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Medicinal Uses, Pharmacology and Phytochemistry of Achyranthes aspera

Abhinav Sharma[1], Mr. Abhishek Soni[2], Mr. Pradeep[3], Mr. Vineet Kapoor[4]
Student, Corresponding Author[1]
M.Pharm, PhD in Pharmaceutics, Dean School of Pharmacy[2]
Assistant Professor, M.Pharm in Pharmacology[3]
Assistant Professor, M.Pharm in Pharmaceutics[4]
abhinavsharma82005@gmail.com, abhisoni.phd@gmail.com
monu35908@gmail.com, vineetkapoor47@gmail.com
School of Pharmacy, Abhilashi University, Mandi, Himachal Pradesh, India

Abstract: *Herbs have served as a vital source of therapeutic agents since ancient times, forming the backbone of traditional medicine systems across the world, particularly within Ayurveda, Siddha, Unani, and other indigenous Indian health practices. These natural resources provide a rich reservoir of bioactive compounds that contribute to the prevention and treatment of various diseases with minimal side effects. The reliance on herbal remedies continues to grow due to their cultural acceptance, accessibility, and proven medicinal significance.*

Achyranthes aspera Linn., commonly known as "Chirchira" in Hindi, is one such highly valued medicinal plant that holds a prominent position in Indian ethnomedicine. It is an indigenous herb widely found in tropical and subtropical regions of India, typically thriving along roadsides, in waste lands, and in rural fields. Traditionally, different parts of the plant—such as roots, leaves, flowers, and seeds—have been utilized in diverse therapeutic formulations.

Chirchira is an essential ingredient in many age-old remedies due to its wide range of pharmacological properties, including anti-inflammatory, antimicrobial, antidiabetic, diuretic, and analgesic activities. It is popularly used in folk medicine for the treatment of ailments such as cough, asthma, fever, digestive disorders, skin diseases, and joint pain. Furthermore, its role in wound healing and immune enhancement has been recognized in various traditional practices.

The present work compiles and discusses the ethnopharmacognostic features, ethnopharmacological significance, traditional uses, and folk medicinal applications of Achyranthes aspera. By documenting and evaluating the medicinal attributes of this herb, the study aims to provide a scientific basis for its therapeutic potential. Such information will be valuable for researchers, herbal scientists, and pharmaceutical developers in exploring its efficacy, safety, and possible future utilization in modern drug development. Continued investigation of this traditional herb could lead to the discovery of novel bioactive compounds and contribute to advancements in natural healthcare solutions..

Keywords: *Herbs.*

I. INTRODUCTION

The ethnic and rural communities of India have preserved a rich heritage of traditional knowledge concerning the medicinal uses of plants found in their surrounding environment. This valuable information has been passed down orally from generation to generation and continues to play a significant role in the treatment of common diseases and health conditions. Among the various medicinal herbs utilized in Indigenous healthcare practices, *Achyranthes aspera* Linn., commonly known as Chirchira, holds a prominent place in Indian culture and folk medicine.

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Chirchira has been widely used in almost all major traditional medicinal systems of India, including Ayurveda, Unani, and Siddha. Since ancient times, tribal, rural, and aboriginal populations have relied on this herb to combat numerous disorders. Botanically, *Achyranthes aspera* Linn. is also known by several synonyms such as *A. canescens* R. Br., *A. argentea* Decne, *A. grandifolia* Moz, *A. obovata* Peter, and *A. repens* L., and it belongs to the family Amaranthaceae. Across the country, it is recognized by various vernacular names: Chirchita (Hindi), Apamarga (Sanskrit), Aghedi (Gujarati), Apang (Bengali), Nayuruvi (Tamil), and Kalalat (Malayalam). The plant typically grows as a widespread wasteland herb throughout India.

Throughout history, *Achyranthes aspera* has been esteemed as a potent medicinal plant, maintaining a reputable position in numerous traditional healing systems. According to Ayurvedic literature, the plant possesses multiple beneficial properties such as bitter and pungent taste, heating nature, and activities including laxative, stomachic, and carminative effects. It has been traditionally recommended for the management of vomiting, bronchitis, heart ailments, piles, itching, abdominal pain, ascites, dyspepsia, dysentery, blood disorders, and many other conditions (Bhandari, 1990; Dwivedi et al., 2007).

References to the herb can be found in classical manuscripts of both Ayurveda and Chinese medicine. Ayurveda identifies two major varieties of the plant—red and white. Sanskrit synonyms describe it as a plant with a rough flowered stalk. The ancient Ayurvedic texts ‘‘Nighantus’’ classify Chirchira as a purgative, stimulant, digestive aid, and a remedy for inflammatory disorders of internal organs, piles, skin ailments like itching, abdominal enlargement, and enlarged lymph nodes of the neck. Traditionally, Hindus have also used the plant ash to prepare caustic alkaline formulations. Its diuretic properties are well recognized by both Indian natives and early European physicians. Various parts of the herb are often incorporated into traditional prescriptions, either alone or in combination with other potent medicinal components (Agharkar, 1991).

Taxonomical classification:

Kingdom	Plantae
Sub kingdom	Tracheobjnota
Super division	Spermatophyte
Division	Mangoliophyta
Class	Manvgoliophsida
Sub class	Caryophyllidae
Order	Caryophyllales
Family	Amaranthaceae
Genus	Achyranthes
Species	Aspera

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Botanical description:

Latin	Achyranthes aspera
Sanskrit	Aghata
Hindi	Latjira, Chirchira
Gujarati	Safad Aghedo
Tamil	Shiru-kadaladi
Telugu	Uttaraene
Malayalam	Kadaladi
Punjabi	Kutri
Unani	Chirchitaa
Ayurvedic	Apaamaarga, Chirchitaa, Shikhari, Shaikharika
Persian	Khare-vazhun
Arabian	Atkumah
French	Achyranth a feuilles rudes, collant, gendarme
Spanish	Mosotillo, rabo de gato, rabo de chango, rabo de raton

Geographical source:

Achyranthes aspera is a highly adaptable species that commonly grows in diverse environmental conditions. It is predominantly found along roadsides, field boundaries, and in waste or disturbed areas, where it often behaves as a prolific weed. In India, the plant is widely distributed from plains to hilly regions, occurring up to an altitude of approximately 2100 meters, and is also naturally present in the South Andaman Islands. Beyond India, the species exhibits a broad global distribution. It is widely spread across regions of Baluchistan, Sri Lanka (formerly Ceylon), various parts of tropical Asia, as well as in Africa, Australia, and the Americas. Its ability to thrive in different climatic zones—from tropical to subtropical—highlights its strong ecological adaptability and abundant natural availability.

Morphology:

Achyranthes aspera L. (commonly known as Latjeera) is an erect or sometimes procumbent annual or perennial herb, generally reaching a height of 1–2 meters. The plant often develops a woody base as it matures. The stems are distinctly angular and ribbed, simple or branched from the base, occasionally tinged with a purplish colour. The branches may appear terete or quadrangular, and are finely striated and pubescent in texture. Leaves are thick and occur oppositely on the stem. They measure approximately 3.8–6.3 × 2.2–5.4 cm in size [9], and range in shape from ovate-elliptic to obovate-rounded. Both surfaces of the leaves are finely and softly pubescent. The leaf margins are entire, and the leaves are petiolate with petiole lengths varying between 6–20 mm. The flowers are small, greenish-white, and borne numerous on elongated axillary or terminal spikes that may extend up to 75 cm in length. The reproductive structures include persistent bracts and bracteoles. Seeds are sub-cylindrical, truncate at the apex, rounded at the base, and typically reddish-brown in colour.

Traditional uses:

Achyranthes aspera has been highly valued in traditional medicine for its diverse therapeutic benefits. The plant is commonly used in the treatment of respiratory ailments such as asthma and cough. It is described as pungent, antiphlegmatic, antiperiodic, diuretic, purgative, and laxative, making it beneficial for conditions including oedema, dropsy, piles, skin eruptions, and boils. A decoction prepared from the crushed whole plant is traditionally administered to individuals suffering from pneumonia.

The root infusion acts as a mild astringent and is recommended in bowel complaints. The flowering spikes and seeds, when ground into a paste with water, are applied externally to treat bites from venomous snakes and reptiles, and are also used for night blindness and various cutaneous diseases. In snakebite cases, the powdered root mixed with water is

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given orally to induce vomiting and revive the patient's consciousness.Inhaling fumes produced by burning a mixture of *Achyranthes aspera* and *Smilax ovalifolia* roots is traditionally believed to enhance appetite and alleviate digestive disorders. The plant is further utilized in the management of haemorrhoids. The leaves and seeds are considered emetic and are used in hydrophobia as well as for their carminative, phlegm-expelling, and swelling-resolving effects.
Additionally, *A. aspera* is traditionally employed to manage liver disorders, rheumatism, scabies, and other skin diseases, and it is believed to possess tranquillizing properties.

Pharmacognosy:
Chirchira (*Achyranthes aspera* Linn.) is an erect perennial herb, typically ranging from 0.3–1 meter in height. The plant bears stiff branches that are terete or distinctly quadrangular, striated, and covered with fine pubescence. The leaves are few in number, generally thick, elliptic to obovate in shape, petiolate, acute at the apex, and exhibit entire margins.
The inflorescences consist of numerous small flowers arranged in dense axillary heads or elongated spikes. The flowers are greenish-white, with persistent bracts and bracteoles that taper into sharp spines, which is a characteristic feature of the species.
The root system comprises a long, cylindrical primary root supported by secondary and tertiary roots. The roots are slightly ribbed, yellowish-brown in colour, with a faint odour and a slightly sweet, mucilaginous taste. The stem is yellowish-brown, erect, cylindrical, and hairy, commonly reaching about 60 cm in height. Seeds are sub-cylindrical, truncate at the apex, rounded at the base, smooth, black, and shining.
The species is widely distributed throughout India, often thriving as a common wasteland herb. It can be found growing at elevations up to 3000 feet.

Phytochemisty:
Achyranthes aspera is known to possess a diverse array of bioactive phytochemicals that contribute to its wide pharmacological spectrum. The plant is particularly rich in triterpenoid saponins, which are considered the major chemical constituents. These saponins are composed of oleanolic acid as the aglycone moiety and are commonly categorized as Saponins A, B, C, and D. These compounds are reported to exhibit significant biological activities including anti-inflammatory, antimicrobial, and hepatoprotective properties.
In addition to saponins, the plant contains several other important constituents such as ecdysterone (a phytoecdysteroid known for anabolic and adaptogenic effects), and various long-chain alcohols including 17-penta-triacontanol, 27-cyclohexyl heptaeosan-7-ol, and 16-hydroxy-26-methyl heptacosan-2-one. Another identified compound is 36,47-dihydroxy hen-pentacontan-4-one, which may further contribute to the plant's metabolic and therapeutic functions.

Pharmacological action:
Anti inflammatory:
The anti-inflammatory potential of *Achyranthes aspera* extracts was evaluated using the carrageenan-induced rat hind paw edema model, which is a well-established method for assessing acute inflammation. Experimental animals were randomly divided into five groups, with six rats in each group.
Group I served as the control and received 1% gum tragacanth suspension at a dose of 2 mL/kg body weight.
Group II was treated with Indomethacin (20 mg/kg) and considered as the standard reference drug.
Groups III, IV, and V were designated as test groups and administered different extracts of *Achyranthes aspera* — hexane, ethyl acetate, and ethanolic extracts respectively—each at a dose of 400 mg/kg body weight, delivered through intraperitoneal injection.
Following carrageenan administration, paw volume was measured at specific time intervals to assess and compare the percentage inhibition of edema among the control, standard, and test groups. This evaluation helped determine the extent of anti-inflammatory activity exhibited by the plant extracts.

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Anti depressant:

The extracts of *Achyranthes aspera* demonstrate significant central nervous system (CNS) depressant and anxiolytic effects, comparable to those of standard therapeutic agents. These activities are likely attributed to the presence of triterpenoid saponins, which are recognized as key bioactive phytochemicals in the plant. The combined CNS depressant, anxiolytic, and strong analgesic properties—also documented in our earlier studies—may act synergistically. Therefore, *Achyranthes aspera* may be effectively utilized in managing various painful and hyper-excitatory conditions.

Anti oxidant:

Achyranthes aspera, L. a member of Amaranthaceae family, a small herb of great economic importance in developing countries because of its several industrial and medicinal values. Roots of Achyranthes aspera was successively extracted with hexane, dichloromethane, ethyl acetate and methanol by Soxhlet extraction then concentrated to dryness in a rotary evaporator under reduced pressure at 40 ˚C. All the four fractions were screened for their antioxidant potential using various in vitro models such as total antioxidant capacity, 2, 2-Diphenyl-2-Picryl hydrazyl (DPPH) radical scavenging activity and reducing power assay at various concentrations. Total phenolic and flavonoid content were assessed by spectrophotometric methods. Among the four different fractions ethyl acetate fraction exhibited good scavenging activity and reducing power. Ethyl acetate fraction has highest total phenolic and flavonoid content (46.8 mg/g GAE) and (13.5 mg/g QE) respectively. Overall, the strong activity suggested that it could be advantageously used as a functional or nutraceutical food, to prevent oxidative-stress related diseases

Anti bacterial:

Achyranthes aspera Linn. (commonly known as *Prickly chaff flower*) belongs to the family **Amaranthaceae** and has a long history of use in traditional medicine. It is valued for its **pungent, antiphlegmatic, antiperiodic, diuretic, purgative, and laxative** properties. Traditionally, it is used to manage **oedema, dropsy, piles, skin boils and eruptions**. An **infusion of the whole plant** is consumed to relieve **pneumonia**, while a **root infusion** is taken as a mild astringent in **bowel complaints**. In cases of **jaundice**, the plant inflorescences are boiled, filtered, and administered orally. Additionally, a **root paste** prepared with water is applied to treat **ophthalmia** and **corneal opacities**.

Phytochemical investigations have revealed that the plant contains **triterpenoid saponins** with **olealonic acid** as aglycone, along with **alkaloids, sterols, and phenolic compounds**. The presence of a significant alkaloid **achyranthine**, various **amino acids** (including arginine, histidine, lysine, cystine, threonine, methionine, leucine, isoleucine, phenylalanine, tryptophan, and valine), diverse **sugars** (such as rhamnose, galactose, xylose, and glucose), **carbohydrates**, and a high amount of **potash** has been documented. The plant is also reported to contain **hormones, ecdysterone, and inokosterone**, which further contribute to its pharmacological significance.

Anti microbial:

Achyranthes aspera Linn. (family: *Amaranthaceae*) is a widely distributed herb throughout India and holds significant value in traditional and folk medicine. It has long been utilized for the management of **pneumonia** and **rheumatoid arthritis**, reflecting its notable anti-inflammatory and respiratory healing potential. In addition, various plant parts are employed in the treatment of **upper respiratory tract infections, urinary tract infections**, and a range of **sexually transmitted diseases** caused by bacterial and fungal pathogens. The broad spectrum of its traditional therapeutic applications indicates the presence of diverse bioactive constituents and supports its relevance in the development of novel herbal remedies.

Diuretic activity:

Achyranthes aspera Linn. (Aa), belonging to the family *Amaranthaceae*, is a perennial herb that typically grows to a height of about 0.3–0.9 meters. In Pakistan, it is popularly known by vernacular names such as **Pathkanda** and

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Khardar Guna. The seeds of the plant are sub-cylindrical in shape, tapering at the apex and rounded at the base, with a characteristic black and glossy appearance. The species thrives abundantly in **arid and desert regions of Pakistan,** making it easily accessible for traditional medicinal use.

Traditionally, the seeds of *A. aspera* are highly valued for their therapeutic properties and are widely used in the management of **respiratory ailments, gastrointestinal disturbances**, **skin infections,** and **urinary tract disorders**. Extensive phytochemical investigations have revealed the presence of several bioactive compounds including **saponins, oleanolic acid, essential amino acids, carbohydrates, proteins**, and **water-soluble bases** such as betaine. Moreover, **vitamin C**, **iron**, **calcium**, and **phosphorus** have also been reported as important nutritional constituents of the plant, further supporting its medicinal relevance.

Wound healing activity:

Achyranthes aspera has been reported to possess notable wound-healing activity. Comparative studies on the protein profiles of granulation tissues from burn, diabetic, and immunocompromised wounds have shown that treatment with a 5.0% (w/w) ointment containing the methanolic extract of the plant significantly enhances the healing process. These findings highlight the plant's potential in promoting tissue repair and regeneration.

Anti-snake venom activity:

The anti-snake venom potential of Achyranthes aspera has been experimentally substantiated through various in vivo and in vitro studies, lending strong scientific support to its traditional use in the treatment of poisonous bites. The plant is believed to exert its protective effects by neutralizing venom-induced toxicity, including haemolytic, haemorrhagic, and neurotoxic activities. This action is attributed to the presence of bioactive constituents such as alkaloids, saponins, and flavonoids, which may interfere with venom enzymes and inhibit their deleterious effects on cellular and systemic levels. These findings not only validate the ethnopharmacological significance of A. aspera but also highlight its potential as a natural adjunct or alternative in the development of anti-venom therapeutics.

Parts of Achyranthes aspera Used Medicinally

Part of Plant	Medicinal Use	Examples
Leaves	Possess anti-inflammatory, anti-dandruff, and wound-healing properties; also used in liver and skin disorders.	Dandruff, eczema, cuts, boils, hepatitis
Roots	Most commonly used part; known for antivenom, diuretic, and purgative actions.	Snake bites, scorpion stings, dropsy, renal disorders, constipation
Seeds	Used for reproductive, digestive, and urinary issues.	Asthma, piles, gonorrhoea, dysentery
Whole plant	Exhibits antimicrobial, antifungal, and antipyretic activities; used in polyherbal formulations.	Fever, cough, asthma, infections
Stem	Less commonly used; shows analgesic and anti-inflammatory potential.	Joint pain, body aches
Flowers	Sometimes used for mild expectorant and diuretic pro	Cough, urinary disorders

II. CONCLUSION

Achyranthes aspera Linn., commonly known as Apamarga, is an abundantly distributed medicinal herb that occupies an important place in traditional systems of medicine such as Ayurveda, Siddha, and Unani. The plant has been extensively utilized across India and other tropical regions for the treatment of a wide range of ailments including asthma, cough, piles, skin disorders, liver complaints, and snake bites. Its wide therapeutic applicability has stimulated

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considerable pharmacological and phytochemical research, confirming its rich composition of bioactive secondary metabolites such as alkaloids, flavonoids, saponins, tannins, terpenoids, steroids, and glycosides. Scientific investigations have validated many of its ethnomedicinal claims, revealing A. aspera to possess diverse pharmacological activities — antimicrobial, antifungal, anti-inflammatory, antioxidant, anticancer, antiasthmatic, hepatoprotective, nephroprotective, diuretic, wound healing, and antilithiatic among others. The plant's extracts have demonstrated significant efficacy in inhibiting bacterial and fungal growth, reducing inflammation, preventing tumor formation, and protecting against toxic injuries in vital organs. Its use in formulations for conditions such as bronchial asthma, hepatitis, and skin diseases further emphasizes its clinical relevance. Moreover, the presence of essential fatty acids, trace elements, and high protein content suggests potential nutritional and nutraceutical applications. Despite this broad pharmacological potential, current research on A. aspera remains largely preclinical. There is a need for advanced investigations focusing on the isolation and structural characterization of active compounds, elucidation of their mechanisms of action, and evaluation through in vivo and clinical studies. Standardization of extraction processes, dosage formulation, and toxicity profiling must also be prioritized to ensure reproducibility and safety. In conclusion, Achyranthes aspera stands as a potent medicinal resource bridging traditional wisdom and modern pharmacological science. Its versatile therapeutic potential, supported by both ethnobotanical evidence and experimental validation, positions it as a promising candidate for future drug discovery and development. Continued interdisciplinary research combining phytochemistry, pharmacology, and biotechnology could unlock new dimensions of its medicinal value and contribute significantly to the advancement of plant-based therapeutics.

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