

Biological Activity of *Achyranthes Aspera* Linn. - A Review

¹Dibya Jyoti Deka, ²Reshi joshi ¹STUDENT OF B.PHARMA 4th yr,

¹Department of Pharmacy,

¹MEWAR UNIVERSITY, Chittaurgarh , India

ABSTRACT :

Achyranthes aspera L. (Amaranthaceae) has long been used in different systems of medicine in the treatment of cancer, leprosy, asthma, fistula, piles, arthritis, wound, insect and snake bite, dandruff, hepatitis, renal disorders, dermatological disorders, gynecological disorders, gonorrhoea, malaria, fever, cough, diabetes, pyorrhea, dysentery, ophthalmia, rabies, hysteria, toothache etc. The plant has been used as antimicrobial, larvicidal, antifertility, immunostimulant, hypoglycemic, hypolipidemic, anti-inflammatory, antioxidant, diuretic, cardiac stimulant, antihypertensive, anti-anasacra, analgesic, antipyretic, antinoiceptive, prothyroidic, antispasmodic and hepatoprotective. The current review deals with the enormous amount of scientific research and reports available in different aspects of this plant involving phytochemistry and pharmacology. This review also includes reports on morphology, anatomy, ecology, plant pathology, tissue culture, chromosome study and medicinal uses of the plant.

Keywords : *Achyranthes Aspera* (history and origin , common names of *Achyranthes Aspera*), Botanical Description , Phytochemistry, Pharmacology, Herbal Medicine, Human Disease , Conclusion , Reference .

INTRODUCTION :

The Plants have been used in traditional medicine for several thousand years. The use of traditional medicine in most developing countries is a normative basis for the maintenance of good health. The plant kingdom has been the best source of remedies for curing a variety of disease and pain. This is why medicinal plant has played a key role in the world wide maintenance of health. Current advancements in drug discovery technology and search for novel chemical diversity have intensified the efforts for exploring leads from Ayurveda the traditional system of medicine in India. World Health Organization has made an attempt to identify all medicinal plants used globally and listed more than 20,000 species [1]. According to the WHO more than 80 % of the world's population relies on traditional herbal medicine for their primary health care [2]. Medicinal plants have been used as an exemplary source for centuries as an alternative remedy for treating human diseases because they contain numerous active constituents of immense therapeutic value. In the present era of drug development and discovery of newer drug molecules many plant products are evaluated on the basis of their traditional uses. The secondary metabolites of the plants are the major sources of pharmaceutical, food additives and fragrances. In the present era of drug development and discovery of newer drug molecules, many plant products are evaluated on the basis of their traditional uses. The curative properties of medicinal plants are mainly due to the presence of various complex chemical substances of different compositions which occur as secondary metabolites [3]. The most important of these bioactive constituents of plants are alkaloids, tannins, flavonoids and phenolic etc. that are responsible for protecting the plants from microorganisms, insects and other natural pests. In the present era of drug development and discovery of newer drug molecules many plant products are evaluated on the basis of their traditional uses. One of the many plants which are being evaluated for their therapeutic efficacies is *Achyranthes aspera* Linn. Belongs to the family Amaranthaceae. It is an annual,

stiff erect herb and found commonly as a weed throughout India and is one of the important medicinal plants having many therapeutic uses. It has been used all the parts in traditional systems of medicines. Seeds, roots and shoots are the most important parts which are used medicinally. The present article gives an account of updated information on its phytochemical and pharmacological properties. The review reveals that wide numbers of phytochemical constituents have been isolated from the plant which possesses activities like antiperiodic, diuretic, purgative, laxative, antiasthmatic, hepato-protective, anti-allergic and various other important medicinal properties. The crushed plant is used in pneumonia and infusion of the root is used as mild astringent in bowel complaints. For the last few decades or so, extensive research work has been done to prove its biological activities and pharmacology of its extracts. Saponins, oleonic acid, dihydroxy ketones, alkaloids, long chain compounds and many other chemical constituents have been isolated.

Geographical Distribution : The plant is widespread in the world as a weed, in Baluchistan, Ceylon, Tropical Asia, Africa, Australia and America. In India, it is easily found anywhere on roadsides or on the edges of field and waste places as a weed throughout up to an altitude of 2100 m and in South Andaman Islands. In the northern part of India it is known as a medicinal plant in different systems of folk medicine .

Collection and Authentication of Plant : Fresh, healthy and young seeds (3 to 6 month old) of *A. aspera* L. were collected from their natural habitat of Kandhari in Thiruvarur district, Tamilnadu, India and authenticated by professionals in Department of Botany, St. Joseph's College, Tiruchirappalli, India. The herbarium number of the plant is RVR001.(Figure.1)

History and Origin :

Two varieties of *A. aspera*, red and white are mentioned in Ayurvedic and Chinese medicines. *Achyranthes aspera* as a rough flowered stalk is described as in Sanskrit synonyms. It is described in 'Nighantas' as pungent, purgative, digestive, and a remedy for inflammation of the internal organs, itch, piles, abdominal enlargements and enlarged cervical glands. The diuretic property of the plant was well known to the natives of India and European physicians. Various plant parts form ingredients in many native prescriptions were used in combination with more active remedies .

The plant is globally available as a medicinal weed in Baluchistan, Ceylon, Tropical Asia, Africa, Australia and America. It is reported as an invasive alien species in northern Bangladesh. It is also found to be the most prevalent weed in Shivbari, Himachal Pradesh and an exotic medicinal herb of district , most prevalent weed in Shivbari, Himachal Pradesh and an exotic medicinal herb of district, Lalitpur (Uttar Pradesh), India [4] . Throughout India *A. aspera* is found in field boundaries, road sides and waste places as a medicinal herb .

Synonyms [5]:

- *Achyranthes argentea* Lam
- *A. aspera* var. *indica* L
- *A. aspera* var. *obtusifolia* (Lam.) Suess.
- *Achyranthes indica* (L.) Mill.
- *Achyranthes obtusifolia* Lam .

Scientific taxonomic classification :

- » Kingdom - Plantae
- » Subkingdom - Tracheobinota
- » Super Division - Spermatophyta
- » Division - Mangoliophyta
- » Class - Mangoliopsida
- » Subclass - Caryophyllidae
- » Order - Caryophyllales
- » Family - Amaranthaceae
- » Genus - Achyranthes
- » Species – aspera .

Common Names Of Aspera : [4 , 6]

- **African vernacular names** : Swahili – Turura , Sotho-Bohomane, Bohome-bo-bolek, Mo-tswarak-gano, Belgian Congo-Denge, Gnegna, Kalambata, Lenge, Lenamo.
- **Arabian** - Atkumah, Na'eem, No'eim, Mahout, Wazer (Yemen)
- **Ayurvedic** - Apamarga, Chirchita, Shikhari, Shaikharika
- **Bengali** - Apaang.
- **English** - Prickly chaff flower, Hawai chaff flower, Devil's horse whip, Prickly chaff flower
- **French** - Achyranth a feuilles rudes, Collant, Gendarme
- **Gujarati** - Safad Aghedo, Anghadi, Andhedi, Agado.
- **Hindi** - Latjira, Chirchira, Lamchichra, Sonpur, Onga.
- **Indonesia** - Jarong.
- **Kannada** - Uttarane, Utame.
- **Latin** - A. aspera .
- **Malayalam** - Kadaladi, Vankadaladi, Katalati.
- **Marathi** - Aghada, Pandhara-aghada.
- **Other** - Pululue, Panga za wayuka, Crockers staff burweed.
- **Persian** - Khare-vazhun .
- **Philippines (Tagalog)** - Hangod .

- **Punjabi** - Kutri .
- **Sanskrit** - Aghata, Apamargah, Mayooraah, Markatapippalee, Durgrahan, Khara-manjari.
- **Sinhala** - Karalheba.
- **Spanish** - Mosotillo , Rabo de gato, Rabo de chango, Rrabo de raton.
- **Swahili** - Shiru-kadaladi.
- **Tamil** - Shiru-kadaladi, Nayuruvi.
- **Telugu** – Uttaraene, Utareni, Aduchinnike, Antisha, Pamargamu, Uttaraene.
- **Unani** – Chirchitaa Habitat .

Habitat :

The plant can grow in absence of shade or in semi-shade (light woodland). It requires moist soil but prefers light sandy, medium loamy, heavy clay soils for its growth [7]. It grows as wasteland herb everywhere. Flowers appear from July to September and seeds ripe in thr month of October.

Botanical description :

(a). Macroscopic information [4,8,9]

○ *A. aspera* is a stiff erect herb

(1) Height- 0.2-2.0 m high. The base is woody, angular or ribbed, simple or branched, nodes are bulged, often tinged with pink color

(2) Root - Cylindrical root, 0.1-1.0 cm in thickness, slightly ribbed, gradually tapering, yellowish-brown in color, secondary and tertiary roots present

(3) Stem - Square, yellowish-brown, branched, hairy, erect, cylindrical, solid, and hollow when dry .

4) Leaf (- Simple, sessile, slightly acuminate stipulate, wavy margin ovate, petiolate or elliptic, ovate or broadly rhomate, opposite, decussate, and pubescent due to the presence of thick coat of long simple hairs. 5-22 cm long with 2-5 cm broad. Occur in various sizes. Type of stomata are present on the lower epidermis is anomocytic.

(5) Flower - Arranged in long spikes form in inflorescences, 8-30 cm long, 3-7 mm wide, bisexual greenish-white, numerous, sessile, bracteate with two bracteoles, one spine lipped, actinomorphic, hypogynous, 5 perianth segments, membranous, 5 stamens, short filament, anther, two celled, 7 gynoecium bicarpellary, syncarpous, ovary superior, single ovule; style, single stigma, white or red flower. Flowers appear during summer.

(6) Fruit - An indehiscent dry utricle enclosed within bracteoles, persistent, and perianth

(7) Seed- These are round at the base, sub-cylindric, truncate at the apex, endospermic, brown coloured.

(b) Chromosome no : Polyploidy *A. aspera* naturally occurring was reported. Sporophytic count was noticed (Punjab, India, Cameroon Mountain and New Zealand)[10-11] Gametophytic count was to be 21[12],24 and 48 [10,13].

Properties and action

i) Fruits

- Rasa-Madhura
- Guna- Rooksha, Sara
- Virya- Seeta

ii) Roots

- Rasa- Tikta, Katu
- Guna- Teekshna, Sara
- Virya – Ushna .

Phytochemistry of plant

Achyranthes aspera possess various phytochemicals like alkaloids, tannins, cardiac glycosides, steroids, flavonoids, terpenoids, reducing sugar and saponin [14,15]. These are responsible for various purposes and are summarized in Table1 .

PHYTOCHEMICAL STUDIES :

□ Chemical constituents :

Betaine, achyranthine, hentriacontane, ecdysterone, achyranthes saponins A, B, C, D are the major chemical constituents found in *A. aspera*. The seeds of *Apamarg* contains α Lrhamnopyranosyl-(1→4)-(β-Dglucopyranosuluronic acid)-(1→3)-Oleanolic acid, α Lrhamnopyranosyl-(1→4)-(β-Dglucopyranosyluronic acid)-(1→3)- Oleanolic acid,-28-O-β-Dglucopyranoside and α -Lrhamnopyranosyl-(1→4)-(β-Dglucopyranosyluronic acid)-(1→3)-oleanolic acid-28-O-β-Dglucopyranosyl-(1→4)-β-Dglucopyranoside [16].

Ethanollic extracts of the roots of *Achyranthes aspera* Linn. Isolated a new aliphatic acid and it has been identified as n-hexacos-14-enoic acid [17] . This compounds reported for the first time from any natural and synthetic source, certain other compound were also isolated and identified as strigmasta-5, 2-dien3-β-ol, trans-13-docasenoic acid, n-hexacosanyl n decanate, nhexacos-17-enoic acid. Rameswar isolated chemical compounds of the volatile oil from *Achyranthes aspera* leaves [18].

■ **Biological Activity of *Achyranthes Aspera*:** The methanolic extracts of leaves of *Achyranthes aspera* has shown different activities against 22 microorganism (bacterial and fungal) [19] . *A. aspera* shows antiviral activity against Papaya viruses. In addition to these *A. aspera* shows various biological activities [20].

■ **Antiviral and Anticarcinogenic:** the in vitro assay the methonolic extract of *A. aspera* leaves (100 μg) revealed significant inhibitory effects on the Epstein-Barr virus early antigen induced by the tumour promoter 12-O-tetradecanoylphorbol-13-acetate in Raji cells. The fraction containing mainly non-polar compounds showed the most significant inhibitory activity (96.9 % and 60 % viability). In the in vivo two stage mouse skin carcinogenesis test the total methanolic extract possessed a pronounced anticarcinogenic effect. The total extract and the fraction are believed to be valuable antitumour promoters in carcinogenesis. [21].

■ **Spermicidal Activity:** Extracts from roots of *Achyranthes aspera* have been reported to possess spermicidal activity in human and rat sperm, as studied by [21] . Study was made on hydroethanolic, nhexane and chloroformextracts, which were found to be most effective for sperm immobilization, sperm viability, acrosome status, 5'-nucleotidase activity and nuclear chromatin decondensation. Vasudeva N 2006 was reported the ethanolic extract of the root of *Achyranthes aspera* shows post coital antifertility activity in female albino rats.

According to their study, the extract exhibited 83.3% anti-implantation activity when given orally at 200 mg/kg body weight [22].

■ **Hepatoprotective Activity:** the methanolic extract of the aerial parts of *Achyranthes aspera* shows hepatoprotective activity on rifampicin induced hepatotoxicity in albino rats. Methanolic extract showed dose dependent decrease in the levels of SGPT, SGOT, ALKP and total bilirubin. [23].

■ **Nephroprotective Activity:** Methanolic extract of the whole plant of *Achyranthes aspera* was shown to produce nephroprotective activity against lead acetate induced nephrotoxicity in male albino rats, as reported by Jayakumar [24].

■ **Antidiabetic Activity:** The ethanolic extract of *A. aspera* seed exhibited significant hypoglycemic activity in streptozotocin induced diabetic rats [25]. M. S. Akhtar & J. Iqbal studied the aqueous and methanolic extracts of the powdered whole plant, which shows hypoglycemic activity. Blood glucose levels of normal and Alloxan induced diabetic rabbits were determined after oral administration of various doses [26].

■ **Antiinflammatory:** An alcohol extract of *A. aspera*, 375 and 500 mg/kg was tested in carrageenan induced hind paw oedema and cotton pellet granuloma models in male albino rats. The alcoholic extract showed a maximum inhibition of rat paw oedema of 65.38% and 72.37% after 3 h. In a chronic test the extract exhibited 40.03% and 45.32% reduction of the granuloma weight in the sub-acute cotton pellet granuloma model [27].

■ **Immuno modulatory:** The indigenous Indian fish *Labeo rohita* was fed with a diet containing 0.01 %, 0.1% and 0.5% of *A. aspera* seeds. The fish immunized with heat-killed *Aeromonas hydrophila* were experimentally infected with living *Aeromonas hydrophila* then. In the *A. aspera* treated groups the mortality was less against controls up to the day after infection. Super oxide anion production, serum bactericidal activity, lysozyme, serum protein and albumin/globulin ratios became enhanced in *Achyranthes*-treated groups. The authors came to the conclusion that *A. aspera* stimulates immunity and increases resistance against the infection in this fish [28].

■ **Antimicrobial Activity:** M. T. J. Khan et al. reported that the ethanol and chloroform extracts of seeds of *Achyranthes aspera* shows mild to moderate antibiotic activity against *B. subtilis*, *E. coli* and *P. aeruginosa* [18]. S. H. K. R. Prasad et al. studied the various extracts of the leaves and callus of the plant also shows antimicrobial activity [29]. P. Saravanan et al. reported the solvent leaf extracts were tested for antibacterial and antifungal activities against *E. coli*, *P. aeruginosa*, *P. vulgaris*, *S. aureus*, *Klebsiella* species [30]. T. N. Misra et al. reported 17-pentatriacontanol as a chief constituent isolated from essential oil of the shoots of plant, the oil shows antifungal activity against *Aspergillus carneus* [31]. S. Sharma et al. studied the alcoholic extract which shows the presence of the triterpenoid saponin with dose dependent inhibitory activity against *Staphylococcus aureus*, a bacteria causing skin disease in human beings. Minimum inhibitory concentration was found to be highest (0.15 mg) for purified fraction. The identification of the compound on spectral analysis gave a triterpenoidal saponin purified fraction [32].

■ **Antiparasitic Activity:** Ethyl acetate extracts of *A. aspera* have been proved to contain anti-parasitic activity by Zahir et al. It has been studied that dried leaf, flower and seed extract of *A. aspera* are active against the larvae of cattle tick *Rhipicephalus (Boophilus) microplus* (Acari:Ixodidae), sheep internal parasite *Paramphistomum cervi* [33].

■ **Anti-allergic:** Datir et al. reported that the petroleum ether extract (200 mg/kg, i.p.) of the plant shows significant antiallergic activity in both milk induced leukocytosis and milk induced eosinophilia in mice. Thus the antiallergic activity of *A. aspera* may be due to the presence of steroids. Thus these steroids present in the plant may be responsible for the antiallergic activity [34].

▣ **Wound Healing Activity:** S. Edwin et al. investigated the ethanolic and aqueous extracts of leaves of *Achyranthes aspera* for wound healing activity. The wound healing activity was studied using two wound models, excision wound model and incision wound model [35].

▣ **Anti-oxidant Activity:** S. Edwin et al. reported free radical scavenging activity of the ethanolic and aqueous extracts. Both extracts were assessed using two methods, DPPH radical scavenging activity, and superoxide scavenging activity [36]. The plant exhibited good antioxidant effect by preventing the formation of free radicals in the two models studied. T. Malarvili & N. Gomathi reported antioxidant activity on seeds of the plant. *Achyranthes aspera* is well documented for the presence of phytoactive constituents. Reduction in rate of lipid peroxidation and enhancement in free radical scavenging activity of the herbal seed powder is due to presence of phytoactive constituent [37].

▣ **Hypolipidemic Activity:** A. K. Khanna et al. investigated the alcoholic extract of *A. aspera*, at 100 mg/kg dose lowered serum cholesterol (TC), phospholipid (PL) triglyceride (TG) and total lipids (TL) levels by 60, 51, 33 and 53% respectively in triton induced hyperlipidemic rats. The chronic administration of this drug at the same doses to normal rats for 30 days, lowered serum TC, PL, TG and TL by 56, 62, 68 and 67% respectively followed by significant reduction in the levels of hepatic lipids. The faecal excretion of cholic acid and deoxycholic acid increased by 24 and 40% respectively under the action of this drug. The possible mechanism of action of cholesterol lowering activity of *A. aspera* may be due to rapid excretion of bile acids causing low absorption of cholesterol [38].

CONCLUSION :

In view of above facts, the medicinal plant, *Achyranthes aspera* L. Traditionally, this plant using since Vedic period to present days using in the treatment of many diseases. Now a day's many experimental studies proves many medicinal values and using in various diseases. It is seen from the literature that *Achyranthes aspera* is a very important plant for its large number of medicinal properties. Thus, *Achyranthes aspera* is proved to be a multipurpose medicinal agent, thus instrumental in curing large number of ailments. Its study paves the way for further attention and research to identify the active compounds responsible for the plant biological activity, to characterize the active compounds and to elucidate the exact mechanism of action by which they exert their antibacterial effects.



Figure . 1 : *Achyranthus aspera* flower and seeds .

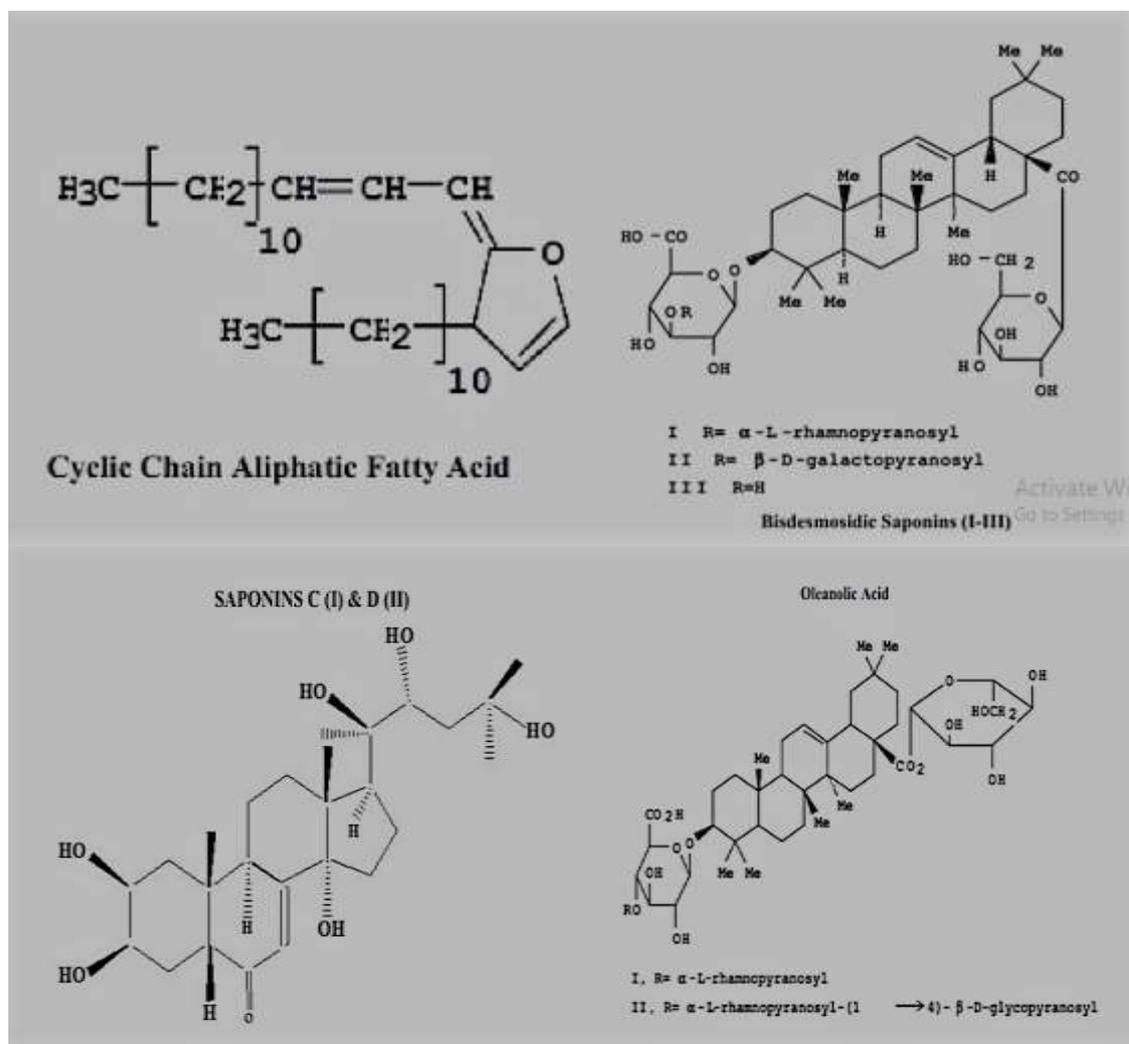


Figure . 2 : Structure of Some Phytoconstituents Isolated From *Achyranthes Aspera*

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