

The Potent Plant for Traditional Medicine System: “*Achyranthes aspera*”

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Abstract

Nature has been a resource of medicinal constituents for thousands of years and an extraordinary number of modern drugs have been isolated from natural sources. India is a soil of prosperous biodiversity, the total number of lower and higher plants in India is about more than 45,000 species. The plants are potential resource of medicines since antiquity. The medicinal plants are used for treatment of various diseases because of their safety and effectiveness. *Achyranthes aspera* (*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, seeds, roots and shoots are the most important parts which are used medicinally. *Achyranthes aspera* (*Amaranthaceae*) has long been used in different systems of medicine in the treatment of cancer, leprosy, asthma, wound, insect and snake bite, dandruff, hepatitis, renal disorders, dermatological disorders, gynecological disorders, gonorrhoea, malaria, fever, cough, diabetes, pyorrhoea, dysentery, ophthalmia, rabies, hysteria, toothache etc. The plant has been used as Antimicrobial, Antiviral and Anti-carcinogenic, Spermicidal, Anti-parasitic, Anti-cancerous, Hypoglycemic, Hypolipidemic, Wound Healing, Anti-inflammatory, anti-arthritic and Anti-oxidant, Nephroprotective, Cardiac, Anti-depressant activity etc. The present review deals with the enormous amount of scientific research and reports available in different aspects of this plant involving phytochemistry and pharmacology.

Keywords: *Achyranthes aspera*; Potential; Phytochemistry; Medicinal properties; Pharmacological activities

Introduction

Nature has given us various ways to treat various kinds of diseases. Herbal plants are one of them to treat these diseases and an impressive number of modern drugs have been isolated from natural sources [1].

The use of traditional medicine in most developing countries is a normative basis for the maintenance of good health. The 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 [2].

World Health Organization (WHO) 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].

The various medicinal plants contain numerous active constituents of immense therapeutic value. In the present era, where highly sophisticated research and development techniques are available, 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. 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 [5].

India is a land of rich biodiversity, the total number of lower and higher plants in India is about 45,000 species [6]. The different plants have been used to treat different types of diseases. Medicinal plants are also varying in their effectiveness against any kind of cure.

These medicinal plants are used in the treatment of various kind of diseases like autoimmune disease, anxiety, depression, allergies and asthma, cancer, celiac disease, crown's and colitis, heart disease, infectious diseases, liver disease etc. At present, anxiety is the most frequent psychiatric condition commonly found and a number of the population suffers from the conditions at some time during their life.

Anxiety is a Central Nervous System disorder [7,8]. Anxiety is a common emotional phenomenon in humans [9]. Anxiety is an emotional state, unpleasant in nature and is associated with uneasiness, discomfort and concern or fear about some defined or undefined future threat [10]. Anxiety is considered to be a normal reaction to stress and is characterized by heart palpitations, fatigue, nausea and shortness of breath. Anxiety is the most common mental illness affecting one eighth of the total population and has become a very important area of research in psychopharmacology in the current decade [11].

Anxiety disorders are psychiatric disorders affecting nearly 25% of the adult population at some point in their life. The prevalence of anxiety disorders is 30.5% and 19.2% in women and men respectively. The prevalence of anxiety disorders is remarkably high in young people. Children aged 7 to 11 years reported a 15.4% prevalence rate of anxiety disorders. A survey has also stated that less than 14% of people with such psychiatric disorders receive treatment [12]. Anxiety can aggravate many physical and mental ailments and also impede recovery from any other problems.

Many plants are used in the treatment of anxiety disorder. *Achyranthes aspera* is one of them. Traditionally, the plant is used in asthma, cough, diuretic, purgative and laxative, useful in oedema, piles, pneumonia, poisonous snakes bites, night blindness in ulcers and warts, in liver complaints, rheumatism, scabies and other skin diseases etc. It also possesses tranquillizing properties [13,14] (Figure 1).



Figure 1: *Achyranthes aspera* linn.

Geographical Distribution

The plant is widespread in the world as a weed, in Baluchistan, Ceylon, Tropical Asia, Africa, Australia, America and in India.

It is found on road sides, field boundaries and waste places as a weed throughout India. In India it is found widely at Maharashtra, Kerala, Karnataka, Tamil Nadu etc [14].

Chemical Constituents

The major chemical constituents are carbohydrates, protein, glycosides, alkaloids, tannins, saponins, flavonoids, lignin, flavonoids, steroids and terpenoids and fatty acids etc. It also contains a water soluble base, betaine [13-17].

Taxonomic Classification

Kingdom: *Plantae* [18]

Subkingdom: *Tracheobinota*

Super Division: *Spermatophyta*

Division: *Mangoliophyta*

Class: *Mangoliophsida*

Subclass: *Caryophyllidae*

Order: *Caryophyllales*

Family: *Amaranthaceae*

Genus: *Achyranthes*

Species: *Aspera*

Botanical Description

Synonyms

Latin: *Achyranthes aspera*

Sanskrit: Aghata [19]

Hindi: Latjira, Chirchira

Gujarat: 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

ACHYRANTHUS ASPERA LINN.

❖ ANTIMICROBIAL ACTIVITY
❖ ANTIVIRAL, ANTI CARCINOGENIC
❖ SPERMICIDAL ACTIVITY
❖ ANTIPARASITIC ACTIVITY
❖ ANTICANCEROUS ACTIVITY
❖ HYPOGLYCEMIC ACTIVITY
❖ HYPOLIPIDEMIC ACTIVITY
❖ WOUND HEALING ACTIVITY
❖ ANTI-INFLAMMATORY
❖ ANTIARTHRITIC
❖ ANTIOXIDANT
❖ NEPHROPROTECTIVE ACTIVITY
❖ CARDIO PROTECTIVE ACTIVITY
❖ ANTI DEPRESSANT ACTIVITY

Figure 2: Potent pharmacological actions of *Achyranthes aspera*.

Antimicrobial Activity

The antimicrobial activity has been reported for this plant. Antibacterial activity of seeds, ethyl acetate extract of the stem, leaf extracts, ethanol and methanol extracts of the leaf and stem, ethanolic extract of the leaves and stem, aqueous flower extract have been reported. Antifungal activity is also found in this plant. Both antibacterial and antifungal activity of petroleum ether, chloroform and methanol extracts of dried leaves has been reported. The plant was found to have antibacterial property against hospital origin gram positive bacteria. It is used as herbal antimicrobial finish for cotton fabric in healthcare textiles [20] (Figure 2).

Antiviral and Anticarcinogenic

The *in vitro* assay the methanolic 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 anti-carcinogenic effect. The total extract and the fraction are believed to be valuable anti-tumour 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 Paul. Study was made on hydroethanolic, n-hexane and chloroform extracts, which were found to be most effective for sperm immobilization, sperm viability, acrosome status, 5'-nucleotidase activity and nuclear chromatin decondensation. Vasudeva and Sharma 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 [18].

Antiparasitic Activity

Ethyl acetate extracts of *A. aspera* activity by Zahir. It has been studied that dried leaf, flower and seed extract of *A. aspera* are active against the larvae of cattle tick *Rhipicephalus microplus* (*Acari: Ixodidae*), sheep internal parasite *Paramphistomum cervi* [18].

Anti-Cancerous

The plant has been reported to have cancer chemopreventive activity and antitumor property. [22]. Non alkaloid fractions of the plant were found to be valuable antitumor promoters [23]. Leaves extracted in methanol were found to have inhibitory activity against human pancreatic cancer cells indicating its anti-proliferative and anti-cancer properties [24]. Swiss albino mice induced by intra-peritoneal injection of mineral oil was used to screen anti-cancerous efficacy of *A.*

aspera [25]. Brine Shrimp Lethality (BSL) bioassay was performed in the plant to select the secondary metabolites with cytotoxic effect [26]. Whole plant extract was found to inhibit N-Nitroso-Di-Ethylamine (NDEA) and Carbon-tetrachloride (CCl₄) induced hepato-carcinogenesis in rats [27].

Hypoglycaemic

Powdered whole plant and certain aqueous and methanolic extracts, when orally administered showed hypoglycemic in normal and alloxan-diabetic rabbits. The authors concluded that there is a possibility that the plant could act by providing some necessary elements like calcium, zinc, magnesium, manganese and copper to the beta-cells. Redox and oxidative status in plasma and other tissues of rats feed with high doses of fructose were studied after applying seeds of the plant [28,29].

Hypolipidemic Activity

The alcoholic extract of *A. aspera* was found to lower serum cholesterol (TC), Phospholipid (PL), Triglyceride (TG) and Total Lipids (TL) in triton induced hyper-lipidemic rats [30]. In sesame oil feed rats, hypolipidemic efficacy of the plant was tested [31]. The plant's activity on sesame oil induced lipid peroxidation has been reported [32].

Wound Healing Activity

Edwin 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 [21].

Anti-inflammatory, Anti-Arthritic and Anti-Oxidant Activity

Alcoholic extract of the roots of *Achyranthes aspera*, was found to exhibit anti-inflammatory activity in Wistar rats using Carragenan-induced paw edema method and cotton pellet granuloma test, as studied by Vijaya Kumar. Gayathri also reported antioxidant activity on leaves and roots.

Nephroprotective Activity

Methanolic extract of the whole plant of *Achyranthes aspera* shows to produce nephroprotective activity against lead acetate induced nephrotoxicity in male albino rats, as reported by Jaya kumar.

Cardiac Activity

Cardiac stimulant activity of the saponin of *A. aspera* seed has been observed when it was found to cause increase in force of contraction of isolated and intact hypodynamic heart [33]. Leaf decoction was reported for cardiovascular toxicity [34]. Achyranthine, the water soluble alkaloid showed lowering of blood pressure, depression of heart and increase in rate and amplitude of respiration in anaesthetized dogs. Effect of saponin

of *A. aspera* on phosphorylase activity of rat heart was noted [35]. In tropical West Africa, the plant was found to have activity on cardiovascular system [36].

Anti-Depressant Activity

Barua 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 [18].

Conclusion

The detailed study on the herbal medicinal plant, *Achyranthes aspera* reveals that this plant is traditionally using since Vedic period to present days using in the treatment of many diseases. Now a day's many phytochemical and pharmacological investigations are carried out in the plant which indicates its multidisciplinary usage. It is seen from the literature that *Achyranthes aspera* is a very important plant for its large number of medicinal properties. Thus, *Achyranthes aspera* has many chemical constituents responsible for their medicinal properties. Its study paves and reinforces further extensive work required on that so that more biological activities can be identified which can serve further mankind.

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