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A REVIEW ON PHARMACOLOGICAL AND PHYTOCHEMICAL CONSTITUENT OF *ACHYRANTHES ASPERA* LINN.

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ABSTRACT: *Achyranthes aspera* Linn. belongs to the family Amaranthaceae is a perennial stiff, erect herb, 2.0 m high is growing up to 1000 m in height. *Achyranthes aspera* is a rough flowered stalk is described as in Sanskrit synonyms. The medicinal plants are used for the treatment of various diseases because of their safety and effectiveness. 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. The major chemical constituents are carbohydrates, protein, glycosides, alkaloids, tannins, saponins, flavonoids, lignin, etc. The review reveals that wide numbers of Phytochemical constituents have been isolated from the plant, which possesses activities like antiperiodic, diuretic, purgative, laxative, antiasthmatic, hepatoprotective, anti-allergic, and various other important medicinal properties. The plant is highly esteemed by traditional healers and used in the treatment of asthma, bleeding, in facilitating delivery, boils, cold, cough, colic, debility, dropsy, dog bite, dysentery, ear complications, headache, leucoderma, pneumonia, renal complications, scorpion bite, snake bite, and skin diseases, etc. Traditional healers claim that the addition of *Achyranthes aspera* would enhance the efficacy of any drug of plant origin. The plant is globally available as a medicinal weed in Baluchistan, Ceylon, Tropical Asia, Africa, Australia, and America. It is reported as an invasive alien species in northern Bangladesh. It is also found to be the most prevalent weed in Shivbari, Himachal Pradesh, and an exotic medicinal herb of the district, Lalitpur (Uttar Pradesh), India.

INTRODUCTION: Historically, the majority of new drugs have been generated (secondary metabolites) from compounds derived from natural products ¹. The R&D thrust in the pharmaceutical sector is focused on the development of new drugs, innovative/indigenous processes for known drugs, and the development of plant-based drugs through the investigation of leads from the traditional systems of medicine.

In addition, many nutraceuticals are being consumed in unregulated markets for perceived benefits in health care and improvement of quality of life ². Indian medicinal system has a long history and one of the oldest organized systems of medicine. It is mainly influenced by Ayurveda, Siddha, Unani, and Homeopathy.

These systems used natural products such as plant, terrestrial and marine animals, micro-organisms derived preparations to cure the dreadful diseases ³. The term 'Pharmacognosy' was coined by German scientist Seydler in 1815. The pharmacognosy was derived from the Greek word Pharmakon (a drug which is meant for dried herb) and gnosys (to acquire knowledge). Hence, pharmacognosy, which literally means knowledge of drugs of

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pharmaceuticals. Charaka and Susruta were renowned ancient Indian physicians, and Charaka classified about 300 vegetable drugs into 50 groups⁴.

Synonyms:

1. *Achyranthes argentea* Lam.
2. *Aspera* var. *indica* L.
3. *Aspera* var. *obtusifolia* (Lam.) Suss.
4. *Achyranthes indica* (L.) Mill.
5. *Achyranthes obtusifolia* Lam.



FIG. 1: INFLORESCENCE, LEAVES & ROOTS OF *ACHYRANTHES ASPERA* LINN.

Vernacular Names⁵:

African	: Mo-tswarak
Arabian	: Atkumah, Wazer (Yemen)
Ayurvedic	: Apamarga, Chirchita, Shikhari, Shaikharika
English	: Prickly chaff flower, Devil's horsewhip
French	: Achyranth a feuilles rudes
Hindi	: Latjira, Chirchira
Kannada	: Uttaranee
Latin	: <i>A. aspera</i>
Marathi	: Aghada, Pandhara-aghada
Sanskrit	: Aghata
Tamil	: Shiru-kadaladi, Nayuruvi

Botanical Description: *Achyranthes aspera* Linn. belongs to the family Amaranthaceae is a perennial stiff erect herb, 2.0 m high is growing up to 1000 m in height. 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. The main root is long cylindrical thick; secondary and tertiary roots present slightly ribbed, yellowish-brown in color; odor is slight, the taste is slightly sweet and mucilaginous; the stem is yellow-

brownish, erect branched, cylindrical hairy about 60 cm high. Seeds are subcylindrical, truncates at apex, rounded at base, black, and shining. The plant is distributed throughout India up to an altitude of 3000 ft⁵. *Achyranthes aspera* L. also known as "Prickly chaff flower" in English. The plant is highly esteemed by traditional healers and used in treatment of asthma, bleeding, in facilitating delivery, boils, cold, cough, colic, debility, dropsy, dog bite, dysentery, ear complications, headache, leucoderma, pneumonia, renal complications, scorpion bite, snake bite, and skin diseases etc. Traditional healers claim that addition of *Achyranthes aspera* would enhance the efficacy of any drug of plant origin⁶.

Ayurvedic Formulations: *Achyranthus aspera* powder. Jeevanras Apamarg Juice⁷.

Geographical Source: Easily found anywhere in India on roadsides or on the edges of field and waste places as a weed throughout up to an altitude of 2100 m and also in South Andaman Islands. Some other places in the world also we can find this plant-like in Baluchistan, Ceylon, Tropical Asia, Africa, Australia and America⁸.

Habitat: The plant can grow in the absence of shade or in semi-shade (light woodland). It requires moist soil but prefers light sandy, medium loamy, heavy clay soils for its growth.

It grows as a wasteland herb everywhere. Flowers appear from July to September, and seeds ripe in the month of October⁹.

TABLE 1: TAXONOMIC CLASSIFICATION OF *ACHYRANTHES ASPERA*¹⁰

Kingdom	Plantae
Subkingdom	Tracheobinota
Super Division	Spermatophyta
Division	Mangoliophyta
Class	Mangoliophsida
Subclass	Caryophyllidae
Order	Caryophyllales
Family	Amaranthaceae
Genus	<i>Achyranthes</i>
Species	<i>Aspera</i>

Phytochemical and Pharmacological Review:

1. Vijai Lakshmi et al., (2019): Reported an ursolic acid, oleanolic acid, sitosterol and triacontanol, hexatriacontane and Palmitic acid

isolated from the of chloroform and ethanol root extract of *Achyranthes aspera*, which shows significant anti diabetic effect in streptozotocin-induced diabetic rats and could therefore be used as a remedy for the treatment of diabetes mellitus ¹¹.

2. Krishna Mohan et al., (2018): Reported that *Calotropis gigantean* & *Achyranthes aspera* ethanolic leaves extract individually and in combination exhibited better anti-inflammatory activities using carrageenan-induced paw edema, cotton pellet induced granuloma & formalin-induced paw edema comparable to standard diclofenac due to the presence of phytoconstituents like ecdysterone achyranthine, betaine, vanillic acid, syringic acid, *p*-coumaric acid saponin ¹².

3. Vijai Lakshmi et al., (2018): Isolated phytoconstituents like ursolic acid, oleonolic acid, sitosterol and Triacontane from ethanol leaves extract of *Achyranthes aspera*, out of which only ursolic and oleonolic acid show potent anti-diabetic effect in streptozotocin-induced diabetic rats ¹³.

4. Jadhav VS et al., (2017): Reported Anthelmintic activity of the ethanolic extract of stems of *Achyranthus aspera* tested by using Indian adult earthworms *Pheretima posthuma*.

And also reports the presence of tannins and phenolic as one of the chemical constituents. Tannins were shown to produce anthelmintic activity ¹⁴.

5. A. Pauline Fatima Mary et al., (2017): carried out GC-MS analysis of ethanolic leaf extracts of *A. aspera* to determine the bioactive components 9-Octadecenamide, (Z) (21.15%), Squalene (19.04%), Phytol (7.06%), Phenol, 4,6-di (1,1dimethylethyl) 2-methyl- (6.50%), β -Amyrin (4.33%), Cyclopropane, nonyl- (3.37%), Dibutyl phthalate (3.19%), etc.

Some of the identified compounds have been reported to possess various biological activities such as Antimicrobial, Antioxidant, Antiseptic, Pesticide, Fungicide, Diuretic, Anti-inflammatory and Anticancer ¹⁵.

6. Bahule BB et al., (2017): Isolated phytoconstituents like tannins, alkaloids, terpenoids ascorbic acid, from aqueous wood and leaf extract

of *Achyranthes aspera* plant aqueous extracts of wood and leaf were screened for their antioxidant activity using DPPH radical scavenging method.

The standard used is ascorbic acid, and the phytochemicals exhibited better activity than the standard compound ¹⁶.

7. Anand Kumar et al., (2017): Carried extraction of plant material with a series of solvent in their increasing order of polarity *i.e.*, petroleum ether, chloroform, acetone, methanol, and water by soxhlet apparatus to isolate phytoconstituents like alkaloid, phenolic compound, saponin, flavonoid, proteins, amino acids alkaloids, glycosides, carbohydrate, tannins, gums & mucilage, steroids & Sterols ¹⁷.

8. Tamanna Talreja et al., (2016): Investigated the preliminary phytochemical screening of different sequential extracts (methanol, ethyl acetate, benzene, aqueous) of seeds of *Achyranthes aspera* Linn. and stem of *Cissus quadrangularis* Linn. by different standard methods of phytochemical screening and showed that the extracts of *A. aspera* seeds and *C. quadrangularis* stem contain alkaloids, phenolic compounds, and tannins, steroids and terpenoids, flavonoids, reducing sugar and saponin. ¹⁸

9. Koushlesh Kumar Mishra et al., (2016): Isolated phytoconstituents like steroids, saponins, glycosides, vitamins from the ethanolic root extract of *Achyranthes aspera* and aqueous extract contain saponins, glycosides further antifungal activity was carried out using agar well diffusion method both extracts were compared with standard Clotrimazole (1% w/w) as positive control and distilled water, ethanol used as a negative control, ethanolic extract of the roots were found to more effective against *Trichophyton rubrum* as compared to aqueous extract ¹⁹.

10. Ajay Shukla et al., (2016): Reported that ethanolic extract of aerial part of *Achyranthes aspera* shows flavonoids, phenolic compound, glycosides, tannins, saponins, alkaloids, and carbohydrates by Phytochemical screening. Current study of the ethanol extract of aerial part of *A. aspera* was performed for the screening of anti-asthmatic activity of the drug and result in the right-side shift of dose response curve in isolated

goat chain and isolated guinea pig, indicating antiasthmatic action of drug²⁰.

11. Archana R. Juvekar et al., (2015): isolated triterpenoid saponin rich (TSR) and non-saponin subfractions and tested for anti-inflammatory activity. The activity of the TSR subfraction was evaluated against oxidative stress induced by carrageenan in rat paw tissues²¹.

12. Siva Prasad Peddi et al., (2015): Used Stem Extract of *Achyranthes aspera* as a reducing and capping agent and single-step green synthesis method for the process of obtaining silver nanoparticles (AGNP)²².

13. Siva Prasad Davuluri et al., (2015) Isolated Trypsin inhibitor (AATI) was purified from the seeds of *Achyranthes aspera* to homogeneity by conventional methods, and its antimicrobial activity was tested on selected pathogenic microbes. The inhibitor significantly affected the growth of *Proteus vulgaris* followed by *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella pneumonia* with zones of inhibition recorded as 28 mm, 26 mm, 25 mm, 20 mm, and 14 mm, respectively²³.

14. R. Vidhya et al., (2014): Evaluated the hypolipidemic activity of aqueous extract of *Achyranthes aspera* (L.) against alloxan-induced diabetic rats. Aqueous extract of *A. aspera* showed an excellent reduction in serum and marked raised tissue cholesterol, triglyceride, and free fatty acid and phospholipid levels. Plant extract help in resuming the lipid profile, urea, and creatinine to normal, and results were comparable to that of standard drug glibenclamide (1 mg/kg)²⁴.

15. Ajay Kumar Sharma et al., (2014): Isolated saponin from ethanolic extract of *A. aspera* seeds husk and Ethanolic extract was screened for their hyperlipidemia by using the high fat diet-induced hyperlipidemic model. So, Ethanolic extract of *A. aspera* seeds husk and its saponin can be used in the treatment of atherosclerosis as well as increased sugar level associated with hyperlipidemia²⁵.

16. Sandip Datir et al., (2014): Reported the phytoconstituents β -sitosterol in petroleum ether extract of aerial parts of *A. aspera* & studied the effect of the extract on clonidine induced catalepsy

to study its antihistaminic effect. Petroleum ether extract (200 mg/kg, i.p.) of the plant significantly inhibited clonidine-induced catalepsy. This proves the antihistaminic activity of the plant. The extract was standardized by HPTLC in the presence of Standard β -sitosterol, which proves that the antihistaminic activity may be due to β sitosterol²⁶.

17. Balaji Kaveti et al., (2013): Isolated tannins, Saponins, Terpenoids, Steroids, Flavonoids, Alkaloids, and Glycosides and investigate the antimicrobial and antioxidant activities of the methanolic seeds extract of *Achyranthes aspera*. The antimicrobial activity test of the methanol extract of the seeds of *Achyranthes aspera* was done using the disc diffusion method. Kanamycin (30 μ g/disc) was used as standard, and the crude extract was used at a concentration of 500 μ g/disc *Achyranthes aspera* possess significant free radical scavenging and antibacterial activities²⁷.

18. Naga Bharathi. M et al., (2013): Isolated saponins A and B, terpenoids, volatile oils phytoconstituents from methanolic and aqueous extracts of stems of *Achyranthes aspera* Linn and carried out Anthelmintic activity of methanolic and aqueous extract separately on Indian adult earthworms *Pheretima posthuma* (Annelida), Various concentrations (2.5, 5, 10, 20 mg/ml) of each extract were tested for anthelmintic activity which involved the determination of time of paralysis and time of death of the worms and compared with the standard drug Albendazole, methanolic extracts showed better anthelmintic activity than the standard drug as well as the aqueous extract²⁸.

19. P. Narisi Reddy et al., (2012): Reported pharmacognostic, preliminary phytochemical, and pharmacological investigations of *Achyranthes aspera*. Pharmacognostical studies are concerned for the determination of physicochemical constants like ash values, extractive values, and loss on drying. Phytochemical studies various phytoconstituents like carbohydrates, proteins, steroids, glycosides, alkaloids, tannins, saponins, flavonoids and lignin. Pharmacological studies were carried out to evaluate acute oral toxicity and antimicrobial activity from petroleum ether, alcohol, a water root extract of *Achyranthes aspera*²⁹.

20. Chandana C. Barua et al., (2012): Evaluated the anxiolytic activity of methanol extract of *Achyranthes aspera* Linn. Hole board (HB), open field (OF), elevated plus maze (EPM), and light/dark exploration (LDE) tests were used for the determination of anxiolytic activity. The methanolic extract of *Achyranthes aspera* significantly increased the number and duration of head poking in HB test. The extract also significantly increased the time spent and the number of entries in the open arm in EPM. In LDE test, the extract produced a significant increase in time spent, and a number of crossing sand decreased the duration of immobility in a lightbox. In OFT, the extract showed a significant increase in the number of rearing, assisted rearing, and the squares crossed. The activity of methanol extract is due to the presence of different phytoconstituents like alkaloids, steroids, and triterpenes³⁰.

21. Sharma Raj Neeta et al., (2011): Reported that Methanol extract of whole dried plants of *Achyranthus aspera* was evaluated against bacterial species, namely *Bacillus cereus*, *Escherichia coli*, *Klebsiella pneumonia*, and *Bacillus cereus*. *Escherichia coli* was maximally inhibited (24mm±0.5) followed by *Klebsiella pneumonia* (23mm±0.7) and *Bacillus cereus* (20mm±0.51) at the concentration of 2000µg. All the bacterial species were found susceptible to methanol extract of whole plants of *Achyranthes aspera*³¹.

22. Abi Beulah G et al., (2011): Isolated the bioactive compounds like alkaloids, glycosides, terpenoids, steroids, flavonoids, and tannins and reported the antioxidant and antibacterial activities of the *Achyranthes aspera* plant extract in Hexane, chloroform, Ethyl acetate, and Methanol organic solvents. The radical scavenging activity of the different extracts of root, stem, leaf, and inflorescences was evaluated by DPPH assay, and the antibacterial activity against *Staphylococcus aureus* a gram-positive and *Escherichia coli* a gram-negative bacteria was studied by Agar well-cut diffusion method. All of the extracts exhibited antioxidant and antibacterial activities, and the activities varied from solvent to solvent and the activities are concentration and time-dependent. The antioxidant and antibacterial activities were compared with the positive control Ascorbic acid and Gentamycin³².

23. Amrutia Jay N et al., (2011): Reported anti-inflammatory activity of different fractions of ethanolic extract of *Achyranthes aspera* leaves. Carrageenan-induced rat paw oedema method was used for screening. Ethanolic, ethyl acetate, and hexane fraction was screened, among which ethyl acetate fraction was found to be the most potent one with percentage inhibition of 50, 74, 84, 86% at 1st to 4th hour respectively³³.

24. Ramesh Londonkar et al., (2011): Isolated alkaloids saponins, carbohydrates, Flavonoids, phenols, tannins, terpenoids and sterols from methanolic, Chloroform and petroleum ether extracts of leaves of *Achyranthes aspera* and analyzed by UV detection at 365 nm. The extracts were screened for their antibacterial and antifungal activities; the extracts were tested against 5 different species of human pathogenic bacteria and 17 fungal strains by the agar-solid diffusion method.

Chloroform and petroleum ether were devoid of antifungal and antibacterial activities, except the methanolic extract of leaves of *Achyranthes aspera* showed strong inhibitory activity against the Gram-positive bacteria *Staphylococcus aureus* with a minimal inhibitory concentration (MIC) of 5000 µl ml-1. The minimal inhibitory concentration values to dermatophyte strains were 2500 µl ml-1 against *Trichophyton rubrum* (LM-09, LM-13) and *Microsporum canis*³⁴.

25. S. B. Datir et al., (2009): Evaluated the Petroleum ether extracts of the aerial parts of the *Achyranthes aspera* for antiallergic activity. Petroleum ether extract (200 mg/kg, i.p.) of the plant shows significant antiallergic activity in both milks induced leukocytosis and milk induced eosinophilia in mice, the phytochemical screening of petroleum ether extract shows the presence of steroids like β-sitosterol, ecdysone, and ecdysterone which is responsible for the antiallergic activity³⁵.

26. Shahazadi Parveen (2008): The reported presence of phytoconstituent like tannins, alkaloids, glycosides, carbohydrate, tannins, proteins & amino-acids, gums & mucilage, flavors & flavonoids, saponins and steroids & Sterols in chloroform and methyl alcohol root and shoot

extracts of *A. aspera*. Chloroform and methyl alcohol root and shoot extracts of *A. aspera* showed the sensible quantity of medication activity against enterobacteria species.

Root extract showed the activity against *B. Substilis*, antifungal activity was found in roots extracts of petroleum ether, chloroform, and methyl alcohol against fusarium species³⁶.

27. S. Edwin et al., (2008): Reported that ethanol and aqueous extracts of leaves of *Achyranthes aspera* were prepared, and its wound healing and antioxidant activity were evaluated. The wound healing activity was studied models excision wound model and incision wound model and antioxidant activity were studied using DPPH radical scavenging activity and superoxide scavenging activity. Phytochemical screening of the tested extracts showed the presence of alkaloids, carbohydrates, tannins, proteins, saponins, and flavonoids in both the extracts³⁷.

28. R. G. Mali et al., (2006): Reported effect of hydroalcoholic extract of aerial parts of *Achyranthes aspera* on neutrophil phagocytic function. The different concentrations (25, 50, and 100 mg/ml) of extract of aerial parts of *Achyranthes aspera* was subjected to study its effect on different *in-vitro* methods of phagocytosis such as neutrophil locomotion and chemotaxis; results show that the hydroalcoholic extract of *Achyranthes aspera* stimulates the cell-mediated immune system by increasing neutrophil phagocytic function³⁸.

29. Muhammad Shoab Akhtar et al., (1991): Reported that methanolic and aqueous extract of the whole plant of *Achyranthes aspera* shows significant dose-related hypoglycemic effect in normal as well as in diabetic rabbits and reports presence of certain chemicals like elements like manganese, magnesium, zinc, calcium and phosphorus³⁹.

CONCLUSION: The review reveals that wide numbers of phytochemical constituents have been isolated from the plant. *Achyranthes aspera* also possesses activities like antiperiodic, diuretic, purgative, laxative, antiasthmatic, hepatoprotective, anti-allergic, antifertility, laxative, abortifacient, anti-helminthic, aphrodisiac, antiviral, anti-

plasmonic, hypoglycemic, antihypertensive, anticoagulant, anti-cancer, and various other important medicinal properties.

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