

**PHARMACOLOGICAL PROPERTIES OF
ACHYRANTHUS ASPERA LINN. –A REVIEW**

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Summary

The present review describes the morphological, phytochemical and pharmacology aspects of *Achyranthus aspera* Linn. (Amaranthaceae). *A. aspera* known as Chirchira in Hindi is an indigenous herb found in Asia, South America and Africa. Chirchira is the basic composition of many traditional remedies. Commonly used by traditional healers for the treatment of fever, especially malarial fever, dysentery, asthma, hypertension and diabetes. So, the present paper enumerates an overview of phytochemical and pharmacological properties, which may help the researchers to set their minds for approaching the efficacy and potency of herb.

Keywords: *Achyranthus aspera*; Chirchira; Pharmacognosy; Phytochemistry; Pharmacological profile.

Introduction

Chirchira, botanically known as *Achyranthes aspera* Linn, belongs to family Amaranthaceae. In the country it is known by different names such as chirchita (Hindi), apamarga (Sanskrit), aghedi (Gujarati), apang (Bengali), nayurivi (Tamil) and kalalat (Malyalam). It grows as wasteland herb every where. Since time immemorial, it is in use as folk medicine. It holds a reputed position as medicinal herb in different systems of medicine in India. According to Ayurveda, it is bitter, pungent, heating, laxative, stomachic, carminative and useful for the treatment of vomiting, bronchitis, heart disease, piles, itching abdominal pains, ascites, dyspepsia, dysentery, blood diseases etc¹.

Chirchira has occupied a pivotal position in Indian culture and folk medicine. It has been used in all most all the traditional system of medicine viz., ayurveda, unani and sidha. From the ancient time the tribal, rural and aboriginal people of our country commonly use this herb in various disorders. Different parts of the plant form ingredients in many native prescriptions in combination with more active remedies².

A. aspera distributed through out India as a weed in pastures, wastelands and roadside upto 1000m altitude. The plant is widespread in the world as a weed, in Baluchistan, Ceylon, Tropical Asia, Africa, Australia and America. In the northern part of India it is known as a medicinal plant in different systems of folk medicine. The decoction of whole plant is useful in diuretic and useful for treating dropsy and in large doses, it acts as ecbolic. The juice of plant is used to treat ophthalmia and dysentery. The decoctions of fresh roots are applied to vagina for terminating pregnancy. The paste of root is applied to external genitalia to induce labour pain³. In Ayurveda, two varieties, red and white are mentioned. In Sanskrit, synonyms describe this as a rough flowered stalk. It is described in 'Nighantas' as purgative, pungent, digestive, a remedy for inflammation of the internal organs, piles, itch, abdominal enlargements and enlarged cervical glands. The ethanol extract of roots, n-butanol extracts of aerial parts, methanolic leaf extract and benzene stem bark extract of *A. aspera* are reported to have anti-implantation and abortifacient activity⁴⁻⁷. The dried herb is used to treat children for colic and also as an astringent in gonorrhoea treatment. The root of *Achyranthes aspera* is reported to have application in infantile diarrhoea and cold⁸ while dry leaves are employed against asthma⁹.

The plant grows all over India in many forests and hills. It is frequently found around the water streams and is also cultivated. The tree is medium, tall, growing 10-16m in height. The rich green foliage provides a good shade. The bark is reddish grey and often cracked.



FIG: ACHYRANTHUS ASPERA

Botanical name: *Achyranthes aspera*

Family: Amaranthaceae

Common name: Devil's Horsewhip chirchita, apamarga, aghedi, nayurivi, kalalat, etc.

Part used: Whole plant, leaves, seeds, roots, flowers and fruits.

Habitant: The plant grows all over India in many forests and hills.

Constituents - Saponins

MORPHOLOGY

It is annual or perennial herb. Stem erect, 0.5 to 2.0 m in height, base woody, angular, simple or branched, often tinged with pink color. Leaves are opposite, petiolate, ovate, elliptic, rounded in various size. Stems are square, leaves elliptic ovate or broadly rhombate, 5.22 cm long, 2.5 cm broad, and adpressed pubescent. The inflorescences are 8 - 30 cm long, with many single, white or red flowers, 3 - 7 mm wide. Flowering time is in summer. Apex usually rounded. Flowers are in auxiliary or terminally spikes, which is more than 50 cm long with greenish white, numerous in small dense auxiliary heads or spikes, bracts and bracteoles persisting ending in a spine. Main root is long cylindrical thick; secondary and tertiary roots present slightly ribbed, yellowish brown in color; odor is slight, taste is slightly sweet and mucilaginous; stem is yellow brownish, erect branched, cylindrical hairy about 60 cm high. The plant is distributed throughout India up to an altitude of 3000 ft. Average stomata index of 6.6, average palisade ratio of 9.2, average vein islet no 9 and average epidermal cell counts 360 are reported¹⁰.

PHYTOCHEMISTRY

The plant contains triterpenoid saponins in major portion, possessing oleanolic acid as aglycone, as major chemical constituents. Other constituents are ecdysterone, long chain alcohol, viz. 17-penta triacontanol, 27-cyclohexyl heptacosan-7-ol, 16-hydroxyl 26-methyl heptacosan-2-one and 36, 47-dihydroxy hen-pentacontan-4-one. It also contains a water soluble base, betaine¹¹. Seeds contain oleanic acid. Other constituents are saponin A, B, C, D from unripe fruits. Protein, Fe, Ca, Phosphorous, Vitamin C, Ecdysterone, several enzymes are also found to be reported¹². A different part of plant contains different constituents are as follows:

Root: From the roots ecdysterone and oleanolic acid have been isolated. In the unripe seeds, saponines, oleanolic acid, amino acids and hentriacontane, a long chained carbohydrate, have been found. The content of free oleanolic acid in *A. aspera* roots is 0.54 %^{13,14}.

Shoot: In the shoots, an aliphatic dihydroxyketone 36,37-dihydroxyhenpentacontan-4-on and triacontanol could be found (4). Two long chain compounds, isolated from the shoots, have been characterized as 27-cyclohexylheptacosan-7-ol and 16-hydroxy.26-methylheptacosan-2- on by chemical and spectral investigations¹⁵.

Seeds: Compounds in the seeds of *A. aspera* are the saponins A and B. They are glycosides of oleanolic acid. The carbohydrate components are the sugars D-glucose, L-rhamnose, Dglucuronic acid. Saponin B is the β -D-galactopyranosyl ester of Saponin A¹⁶.

PHARMACOLOGICAL ACTIVITIES***Anti-inflammatory activity:***

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 hr. In a chronic test the extract exhibited 40.03 % and 45.32 % reduction of the granuloma weight in the subacute cotton pellet granuloma model¹⁷. The ethanolic extract of *A. aspera* inhibited inflammatory responses in the paw oedema induced by carrageenan and Freund's complete adjuvant in mice and rats at concentrations of 100-200 mg/kg. The authors see the traditional use of these plants supported by these results¹⁸.

Antimicrobial activity:

A leaf extract from *A. aspera* collected in different areas of the United Arab Emirates was tested against Gram-positive bacteria. It showed inhibition against *Staphylococcus aureus*, *Bacillus subtilis*, *E. coli* and *Aspergillus terreus*, respectively. The root extract was less active¹⁹. The Indian major carp *Catla catla* was fed a diet with 0.5 % *A. aspera* seeds for four weeks.

After immunisation with chicken erythrocytes, haemagglutination antibody titres, serum globulin levels on days 14 and 21, alpha 1-antiprotease and RNA/DNA ratio of spleen and kidney were higher in the test group, significantly ($p < 0.05$). All these results confirm the hypothesis that *A. aspera* enhances the immunity²⁰.

From the hexane eluate of *A. aspera* shoots an essential oil was obtained which is toxic for the fungus *Aspergillus aspera*. The mycelia growth was inhibited with 100 % by an oil concentration of 3000 ppm²⁰.

Anticarcinogenic activity:

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 carcinogenesis²¹.

Antiviral activity:

In an 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)²¹.

Antinociceptive activity:

Antinociceptive activity of methanolic extract of *A. aspera* leaves was studied by peripheral/non-narcotic model of nociception like acetic acid induced writhing syndrome test and central/narcotic models like hot plate and tail flick tests. The methanolic extract of the plant, administered orally (300, 600 and 900 mg/kg, body weight) and the standard drug compared to the vehicle treated control group. In the tail flick test, the plant extract produced dose dependant increase in reaction time which was significantly higher in the test and standard group compared to the control group. The plant possesses significant antinociceptive property as evidenced in all the animal models of nociception²².

Antifertility activity:

The ethanol extract of the root of *A. aspera* was screened for anti-fertility activity in proven fertile female albino rats at 200 mg/kg body weight and given orally on days 1–7 of pregnancy. The ethanol extract exhibited 83.3% anti-implantation activity when given orally at 200 mg/kg body weight. The rats, which continued their pregnancy, did not deliver any litters after their full term. Hence the combined antifertility (anti-implantation and abortifacient) activity of ethanol extract was 100%. The results suggest that the ethanol extract possess both anti-implantation and abortifacient activity. The ethanol extract also exhibited estrogenic activity tested in immature ovariectomised female albino rats²³.

Antidiabetic activity: Oral administration of 2, 3, and 4 g/kg of *A. aspera* powder produced a significant dose-related hypoglycaemic effect in normal as well as in alloxan diabetic rabbits. In the same way the water and methanol extract decreased blood glucose levels. A 7-day acute toxicity study in rabbits did not reveal any further side effects at doses up to 8 g/kg orally. It is possible that the plant could act by providing certain necessary elements like calcium, zinc, magnesium, manganese and copper to the β -cells²⁴.

Toxic effects:

The following single comment reports about cardiac toxicity caused by *A. aspera*. A 57 year old man drank 1000 ml decoction made from *A. aspera* and was found unconscious in his bathroom. Hypotension and bradycardia were noted. He recovered four days later after supportive care with dopamine. In the serial cardiac examinations further cardiac abnormalities were not noted. *A. aspera* may cause a transient dose-related cardiovascular toxicity²⁵.

Conclusion

The multiple benefits of *Achyranthes aspera* made it a true miracle of nature. Numerous studies have been conducted on different parts of *Achyranthes aspera*, but this plant has not yet developed as a drug by pharmaceutical industries. A detailed and systematic study is required for identification, cataloguing and documentation of plants, which may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plants. The present review reveals that the herb chirchira is used in treating various ailments. It elicits on all the aspects of the herb and throws the attention to set the mind of the researchers to carry out the work for developing its various formulations, which can ultimately be beneficial for the human beings as well as animals.

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