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Ethanopharmacology Study of *Achyranthes aspera*

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ABSTRACT

Achyranthes aspera, a species of the Amaranthaceae family, holds significant therapeutic value and is widely distributed as a weed over the Indian subcontinent. The utilization of seeds, roots, and shoots in traditional medical systems is widespread, as these particular plant components are considered to be of utmost significance. This article provides an overview of the current knowledge regarding the phytochemical and pharmacological aspects of the subject matter. The review demonstrates that a diverse range of phytochemical compounds have been extracted from the plant, exhibiting numerous therapeutic capabilities such as antiperiodic, diuretic, purgative, laxative, antiasthmatic, hepatoprotective, anti-allergic, and other significant medicinal effects. The pulverized botanical specimen is employed in the treatment of pneumonia, while the infusion derived from the root is utilized as a gentle astringent for addressing bowel-related ailments. The utilization of a concoction consisting of powdered leaves combined with honey or sugar candy has been found to be beneficial in the initial phases of both diarrhoea and dysentery. Over the past few decades, a significant amount of research has been conducted to substantiate the biological activities and pharmacological properties of its extracts. Various chemical ingredients, including as saponins, oleonolic acid, dihydroxy ketones, alkaloids, and long chain compounds, have been successfully identified.

Keywords- *Achyranthes aspera*, Latjeera, Medicinal properties, chemical constituents, pharmacological activities.

I. INTRODUCTION

The transmission of herbal knowledge has persisted over numerous generations over the course of millennia [1]. Herbal drugs play a significant role in all traditional systems of medicine. The use of herbal medicine represents a notable achievement in the realm of diverse therapeutic approaches embraced by the general populace. Throughout history, plants have been widely utilized for medicinal purposes due to their ability to fulfill immediate personal needs, as well as their accessibility and affordability [2]. There has been a notable surge in the utilization of plant-based health goods in both emerging and developed nations, leading to a substantial expansion of herbal products on a global scale in recent times. There has been a discernible increase in scholarly investigations pertaining to herbal remedies. Herbal medicines provide a robust foundation rooted in tradition or intellectual frameworks, and their potential as viable pharmaceutical agents in terms of safety and efficacy holds promise for the treatment of various ailments.

The topic of discussion pertains to various illnesses or medical conditions. The World Health Organization (WHO) has undertaken an endeavor to comprehensively identify all medical plants that are

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utilized on a global scale, resulting in the documentation of over 20,000 distinct species [3].

According to the World Health Organization (WHO), over 80% of the global population depends on traditional herbal medicine as their primary form of healthcare [4]. Plants persist in their role as potential reservoirs for novel pharmaceuticals and compounds obtained from diverse plant components [5]. In recent years, there has been a noticeable trend towards the utilization of herbal remedies due to the significant and irreversible side effects associated with contemporary pharmaceuticals. Nevertheless, the depletion of natural resources and the associated traditional knowledge is occurring as a result of factors such as overpopulation, urbanization, and ongoing use of these herbal assets [6]. In the contemporary period of pharmaceutical research and the exploration of novel pharmacological compounds, several botanical substances are assessed with regard to their historical medicinal applications. Achyranthes aspera, usually referred to as Latjeera in Hindi and Rough Chaff tree in English, is among the several plant species currently being evaluation to determine its therapeutic efficacies. The plant in question is a herbaceous species that can grow either erect or procumbent. It has an annual or perennial life cycle and often reaches a height of 1-2 meters. It is worth noting that this plant often has a woody base. It is commonly observed as a weed in areas adjacent to roadways, such as waysides and roadsides [7, 8, 9]. Despite possessing numerous medical qualities, this substance is specifically employed as a spermicidal agent [41], an antipyretic agent [52], and a cardiovascular agent [34].

Fig:1 Plant of *Achyranthes aspera*

Taxonomic classification

Kingdom	-	Plantae
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
Hindi	-	Latjira, Chirchira
Gujarati	-	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

II. GEOGRAPHICAL SOURCE

The plant species in question is commonly observed as a weed in many locations across India, including road sides, field boundaries, and waste places. Its distribution extends up to an elevation of 2100 m, and it is also present in the South Andaman Islands [8, 10]. The plant exhibits a wide distribution throughout several regions, including Baluchistan, Ceylon, Tropical Asia, Africa, Australia, and America.

Morphology

Achyranthes aspera L., commonly known as Latjeera, is a plant characterized by its upright or procumbent growth habit. It can be classified as either an annual or perennial herb, reaching a height of approximately 1-2 meters. It is worth noting that this plant often possesses a woody base. The stems of the plant exhibit an angular or ribbed structure, and may be either simple or branched from the base. Additionally, these stems often display a purple tinge [8]. The branches, on the other hand, are either cylindrical or possess a quadrangular shape, with distinct striations and a covering of fine hairs [9]. The leaves of the plant are thick in texture, measuring approximately 3.8 - 6.3 cm in width and 22.5 - 4.5 cm in length [9]. They have an ovate to elliptic or obovate to rounded shape [8], and are characterized by a soft and fine hair covering on both surfaces. The leaves are also undivided, possess a petiole, and have a petiole length ranging from 6 to 20 mm [9]. The flowers of the plant are greenish white in color and are found in abundance in axillary or terminal spikes, which can reach lengths of up to 75 cm. Finally, the seeds of the plant are subcylindrical in shape, with a truncated apex and a rounded base. They exhibit a reddish brown coloration.

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Traditional Uses

Historically, the utilization of the herb has been associated with the treatment of asthma and cough symptoms. The substance exhibits pungent properties and possesses antiphlegmatic, antiperiodic, diuretic, purgative, and laxative effects. It has been found to be beneficial in the treatment of conditions such as oedema, dropsy, piles, boils, and skin eruptions, among others. The plant material is subjected to a boiling process in water and thereafter employed in the treatment of pneumonia. The infusion of the root exhibits mild astringent properties when used to address intestinal issues. The utilization of the blooming spikes or seeds, which are pulverized and combined with water to form a paste, is employed as a topical treatment for venomous snake and reptile bites, as well as for the management of night blindness and dermatological ailments [11]. In cases of snake bites, the ground root is administered with water until emesis occurs and the patient regains consciousness. According to research findings, it has been indicated that the inhalation of a combination of Achyranthes aspera fumes and Smilax ovalifolia roots may have potential benefits in enhancing appetite and treating a range of gastrointestinal diseases [12]. The plant under consideration possesses several medicinal properties. It has been found to be beneficial in the treatment of haemorrhoids, as well as possessing emetic properties in its leaves and seeds. Additionally, it has been observed to exhibit efficacy in addressing hydrophobia, acting as a carminative, resolving swelling, aiding in digestion, and facilitating the expulsion of phlegm. The application of plant ash externally has been observed for its potential efficacy in treating ulcers and warts. In a study conducted by Smith et al. (2013), it was observed that crushed leaves were applied topically to alleviate discomfort in the back caused by strain. In dental hygiene practices, a recently harvested segment of a plant's root is employed as a tool for brushing teeth. The use of a water-based solution containing the extract of certain plant roots has been employed in the treatment of ophthalmia and corneal opacities. The use of freshly crushed leaves has been documented as a remedy for alleviating pain resulting from wasp stings [10]. The plant possesses beneficial properties for treating liver ailments, rheumatism, scabies, and many dermatological conditions. Additionally, it exhibits sedative effects [14, 15]

Phytochemistry

Two independent studies undertaken by V. Hariharan and S. Rangaswami in 1970, and M. Ali in 1993, involved the chemical examination of the seeds of Achyranthes aspera. The aforementioned inquiries led to the isolation and characterization of Saponins A and B, as recorded in references 16 and 18, correspondingly. The identification of Saponin A revealed it to be D-Glucuronic Acid, whereas Saponin B was characterised as the β-D-galactopyranosyl ester of D-Glucuronic Acid. Furthermore, the analysis revealed the presence of other chemicals, including oleanolic acid, amino acids, and hentriacontane. The seeds also contain chemical compounds, namely 10-tricosanone, 10-octacosanone, and 4-tritriacontanone, as documented.

In their 2007 study, R.D. Rameshwar and N. Akito conducted research on the seeds of Achyranthes aspera, resulting in the identification of three oleonolic acid glycosides. These glycosides were specifically identified as α-L-rhamnopyranosyl-(1□4)-(β-D-glucopyranosyluronic acid)-(1□3).The compound mentioned is oleanolic acid, specifically α-L-rhamnopyranosyl-(1□4)-(β-D-glucopyranosyluronic acid)-(1□3).The compounds mentioned are oleanolic acid-28-O-β-D-glucopyranoside and α-L-rhamnopyranosyl-(1□4)-(β-D-glucopyranosyluronic acid)-(1□3)-oleanolic acid-28-O-β-D-glucopyranosyl-(1□4).The compound referred to as -β-D-glucopyranoside has been mentioned in reference [19].

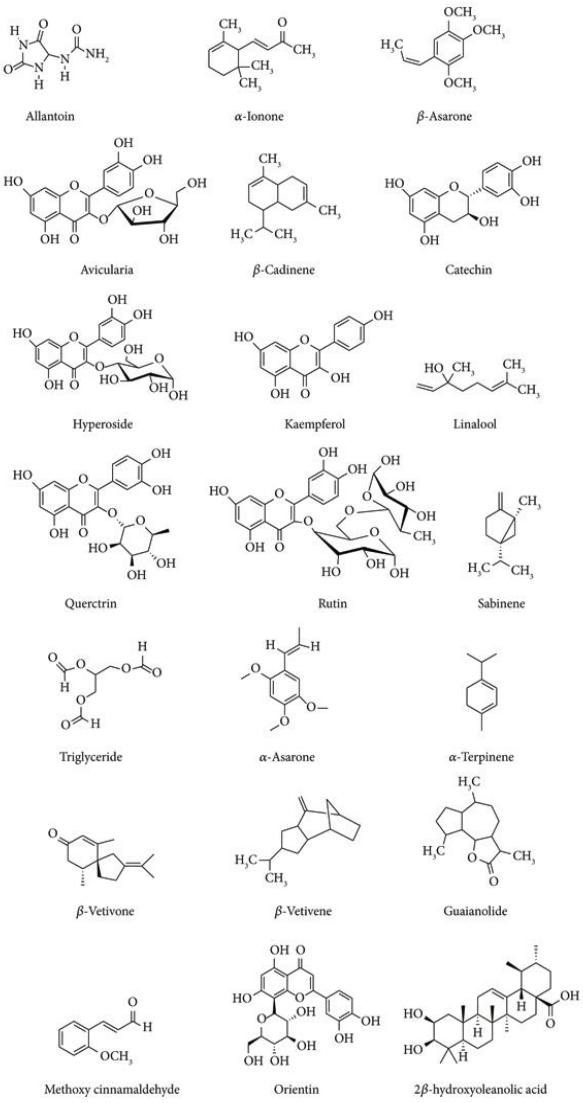

Fig: 2 Phytochemical Compounds of achyranthes aspera

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In a study conducted by A.S. Chauhan et al. (2002), a novel cyclic chain aliphatic fatty acid (I) was extracted from the seeds of the plant [20]. In a study conducted by H.N. Khastgir et al. in 1958, sapogenin was successfully extracted from the seeds, coupled with oleanolic acid [21].

In their study, Banerji et al. (1970) successfully extracted ecdysterone from the methanolic extract of Achyranthes aspera roots [22]. In their study, R. Ikan et al. (1971) successfully extracted ecdysterone from Achyranthes aspera root extracts using chromatography on a silica gel column, followed by elution with a CHCl3-MeOH (4:1) solvent mixture [23]. Ecdysone was isolated from the roots of Achyranthes aspera by Banerji et al. (1970) and Batta and Rangaswami (1973) [22, 24, 25]. In a study conducted by H.N. Khastgir et al. in 1958, oleanolic acid was extracted from the glycosidic fraction of the roots [25, 26]. In their study, Sharma et al. (2009) successfully isolated a novel aliphatic acid, specifically identified as n-hexacos-14-enoic acid, from the roots of Achyranthes aspera using ethanolic extracts. This molecule is being documented for the initial time in both natural and synthetic sources. Additionally, several additional compounds were isolated and identified, namely strigmasta-5, 22-dien-3-β-ol, trans-13-docasenoic acid, n-hexacosanyl n-decaniate, n-hexacos-17-enoic acid, and n-hexacos-11-enoic acid. The compound known as Strigmasta-5, 22-dien-3-β-ol is classified as a phytosterol. It was isolated in the form of a colourless crystalline substance using a petroleum ether: benzene 75:25 elution mixture. A good response was observed in the Liebermann Burchard test for sterols [27]. In their study, Batta and Rangaswami (1973) successfully extracted dihydroxy ketones from the shoots, specifically identifying them as 36, 37-dihydroxyhenpentacontan-4-one and Triacontanol [24]. Triacontanol, as well as 36, 47-dihydroxyhenpentacontan-4-one, was isolated by T.N. Misra et al. in 1991 [17, 28]. In their study, Misra et al. (1993) documented the presence of specific long chain chemicals, such as 27-cyclohexylheptacosan-7-ol and 16-hydroxy-26-methylheptacosan-2-one, in the shoots [29] In a study conducted by Y. Gariballa et al. (1983), an aliphatic alcohol known as 17-pentatriacontanol was extracted from the shoots [30]. In their study, T.N. Misra et al. (1996) successfully isolated several substances, including tetracontanol-2 (C40H82O, with a melting point of 76-77ºC), 4-methoxyheptatriacont-1-en-10-ol (C38H76O), and β-sitosterol [31]. Ecdysterone was extracted from the entire plant by Banerji et al. (1971) [32]. In a study conducted by K.S. Laddha and colleagues in 2005, the authors documented the process of extracting, isolating, and purifying 20-hydroxyecdysone from Achyranthes aspera. The compound was further characterised using several analytical techniques, including differential scanning calorimetry (DSC), ultraviolet spectroscopy (UV), infrared spectroscopy (IR), circular dichroism (CD), proton nuclear magnetic resonance (1H NMR), carbon-13 nuclear magnetic resonance (13C NMR), mass spectrometry (MS), and quantified using high-performance liquid chromatography (HPLC) [33]. In their study, Neogi et al. (1970) documented the presence of Achyranthine, a water-soluble alkaloid exhibiting several pharmacological effects such as vasodilation, hypotensive activity, negative inotropic effect on the heart, and enhancement in respiratory rate and amplitude [8, 34]. In their study, Kapoor and Singh (1966) documented the presence of betaine (C5H11NO2) in the entire plant. This compound exhibits a melting point of 292ºC and is classified as a water-soluble alkaloid [8, 35]. The confirmation of betaine's identification was achieved through the use of mixed melting point (m.p.) detection, specifically by examining its HCl-salt, oxalate, and picrate derivatives. These derivatives were then compared with those of an authentic sample for verification. In a study conducted by V. Seshadri et al. in 1981, two compounds were extracted from the fruits and subsequently identified as Saponins C and D [36, 37]. In a study conducted by Ali (1993), several chemicals were extracted from the stem, including Pentatriaontane, 6-pentatriacontanone, Hexatriacontane, and Tritriacontane [17, 18]. In their study, Kunert et al. (2000) documented the presence of three bisdesmosidic saponins (I-III) as well as 20-hydroxyecdysone. Quercetin-3-O-β-D-galactoside was obtained using the isolation process from the methanol extract derived from the aerial components of Achyranthes aspera. The structures of the compounds were determined by NMR spectroscopic research. The compounds' comprehensive 1H and 13C assignments were accomplished using 2D NMR studies [38]. In their study, G. Michl et al. (2000) documented the isolation of two novel bisdesmosidic triterpenoid saponins, in addition to the three previously identified saponins, from the Methanolic extract derived from the aerial components of Achyranthes aspera. The structures were determined to be β-D-glucopyranosyl3β-[O-α-L-rhamnopyranosyl-(1→3)-O-β-D-glucopyranuronosyloxy]machaerinate and β-D-glucopyranosyl3β-[O-β-D-galactopyranosyl-(1→2)-O-αThe term "machaerinate" refers to the act of wielding or using a mach The remaining saponins were characterised as β-D-glucopyranosyl-3β[O-α-L-rhamnopyranosyl-[1→3)-O-β-D-glucopyranuronosyloxy]oleanolate and β-D-glucopyranosyl-3β-[O-β-D-galactopyranosyl (1→2)The chemical compound referred to as "-O-β-D-glucopyranuronosy The compound referred to as oleanolate, β-D-glucopyranosyl 3β-[O-β-D-glucopyranuronosyloxy] oleanolate, has been documented in literature [39].

In a study conducted by R.D. Rameshwar in 2007, chemical components present in the volatile oil derived from the leaves of Achyranthes aspera, a plant species found in Dehra Dun, were examined using gas chromatography-mass spectrometry (GC-MS). A total of seven chemicals, namely p-benzoquinone,

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hydroquinone, spathulenol, nerol, α-ionone, asarone, and eugenol, were found in the oil, together accounting for 63.05% of its composition. The primary component identified in the study was hydroquinone, accounting for 57.7% of the composition [40].

III. PHARMACOLOGICAL ACTIONS

SPERMICIDAL ACTIVITY

In their study, D. Paul et al. (2010) examined the impact of several extracts derived from the roots of Achyra nthes aspera on human and rat sperm, and observed the presence of spermicidal activity. The hydroethanolic, n-hexane, and chloroform extracts exhibited the highest efficacy in terms of sperm immobilisation, sperm vitality, acrosome status, 5'-nucleotidase activity, and nuclear chromatin decondensation, as reported in a previous study [41].

In a study conducted by N. Vasudeva and S.K. Sharma (2006), it was shown that the ethanolic extract derived from the root of Achyranthes aspera exhibited post coital antifertility effect in female albino rats. The aforementioned extract demonstrated a significant anti-implantation efficacy of 83.3% when administered orally at a dosage of 200 mg/kg body weight, as reported in reference [42].

In their study, Shibeshi et al. (2006) examined the impact of the methanolic extract derived from leaves. Their findings indicated many anti-fertility effects in female rats, including abortifacient properties, estrogenicity, alterations in pituitary weight, ovarian hormone levels, and changes in lipid profiles. The abortifacient potential of the methanolic extract derived from the leaves of Achyranthes aspera was assessed through in vivo observation of foetal mortality rates. The impact of estrogenicity was evaluated by calculating the ratio of uterine weight to body weight. Additionally, the calculation of the ratio between the weight of the pituitary gland and the whole body weight was performed. The impact of the extract on the concentration of ovarian hormones and lipid profile was assessed by the utilisation of electrochemiluminescence immunoassay [43].

In their study, Pakrashi and Bhattacharya (1977) documented that the benzene extract derived from the entire plant exhibited abortifacient properties in mice [44]. In their study, D. Paul et al. (2006) investigated the impact of a 50% ethanolic extract derived from the leaf of Stephania hernandifolia and the root of Achyranthes aspera on sperm motility and function. The researchers observed that the extract exhibited its effects in a weight ratio of 1:3 at various concentrations [45]. In a study conducted by V. Wadhwa et al. in 1986, it was observed that the n-butanol fraction derived from the aerial parts of a certain plant had contraceptive and hormonal activities [46].

Antiparasitic Activity

In their study, Zahir et al. (2009) documented the antiparasitic activity of ethyl acetate extracts derived from various parts of A. aspera, including dried leaves, flowers, and seeds. The extracts were found to exhibit efficacy against the larvae of Rhipicephalus (Boophilus) microplus, a species of cattle tick, as well as against Paramphistomum cervi, an internal parasite commonly found in sheep [47].

In their study, Bagavan et al. (2008) examined the effects of several leaf extracts (acetone, chloroform, ethyl acetate, hexane, and methanol) derived from Achyranthes aspera on the early fourth-instar larvae of Aedes aegypti L and Culex quinquefasciatus Say. The mortality of the larvae was recorded following a 24-hour exposure period. All the extracts exhibited modest larvicidal effects; yet, the ethyl acetate extract of A. aspera demonstrated the maximum larval mortality. The current investigation involved the bioassay-guided fractionation of A. aspera, resulting in the isolation and characterization of a saponin molecule that exhibits potential as a mosquito larvicidal agent. The compound demonstrated LC50 values of 18.20 ppm and 27.24 ppm against A. aegypti and C. quinquefasciatus, respectively. The active compound was identified through the confirmation of its identity using 1H NMR, 13C NMR, and mass spectrum data. This study presents the initial investigation into the larvicidal properties of the saponin derived from the ethyl acetate extract of A. aspera [48].

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 [49].

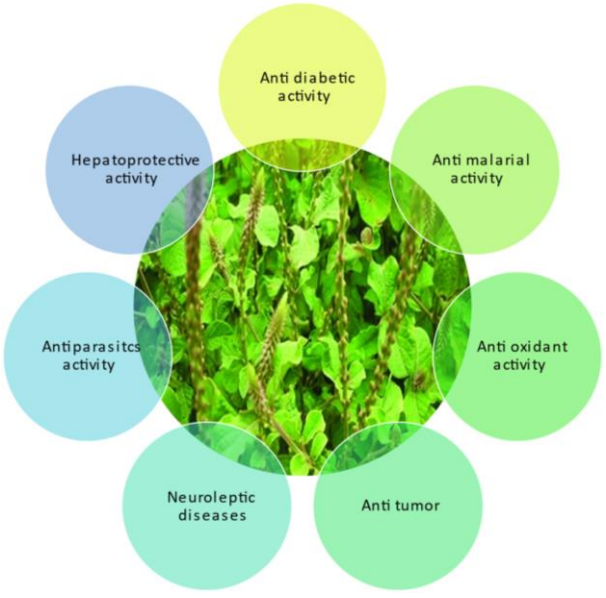

Fig:3 Pharmacological Activity of *ACHYRANTHES ASPERA*

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Cancer Chemo preventive Activity

A. Chakraborty *et al*. (2002) reported that the methanolic extracts of leaves, alkaloid, non- alkaloid and saponin fractions shows cancer chemo preventive action on Epstein- Barr virusearly antigen activation induced by tumor promoter 12-O-tetradecanoylphorbol-13-acetate in Raji cells [50].

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 [51].

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.[52]. 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 [53]. 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/kgleaf extract has shown the maximum analgesic activity [54]. Neogi N *et al*. (1970) reported that achyranthine a water soluble alkaloid had a slight antipyretic activity in rats [34].

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 [55].

The alcoholic extracts of leaves and seeds show anti-inflammatory activity in rats using carrageenan-induced paw edema method and formalin model [53].

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 3 h with carrageenan-induced rat paw oedema. Using a chronic test, the extract exhibited a 40.03%and 45.32% reduction in granuloma weight [56]. 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 [57].

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* [58]. S.H.K.R. Prasad *et al*. (2009) studied the various extracts of the leaves andcallus of the plant also shows antimicrobial activity [59].

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 [60].

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* [61].

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 [62].

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 wellplate 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 50µg/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 [63].

Anti-oxidant Activity

P. Tahiliani & A. Kar (2000) studied various extracts of the leaves for anti-oxidant activity [64]. D.S. Gayathri *et al*. (2009) also reported antioxidant activity on leaves and roots [65].

T. Malarvili & N. Gomathi (2009) reported antioxidant activity on seeds of the plant [66]. *Achyranthes aspera* is well documented for the presence

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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 [67].

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 [68].

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 [69].

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 [70]. Achyranthine (5 mg/kg, orally) had diuretic activity in rats [34].

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 [71].

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 [34].

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 µg) 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 [72].

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 [73].

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 [74].

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 [75].

Immunomodulatory Activity

R. Chakrabarti & R.Y. Vasudeva reported that *Achyranthes aspera* show immuno-stimulant 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 [76].

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) levelsby 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 absorptionof cholesterol [77].

IV. CONCLUSION

The herbals occupied a distinct place in the life right from the primitive period till date and provided information on the use of plants or plant products and products as medicine. The use of medicinal plants in the management of various illnesses is due to their phytochemical constituents and dates back antiquity.

It is seen from the literature that *Achyranthes aspera* is a very important plant for its largenumber of medicinal properties as well as medicinally important

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chemicals like ecdysterone, achyranthine, betaine, pentatriaontane, 6-pentatriacontanone, hexatriacontane and tritriacontane. The plant shows many pharmacological activities like spermicidal, anti-allergic, cardiovascular, nephroprotective, antiparasitic, hypoglyceamic, 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.

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