish-red when ripe, crowned by persistent calyx-limb. The flowering season is February to June.

6 Chemical constituents of Alangium salvifolium

The Alangium salvifolium consist different phytoconstituents in different part of the plant was confirmed by TLC. Leaves, roots and seeds of Alangium salvifolium contain the alkaloids (like alangidiol, alangicine, alangimarcarnine, alamaridines, dimethyl aptaline, iso alamarin, alangimarinone, dimethyl phycotrine, ankorine, marckidin, marckine, tubulosine, alangicine, cephaeline, psychotrine), steroids (alangol, alengol), triterpenoids flavonoids, steroids, glycosides, tannins, oil and saponins. Plant (root, leaves and fruit) also consist monoterpenoid lactam, alangiside, loganic acid, venetopine, di-salsoline and isocepheline.

Leaves of Alangium salvifolium contain alkaloids, deoxytubulosine, alangimarcarnine, dehydrotrotoetemene etc. Three new phenolic glycosides, salvisofides A-C, and three known compounds salcin, kaempferol, and kaempferol 3-O-b-D-glucopyranoside were isolated from the leaves of Alangium salvifolium.

Root bark contains the alkaloids, emetine, cephaeline, psychotrine, tubulosine, isotubulosine alangium A, alangium B, marckidine, marckine, and alangine, and also myrcyl alcohol, de-Me-psychotrine, alangicin, stigmasterol and β-sitosterol. Stem bark contains the alkaloids, alangine, akharkantine, akoline and lamarkine.

Seed alkaloids include emetine, cephaeline, N-methylcephaeline, psychotrine, betuline, betulinaldehyde, lipoel, betulinic acid and β-sitosterol. Stigmasta- 5, 22, 25- trien-3β-ol, myristic acid, E-cis- fused neohopane derivatives, alangidiol and its isomer; N-benzoyl-L-Ph-alaninol, and 3 unidentified triterpenoids also isolated from the plant.

7 Medicinal properties of Alangium salvifolium

The leaves of Alangium salvifolium are used as astringent, laxative, refrigerant. It is used for the treatment of rheumatism, leprosy, gastric ulcers, Wound healing, epilepsy, scabies, gonorrhea, jaundice, hepatitis, diabetes, syphilis and asthma. The root bark is used as purgative, astringent, anthelmintic, antipyretic, expectorant, anti-inflammatory, emetic, diaphoretic, anticancer, antimicrobial and antitumor agents. The root bark is used as astringent, laxative, refrigerant, emetic and anthphlegmatic agent, whereas the seeds are used in hemorrhage, leprosy. Stem is used in vomiting and diarrhea.

8 Pharmacological properties

Sakthidevi G et al (2014) investigated in vitro antioxidant activity of petroleum ether, benzene, ethyl acetate, methanol and ethanol extracts of leaf of Alangium salvifolium using various antioxidant model system viz, DPPH, hydroxyl, superoxide, ABTS and reducing power. The methanol extract of leaf showed potent DPPH, ABTS radical cation scavenging activities. Ethanol extract of leaf showed strong hydroxyl, superoxide radical scavenging activities. Methanol extract of Alangium salvifolium showed the highest reducing ability. This study indicated that the free radical scavenging potential of Alangium salvifolium which can be exploited for the treatment of various free radical mediated ailments.

Chander and Reddy (2014) evaluated Hepatoprotective Activity of ethanol extracts of Alangium salvifolium leaf on CCl4 induced Rats. Acute toxicity study was conducted in animals to identifying of LD50 value. The results indicated that leaves of Alangium salvifolium have potent hepatoprotective against CCl4.

Alangium salvifolium subjected for successive extraction with petroleum ether, chloroform, methanol using soxhlet apparatus and distilled water by maceration. The acute toxicity studies were carried out according to the ICH Guideline and anti-diabetic activity by Vogel’s screening model. The result revealed that the aqueous extract of Alangium salvifolium showed lowering of blood glucose level.24

Zahan R et al (2013) investigated the antinociceptive and anti-inflammatory activity of Alangium salvifolium (AS) flower in mice using tail immersion, acetic acid induced writhing and formalin induced licking test. Anti-inflammatory effects were evaluated using carrageenan and formalin induced paw edema in mice. The methanol extract of flower of AS followed by chloroform extract produced a significant inhibition of both phases of the formalin pain test in mice. All flowers extract of AS also produced a substantial inhibition (nearly 50%) of carrageenan and formalin induced paw edema. The different alkaloids and flavonoids found in the extract could be account for the antinociceptive and anti-inflammatory actions.25

Pandey RS (2012) investigated phytochemical screening and anthelmintic activity of Alangium salvifolium bark. Investigation revealed the presence of flavonoids, Saponins, phenols, bitter principles and steroids. Three different concentrations of crude extract of hexane, ethyl acetate, chloroform and methanol were tested against earthworms (Pheretima posthuma), which involved the evaluation of paralysis and death period of the worm. Methanol and chloroform extracts exhibited significant anthelmintic activity at highest concentration.26

Hepcy Kalarani D et al (2012) investigated the effect of ethanolic extracts of stem and leaves of Alangium Salviollium (EEAS) and Pavonia Zeylanica (EEPZ) on blood glucose level in normal and streptozotocin (STZ) induced diabetic rats. Oral administration of EEAS and EEPZ (400 and 800mg/kg body weight) resulted in a significant reduction in blood glucose level. The effect was compared with a standard drug Gilbenclamide. The results support the traditional usage of the plants of Alangium Salviollium and Pavonia zeylanica by ayurvedic physicians for the control of diabetes.27

Hepcy Kalarani D et al (2012) reported the antidiabetic, analgesic and anti-inflammatory effect of aqueous extracts of stem and leaves of Alangium salvifolium and Pavonia zeylanica. The antidiabetic activity was evaluated by measuring blood glucose level in normal and streptozotocin (STZ) induced diabetic rats, the acetic acid induced writhing and hot plate methods in mice were used to assess analgesic activity and Carrageenan induced paw edema in rats, which is an acute model used to assess antiinflammatory activity. The results support the traditional usage of the plants of by ayurvedic physicians for the control of diabetes, pain and inflammation.28

Prusty KB et al (2012) reported phytochemical constituents and hepatoprotective activity of methanol and aqueous extracts of leaves of Alangium salvifolium. Silymarin (20mg/Kg) was administered as hepatoprotective drug. After the acute toxicity studies the extracts were administered to experimental animals orally and Silymarin was administered as hepatoprotective drug. It has been observed that as the dose increases the protective capacity also increases.29

Tanwer et al (2012) verified Antibacterial activity of ethanolic extracts of different plant parts of Alangium salvifolium, Andrographis paniculata and Spilanthus acmella against E. coli, P. aeruginosa, S. aureus and antifungal activity against A. flavus, A. niger, A. fumigatus and Fusarium oxysporium. Alangium salvifolium root extract and S. acmella leaf extract showed highest antibacterial activity against E. coli and Staphylococcus aureus. Root and stem extracts of Alangium salvifolium recorded significant activity against all the test bacteria and fungi.30

Zahan et al (2012) investigated in vivo anxiolytic and CNS depressant activities of the methanol extract and its chloroform soluble fraction of flowers of Alangium salvifolium. CNS depressant activity was evaluated by using open field and hole cross tests. The results of the statistical analysis showed that the plant extract had significant dose dependent anxiolytic and CNS depressant activities.31

Zahan et al (2011) reported anticancer activity Crude extract and diethyl ether fractions of Alangium salvifolium flower in Ehrlich ascites carcinoma bearing mice. Studies revealed that the hemoglobin content was decreased in EAC treated mice whereas restoration to near normal level was observed in extract treated animals.32

Hepcy KD et al (2011) studied on the Hypoglycemic and Antidiabetic activity of Aqueous extract of stem and leaves of Alangium salvifolium in Alloxan induced diabetic rats and found reduction in blood glucose level in normal and alloxan induced diabetic rats.33

Sharma AK et al (2011) verified the traditional claims and evaluated the ethanol, and water extracts of Alangium salvifolium bark in organic solvents to screen the antidiabetic activity in alloxan induced diabetic rats. The results of biochemical estimation showed that the ethanol extract was most active in normalizing the blood serum parameters pertaining to liver function test, an attempt was also made to see that is there any correlation between the active extract and metformin significantly (P<0.01). The study results suggested that Alangium salvifolium bark possess potential anti-diabetic activity.34

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Sharma AK et al (2011) evaluated the pharmacological activities such as antidiabetic, antiepileptic, analgesic and anti-inflammatory activities in various organic extracts of Alangium salvifolium seeds. The chloroform, ethanol, and water extracts of Alangium salvifolium. It was observed that chloroform, ethanol, and aqueous extracts of Alangium salvifolium seeds are non-toxic at a fixed dose of 2000 mg/kg. Among all three extracts ethanol extracts exhibited significant antidiabetic, antiepileptic, analgesic and anti-inflammatory activities. The phytochemical analysis revealed the presence of alkaloids, glycosides, terpenoids, steroids and tannins. Phytochemical screening of Alangium salvifolium leaves extract were investigated by Saravanan D et al, (2011) and revealed the presence of alkaloids, flavonoids, steroids, glycosides and saponins. Extract have been demonstrated in treatment of epilepsy, jaundice and hepatitis.

Ahad HA et al (2011) performed phytochemical screening and studied anti-hyperglycaemic activities of Alangium salvifolium root extract in normal and alloxan induced diabetic rats. The extract gave positive tests for phytosterols, triterpenes, flavonoids, carbohydrates and alkaloids. The ethanolic extract of A. salvifolium was found to be nearly as potent as tolbutamide in decreasing the blood glucose levels in normal fasting rats. The extract showed significant decrease in blood glucose, when compared with tolbutamide. These data confirmed the hypoglycaemic and anti-hyperglycaemic effect of alcoholic extract of A. salvifolium root.

Sreekanth P et al (2011) documented anti ulcer effect of ethanolic extract of leaves of Alangium salvifolium on gastric lesion induced by ethanol in rats. From findings it concluded that the ethanolic extract of Alangium salvifolium has a significant anti ulcer activity at 400mg/kg and 800mg/kg dose. The results were comparable with that of standard and control groups.

Rajkumar and Kumar (2011) investigated the hypoglycemic activity of bark of Alangium salvifolium in Alloxan induced hyperglycemic rats by alloxan induced method. Significant reductions in the blood glucose levels were observed. The study revealed that bark extracts of Alangium salvifolium used as hypoglycemic drug.

Dahiya and Purkeyastha(2011) evaluated The antimicrobial activities of various solvent extracts of Alangium salvifolium and Piper longum against clinically proved multi-drug resistant bacteria by using agar well diffusion assay. The patterns of inhibition varied with the plant extract, the solvent used for extraction, and the organism tested. The highest antimicrobial potentials were observed for the hexane and acetone extracts of A. salvifolium and P. longum, displaying maximum inhibitory zone against Enterococcus sp. Acinetobacter sp. was susceptible only to hexane extract of A. salvifolium. However, aqueous extracts did not present any antibacterial activity. Phytochemical screening showed that all the extracts contain alkaloids and reducing sugars. Hexane and acetone extracts were separated using TLC and relative mobilities of bioactive components showing significant inhibitory zones against S. aureus MRSA and Enterococcus sp.

Mishra and Prasad (2011) investigated antidiabetic potential of methanol extract of fruits of Alangium salvifolium in glucose loaded animals and alloxan induced diabetic animals. In both the models Alangium salvifolium reduced the blood glucose level when compared to diabetic control group and exert a significant hypoglycemic and antidiabetic activity. The results revealed the presence of a significant antidiabetic potential of methanol extract of Alangium salvifolium in alloxan induced diabetic rats.

Parida NK et al (2010) evaluated neuropharmacological activities of the aqueous extract of Alangium salvifolium of stem bark extract in rat. The extract produced a significant prolongation of pentobarbital-induced sleeping time and reduced the spontaneous motor activity and exploratory behaviour. These results suggested that the extract contained an agent with neuropharmacological activity that may be sedative in nature.

Vineet C Jain et al (2010) evaluated the antimicrobial and antioxidant activity of the alcoholic and aqueous extracts of roots of Alangium salvifolium on Gram positive and Gram negative bacteria. The results of antimicrobial assays showed that all tested extract were active against all microbial species. The results of DPPH method showed 50% inhibition rate at the 120.48μg/ml and 135.14 μg/ml with alcoholic and aqueous extract, respectively. Nitric oxide scavenging inhibition showed 50% inhibition rate in alcoholic and aqueous extract. The overall results indicated that the roots extract have antimicrobial and potential free radical scavenging activity for treatment of diseases.

Chaudhari and Somwanshi (2010) studied Methylene Blue adsorption from an aqueous solution on to Alangium salvifolium Tree Bark (ASTB) using the batch adsorption method. Adsorption isotherm (Langmuir and Freundlich) and kinetics model were studied. The adsorption capacity of ASTB was found to increasing with in temperature. Thermodynamics parameters such as DG, DH and DS for adsorption were evaluated.

Balakrishna N et al (2010) investigated the anticonvulsant effect of the aqueous and ethanol extracts of the leaves of Alangium salvifolium on maximal electroshock induced seizures and Pentylene tetrazole induced seizures in mice. Both the extracts proved to have shows anticonvulsant effect.

Prathyusha and Subramanian (2010) studied the phytochemical analysis of fruits and seeds of Alangium salvifolium. The result of
phytochemical analysis showed the presence of alkaloids, flavonoids, phenols, steroids, glycosides, tannins, oils and fats, saponins and fatty acids. Absence of thiols, gums, mucilage and resins.46

Praveen kumar P et al (2010) evaluated the cardiac effects and anti diabetic activity of extracts derived from Flower extract of Alangium salvifolium. The extracts were screened for their effects on frog-heart in situ preparation. The extracts produced significant positive ionotropic and negative chronotropic actions on frog heart. The extraction of flowers of Alangium salvifolium exhibited anti diabetic principles.5

Saraswathy A et al (2010) performed Pharmacognostic studied on Root bark of Alangium salvifolium. Microscopic studies have shown stratified phellem, rhytidome, cluster crystals of calcium oxalate and uniseriate medullary rays in the root bark. Chloroform, ethyl acetate, ethanol extracts and alkaloid fraction revealed characteristic chromatographic patterns with presence of alkaloids in varying concentrations.46

Jubie S et al (2008) studied acute toxicity and anti-arthritic activity of stem barks of Alangium salvifolium in rats by Freunds adjuant arthritis model. All the extracts (petroleum ether, Ethyl acetate, chloroform, and methanol) have exhibited significant anti-arthritic activity.67

Rajamanickam et al (2008) investigated Diuretic activity of Alangium salvifolium. Benzene and ethyl acetate extracts of Alangium salvifolium were prepared by hot continuous extraction technique using soxhlet apparatus. The study involved determination of total urine volume and Na+, K+ and Cl concentration in urine. Frusemide was included as standard. Both the extracts exhibited significant diuretic activity. Ethyl acetate extract was found to be more active than benzene extracts.46

Wuthi-udomlert M et al (2002) investigated Antifungal activity against dermatomycotic organisms and its toxicity of Alangium salvifolium. The lyophilized powder extract (4.59%) of pulverized wood was tested for its inhibitory effect by agar disc diffusion test. Using Buehler’s method, different amounts of extract were tested in five male New Zealand white rabbits. The results demonstrated the inhibitory effect of Alangium salvifolium subsp hexapetalum against fungi without any local toxicity.49

Anjum A et al (2002) reported that the Phytoconstituents such 1-methyl-1H pyrimidine-2,4-dione and 3-O-β-glucopyranosyl-24(β)-ethyl chalesta-5,22,25-triene isolated from the flowers of Alangium salvifolium showed remarkable antibacterial activity against gram positive and gram negative bacterial species.50

Murugan V et al (2000) reported Antifertility activity of the ethyl acetate, chloroform and aqueous extracts of stem bark of Alangium salvifolium in Swiss albino mice and Wister female rats. Results indicated that Alangium salvifolium produced mainly abortifacient activity and less anti implantation activity which showed that the herbal drugs may have anti-progesterone effects.51

9 Conclusion

The Alangium salvifolium is the most inexpensive plant and used to cure and prevent a lot of disease such as epilepsy, scabies, gonorrhea, jaundice, hepatitis, diabetes, syphilis and asthma. The manifold benefits of Alangium salvifolium made it a miracle plant of nature. Numerous studies have been conducted on different parts of Alangium salvifolium, but this plant has not yet developed as a drug by pharmaceutical industries. More research work can be done on plant so that a drug with multifarious effects will be available in the future market. Alangium salvifolium bioactive components can be further developed into naturally based cosmetic, externally used products and herbal drugs for treatment of dermatomycotic infections.

10 Conflict of interests

The authors declare that they have no competing interests.

11 Authors’ contributions

MR and RG carried out literature review and draft the manuscript. All authors read and approved the final manuscript.

12 References


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