INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

Review Article

Medicinal Properties and Phytoconstituents of *Alstonia Scholaris*: A Comprehensive Review

Dr. Pranay Soni*, Dr. Akhilesh Tiwari, Dr. Sunita Minz, Narendra Bankira, Aniket Kumar

Department of Pharmacy, Indira Gandhi National Tribal University, Amarkantak, Madhya Pradesh- 484887, India.

ARTICLE INFO
Published: 28 May 2025
Keywords:
Alstonia Scholaris, Ethnopharmacology, Folk Medicine
DOI:
10.5281/zenodo.15536345

ABSTRACT

Alstonia scholaris, commonly known as devil's tree, is an important medicinal plant in the various folk and traditional systems of medicine in Asia, Australia, and Africa. The floral part of A. scholaris is rich in volatile oils, however, alkaloidal contents are higher in the plants. These phytoconstituents produce biological activities including antioxidant, antibacterial, bronchodilator, hepatoprotective, anticancer, antidiabetic, antistress, antidiarrheal, antispasmodic, analgesic, anti-inflammatory, immune-stimulating effect, antitussive, anti-asthmatic, molluscicidal, and anticholinesterase activity. Almost all parts of the plant contain medicinal properties; decoction of A. scholaris leaves is used for treating beriberi, the bark is used for relieving asthma and pneumonia, latex is used for healing ulcers and sores, and roots and flowers exhibit potent antimicrobial activity. Therefore, this review aims to compile phytochemistry, ethnobotanical, and pharmacological uses of A. scholaris to provide a better scope for the use of this plant in pharmacologically related studies.

INTRODUCTION

Alstonia scholaris, commonly known as the Indian Devil Tree, is a striking evergreen that thrives in the tropical regions of Asia. It can reach towering heights, sometimes up to 100 meters, making it a true giant among Phyto-medicines are an integral part of present research to provide safe and effective therapeutic measures [1]. These medicines are the generations of practicing physicians of indigenous systems for over hundreds of years. The contribution made by traditional medicine to the modern system of medicine is worth noting [2]. Herbal medicines are in great demand throughout the world due to their

***Corresponding Author:** Dr. Pranay Soni
Address: *Department of Pharmacy, Indira Gandhi National Tribal University, Amarkantak, Madhya Pradesh- 484887, India.*
Email : psoniigntu@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

efficacy, safety, and fewer side effects. It is still mainstay in the rural areas for primary health care due to better cultural acceptability and better compatibility with an individual[2]. India has a vast treasure of herbal and natural resources since its origin. *A. scholaris* Linn (AS) is a medium-sized, traditionally important evergreen tree that belongs to the family Apocynaceae. It is a panoramic herbal medicine native to the Indian subcontinent and Southeast Asian countries[3]. It is native to China, India, Nepal, Pakistan, Bangladesh, Sri Lanka, Myanmar, Vietnam, New Guinea, and the Philippines. In India, it is especially present in West Bengal and the western coast forests of South India[4]. It is popularly called Saptaparni, Devil's tree, Dita bark tree, Blackboard tree, Milk-wood pine, and White cheese wood. *A. scholaris* wood has been used for school blackboards; due to this, the name given is ‘scholar's [5]. *A. scholaris* has several uses in the Indian system of medicine. It has been used since ancient times for the treatment of diarrhea and malaria[3]. Its bark contains several medicinal values and is used as a tonic, febrifuge, emmenagogue, and anticholinergic[5]. The decoction of the bark trunk in concentrated form is used as a gargle in dental caries and for washing in furunculosis and impetigo. *A. scholaris* is given to lactating mothers to increase lactation, improve post-delivery weakness, and act as a hepatoprotective and antipyretic. Ayurveda relies heavily on plant-based formulations created over centuries of medical trial and experience. *A. scholaris,* an Indian herb, has been studied for its potential cancer treatment benefits. Its seeds are rich in indole alkaloids, including venenatine, chlorogenine, reserpine, and chlorogenic acid. It is a rich source of alkaloids; about 180 alkaloids have been isolated from the plant. The leaves, having allelopathic properties, were found to be effective against the seedlings of the weed. Posse *A. scholaris has* potent antibacterial activity against gram-positive and gram-negative bacteria. The milky juice of *A. scholaris* helps in healing wounds, remedy for ulcers, and is mixed with oil to use in earache. The beautiful foliage and large canopy of this tree have made it a popular ornamental tree in warm and temperate regions such as Florida, Texas, and California. In Sanskrit, the plant is known as phalagaruda[4], sapthaparna, and saptaparni (sapta means 7 and parna or parni means leaves) due to its seven whorls of leaves[7]. Trees only bloom after extended periods of dry weather. The plant may thrive in a range of climates in India, from dry tropical to subtemperate. It thrives in locations with high annual rainfall (100-150 cm) and loves a damp environment. The species thrives on red alluvial soil with adequate aeration. It may blossom on black cotton soils; however, growth is sluggish owing to damp circumstances during the rainy season[8]. Screening natural products from plants can lead to the discovery of novel compounds with unique structures and high activity and selectivity[9].

Indian names

Bengali: Chattim, Hindi: Saptaparni, Shaitankajhar, Chitvan, Kannada: AeleleHaale, Bantale, Doddapala, Malayalam: Daivappala, Marathi: Satvin, Sanskrit: Saptaparna, Tamil: Ezilaipillai, mukumpalai Telugu: Daevasurippi, Gujrati: Satvana[10].

Synonyms

Echites scholaris, Alstonia kurzii, Acokanthera scholaris, and Echitespala[11].

Common names

Indian pulai, white cheesewood, devil tree, blackboard tree, milkwood pine, dita bark, and bitter bark[12].

1.1 Plant botany

A. scholaris is a medium-sized plant with a height maximum up to 40 m, bark is odorless, bitter, tessellated, corky grey, with abundant milky latex[13]. Leaves are elliptical or elliptical-lanceolate, present in whorls of 4-8 in the upper axis and tapering towards the base. The tip of the leaf is round, with the upper surface dark green and the lower surface green-white. *A. scholaris* flowers contain a high aroma, 7-10 mm long, white, hairy, and densely pubescent. Fruits are pendulous, spindle-shaped, two-lobed, brown or green, and contain numerous seeds. Seeds are oblong, with a ciliated margin and end with tufts of hairs. Ripe fruits are used in the treatment of syphilis and epilepsy[14].

1.2. Classification

Kingdom: Plantae Order: Gentianales Family: Apocynaceae Subtribe: Alstoniinae Genus: Alstonia Species: *Alstonia scholaris*

1.3. Traditional uses

The bark of A. scholaris is beneficial for malarial fevers, stomach ailments, dyspepsia, and skin illnesses. The bark has bitter, astringent, digestive, laxative, anthelmintic, antipyretic, stomachic, cardiotonic, and tonic properties. The bark extract has been shown to have antiplasmodial, immunostimulant, anticancer, and hepatoprotective properties. According to Ayurveda, soaking the plant bark in water overnight helps lower blood glucose levels following oral administration. Bark can also be used as a febrifuge, depurative, or galactagogue. It treats leprosy, skin illnesses, pruritus, chronic and nasty ulcers, asthma, bronchitis, agalactia, and debility. In folkloric medicine, milky juice is administered to wounds, ulcers, and rheumatic aches; combined with oil and poured into the ear, it cures ear discomfort. The leaves have long been utilized as folk medicines to cure a variety of ailments, including diarrhea, dysentery, malaria, and snake bites. In certain situations, the juice from the leaves works as a potent galactagogue. Leaves are used to treat beriberi, dropsy, and a clogged liver. Latex is used on sores, ulcers, tumors, and rheumatic swellings. The plant's mature fruits are used to treat syphilis and epilepsy. It is also used as a tonic, antiperiodic, and anthelmintic[15], [16].

(a) (b)

Fig 1:(a) Tree and (b) Flower of *A. scholaris*

2. Ethnic value

The traditional ethno-medicine plays an important role in discovering novel therapeutic compounds. *A. scholaris* has several folkloric uses. All parts of plants, including bark, roots, stems, leaves, and fruits, have been traditionally used to treat many diseases. Several ethnic groups of North-East India use the bark of *A. scholaris* for the treatment of disorders like bacterial infection, malarial fever, toothache, rheumatism, snake bite, dysentery, bowel syndrome, and asthma[17].

2.1. Phyto-constituents

The use of phytomedicines in current research to create safe and efficient treatment methods is essential. These medications are the result of generations of indigenous medical professionals who have been practicing for hundreds of years. It is noteworthy that traditional medicine has contributed to the current medical system. The effectiveness, safety, and reduced side effects of herbal medications have made them highly sought-after worldwide. Because it is more culturally acceptable and more suited to an individual, it continues to remain the standard for primary healthcare in rural regions. The chemical structure of phytoconstituents present in *A. scholaris* is shown in Figure 2. Researchers reported that the alkaloidal contents, corialstonine and corialstonidine, are effective against *P. falciparum*. Alistonitrine A, a new caged monoterpene indole alkaloid isolated [1], [3], [18]. An indole alkaloid from *A. scholaris* scholar sine H was synthesized by new skeleton-activating neural stem cells Five novel monoterpenoid indole alkaloids, Altoscholarisines A, E. A novel alkaloid called picrinine was extracted from *A. scholaris* leaves. Ursolic acid has also been reported to be present in AS, in contrast to alkaloids. This substance has several biological effects, including hepatoprotective, anti-inflammatory, hair-growth-stimulating, and anti-tumour properties. The bark of *A. scholaris* contains alkaloids, ditamine, echitenine, echicaoutchin, echicerin, echitin, and echitei One non-toxic natural product called Loganetin was isolated, which acts as an antibacterial agent for treating multidrug-resistant gram-negative infections[7], [19].

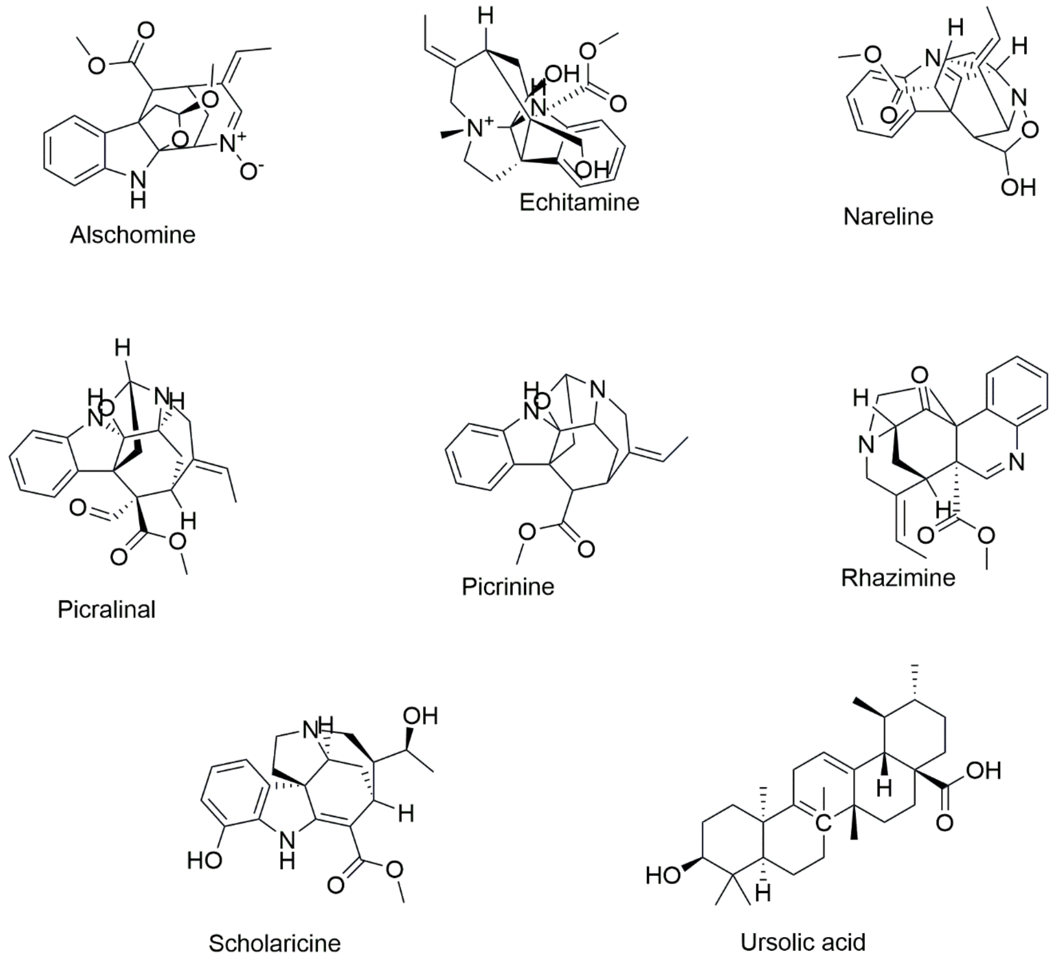

Fig 2: Main Phytoconstituents of *A. Scholaris*

3. Pharmacological activities

3.1 Anti-oxidant activity

Bark extract shows antioxidant properties in vitro. *A. scholaris* Leaf, follicle, and latex extracts demonstrated strong 2, 2-diphenyl-1-picrylhydrazyl (DPPH) free radical and superoxide anion scavenging abilities [13]. Antioxidants are substances that counteract the damaging effects of an excess of free radicals, reactive oxygen species, and nitric oxide. Natural antioxidants sourced from plants effectively reduce the risk of developing certain diseases, including cancer, heart disease, and stroke. *In vitro* studies have been conducted to investigate the antioxidant properties of *A. scholaris*. The methanolic extract derived from the flowers exhibited greater antioxidant activity compared to the fruit extract. The presence of phenolic and flavonoid compounds[20].

3.2 Antihypertensive activity

A. scholaris exhibits antihypertensive activity by non-selectively inhibiting the contraction brought on by Ca+2. This activity results from inhibiting IP3 synthesis or disrupting the sarcoplasmic reticulum's IP3R. Rats with spontaneous hypertension showed a notable reduction in blood pressure when given a methanolic extract of AS leaves. Additionally, it demonstrated a vasorelaxation effect on aortic rings that were already contracted[21], [22].

3.3 Antimicrobial activity

A. scholaris reported that methanolic extracts of the leaves, stem, and root barks of *A. scholaris* exhibited a broader spectrum of antibacterial activity. The butanoic extract of *A. scholaris* bark was found effective against *Mycobacterium tuberculosis* susceptibility. The methanolic root extract was also effective in reducing the growth rate of E. coli using the Monod kinetic model. The methanolic extract of *A. scholaris* revealed significant antimicrobial activity. The *A. scholaris* latex extract displayed potential antibacterial activity[23].

3.4 Antiviral activity

A. scholaris showed significant antiviral activity against Coxsackie virus B2, poliovirus, and herpes simplex virus. The antiviral assessment of As1 against Dengue type 2 (DENV2) and respiratory syncytial virus type A (RSV A) was conducted using a similar protocol. The cell cultures were kept for incubation for 2 days for RSV A and 3 days for DENV2 until over 50% of the cytopathic effect was observed. The cells exposed solely to the virus served as the control group. The anti-RSV antibody was obtained from Abcam (ab43812). The antibody targeting DENV2 NS3 was prepared internally[24], [25].

3.5 Antidiabetic activity

A. scholaris Bark possesses significant antidiabetic. It increases the utilization of glucose by peripheral tissue, improves the sensitivity of target tissues for insulin, and improves metabolic regulation of glucose. It exhibited a fall in serum triglyceride levels in STZ-induced diabetic rats to give hypolipidemic activity using oral glucose tolerance test (OGTT). The leaves and bark of *A. scholaris* have demonstrated potent anti-diabetic effects so far. *A. scholaris* leaf powder reliably reduces blood sugar levels in people with non-insulin-dependent diabetes mellitus and influences hypoglycemia. The powdered leaves of *A. scholaris* were observed to exhibit direct insulin-like and insulin-stimulating effects in individuals with non-insulin-dependent diabetes mellitus[26], [27].

3.6 Hepatoprotective activity

A.scholaris was found effective against carbon tetrachloride (CCl_4), beta-D-galactosamine, acetaminophen and ethanol induced hepatotoxicity*)* The extract showed a significant protective effect by lowering the increased serum levels of various biochemical parameters such as serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), serum alkaline phosphatase (ALP), and total serum bilirubin. The aqueous extract of *A. scholaris* bark was evaluated for its hepatoprotective potential against paracetamol and ethanol-induced liver toxicity in male rats. A. scholaris (L.) R. Br offers protection to multiple organs and demonstrates strong hepatoprotective effects[28]. Research has shown that extracts from different parts of Alstonia are effective in improving the function of hepatocytes. Numerous studies have highlighted the hepatoprotective capabilities of Alstonia. In experiments involving Swiss Albino rats, the hepatoprotective effects of *A. scholaris* were observed following liver damage induced by carbon tetrachloride (CCl4). The findings from the study indicated that the methanolic extract of *A. scholaris'* study depicted that the administration of ethanol and paracetamol caused severe liver damage in rats, which was proved by elevated serum aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), and total bilirubin levels. The extract administration mitigated the toxic effects of ethanol and paracetamol on the serum parameters in both preventive and curative models[29], [30].

3.7 Anticonvulsant and sedative activity

A. scholaris reported that the ethanolic extract of reported that the ethanolic extract of leaves exhibited anticonvulsant and sedative activity. leaves exhibited anticonvulsant and sedative activity. The ethanolic extract of *A. scholaris* leaves was tested for its anticonvulsant properties in rats subjected to maximal electroshock (MES), pentylenetetrazol (PTZ), and Isoniazid (INH). The ethanolic extract of *A. scholars* significantly diminished the extension phase and exhibited anticonvulsant effects in a dose-dependent manner, with the highest efficacy observed at 400 mg/kg[31] .The ethanolic extract of bark demonstrated antiepileptic effects in mice experiencing convulsions induced by PTZ, pilocarpine, and MES, significantly reducing the duration of tonic flexion and clonus in the test subjects. The ethanolic extract of leaves displayed dose-dependent antiepileptic activity in Wistar rats against convulsions induced by MES, PTZ, and strychnine. The onset of colonic convulsions was notably delayed in animals pretreated with the ethanolic extract (200 mg/kg and 400 mg/kg) compared to those given the standard drug diazepam [32], [33].

3.8. Analgesic, Antipyretic, and Anti-inflammatory Activity

A. scholaris reported that the methanolic extract of *A. scholaris* root showed analgesic activity. , found to possess both analgesic and antipyretic activity on the methanolic extract of flowers. The root bark of *A. scholaris* showed anti-inflammatory activity. reported that *A. scholaris* exhibited *an* anti-arthritic effect. The methanolic extract obtained from the bark of *A. scholaris* at a dosage of 400 mg/kg demonstrated notable anti-inflammatory effects comparable to indomethacin in models of carrageenan-induced acute pedal edema, cotton pellet-induced granuloma, and dextran-induced edema[34]. An investigation was conducted on the total alkaloids extracted from the leaves of *A. scholaris* for their anti-inflammatory effects in rats with lipopolysaccharide (LPS)-induced airway inflammation. The total alkaloids decreased the ratio of neutrophils, the overall white blood cell count, and the levels of albumin (ALB), alkaline phosphatase (AKP), and lactate dehydrogenase (LDH) in the bronchoalveolar lavage fluid (BALF) while elevating the concentration of ALB in serum[35]. Additionally, they enhanced superoxide dismutase (SOD) activity and nitric oxide (NO) levels in the lungs, serum, and BALF, while also reducing malondialdehyde (MDA) levels in the lungs. Furthermore, total alkaloids lowered the concentrations of inflammatory cytokines TNF-α and IL-8 in the BALF and lung tissue, which was corroborated by histological analysis showing less damage to the lung tissue[36], [37] .

3.9. Antidiarrheal activity

The ethanolic extract of *A. scholaris* bark exhibited antidiarrheal and cytotoxic activities It delayed the onset of diarrhea and decreased the frequency of defecation in mice at the dose of 250 mg/kg of body weight. The application of *A. scholaris* as an agent for treating diarrhea and dysentery is prevalent across the four nations in the lower Mekong basin. The bark and leaves of the plant were the most commonly referenced parts. Additional research from India, Indonesia, Papua New Guinea, and the Philippines has also documented the use of *A. scholaris* for managing diarrheal conditions .[38] In terms of its pharmacological attributes, a methanolic extract of *A. scholaris* demonstrated an antidiarrheal effect (a decrease in the frequency of defecation) in a mouse model of diarrhea induced by castor oil, and its spasmolytic properties were validated using an isolated rabbit jejunum preparation . Furthermore, the methanolic extract was evaluated for both acute and sub-acute toxicity, revealing liver damage (mild degeneration and centrilobular necrosis) after 28 days at doses of 500 and 1000 mg/kg, although toxicity was not observed after 14 days It has been previously suggested that the subacute toxicity could be attributed to the presence of echitamine[39], [40] .

3.10. Antifertility activity

One study showed that *A. scholaris* possesses an antifertility effect by significantly reducing the weights of the testes, epididymis, seminal vesicle, and ventral prostate. Gupta et al. have shown that the feeding of the bark extract for 60 consecutive days causes antifertility in rats. The extract selectively decreased the weight and protein content of the testes, epididymis, seminal vesicle and ventral prostate without affecting the total body weight. The sialic acid content of the testes, cauda epididymides, and ventral prostate, as well as the glycogen content of the testes and fructose content of the seminal vesicles, were also reduced, whereas the testicular cholesterol levels were significantly elevated [41]. A significant reduction in the sperm concentration, coupled with reduced sperm motility in the testes and cauda epididymides, was observed, further indicating that treatment of male rats with *A. scholaris* reduced fertility. Lupeol acetate, a component of *A. scholaris*, showed similar cellular, biochemical, and histological manifestations as those seen with the whole extract, suggesting that it could account for the antifertility properties of *A. scholaris*[42].

3.11. Radioprotective

The hydroethanolic extract of *A. scholaris* exhibits radioprotective effectiveness against hematological and biochemical alterations brought on by radiation. Compared to the irradiated controls, the animals that had been pretreated with *A. scholaris* extract exhibited noticeably greater hemoglobin and red blood cell counts. Additionally, *A. scholaris* shielded cultured human cells against bleomycin-induced chromosomal damage by preventing complete chromatid breaks at the G2 and G0 phases [43], [44].

3.12. Nematocidal activity

A. scholaris found in their study that the methanolic extract of *A. scholaris* possesses good nematocidal activity against the *Meloidogyne incognita* nematode. Experiments were conducted under controlled laboratory conditions at a temperature of 28 ± 2°C. Fresh egg masses obtained from a stock culture maintained on tomato root tissues were placed in water to facilitate hatching. The larvae hatched after 48 hours from the egg masses that were incubated at 30°C and served as the test species for studies on larval mortality. The movement of the nematodes was assessed by touching them with a needle. Stock solutions (30 mg/ml) of the various fractions and pure compounds were prepared. To evaluate the nematocidal effects of the different fractions and pure compounds, 100 freshly hatched second-stage juveniles were placed in 5 ml of tap water. Freshly hatched second-stage juveniles were utilized, while a control was maintained using distilled water with nematode[45], [46], [47] .

3.13. Antivenom Activity

Gosh et al. Examining the plant's ability to neutralize venom, he discovered that when the bark extract of *A. scholaris* was given to models of viper snake poisoning in Swiss albino mice, it dramatically decreased biochemical and histological alterations such as apoptosis, cytoplasmic vacuole formation, kidney tubule necrosis, and changes in liver cell size. Pain, swelling, hemorrhage, and necrotic damage at the bite site are local symptoms of snake poison envenomation, and aqueous *A. scholaris* extract at 200 mg/kg BW dramatically reduces these symptoms[48], [49], [50].

3.14. Anticancer activity

Preclinical evaluation of *A. scholaris* stem bark extract in Ehrlich ascites carcinoma transplanted in the Swiss albino mice exhibited anti-cancerous activity. The hexane extract of stem bark from *A. scholaris* showed anticancer activity, and it may be a novel drug for the treatment of lymphoma and leukemia.*)*. The hexane extracts also showed *in vitro* radical scavenging activity against DLA-cell-specific cytotoxicity and induced apoptosiDespite notable progress in discovering and developing new cancer treatments, cancer still ranks as the second leading cause of death globally. For many years, compounds derived from plants have emerged as a primary source of anticancer drugs, significantly contributing to cancer prevention and treatment due to their accessibility and comparatively lower toxicity than chemotherapy. The chemo preventive properties of bark extract from A. scholars (ASE) were assessed in Swiss albino mice subjected to skin tumorigenesis induced by 7, 12-dimethylbenz(a)anthracene (DMBA). This evaluation was conducted over a two-stage process of skin carcinogenesis, which began with a single application of DMBA (100 µg/100 µl acetone) followed by the application of croton oil (1% in 100 µl acetone) three times a week for three weeks, continuing until the experiment concluded (16 weeks). The control group, which did not receive ASE treatment, showed a greater incidence of tumors, tumor burden, tumor yield, and a higher cumulative number of papillomas compared to the experimental group, which received ASE treatment[51], [52].

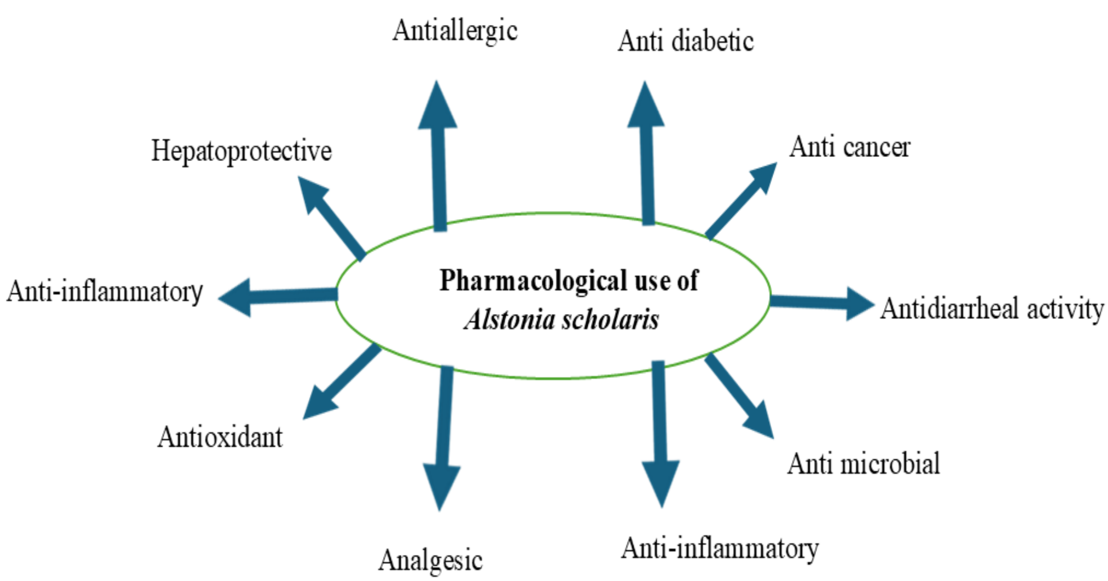

Fig 3: Pharmacological Properties of *A. Scholaris*

4. DISCUSSION

A. scholaris is a beautiful foliage tree with a large canopy, and because of this, it has become a popular ornamental tree in the landscape and gardens in the warm and temperate regions of Florida, Texas, and California in the United States. It grows in the lowland and mountain rainforests of India, Asia-Pacific, and China. *A. scholaris* used extensively in the preparation of several products like latex provides a good quality chewing gum, used as fuelwood spices for patina lands, bark and wood is suitable for paper production and manufacture of pencils, most important source of Pulai timber, its essential oil is used for making perfumes and wood charcoal is used for gun powder. Ayush-64, an antimalarial ayurvedic preparation, contains *A. scholaris*. The density of the wood is 270-490 kg/cubic m. The watering of plants is essential for proper growth, and deep mulch for young trees during the dry season. *A. scholaris* possesses several bio-control agents to kill soil-borne root pathogens[53]. *Alstonia scholaris* can be stored in closed tins for 2 months for germplasm management, maintaining a germination rate of 90%. Few pests may harm the nursery stock and young plantations of leaves, i.e., *A. scholaris* letonize and Parotia marginata. Termites and marine borers destroy the timber of *A. scholaris*, while lyctid borers damage the sapwood[54]. *A. scholaris* leaves have also been used as biosorbents for metal-bearing wastewater However, acid-treated leaves have more biosorption capacity than untreated leaves and base-treated treated. Therefore, this plant helps to absorb industrial effluents loaded with chromium [Cr (IV)] or other heavy metals, which are harmful to human consumption and various living organisms. The major sources of heavy metal toxicity is thorough steel industries, leather industries, metal finishing industry, and inorganic chemical production units. This industrial toxicity has a severe impact on the ecosystem[55]. *A. scholaris* is an effective weedicide herb against *Parthenium hysterophorus*, a well-known weed. This weed has several harmful impacts and acts as an allelopathic to the seeds and seedlings). *A. scholaris* serves as a host for foliar galls caused by *Pauropsylla tuberculata*, Craw. Gall formation results in anatomical and biochemical alterations in the host-plant tissues. It was confirmed by the increased activity of two foliar antioxidant enzymes i.e., catalase and peroxidase[56], [57], [58]. *A. scholaris* possesses anticholinesterase activity so it may be an alternative treatment for Alzheimer's disease . *A. scholaris* bark possesses a radio-protective potential.*)*.Ethanolic extract of *A. scholaris* possesses neuroleptic activity. Bio-guided fractionation of the ethanolic extract of *A. scholaris* leaves revealed antihyperglycemic activity relative to metformin and hepatoprotective activity relative to sill The dichloromethane extract of *A. scholaris* leaves yielded mixtures of erythroid, uviol, botulin, oleanolic acid, ursolic acid, β-amyrin acetate, α-amyrin acetate, β-sitosterol, stigmasterol, and chlorophyll . Bioguided isolation of AS leaves growing in Egypt revealed the presence of pentacyclic triterpenes such as botulin, botulinic acid, and ursolic acid from chloroform active subfraction; sitosterol and n-tetracosane as a major sterol and hydrocarbon fraction, respectively, from hexane extract. *Synthesized* histamine by *in vitro* biosynthesis from *A. scholaris* and offers an alternative source of echitamine without harming the natural plant population. Echitamine is a good source for targeting cancer and cell proliferation[59], [60], [61], [62].

5. CONCLUSION

The plant is of economic importance and medicinal value. *A. scholaris* has significantly contributed to health care and scientific studies. Phytochemicals obtained from *A. scholaris* have several biological activities. Different plants, such as the bark, stem, roots, and leaves, have been shown to have anticancer, antibacterial, and hepatoprotective properties. There is a need to isolate more potential constituents from *A. scholaris* to improve health facilities. It may lead to the discovery of new and effective drugs.

REFERENCES

1. X.-X. Zhu et al., "Alstonlarsines A–D, Four Rearranged Indole Alkaloids from Alstonia scholaris," Org. Lett., vol. 21, no. 5, pp. 1471–1474, Mar. 2019, doi: 10.1021/acs.orglett.9b00230.
2. R. Ghosh, K. Mana, and S. Sarkhel, "Ameliorating effect of Alstonia scholaris L. bark extract on histopathological changes following viper envenomation in animal models," Toxicology Reports, vol. 5, pp. 988–993, 2018, doi: 10.1016/j.toxrep.2018.10.004.
3. R. Guo, J.-H. Shang, R.-H. Ye, Y.-L. Zhao, and X.-D. Luo, "Pharmacological investigation of indole alkaloids from Alstonia scholaris against chronic glomerulonephritis," Phytomedicine, vol. 118, p. 154958, Sep. 2023, doi: 10.1016/j.phymed.2023.154958.
4. L. Jin, J. Yang, C. Liu, and M. He, "Complete plastome of the medicinally important plant, Alstonia scholaris (Apocynaceae)," Mitochondrial DNA Part B, vol. 4, no. 2, pp. 2896–2897, Jul. 2019, doi: 10.1080/23802359.2019.1660277.
5. M. S. Khyade, D. M. Kasote, and N. P. Vaikos, "Alstonia scholaris (L.) R. Br. and Alstonia macrophylla Wall. ex G. Don: A comparative review on traditional uses, phytochemistry and pharmacology," Journal of Ethnopharmacology, vol. 153, no. 1, pp. 1–18, Apr. 2014, doi: 10.1016/j.jep.2014.01.025.
6. A. N. Labaran et al., "Biosynthesis of copper nanoparticles using Alstonia scholaris leaves and its antimicrobial studies," Sci Rep, vol. 14, no. 1, p. 5589, Mar. 2024, doi: 10.1038/s41598-024-56052-y.
7. M. Ojha et al., "Anti-psoriatic potential of medicinal plants, Alstonia scholaris, Wrightia tinctoria, and Solanum xanthocarpum, using human HaCaT keratinocytes by multi-parametric analysis," Journal of Ethnopharmacology, vol. 334, p. 118596, Nov. 2024, doi: 10.1016/j.jep.2024.118596.
8. C.-M. Wang et al., "The Role of Pentacyclic Triterpenoids in the Allelopathic Effects of Alstonia scholaris," J Chem Ecol, vol. 40, no. 1, pp. 90–98, Jan. 2014, doi: 10.1007/s10886-013-0376-y.
9. P. Shetty, N. Supraja, M. Garud, and T. N. V. K. V. Prasad, "Synthesis, characterization and antimicrobial activity of Alstonia scholaris bark-extract-mediated silver nanoparticles," J Nanostruct Chem, vol. 4, no. 4, pp. 161–170, Dec. 2014, doi: 10.1007/s40097-014-0132-z.
10. S.-C. Lin, C.-C. Lin, Y.-H. Lin, S. Supriyatna, and S.-L. Pan, "The Protective Effect of Alstonia scholaris R. Br. on Hepatotoxin-induced Acute Liver Damage," Am. J. Chin. Med., vol. 24, no. 02, pp. 153–164, Jan. 1996, doi: 10.1142/S0192415X96000207.
11. C.-M. Wang, H.-T. Chen, Z.-Y. Wu, Y.-L. Jhan, C.-L. Shyu, and C.-H. Chou, "Antibacterial and Synergistic Activity of Pentacyclic Triterpenoids Isolated from Alstonia scholaris," Molecules, vol. 21, no. 2, p. 139, Jan. 2016, doi: 10.3390/molecules21020139.
12. Khyade, S. M, Vaikos, and P. N, "Phytochemical and antibacterial properties of leaves of Alstonia scholaris R. Br.," Afr. J. Biotechnol., vol. 8, no. 22, pp. 6434–6436, Nov. 2009, doi: 10.5897/AJB2009.000-9489.
13. Z. A. Rizvi et al., "Evaluation of Ayush-64 (a Polyherbal Formulation) and Its Ingredients in the Syrian Hamster Model for SARS-CoV-2 Infection Reveals the Preventative Potential of

Alstonia scholaris," Pharmaceuticals, vol. 16, no. 9, p. 1333, Sep. 2023, doi: 10.3390/ph16091333.
14. M. Rizwan, S. R. Gilani, A. I. Durrani, and S. Naseem, "Cellulose extraction of Alstonia scholaris: A comparative study on efficiency of different bleaching reagents for its isolation and characterization," International Journal of Biological Macromolecules, vol. 191, pp. 964–972, Nov. 2021, doi: 10.1016/j.ijbiomac.2021.09.155.
15. A. N. Labaran et al., "Biosynthesis of copper nanoparticles using Alstonia scholaris leaves and its antimicrobial studies," Sci Rep, vol. 14, no. 1, p. 5589, Mar. 2024, doi: 10.1038/s41598-024-56052-y.
16. Manjeshwar Shrinath Baliga, "Alstonia scholaris Linn R Br in the Treatment and Prevention of Cancer: Past, Present, and Future," Integr Cancer Ther, vol. 9, no. 3, pp. 261–269, Sep. 2010, doi: 10.1177/1534735410376068.
17. M. Gandhi and V. K. Vinayak, "Preliminary evaluation of extracts of Alstonia scholaris bark for in vivo antimalarial activity in mice," Journal of Ethnopharmacology, vol. 29, no. 1, pp. 51–57, Apr. 1990, doi: 10.1016/0378-8741(90)90097-D.
18. G. Zhan et al., "Alscholarines A and B, two rearranged monoterpene indole alkaloids from Alstonia scholaris," Org. Biomol. Chem., vol. 21, no. 40, pp. 8190–8196, 2023, doi: 10.1039/D3OB01424J.
19. H.-X. Zhou et al., "Total alkaloids from Alstonia scholaris inhibit influenza a virus replication and lung immunopathology by regulating the innate immune response," Phytomedicine, vol. 77, p. 153272, Oct. 2020, doi: 10.1016/j.phymed.2020.153272.
20. G. George, D. P. S, and A. T. Paul, "Development and validation of a new HPTLC-HRMS method for the quantification of a potent pancreatic lipase inhibitory lead Echitamine from Alstonia scholaris," Natural Product Research, vol. 35, no. 22, pp. 4680–4684, Nov. 2021, doi: 10.1080/14786419.2019.1705817.
21. G. Zhan et al., "Polycyclic pyrroloindoline-containing natural products with a unique 3-heptyl-2a,4a-diazapentaleno[1,6- ab]indene core isolated from Alstonia scholaris," Org. Biomol. Chem., vol. 22, no. 2, pp. 296–301, 2024, doi: 10.1039/D3OB01637D.
22. G. George, D. P. S, and A. T. Paul, "Development and validation of a new HPTLC-HRMS method for the quantification of a potent pancreatic lipase inhibitory lead Echitamine from Alstonia scholaris," Natural Product Research, vol. 35, no. 22, pp. 4680–4684, Nov. 2021, doi: 10.1080/14786419.2019.1705817.
23. R. Li et al., "Pharmacokinetics and safety evaluation in healthy Chinese volunteers of alkaloids from leaf of Alstonia scholaris: A multiple doses phase I clinical trial," Phytomedicine, vol. 61, p. 152828, Aug. 2019, doi: 10.1016/j.phymed.2019.152828.
24. X.-H. Cai et al., "A Cage-Monoterpene Indole Alkaloid from Alstonia scholaris," Org. Lett., vol. 10, no. 4, pp. 577–580, Feb. 2008, doi: 10.1021/ol702682h.
25. H. Chen et al., "Chromosome-level Alstonia scholaris genome unveils evolutionary insights into biosynthesis of monoterpenoid indole alkaloids," iScience, vol. 27, no. 5, p. 109599, May 2024, doi: 10.1016/j.isci.2024.109599.
26. B.-Y. Hu, Y.-L. Zhao, Y. Xu, X.-N. Wang, and X.-D. Luo, "New Lupanes from Alstonia scholaris Reducing Uric Acid Level," Planta Med, vol. 90, no. 01, pp. 38–46, Jan. 2024, doi: 10.1055/a-2186-3260.
27. C.-M. Wang et al., "The Role of Pentacyclic Triterpenoids in the Allelopathic Effects of Alstonia scholaris," J Chem Ecol, vol. 40, no.

1, pp. 90–98, Jan. 2014, doi: 10.1007/s10886-013-0376-y.
28. Manjeshwar Shrinath Baliga, “Alstonia scholaris Linn R Br in the Treatment and Prevention of Cancer: Past, Present, and Future,” Integr Cancer Ther, vol. 9, no. 3, pp. 261–269, Sep. 2010, doi: 10.1177/1534735410376068.
29. M. Ojha et al., “Anti-psoriatic potential of medicinal plants, Alstonia scholaris, Wrightia tinctoria, and Solanum xanthocarpum, using human HaCaT keratinocytes by multi-parametric analysis,” Journal of Ethnopharmacology, vol. 334, p. 118596, Nov. 2024, doi: 10.1016/j.jep.2024.118596.
30. Y.-L. Zhao et al., “Effect of total alkaloids from Alstonia scholaris on airway inflammation in rats,” Journal of Ethnopharmacology, vol. 178, pp. 258–265, Feb. 2016, doi: 10.1016/j.jep.2015.12.022.
31. S.-J. Lee et al., “Alstonia scholaris R. Br. Significantly Inhibits Retinoid-Induced Skin Irritation In Vitro and In Vivo,” Evidence-Based Complementary and Alternative Medicine, vol. 2012, pp. 1–11, 2012, doi: 10.1155/2012/190370.
32. Z.-P. Gou et al., “The safety and tolerability of alkaloids from Alstonia scholaris leaves in healthy Chinese volunteers: a single-centre, randomized, double-blind, placebo-controlled phase I clinical trial,” Pharmaceutical Biology, vol. 59, no. 1, pp. 482–491, Jan. 2021, doi: 10.1080/13880209.2021.1893349.
33. X. Tong et al., “Effects of total alkaloids from (L.) R. Br. on ovalbumin-induced asthma mice,” Journal of Ethnopharmacology, vol. 318, p. 116887, Jan. 2024, doi: 10.1016/j.jep.2023.116887.
34. M. M. Hussain, J. Mandal, and K. Bhattacharya, “Aerobiological, clinical, and immunobiochemical studies on Alstonia scholaris pollen from eastern India,” Environ Monit Assess, vol. 186, no. 1, pp. 457–467, Jan. 2014, doi: 10.1007/s10661-013-3390-1.
35. R. Guo, J.-H. Shang, R.-H. Ye, Y.-L. Zhao, and X.-D. Luo, “Pharmacological investigation of indole alkaloids from Alstonia scholaris against chronic glomerulonephritis,” Phytomedicine, vol. 118, p. 154958, Sep. 2023, doi: 10.1016/j.phymed.2023.154958.
36. R. Mahar, N. Manivel, S. Kanojiya, D. K. Mishra, and S. K. Shukla, “Assessment of Tissue Specific Distribution and Seasonal Variation of Alkaloids in Alstonia scholaris,” Metabolites, vol. 12, no. 7, p. 607, Jun. 2022, doi: 10.3390/metabo12070607.
37. X.-X. Zhu, Y.-Y. Fan, C.-Y. Zheng, H.-Y. Yang, K. Gao, and J.-M. Yue, “Alstolarsines A–E, Indoline Alkaloids with Two Different Carbon Skeletons from Alstonia scholaris,” J. Nat. Prod., vol. 88, no. 3, pp. 815–820, Mar. 2025, doi: 10.1021/acs.jnatprod.5c00027.
38. P.-Q. Wu et al., “Monoterpenoid indole alkaloids from Alstonia scholaris and their Toxoplasma gondii inhibitory activity,” Phytochemistry, vol. 220, p. 113993, Apr. 2024, doi: 10.1016/j.phytochem.2024.113993.
39. N. Kratena, M. Kaiser, K. Naumov, M. Waxmann, and P. Gaertner, “Bioinspired Synthesis of Alstoscholarinoids A and B,” JACS Au, vol. 5, no. 3, pp. 1076–1082, Mar. 2025, doi: 10.1021/jacsau.5c00102.
40. F. Bonvicini, M. Mandrone, F. Antognoni, F. Poli, and G. Angela Gentilomi, “Ethanolic extracts of Tinospora cordifolia and Alstonia scholaris show antimicrobial activity towards clinical isolates of methicillin-resistant and carbapenemase-producing bacteria,” Natural Product Research, vol. 28, no. 18, pp. 1438–1445, Sep. 2014, doi: 10.1080/14786419.2014.909421.
41. C.-M. Wang, S.-J. Tsai, Y.-L. Jhan, K.-L. Yeh, and C.-H. Chou, “Anti-Proliferative Activity of Triterpenoids and Sterols Isolated from

Alstonia scholaris against Non-Small-Cell Lung Carcinoma Cells," Molecules, vol. 22, no. 12, p. 2119, Dec. 2017, doi: 10.3390/molecules22122119.
42. C.-M. Wang, H.-T. Chen, Z.-Y. Wu, Y.-L. Jhan, C.-L. Shyu, and C.-H. Chou, "Antibacterial and Synergistic Activity of Pentacyclic Triterpenoids Isolated from Alstonia scholaris," Molecules, vol. 21, no. 2, p. 139, Jan. 2016, doi: 10.3390/molecules21020139.
43. H.-F. Yu et al., "Alstoscholarisine M, a 6,7-seco -vallesamine monoterpenoid indole alkaloid with antimicrobial activity from Alstonia scholaris," Org. Biomol. Chem., vol. 23, no. 18, pp. 4451–4456, 2025, doi: 10.1039/D5OB00420A.
44. M. M. Hussain, J. Mandal, and K. Bhattacharya, "Aerobiological, clinical, and immunobiochemical studies on Alstonia scholaris pollen from eastern India," Environ Monit Assess, vol. 186, no. 1, pp. 457–467, Jan. 2014, doi: 10.1007/s10661-013-3390-1.
45. X. Tong et al., "Effects of total alkaloids from (L.) R. Br. on ovalbumin-induced asthma mice," Journal of Ethnopharmacology, vol. 318, p. 116887, Jan. 2024, doi: 10.1016/j.jep.2023.116887.
46. P.-Q. Wu et al., "Monoterpenoid indole alkaloids from Alstonia scholaris and their Toxoplasma gondii inhibitory activity," Phytochemistry, vol. 220, p. 113993, Apr. 2024, doi: 10.1016/j.phytochem.2024.113993.
47. R. B. Indradi, M. Muhaimin, M. I. Barliana, and A. Khatib, "Potential Plant-Based New Antiplasmodial Agent Used in Papua Island, Indonesia," Plants, vol. 12, no. 9, p. 1813, Apr. 2023, doi: 10.3390/plants12091813.
48. H.-F. Yu et al., "Alstoscholarisine L, a novel caged monoterpenoid indole alkaloid with antifungal activity from Alstonia scholaris," Fitoterapia, vol. 180, p. 106341, Jan. 2025, doi: 10.1016/j.fitote.2024.106341.
49. S. Mitra et al., "Therapeutic potential of indole alkaloids in respiratory diseases: A comprehensive review," Phytomedicine, vol. 90, p. 153649, Sep. 2021, doi: 10.1016/j.phymed.2021.153649.
50. A. Diantini, R. M. Febriyanti, and J. Levita, "Efficacy and Safety of Add-On Plant-Based Drugs for COVID-19 Patients: A Review of the Randomized Control Trials," IDR, vol. Volume 16, pp. 3879–3891, Jun. 2023, doi: 10.2147/IDR.S417727.
51. A. Datta et al., "Allergen Immunotherapy Modulates Sensitivity of Treg Cells to Apoptosis in a Rat Model of Allergic Asthma," Immunotherapy, vol. 9, no. 15, pp. 1239–1251, Nov. 2017, doi: 10.2217/imt-2017-0038.
52. J.-H. Shang et al., "Pharmacological evaluation of Alstonia scholaris: Anti-inflammatory and analgesic effects," Journal of Ethnopharmacology, vol. 129, no. 2, pp. 174–181, May 2010, doi: 10.1016/j.jep.2010.02.011.
53. D. Mistry and M. Pithawala, "Protective effect of Alstonia scholaris Linn. R. Br. against Bleomycin induced chromosomal damage in cultured human lymphocytes, in vitro," Drug and Chemical Toxicology, vol. 41, no. 2, pp. 162–168, Apr. 2018, doi: 10.1080/01480545.2017.1329316.
54. B.-Y. Hu, Y.-L. Zhao, Y.-J. He, Y. Qin, and X.-D. Luo, "Undescribed indole lactones from Alstonia scholaris protecting hepatic cell damage," Phytochemistry, vol. 217, p. 113926, Jan. 2024, doi: 10.1016/j.phytochem.2023.113926.
55. H. Singh, R. Arora, S. Arora, and B. Singh, "Ameliorative potential of Alstonia scholaris (Linn.) R. Br. against chronic constriction injury-induced neuropathic pain in rats," BMC

Complement Altern Med, vol. 17, no. 1, p. 63, Dec. 2017, doi: 10.1186/s12906-017-1577-7.

56. F. Zhang et al., “Structurally diverse monoterpene indole alkaloids with vasorelaxant activities from the branches of Alstonia scholaris,” Phytochemistry, vol. 209, p. 113610, May 2023, doi: 10.1016/j.phytochem.2023.113610.
57. S.-C. Lin, C.-C. Lin, Y.-H. Lin, S. Supriyatna, and S.-L. Pan, “The Protective Effect of Alstonia scholaris R. Br. on Hepatotoxin-induced Acute Liver Damage,” Am. J. Chin. Med., vol. 24, no. 02, pp. 153–164, Jan. 1996, doi: 10.1142/S0192415X96000207.
58. A. K. Singh et al., “Environmental impacts of air pollution and its abatement by plant species: A comprehensive review,” Environ Sci Pollut Res, vol. 30, no. 33, pp. 79587–79616, Jun. 2023, doi: 10.1007/s11356-023-28164-x.
59. A. C. Narsa, C. Suhandi, J. Afidika, S. Ghaliya, K. M. Elamin, and N. Wathoni, “A Comprehensive Review of the Strategies to Reduce Retinoid‐Induced Skin Irritation in Topical Formulation,” Dermatology Research and Practice, vol. 2024, no. 1, p. 5551774, Jan. 2024, doi: 10.1155/2024/5551774.
60. J. D. Mason and S. M. Weinreb, “The Alstoscholarisine Alkaloids: Isolation, Structure Determination, Biogenesis, Biological Evaluation, and Synthesis,” in The Alkaloids: Chemistry and Biology, vol. 81, Elsevier, 2019, pp. 115–150. doi: 10.1016/bs.alkal.2018.09.001.
61. J.-H. Shang, X.-H. Cai, Y.-L. Zhao, T. Feng, and X.-D. Luo, “Pharmacological evaluation of Alstonia scholaris: Anti-tussive, anti-asthmatic and expectorant activities,” Journal of Ethnopharmacology, vol. 129, no. 3, pp. 293–298, Jun. 2010, doi: 10.1016/j.jep.2010.03.029.
62. U. Gupta, S. Jahan, R. Chaudhary, and Pradeep Kumar Goyal, “Amelioration of Radiation-induced Hematological and Biochemical Alterations by Alstonia scholaris (a Medicinal Plant) Extract,” Integr Cancer Ther, vol. 7, no. 3, pp. 155–161, Sep. 2008, doi: 10.1177/1534735408322850.

HOW TO CITE: Dr. Pranay Soni*, Dr. Akhilesh Tiwari, Dr. Sunita Minz, Narendra Bankira, Aniket Kumar, Medicinal Properties and Phytoconstituents of Alstonia Scholaris: A Comprehensive Review, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 5, 4566-4580. https://doi.org/10.5281/zenodo.15536345