



Review Article

A REVIEW ON PHYTOPHARMACOLOGICAL STUDIES OF AN INDIAN MEDICINAL WEED: *ACHYRANTHES ASPERA*

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ABSTRACT

Achyranthes aspera is an important medicinal herb found as a weed and widely distributed in India. It belongs to the family Amaranthaceae. In Sanskrit it is called as Apamarga and commonly called as Prickly chaff flower. All parts of this herb, root, leaves, inflorescence and seeds are used traditionally and medicinally. Traditionally this herb is used in the treatment of renal dropsy. The seeds of this plant are used in the treatment of hydrophobia, snake bite, ophthalmic and cutaneous disease. The pharmacological attributes of this herb reveal that it is used in the treatment of diseases like liver disorders, antihyperlipidemic, anti-allergic, anti-diabetic, anti-inflammatory, antidepressant and diuretic. This present review spotlights the detailed information related to Geographical distribution, Morphological characters, phytochemical constituents, Traditional and Pharmacological attributes of this herb.

Keywords: *Achyranthes aspera*, weed, Saponins, Prickly chaff

INTRODUCTION

India has a rich flora of plants and it has a history of using plants for medicinal purposes. Ancient treatises of Indian medicine Charaka Samhita mentioned the benefits of around 2000 herbal drugs for medicinal use. The world health organization (WHO) estimates 80% of population in developed and developing countries relies mostly on traditional medicines for primary health care needs. Since ancient time's plants serves as a potential source of medicines.¹ In present era tremendous demand has been increased for the plant-based health products, this leads to increase in exponential growth of herbal products globally. In terms of safety and effectiveness, herbal medicines had a strong traditional and conceptual base which serves as therapeutic agents to treat various diseases.² Isolation and characterization of various chemical constituents from the plants and its pharmacological screening may provide us for the basis of developing the leads and the development of novel agents from plants. *Achyranthes aspera* is the important medicinal herb found as weed and widely distributed throughout the tropical subtropical regions of the world. In Sanskrit it is called as Apamarga and commonly called as prickly chaff flower. It belongs to the family Amaranthaceae. All parts of this plant like root, shoot, stem, leaves, seeds and inflorescence are used medicinally. The whole plant possesses wide spectrum of biological activity.³

Taxonomical classification

Kingdom - Plantae
Subkingdom - Tracheobionota
Unranked - Angiosperms
Super division - Spermatophyte
Division - Mangoliophyta
Class - Mangoliopsida

Subclass - Caryophyllidae
Order - Caryophyllales
Family - Amaranthaceae
Genus - *Achyranthes*
Species - *aspera*

Vernacular names

English: Prickly chaff flower,
Hindi: Andhi jalo, andhijhara, apang, Apamarga, chichra
Kannada: Kempu uthraani, mayooraka, utrani-gida, utranigida, uttaraane
Malayalam: Cadelari, kadaladi, katalati, valiyakatalati,
Marathi: Aghaada, aghada, aghadha, aghado, aghara, pandhara-
aghada
Persian: Khare-vazhgunah, khare-vazhun
Sanskrit: Adhahsalya, adhoghanta, adhvasalya, aghamargava,
aghata, apamarga, apamargah, apamargaha
Tamil: Akatam, akatamonicceti, akatturam, akayamauni, ancanati
Telugu: Antisa, antisha, apamargamu, uttarani

Geographical distribution

Achyranthes aspera is geographically distributed in tropical and sub-tropical regions of the world. It is a perennial herb, which can grow up to 2 m tall. It is widely spread in Baluchistan, Ceylon, Tropical Asia, Africa, Australia and America. In India, it is commonly found as weed on roadsides, waste places and field boundaries.^{4,5}

Morphological characters

Achyranthes aspera is an erect, short perennial herb which can grow up to 2 m tall. Its stems are woody at the base. Leaves are

short-stalked, opposite, simple and egg-shaped with broad end at the base, ovate up to 10 cm long and 8 cm wide, densely to sparsely hairy tapering at both ends and shortly stalked.⁴ Its inflorescence has elongated terminal spikes up to 60 cm long. As



Figure 1: *Achyranthes aspera* Plant

the flowers age up, they bend downwards and pressed closely against the stem. In fruiting stage, the bracts surround the flowers, sharp pointed tips making the heads spiny to touch. Fruits are orange to reddish purple or straw brown colour capsules.⁶



Figure 2: *Achyranthes aspera* inflorescence

Traditional uses

Achyranthes aspera is used as a folk medicine in India, Kenya and Australia. In India, traditionally this herb is used to treat renal dropsy. The seeds of this plant are used in the treatments of hydrophobia, snake bite, ophthalmic and cutaneous disease. The seeds are pulverized and made into a paste with water and it is used as external application for bites of poisonous snakes and reptiles. Paste of fresh leaves is used for relieving pain from wasp bite. Plant ash is used externally to treat ulcers and warts. The root paste is used in corneal opacity.⁷ Leaf powder mixed with honey used in the treatment of early stages of asthma. In veterinary purposes it is given as diuretic in goats. Crushed plant boiled with water used for the treatment of pneumonia. The leaves and roots of this plant possess diuretic and urolithiatic activity. The plant is useful in treating liver complaints, rheumatism, scabies, bronchitis, renal dropsy, gonorrhoea, urinary calculi, abdominal pain and other skin diseases. It also possesses tranquillizing properties.^{8,9}

Phytochemical constituents

Preliminary phytochemical evaluation of different parts of *Achyranthes aspera* in various extracts shows the presence of secondary metabolites like alkaloids, carbohydrates, flavonoids, saponins and phytosterols.

R.D. Rameshwar and N. Akito isolated oleanolic acid glycosides from the seeds of *Achyranthes aspera*. They were identified as α -L-rhamnopyranosyl-(1 \rightarrow 4)-(β -D-glucopyranosyluronic acid)-(1 \rightarrow 3)-oleanolic acid, α -L-rhamnopyranosyl-(1 \rightarrow 4)-(β -D-glucopyranosyluronic acid)-(1 \rightarrow 3)-oleanolic acid-28-O- β -D-glucopyranoside and α -L-rhamnopyranosyl-(1 \rightarrow 4)-(β -D-glucopyranosyluronic acid)-(1 \rightarrow 3)-oleanolic acid-28-O- β -D-glucopyranosyl-(1 \rightarrow 4)- β -D-glucopyranoside.¹⁰

A.S. Chauhan *et al.* isolated a fatty acid from the seeds of the plant.¹¹ A. Banerji *et al.* (1970) isolated ecdysterone from the root extracts of *Achyranthes aspera*.¹²

S.K. Sharma *et al.* isolated an aliphatic acid, which is identified as n-hexacos-14-enoic acid from *Achyranthes aspera* root extract. Other compounds like strigmasta-5, 22-dien-3- β -ol, trans-13-docaseanoic acid, n-hexacosanyl n-decanate, n-hexacos-17-enoic acid and n-hexacos-11-enoic acid. Strigmasta-5, 22-dien-3- β -ol is identified and shown positive towards liebermann burchard test.¹³

A.K. Batta and S. Rangaswami reported 36, 37-dihydroxyhenpentacontan-4-one and Triacontanol dihydroxy ketones from the shoots of *Achyranthes aspera*.¹⁴

T.G. Misra *et al.* reported 27- cyclohexylheptacosan-7-ol and 16-hydroxy-26-methylheptacosan-2-one [29] from the shoots of *Achyranthes aspera*.¹⁵ Y. Gariballa *et al.* (1983) reported an aliphatic alcohol 17-pentatriacontanol from the shoots of *Achyranthes aspera*.¹⁶

V. K. Kapoor and H. Singh reported water soluble alkaloid betaine from the whole plant of *Achyranthes aspera*.¹⁷ O. Kunert *et al.* isolated 20-hydroxyecdysone and quercetin-3-O- β -D-galactoside were isolated from the methanol extract of the aerial parts of *Achyranthes aspera*.¹⁸

G. Michl *et al.* reported bisdesmosidic triterpenoid saponins as β -D-glucopyranosyl3 β -[O- α -L-rhamnopyranosyl-(1 \rightarrow 3)-O- β -D-glucopyranuronosyloxy]machaerinate, β -D-glucopyranosyl3 β -[O- β -D-galactopyranosyl-(1 \rightarrow 2)-O- α -D-glucopyranuronosyloxy]machaerinate from the aerial parts of the methanolic extract of *Achyranthes aspera*.¹⁹

Pharmacological activities

Spermicidal Activity

D. Paul *et al.* reported spermicidal activity in human and rat sperm by various extracts of the roots of *Achyranthes aspera*. The sperm immobilization, sperm viability, acrosome status, 5'-nucleotidase activity and nuclear chromatin de condensation are shown to be more effective in hydro ethanolic, n-hexane and chloroform extracts.²⁰ N. Vasudeva and S.K. Sharma reported the ethanolic extract of *Achyranthes aspera* shows post coital anti fertility activity in female albino rats.²¹

Cardiovascular Activity

Hawiaran V, Rangaswami S, isolated the saponins from seeds of *Achyranthes aspera* and saponins has shown decrease in contractility of isolated hypodermic heart.²²

Hypoglycemic Activity

G. Thilagavathi and T. Kannaian, reported *A. aspera* extract activated thyroid gland and induced changes in thyroid hormone concentration.²³ M.S. Akhtar and J. Iqbal stated that the aqueous and methanolic extracts of the whole plant, reported

hypoglycemic activity. Blood glucose levels of normal and alloxan induced diabetic rabbits were determined after oral administration of various doses.²⁴

Cancer Chemo preventive Activity

A. Chakraborty *et al.* Studied phytochemical constituents of methanolic extracts of leaves. Alkaloid and saponin fractions were isolated from the methanolic extract of *A. aspera*. Isolated saponin fraction shown chemopreventive action against cancer.²⁵

Hepatoprotective Activity

A.R. Bafna and S.H. Mishra stated that aerial parts of the methanolic extract of the *Achyranthes aspera* reported the hepatoprotective activity against rifampicin induced hepatotoxicity in albino rats. Histopathological liver sections examination confirms the methanolic fraction of aerial parts of *Achyranthes aspera* prevented the hepatic damage induced by the paracetamol.²⁶

Analgesic and Antipyretic Activity

F.A. Mehta *et al.* conducted study on methanolic extract of seeds and leaves of *Achyranthes aspera*. The results of this study confirms leaves and seeds of this plant possess analgesic and antipyretic action.²⁷ H. Kumar *et al.* (2009) reported the hydro alcoholic extract of the roots and leaves of *Achyranthes aspera* shown centrally acting Analgesic in adult male albino rats.²⁸ S. Vijaya Kumar *et al.* (2009) studied the alcoholic extract of the roots of *Achyranthes aspera*, as anti-inflammatory in Wistar albino rats by using carrageenan induced paw edema method and cotton pellet granuloma test. Results suggest that alcoholic extract of *Achyranthes aspera* possess good anti-inflammatory activity.²⁹

Antimicrobial Activity

M.T.J. Khan *et al.* studied the ethanol and chloroform extracts of seeds of *Achyranthes aspera* and reported that it possess mild to moderate antibiotic activity against *B. subtilis*, *E. coli* and *P. aeruginosa*.³⁰ P. Saravanan *et al.* (2008) studied the leaf extracts of *Achyranthes aspera* and reported antibacterial and antifungal activities against *E. coli*, *P. aeruginosa*, *P. vulgaris*, *S. aureus* and *Klebsiella* species.³¹ S. Sharma *et al.* (2006) studied the alcoholic extract which shows the presence of the triterpenoid saponin which has shown dose dependent inhibitory activity against *Staphylococcus aureus*.³²

Anti-depressant Activity

C.C. Barua *et al.* Reported, Methanolic extract of the leaves of *Achyranthes aspera* shown anti-depressant effect in mice and rats in forced swimming test and tail suspension test.³³

Diuretic Activity

S.S. Gupta *et al.* isolated a saponin from the seeds of *Achyranthes aspera* which shows significant diuretic effect in adult male albino rats.³⁴ N. C. Neogi, R. D. Garg reported that an alkaloid, achyranthine (5 mg/kg, orally) shows diuretic activity in rats.³⁵

Wound Healing Activity

S. Edwin *et al.* studied the ethanolic and aqueous extracts of leaves of *Achyranthes aspera* on wound healing activity. The two wound models are excision and incision wound model.³⁶ Sumanta Mondal, Debjit Ghosh *et al* studied the ethanolic extract of seeds of *Achyranthes aspera* on wound healing activity. The results of

wound healing activity revealed that ethanolic extract of *Achyranthes aspera* showed an enhanced wound contraction and epithelialization period in both excision and burn wound models.³⁷

Hypolipidemic Activity

A.K. Khanna *et al.* studied the alcoholic extract of *A. aspera* at 100 mg/kg dose, lowered serum cholesterol (TC), phospholipid (PL), triglyceride (TG) and total lipids (TL) levels are 60, 51, 33 and 53% respectively in triton induced hyperlipidemic rats. Hypolipidemic activity is due to increased fecal excretion of cholic and deoxycholic acid. The underlying mechanism involved in cholesterol lowering activity of *A. aspera* may be due to rapid excretion of bile acids which leads to low absorption of cholesterol.³⁸

Anti-parasitic Activity

A. A. Zahir *et al.* studied the ethyl acetate extracts of *A. aspera*, which exhibits anti parasitic activity (dried leaf, flower and seed extract) against the larvae of cattle tick *R. microplus*, sheep internal parasite *Paramphistomum cervi*.³⁹ Bagavan *et al.* reported, acetone, chloroform, ethyl acetate, hexane and methanol leaf extracts of *Achyranthes aspera* against larvae of *Aedes aegypti* L and *Culex quinquefasciatus*. The mortality rate of these larvae was observed after 24 hours exposure. The mortality rate of larva was highest in ethyl acetate extract of *A. aspera*. In the present study, ethyl acetate extract was subjected to fractionalization which led to the separation and identification of a saponin as a potential mosquito larvicide compound against *A. aegypti* and *C. quinquefasciatus* respectively. ¹H NMR, C13 NMR and mass spectral data confirmed the identification of the active compound.⁴⁰

Antioxidant Activity

P. Tahiliani and A. Kar screened the various extracts of the leaves of *Achyranthes aspera* for antioxidant activity.⁴¹ D.S. Gayathri *et al.* (2009) reported antioxidant activity of various extracts of leaves and roots.⁴² T. Malarvili and N. Gomathi studied antioxidant activity on seeds of this plant.⁴³ Results of this study reported reduction in lipid peroxidation and enhancement of free radical scavenging activity of the seed powder is due to presence of phytoactive constituents.

Anti urolithiatic Activity

Anshu Aggarwal, Simran Tandon *et al* reported the aqueous extract of *A. aspera* root possess anti calcifying properties in *in-vitro*. The inhibitory potency of the plant was tested on the nucleation and growth of the most commonly occurring kidney stones, COM (Calcium oxalate monohydrate)⁴⁴

CONCLUSION

In the present review, Phytochemical and pharmacological evaluation of the *Achyranthes aspera* reported various chemical constituents like alkaloids, flavonoids, phenolics, saponins and steroids. Pharmacological activities of various extracts of this plant confirm the therapeutic potential of *Achyranthes aspera*. Due to wide range of chemical constituents it serves as a lead for the development of various novel compounds. Further research like standardization of herbal extracts, identification and isolation of active principles and pharmacological activities for the isolated compounds can be carried out. Further research of this plant serves to be used as specific extract in herbal formulation.

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