

A REVIEW ARTICLE ON PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILES OF APAMARGA (*ACHYRANTHES ASPERA* LINN)

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ABSTRACT

Apamarga (*Achyranthes aspera* Linn.) is a perennial herb occurs naturally throughout India. It is commonly known as Chaff Tree, Prickly- chaff Flower, Rough-chaff Tree. As this is having *Laghu*, *Ruksha*, *Tikshna Guna*, *Katu*, *Tikta*, *Rasa*, *Katu Vipaka* and *Ushna Virya*. By the virtue of above property this is *Kaphavatashamaka* and *Kaphapittasanshodhana*. *Achyranthes aspera* contains a number of bioactive chemicals, including tannin, glucoside and saponin. Its ash contains potash mainly. It helps to purify blood. It is an effective anti-inflammatory medicine and recommended for *shirovirechana* in the treatment of various diseases as mentioned in classical texts of Indian medicine. The present review is therefore, an effort to give a detailed focus on its botanical details, phytochemistry, pharmacodynamics, therapeutic importance and its pharmacological studies.

Keywords: Ayurveda, *Apamarga*, *Achyranthes aspera*, *Shirovirechana*, *Vedanasthapana*

INTRODUCTION

Apamarga (*Achyranthes aspera* Linn) Family: Amaranthaceae is an erect stiff, annual-perennial herb, often will woody base, occurs naturally throughout India. Plant is found common in waste places roadsides, hedges, gardens, fields or farms, fore edges, forest clearings and other places. It is commonly known as Chaff Tree, Prickly- chaff Flower, Rough-chaff Tree. (Fig. 1) It contains tannin, glucoside and

saponin. The plant (whole herb) and seeds contain alkaline Substance specially potash. The plant possesses various medicinal properties useful as pungent, laxative, anti-dermatosis, wound healer, blood purifier, poison antidote and cholagogue drug, and also for other activities, useful in doopsy, piles, boils, eruptions of skin and other diseases.



Figure 1

A. aspera. (A) Roots. (B) Inflorescence.

History

On comprehensive review of Ayurvedic classics it was found that *Apamarga* is described in *Charaka Samhita*, *Nighantus* and *Chikitsagranthas*. In *Charaka Samhita*, it is described as *shirovirechana*(C.Su.25), also used as *apamargakshara taila* in *parshvashula*(C.Ci.13/171). *Madhuka-shara* and seeds of *shigru* or *apamarga* are used as pressed snuff (S.Ci.18/23). In *Kaiyadeva Nighantu*, its properties and uses are described¹. In *Bhavaprakash Nighantu*, its properties and uses are described². In *Raj Nighantu*, its properties and uses described as *vranakanduvishaghna*³. It is also mentioned in *Chikitsa Granthas* like *Chakradatta*, it is described in *sadyovrana*(CD.44/52), *vishamajvara* (CD.1/229), *apamargakshara taila* is used in *karnavyadhi* (CD.57/25). *Bhavamishra*, in his section *Bhavaprakash, madhyamakhanda* mentions indication of *apamarga* in *vishuchika*(BP.6/110,114), *kushtharoga* (BP.54/128), *karnaroga* (BP.64/38). *Apamargataila* (RM.26/7) and *apamargadalalepa* in *shastrakshata*(VM.16/120).

Botanical classification

Streblus asper Lour belongs to the family Moraceae.

Kingdom: Planate

Unranked: Angiosperms

Unranked: Eudicots

Unranked: Core eudicots

Order: Caryophyllales

Family: Amaranthaceae

Genus: *Achyranthes*

Species: *Aspera*

Part used: Whole Plant, Leaves, Spikes, Roots, Seeds Doses Fresh juice 5-10 ml., Decoction 10-15 ml., Seeds powder 3 gm.

Specific formulations: *Apamarga Ksara*, *Apamarga Ksara Taila*.

Vernacular Names

Sanskrit names: *Pratykpuspa*, *Sikhari*, *Kharamanjari*. *Kitnihi*, *Adhahsalya*, *Mayuraka*.

Hindi: Chirchita, Chichrha, Latjira, Apamarg

English: Chaff Tree, Prickly- chaff Flower, Rough-chaff Tree.

Bengali: Apang

Gujarati: Aghedo

Tamil: Najurivi

Telugu: Apamargam

Arabian: Alkum

Persian: Kharevajgun

Pharmacodynamics

Rasa : *Katu*, *Tikta*

Guna : *Laghu*, *Ruksha*, *Tikshna*

Virya : *Ushna*

Vipaka : *Katu*

Doshakarma : *Kaphavatasma*, *Kaphapittasamsodhaka*

Chemical composition

Saponin A was identified as D-Glucuronic Acid and saponins B was identified as -Dgalactopyranosyl ester of D-Glucuronic Acid. Along with these constituents certain other constituents were also isolated like oleanolic acid, amino acids and hentriacontane. The seeds also contain chemical constituents like 10-tricosanone, 10-octacosanone & 4 tritriacontanone^{4,5}. The studies of R.D. Rameshwar & N. Akito (2007) revealed three oleanolic acid glycosides from the seeds of *Achyranthes aspera* which were identified as -L-rhamnopyranosyl-(1 4)-(-Dglucopyranosyluronic acid)-(1 3)-oleanolic acid, -L-rhamnopyranosyl-(1 4)-(-Dglucopyranosyluronic acid)-(1 3)-oleanolic acid-28-O- -D-glucopyranoside and -Lrhamnopyranosyl-(1 4)-(-D- glucopyranosyluronic acid)-(1 3)-oleanolic acid-28-O- -Dglucopyranosyl-(1 4)-D-

glucopyranoside⁶. A.S. Chauhan *et al.* (2002) isolated a new cyclic chain aliphatic fatty acid (I) was also isolated from seeds of the plant⁷. H.N. Khastgir *et al.* (1958) isolated sapogenin along with oleanolic acid from the seeds⁸. A. Banerji *et al.* (1970) isolated ecdysterone from the methanolic extract of roots of *Achyranthes aspera*⁹. R. Ikan *et al.* (1971) also isolated ecdysterone from *Achyranthes aspera* root extracts by chromatography on silica gel column, followed by elution with CHCl₃-MeOH (4:1)¹⁰. A. Banerji *et al.* (1970) and A.K. Batta & S. Rangaswami (1973) isolated ecdysone from the roots of *Achyranthes aspera*¹¹. H.N. Khastgir *et al.* (1958) isolated oleanolic acid from glycosidic fraction of the roots^{12,13}. S.K. Sharma *et al.* (2009) from the ethanolic extracts of the roots isolated a new aliphatic acid and identified as n-hexacos-14-enoic acid from the roots of *Achyranthes aspera*. This compound is reported for the first time from any natural and synthetic source. Certain other were also isolated and identified as strigmasta-5, 22-dien-3-ol, trans-13 docasenoic acid, n-hexacosanyl n-decaniate, n-hexacos-17-enoic acid and n-hexacos-11-enoic acid. Strigmasta-5, 22-dien-3-ol is a phytosterol, was obtained as a colourless crystalline mass from petroleum ether: benzene 75:25 elute. It responded positively to Liebermann Burchard test for sterols¹⁴. Triacontan-1-ol was also isolated by T.N. Misra *et al.* (1991) along with 36, 47-dihydroxyheptacontan-4-one¹⁵. T.G. Misra *et al.* (1993) reported certain long chain compounds from the shoots like 27-cyclohexylheptacosan-7-ol and 16-hydroxy-26-methylheptacosan-2-one¹⁶. Y. Gariballa *et al.* (1983) isolated an aliphatic alcohol, 17-pentatriacontanol from the shoots¹⁷. T.N. Misra *et al.* (1996) isolated various com-

pounds like tetracontanol-2 (C₄₀H₈₂O, melting point 76-77°C), 4-methoxyheptatriacont-1-en-10-ol (C₃₈H₇₆O) and -sitosterol¹⁸. A. Banerji *et al.* (1971) isolated ecdysterone from the whole plant¹⁹. K.S.Laddha (2005) *et al.* reported extraction, isolation and purification of 20-hydroxyecdysone from *Achyranthes aspera* and its characterization by DSC, UV, IR, CD, ¹H and ¹³C NMR, MS and quantification by HPLC²⁰. N. C. Neogi *et al.* (1970) reported Achyranthine a water soluble alkaloid which possess pharmacological actions like dilation of the blood vessels, lowering of the blood pressure, depression of the heart and increase the rate and amplitude of respiration²¹. V. K. Kapoor & H. Singh (1966) reported betaine (C₅H₁₁NO₂) (m.p. 292°C) from the whole plant which is also a water soluble alkaloid²². The identity of betaine was confirmed by mixed m.p. detection of the HCl-salt, oxalate and picrate derivatives and compared with those of an authentic sample. V. Seshadri *et al.* (1981) isolated two constituents from the fruits and were identified as Saponins C and D^{23,24}. O. Kunert *et al.* (2000) reported three bisdesmosidic saponins (I-III), 20-hydroxyecdysone, and quercetin-3-O-β-D-galactoside, were isolated from the methanol extract of the aerial parts of *Achyranthes aspera*. Their structures were established on the basis of NMR spectroscopic analysis; the complete ¹H and ¹³C assignments of the compounds were achieved by means of 2D NMR studies²⁵. G. Michl *et al.* (2000) reported two new bisdesmosidic triterpenoid saponins were isolated, besides the three known saponins from the Methanolic extract of the aerial parts of *Achyranthes aspera*. Their structures were elucidated as β-D-glucopyranosyl3-O-β-L-

rhamnopyranosyl-(1 3)-O- -D-glucopyranuronosyloxy]machaerinate, -D-glucopyranosyl3-[O- -Dgalactopyranosyl-(1 2)-O- -Dglucopyranuronosyloxy]machaerinate. The other saponins were identified as -D-glucopyranosyl-3 [O- -L-rhamnopyranosyl-[1 3)- O- -D-glucopyranuronosyloxy]oleanolate, -D-glucopyranosyl3- -[O- -D-galactopyranosyl (1 2)-O- -D-glucopyranuronosyloxy] oleanolate, -D- glucopyranosyl 3-[O- -Dglucopyranuronosyloxy] oleanolate²⁶. R.D. Rameshwar (2007) isolated chemical compounds of the volatile oil from *Achyranthes aspera* leaves, growing in Dehra Dun were analyzed by G.C. M.S. Seven compounds viz., pbenzoquinone, hydroquinone, spathulenol, nerol, -ionone, asarone and eugenol constituting 63.05% of the oil were identified. Hydroquinone (57.7%) was found to be the chief constituent²⁷.

Therapeutic uses

The dried plant is given to children for colic and also as anastringent in gonorrhoea. Plant is crushed in water and boiled, and solution is given in treating pneumonia. The infusion of roots of plant is given as a mild as tringent. Plant's infusion is applied to the wounds caused, by Acacia (Babula) thorns in the forests as per forest-tribal practices, used in as acure stage of coughs a rheumatism. The seeds and leaves are considered emetic and are useful in hydrophobia. The juice of leaves is given in dysentery and diarrhoea.

The flowering spikes made into pills with a little sugar is popular preventive medicine for persons bitten by rabid dogs and this kind of herbal therapy is prevalent in certain rural areas. The ash of the whole plant (alkalies of kshara) is prepared by burning of herb and it contains potash in a

large quantity and the same is used in treatment of coughs and asthma. The ash is mixed with sesamum oil (*Tila taila*) and used externally over wounds, ulcers and on warts of penis (male genital) and also other parts of body. The ash of whole plant (*Apamarga*) is mixed and prepared with sesame oil (*Apamarga Ksara taila*) and dropped into ear as an effective remedy for ear complaints. The herb is commonly used as a depurative, astringent, diuretic and pectoral remedy. The roots are given in puerperal, pulmonary, syphilitic and rheumatismal troubles. It is also used in ophthalmia, dropsy and various cutaneous complaints.

An infusion of the roots is used as an emetic for pains in the chest not due to cough. The steam coming from boiling the whole herb is inhaled and also used it as a hot bath for checking acute chills and this kind of fomentation causes sweating and relieving chills and fever temperature. Whole plant or almost every part of the herb are recommended as a good remedy in treatment of snake-bite and scorpion-sting. Roots of the plants are pounded with black pepper and given orally with water in cases of snake bite for checking venomous poison. A paste of fresh leaves is topically applied over in-sect. bites. The herb is used in various forms against the scorpion-sting as well as snake bite and whole plant or its particular parts are frequently administered internally as well as externally both. This carries classical (textual) and traditional background. The plant is also esteemed to apply in magico-medical therapy (*Tantra-mantra cikitsa*) against the scorpion-bite other than two major modes oral and topical usage of drug. For the instance, a fresh plant is plucked and repeatedly touched downwards for extracting out the poi-son from scorpion-

bite point under traditional belief of specific herbal effect (prabhavajanyakarma).

The plant is also considered as an anti-appetizer with special reference. The seeds are boiled in milk and given in cases of over or excessive appetite (Bhasmaka and atyagni), though plant has normally appetizer property. The herb is sometimes claimed to help control appetite (ksudhaniyantraka or nasaka). A paste of the roots is applied in ophthalmia and opacity of the cornea in eye complaints. An infusion of the roots is a mild astringent and it is used for bowel complaints, night blindness, skin diseases and other complaints; it is also given in cases of menorrhagia, piles and inflammation of in ten organs. The juice of leaves or plant is used in large doses hasten labour pains or may cause abortion. The ash of the seed containing a high proportion of potash and therefore the ash is an important constituent alkaline medicines and caustic pastes; and the ash is a acid. It is recommended in respiratory ailments and other various disorders in different modes suitably.

The mixture of ash made of whole plant and time its weight of water is allowed to stand for 24 hours; a the residue obtained by evaporating the supernatant liquid; and it is finally used as a powder in colic, cough, asthma and several other ailments with honey or any other adjuvant as required in treatment. The calcinated powder is also give in splenic disorders.

The spikes of herb is rubbed or chewed to help the tooth and gums healthy as a dentifrice application. The leaves are warmed up little over heat and juice is extracted; the expressed juice is topically applied over fresh cuts and bleeding for checking it as a styptic and coagulant remedy; the fresh leaves pasts is also applied for the pur-

pose of treating wounds. The water obtained from washing rice (tandulodaka) is will mixed by seeds and it is orally used in bleeding pile or haemorrhoids. The leaves of herb are used to check vaginal pain and leaves are locally applied in vagina for relieving pain. The leaves, branch, root and spikes are combine and put into water for boiling to prepare decoction which orally given in cases of asthma. The herb is one of the highly medicinally potent and common drug in Indian medicine and prevalent as a yak able plant²⁸.

Pharmacological Properties

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 sperm²⁹.

Antiparasitic Activity

A. A. Zahir *et al.* (2009) reported that the ethyl acetate extracts of *A. aspera* shows antiparasitic activity (dried leaf, flower and seed extract) against the larvae of cattle tick *Rhipicephalus* (Boophilus) *microplus* (Canestrini, 1887) (Acari: Ixodidae), sheep internal parasite *Paramphistomum cervi*³⁰.

Hypoglycemic Activity

M.S. Akhtar & J. Iqbal (1991) 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 doses³¹.

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 cells³².

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 bilirubin³³.

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 drug³⁴.

Anti-inflammatory and anti-arthritis 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 test³⁵.

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*³⁶.

Anti-oxidant Activity

P. Tahiliani & A. Kar (2000) studied various extracts of the leaves for anti-oxidant activity³⁷.

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 rats³⁸.

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 rats³⁹.

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 rats⁴⁰.

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) fluid⁴¹.

Cardiovascular Activity

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 activity⁴².

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 mice⁴³.

Wound Healing Activity

S. Edwin *et al.* (2008) investigated the ethanolic and aqueous extracts of leaves of *Achyranthes aspera* for wound healing activity⁴⁴.

Immunomodulatory Activity

R. Chakrabarti & R.Y. Vasudeva reported that *Achyranthes aspera* show immunostimulant action in *Catla catla*⁴⁵.

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 rats⁴⁶.

DISCUSSION AND CONCLUSION

On comprehensive review of Ayurvedic classics it was found that *Apamarga* is described in *Charaka Samhita*, *Sushruta Samhita*. Some synonyms of *apamarga* like *Pratykuspa*, *Sikhari*, *Kharamanjari*. *Kitnihi*, *Adhahsalya*, *Mayuraka* are described in various *Nighantu*. *Apamarga* (*Achyranthes aspera* Linn.) is commonly known as Chaff Tree, Prickly- chaff Flower, Rough-chaff Tree. As this is having Laghu, Ruksha, Tikshna Guna, Katu, Tikta, Rasa, Katu Vipaka and Ushna Virya. By the virtue of above property this is Kaphavatashamaka and Kaphapittasanshodhana. Its phytochemical, therapeutic uses and pharmacological studies well described.

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