PHARMACOLOGICAL ACTIVITIES OF ACHYRANTHUS ASPERA: AN OVERVIEW
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ABSTRACT
Many plants are essential in human health care, both in self-medication and in national services. India has a great wealth of various naturally occurring plant drugs which have great potential pharmacological activities. A number of medicinal plants are used as rejuvenators as well as for treating various disease conditions. Achyranthes aspera belonging to the family Amaranthaceae is an important medicinal herb found as a weed throughout India. Though almost all of its parts are used in traditional systems of medicines. This review summarized the plant characteristics with their pharmacological activities.

Keywords: Pharmacological activities, Achyranthes aspera.

INTRODUCTION
Knowledge of herbs has been handed down from generation to generation for thousands of years [1]. Herbal drugs constitute a major part in all traditional systems of medicines. Herbal medicine is a triumph of popular therapeutic diversity. Plants above all other agents have been used for medicine from time immemorial because they have fitted the immediate personal need, are easily accessible and inexpensive [2]. In the recent past there has been a tremendous increase in the use of plant based health products in developing as well as developed countries resulting in an exponential growth of herbal products globally. An upward trend has been observed in the research on herbals. Herbal medicines have a strong traditional or conceptual base and the potential to be useful as drugs in terms of safety and effectiveness leads for treating different diseases. World Health Organization has made an attempt to identify all medicinal plants used globally and listed more than 20,000 species [3]. According to the WHO more than 80 % of the world’s population relies on traditional herbal medicine for their primary health care [4]. Plants continue to serve as possible sources for new drugs and chemicals derived from various parts of plants [5]. In recent time there has been a marked shift towards herbal cures because of the pronounced cumulative and irreversible reactions of modern drugs.
However, due to over population, urbanization and continuous exploitation of these herbal reserves, the natural resources along with their related traditional knowledge are depleting day by day.[6] As we know that India, with its mega-biodiversity and knowledge-rich ancient traditional systems of medicine viz. Ayurveda, Siddha, Unani and local health traditions, provides a strong base for the utilization of a large number of plants in general healthcare and alleviation of common ailments of the people. In the present era, allopathic medication is showing severe side effects, it is important to look always a new herbal remedy for treating diseases. Based on the reported data, we are trying to give a brief review on Achyranthes aspera belonging to the family Amaranthaceae for the public interest to implement in daily life which is not reported till now. So in this review, the literature tells us about various pharmacological properties. 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 which is commonly known as Latjeera (Hindi) & Rough Chaff tree (English). It is an erect or procumbent, annual or perennial herb, 1-2m in height, often with a woody base, commonly found as a weed of way sides, on roadsides.[7, 8, 9] Although it has many medicinal properties. It is found on road sides, field boundaries and waste places as a weed throughout India up to an altitude of 2100 m and in South Andaman Islands[10]. The plant is also widespread in Baluchistan, Ceylon, Tropical Asia, Africa, Australia and America.

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Spermicidal activity:
D. Paul et al. (2010) studied effects of various extracts from the roots of Achyranthes aspera and reported spermicidal activity in human and rat sperm. The hydroethanolic, n-hexane and chloroform extracts were found to be most effective for sperm immobilization, sperm viability, acrosome status, 5'-nucleotidase activity and nuclear chromatin decondensation.[11]

N. Vasudeva & S.K. Sharma (2006) reported the ethanolic extract of the root of Achyranthes aspera shows post coital antifertility activity in female albino rats. The said
extract exhibited 83.3% anti-implantation activity when given orally at 200 mg/kg body weight\cite{12}.

W. Shibeshi \textit{et al.} (2006) studied effects of methanolic extract of the leaves and reported for antifertility activities such as abortifacient, estrogenesity, pituitary weight, and ovarian hormone level and lipids profile in female rats. The abortifacient effect of the methanolic extract of the leaves of \textit{Achyranthes aspera} was determined by counting the dead fetuses \textit{in vivo}. Effect on estrogenesity was assessed by taking the ratio of the uterine weight to body weight. The ratio of the pituitary weight to body weight was also calculated. The effect of the extract on the level of ovarian hormones and lipid profile were evaluated using electrochemiluminescence immunoassay\cite{13}.

A. Pakrashi \& N. Bhattacharya (1977) reported that benzene extract of the whole plant shows abortifacient activity in mice\cite{14}.

D. Paul \textit{et al.} (2006) reported 50% ethanolic extract of the leaf of \textit{Stephania hernandifolia} and the root of \textit{Achyranthes aspera} shows effect on sperm motility and function in a ratio of 1:3 by weight at different concentrations\cite{15}.

V. Wadhwa \textit{et al.} (1986) reported \textit{n-butanol} fraction of aerial parts also shows contraceptive and hormonal properties\cite{16}.

Antiparasitic activity:

A. A. Zahir \textit{et al.} (2009) reported that the ethyl acetate extracts of \textit{A. aspera} shows antiparasitic activity (dried leaf, flower and seed extract) against the larvae of cattle tick \textit{Rhipicephalus (Boophilus) microplus} (Canestrini, 1887) (Acari: Ixodidae), sheep internal parasite \textit{Paramphistomum cervi}\cite{17}.

A. Bagavan \textit{et al.} (2008) studied the acetone, chloroform, ethyl acetate, hexane and methanol leaf extracts of \textit{Achyranthes aspera} against the early fourth-instar larvae of \textit{Aedes aegypti} L and \textit{Culex quinquefasciatus} Say. The larval mortality was observed after 24 h exposure. All extracts showed moderate larvicidal effects; however, the highest larval mortality was found in the ethyl acetate extract of \textit{A. aspera}. In the present study, bioassay-guided fractionation of \textit{A. aspera} led to the separation and identification of a saponin as a potential mosquito larvicidal compound, with LC50 value of 18.20 and 27.24 ppm against \textit{A. aegypti} and \textit{C. quinquefasciatus}, respectively. \textit{1H NMR, 13C NMR} and mass spectral data confirmed the identification of the active compound. This is the
first report on the mosquito larvicidal activity of the saponin from the ethyl acetate extract of A. aspera [18].

Hypoglyceamic activity:
M.S. Akhtar & J. Iqbal (1991) studied the aqueous and methanolic extracts of the powdered whole plant, which shows hypoglyceamic activity. Blood glucose levels of normal and Alloxan induced diabetic rabbits were determined after oral administration of various doses [19].

Cancer Chemo preventive activity:
A. Chakraborty et al. (2002) reported that the methanolic extracts of leaves, alkaloid, nonalkaloid and saponin fractions shows cancer chemo preventive action on Epstein-Barr virus early antigen activation induced by tumor promoter 12-O-tetradecanoylphorbol-13-acetate in Raji cells [20].

Hepatoprotective activity:
A.R. Bafna & S.H. Mishra (2004) reported that 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 [21].

Analgesic and antipyretic activity:
Sutar N.G. et al. (2008) reported methanolic extract of leaves for analgesic and antipyretic activities by using hot plate and brewer’s yeast induced methods using aspirin as a standard drug [22].

F.A. Mehta et al. (2009) studied the leaves and seeds of Achyranthes aspera which shows analgesic activity. Both leaves and seeds show analgesic activity in mice using acetic acid induced writhing response and hot plate method [23].

H. Kumar et al. (2009) reported the hydro alcoholic extract of the roots and leaves of Achyranthes aspera shows centrally acting analgesic activity in adult male albino rats using tail flick, hot plate and acetic acid induced writhing method for peripherally acting analgesic activity using aspirin as standard drug. The doses administered were 200 mg/kg and 400 mg/kg. The animal that administered a dose of 400 mg/kg leaf extract has shown the maximum analgesic activity [24].
Neogi N et al. (1970) reported that achyranthine a water soluble alkaloid had a slight antipyretic activity in rats [25].

Anti-inflammatory and anti-arthritic activity:

S. Vijaya Kumar et al. (2009) studied the alcoholic extract of the roots of Achyranthes aspera, which shows anti-inflammatory activity in Wistar rats using carrageenan-induced paw edema method and cotton pellet granuloma test [26].

The alcoholic extracts of leaves and seeds show anti-inflammatory activity in rats using carrageenan-induced paw edema method and formalin model [23].

T. Vetrichelvan & M. Jegadeesan (2003) reported the alcohol extract of Achyranthes aspera was tested on carrageenin-induced hind paw oedema and cotton pellet granuloma models in albino male rats. The paw volume was measured plethysmometrically at 0, 1, 2, 3, 4 and 5 h and diclofenac sodium was used as a standard drug. The alcohol extract (375 and 500 mg/kg) showed the maximum inhibition of oedema of 65.38% and 72.37%, respectively, at the end of 3h with carrageenan-induced rat paw oedema. Using a chronic test, the extract exhibited a 40.03% and 45.32% reduction in granuloma weight [27].

A.B. Gokhale et al. (2002) reported the ethanolic extracts of the Achyranthes aspera at the doses of 50, 100 and 200 mg/kg were screened for their effect on acute and chronic inflammation induced in mice and rats using carrageenan and Freund's complete adjuvant model. A. aspera inhibited these inflammatory responses at doses of 100-200 mg/kg [28].

Antimicrobial activity:

M.T.J. Khan et al. (2010) 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 [29].

S.H.K.R. Prasad et al. (2009) studied the various extracts of the leaves and callus of the plant also shows antimicrobial activity [30].

P. Saravanan et al. (2008) reported the solvent leaf extracts were tested for antibacterial and antifungal activities against E. coli, P. aeruginosa, P. vulgaris, S. aureus, Klebsiella species [31].

T.N. Misra et al. (1992) reported 17-pentatriacontanol as a chief constituent isolated from essential oil of the shoots of plant, the oil shows antifungal activity against Asperigillus carneus [32].
S. Sharma et al. (2006) 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 \[^{33}\].

M. Manjula et al. (2009) studied the extracts of *Achyranthes aspera* for antibacterial activity against various pathogenic strains such as *Escherichia coli*, *Pseudomonas aeruginosa*, *Citrobacter* species, *Bacillus subtilis* and *Micrococcus* species using disk diffusion and well plate method. Phytochemical characterization of *Achyranthes aspera* extracts was done by thin layer chromatography (TLC) techniques and other phytochemical analysis. It was found that extracts of *Achyranthes aspera* shows the maximum inhibition of *E. coli* (17 mm) followed by *Pseudomonas* species (14 mm), *Citrobacter* species (12 mm), *Bacillus* species (12 mm) and *Micrococcus* species (12 mm). *Achyranthes aspera* shows predominant inhibition against gram negative bacteria at a higher concentration of 50 g/ml. In the well plate method the inhibition zone ranges from 7 to 19 mm against pathogenic strains thus by increasing the concentration of extracts. From the TLC analysis it shows that formation of color and the RF value indicate the presence of different phytochemicals in the sample. The samples of *Achyranthes aspera* were found to contain alkaloids and tannins \[^{34}\].

**Anti-oxidant activity:**

P. Tahiliani & A. Kar (2000) studied various extracts of the leaves for anti-oxidant activity \[^{35}\].

D.S. Gayathri et al. (2009) also reported antioxidant activity on leaves and roots \[^{36}\].

T. Malarvili & N. Gomathi (2009) reported antioxidant activity on seeds of the plant \[^{37}\].

*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.

S. Edwin et al. (2008) 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. The plant exhibited good
antioxidant effect by preventing the formation of free radicals in the two models studied [38].

**Nephroprotective activity:**
T. Jayakumar et al. (2009) reported the methanolic extract of the whole plant of *Achyranthes aspera* shows nephroprotective activity against lead acetate induced nephrotoxicity in male albino rats [39].

**Anti-depressant activity:**
C.C. Barua et al. (2009) showed that Methanolic extract of the leaves of *Achyranthes aspera* shows anti-depressant effect in mice and rats using forced swimming test in mice and rats and tail suspension test in rats [40].

**Diuretic activity:**
S.S. Gupta et al. (1972) reported a saponin isolated from the seeds of *Achyranthes aspera* which shows significant diuretic effect in adult male albino rats [41]. Achyranthine (5 mg/kg, orally) had diuretic activity in rats [25].

**Bronchoprotective activity:**
B.R. Goyal et al. (2007) reported ethanolic extract of *Achyranthes aspera* shows bronchoprotective effect in toluene diisocyanate (TDI) induced occupational asthma in Wistar rats. The total and differential leucocytes were counted in blood and bronchoalveolar (BAL) fluid. Liver homogenate was utilized for assessment of oxidative stress and lung histological examination was performed to investigate the inflammatory status of airway. The results suggest that *Achyranthes aspera* treated rats did not show any airway abnormality [42].

**Cardiovascular activity:**
Achyranthine, a water-soluble alkaloid isolated from *Achyranthes aspera*, decreased blood pressure and heart rate, dilated blood vessels, and increased the rate and amplitude of respiration in dogs and frogs. The contractile effect of the alkaloid at 0.5 mg/ml on frog rectus abdominal muscle was less than that of acetylcholine (0.1 mg/ml), and its spasmogenic effect was not blocked by tubocurarine [25].
S.S. Gupta et al. (1972) studied a mixture of saponins isolated from the seeds of *Achyranthes aspera* increased the force of contraction of the isolated frog, guinea pig and rabbit heart. The stimulant effect of the lower doses (1-50 g) was blocked by pronethalol
and partly by mepyramine. At higher saponin doses, the effect was not blocked by pronethalol. The saponins also increased the tone of the hypodynamic heart and the force of contraction of the failing papillary muscle \[43\].

A. K. Ram et al. (1971) studied perfusion of isolated rat heart with adrenaline bitartrate or the saponin of Achyranthes aspera increased the activity of phosphorylase a but had no effect on the total phosphorylase activity \[44\].

Anti-allergic activity:

S.B. Datir et al. (2009) 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 nonpolar constituents. The phytochemical screening of petroleum ether extract shows the presence of steroids. Literature shows the presence of steroids like β-sitosterol, ecdysone and ecdysterone. Thus these steroids present in the plant may be responsible for the antiallergic activity \[45\].

Wound Healing activity:

S. Edwin et al. (2008) 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 \[46\].

Immunomodulatory activity:

R. Chakrabarti & R.Y. Vasudeva reported that Achyranthes aspera show immunostimulant action in Catla catla. Achyranthes has significantly (\(P < 0.05\)) enhanced the BSA-specific antibody titers than the untreated control group throughout the study period. The efficiency of antigen clearance was also enhanced \[47\].

Hypolipidemic activity:

A.K. Khanna et al. (1992) 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\(^{[48]}\).

**DISCUSSION AND CONCLUSION**

Herbal medicine has become a popular form of health care, even though several differences exist between herbal and conventional pharmacological treatments. Several specific herbal extracts have been demonstrated to be efficacious for specific conditions. Even though public do the carry risk of taking allopathic medicine instead of herbal treatments. It is seen from the literature that *Achyranthes aspera* is a very important plant for its large number of medicinal properties as well as medicinally important chemicals like ecdysterone, achyranthine, betaine, pentatriacontane, 6-pentatriacontanone, hexatriacontane and tritriacontane. The plant shows many pharmacological activities like spermicidal, anti-allergic, cardiovascular, nephroprotective, antiparasitic, hypoglycemic, analgesic and antipyretic. Many traditional uses are also reported like antiperiodic, purgative and laxative, in various types of gastric disorders and in body pain which are being studied till today and further research has to be done. Thus, *Achyranthes aspera* is quite promising as a multipurpose medicinal agent so further clinical trials should be performed to prove its efficacy.

**REFERENCES**


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