

AN OVERVIEW ON INDIGENOUS KNOWLEDGE OF *ACHYRANTHES ASPERA*

VEENA SHARMA*, URMILA CHAUDHARY

Dept. of Bioscience and Biotechnology, Banasthali University Niwai, Tonk, Rajasthan, 304022
Email: drvshs@gmail.com

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ABSTRACT

Achyranthes aspera Linn. (Amaranthaceae family) a medicinal plant is found throughout India as an annual herb. In this plant many antioxidants like alkaloids, terpenoids, saponins etc. of various pharmacological properties are present. Many chemical constituents have also been isolated from this plant by various techniques. All chemical constituents and pharmacological properties are responsible for the treatment of various human disorders. In the present review, complete updated information about *Achyranthes aspera* pharmacological, phytochemical and ethnobotanical uses is provided. The above information about *A. aspera* may be helpful to researchers in further research.

Keywords: *Achyranthes aspera*, Anticancer, Antioxidants, Medicinal plants.

INTRODUCTION

Herbal medicine has a long history in treatment of several diseases [1]. Medicinal herbs are used to treat illness, maintain and promote health [2] and are the only available and inexpensive source of primary health care, especially in the absence of access to modern medical facilities. Various plant parts (leaves, stems, root and bark) are used for medicine preparation, because they contain biologically active ingredients, for treating mild or chronic ailments. Alkaloids, tannins, flavonoids, and phenolic compounds are the most important bioactive constituents of plant. Sometimes they are also added to foods of pregnant and nursing mothers for medicinal purposes [3]. Now-a-days pills, capsules, powders or in more concentrated liquid form called extracts and tincture forms of herbal medicines are also available. These can also be used topically in creams or applied directly to the skin [4]. *Achyranthes aspera* Linn. (family-Amaranthaceae) is commonly known as Latjira in Hindi. It is an erect stiff medicinal plant. The plant is used by traditional healers for the treatment of dysentery, fever and diabetes [5]. *A. aspera* is available as weed in whole India, Asia and many parts of the world such as Mexico, Central America and Africa [6]. It is described as bitter, pungent, purgative, heating, laxative, stomachic, carminative and digestive and is useful for the treatment of bronchitis, heart maladies, piles, itching abdominal problems, ascites, rheumatism, abdominal enlargement, rabies and for enlarged cervical gland [7-8]. The aim of present review is to provide entire available information regarding pharmacology and ethnobotanical uses of *A. aspera*.

History and Origin

Two varieties of *A. aspera*, red and white are mentioned in Ayurvedic and Chinese medicines. *Achyranthes aspera* as a rough flowered stalk is described as in Sanskrit synonyms. It is described in 'Nighantas' as pungent, purgative, digestive, and a remedy for inflammation of the internal organs, itch, piles, abdominal enlargements and enlarged cervical glands. The diuretic property of the plant was well known to the natives of India and European physicians. Various plant parts form ingredients in many native prescriptions were used in combination with more active remedies.

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 Shivburi, Himachal Pradesh and an exotic medicinal herb of district, Lalitpur (Uttar Pradesh), India [9]. Throughout India *A. aspera* is found in field boundaries, road sides and waste places as a medicinal herb.

Synonyms [10]

- *Achyranthes argentea* Lam.

- *A. aspera* var. *indica* L.
- *A. aspera* var. *obtusifolia* (Lam.) Suess.
- *Achyranthes indica* (L.) Mill.
- *Achyranthes obtusifolia* Lam.

Scientific taxonomic classification-

- Kingdom - Plantae
- Subkingdom - Tracheobionta
- Super Division - Spermatophyta
- Division - Mangoliophyta
- Class - Mangoliopsida
- Subclass - Caryophyllidae
- Order - Caryophyllales
- Family - Amaranthaceae
- Genus - *Achyranthes*
- Species - *aspera*

Common names of *A. aspera* [9,11]

- **African vernacular names:** Swahili- Turura, Sotho-Bohomane, Bohome-bo-bolek, Mo-tswarak-gano, Belgian Congo-Denge, Gnegna, Kalambata, Lenge, Lenamo.
- **Arabian** - Atkumah, Na'eem, No'eim, Mahout, Wazer (Yemen)
- **Ayurvedic** - Apamarga, Chirchita, Shikhari, Shaikharika
- **Bengali** - Apaang.
- **English** - Prickly chaff flower, Hawai chaff flower, Devil's horse whip, Prickly chaff flower
- **French** - Achyranth a feuilles rudes, Collant, Gendarme
- **Gujarati** - Safad Aghedo, Anghadi, Anhdedi, Agado.
- **Hindi** - Latjira, Chirchira, Lamchichra, Sonpur, Onga.
- **Indonesia** - Jarong.
- **Kannada** - Uttaranee, Utame.
- **Latin** - *A. aspera*
- **Malayalam** - Kadaladi, Vankadaladi, Katalati.

- **Marathi** - Aghada, Pandhara-aghada.
- **Other** - Pululue, Panga za wayuka, Crokars staff burweed
- **Persian** - Khare-vazhun
- **Philippines (Tagalog)** - Hangod
- **Punjabi** - Kutri
- **Sanskrit** - Aghata, Apamargah, Mayoorah, Markatapippalee, Durgrahan, Khara-manjari.
- **Sinhala**- Karalheba.
- **Spanish** - Mosotillo, Rabo de gato, Rabo de chango, Rrabo de raton.
- **Swahili**- Shiru-kadaladi
- **Tamil** - Shiru-kadaladi, Nayuruvi
- **Telugu**- Uttaraene, Utareni, Aduchinnike, Antisha, Pamargamu, Uttaraene.
- **Unani** - Chirchitaa

Habitat

The plant can grow in 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 [12]. It grows as wasteland herb everywhere. Flowers appear from July to September and seeds ripe in the month of October.

Botanical description

(a). Macroscopic information [9,13-14]

A. aspera is a stiff erect herb.

(1) **Height**- 0.2-2.0 m high. The base is woody, angular or ribbed, simple or branched, nodes are bulged, often tinged with pink color.

(2) **Root** - Cylindrical root, 0.1-1.0 cm in thickness, slightly ribbed, gradually tapering, yellowish-brown in color, secondary and tertiary roots present.

(3) **Stem** - Square, yellowish-brown, branched, hairy, erect, cylindrical, solid, and hollow when dry.

(4) **Leaf** - Simple, sessile, slightly acuminate stipulate, wavy margin ovovate, petiolate or elliptic, ovate or broadly rhombate, opposite, decussate, and pubescent due to the presence of thick coat of long simple hairs. 5-22 cm long with 2-5 cm broad. Occur in various sizes. Type of stomata are present on the lower epidermis is anomocytic.

(5) **Flower** - Arranged in long spikes form in inflorescences, 8-30 cm long, 3-7 mm wide, bisexual greenish-white, numerous, sessile, bracteate with two bracteoles, one spine lipped, actinomorphic, hypogynous, 5 perianth segments, membranous, 5 stamens, short filament, anther, two celled, 7 gynoecium bicarpellary, syncarpous, ovary superior, single ovule; style, single stigma, white or red flower. Flowers appear during summer.

(6) **Fruit** - An indehiscent dry utricle enclosed within bracteoles, persistent, and perianth.

(7) **Seed**- These are round at the base, sub-cylindric, truncate at the apex, endospermic, brown coloured.

(b) **Chromosome no**: Polyploidy *A. aspera* naturally occurring was reported. Sporophytic count was noticed (Punjab, India, Cameroon Mountain and New Zealand)[15-17] Gametophytic count was to be 21[18],24 and 48 [15,19].

Properties and action

i) Fruits

- Rasa-Madhura
- Guna- Rooksha, Sara
- Virya- Seeta

ii) Roots

- Rasa- Tikta, Katu
- Guna- Teekshna, Sara
- Virya- Ushna

Phytochemistry of plant

Achyranthes aspera possess various phytochemicals like alkaloids, tannins, cardiac glycosides, steroids, flavonoids, terpenoids, reducing sugar and saponin [20, 21]. These are responsible for various purposes and are summarized in Table 1.

Table 1: Enlisted various chemical phyto-constituents of *A. aspera* Linn

Plant Part	Compound Family	Active Ingredient	References
Whole plant	Saponins	a) Ecdysterone	[22-23]
		b) 20-hydroxy- ecdysone	
Aerial Part	Alkaloid	Betaine (C ₅ H ₁₁ O ₂)	[24]
		a) Three bisdesmosidic saponins (I-III)	[25]
	Triterpenoid Saponins	b) 20-hydroxyecdysone	[26]
		c) Quercetin 3-O-β-D-galactoside	
		a) β-D-glucopyranosyl-13- β-[O-α-L-rhamnopyranosyl-(1→3)-O-β-D-glucopyranuronosyloxy] machaerinate	
Shoots	Ketons	b) β-D-glucopyranosyl-13- β-[O-β-D-galactopyranosyl-(1→2)-O-α-Dglucopyranuronosyloxy] machaerinate	[27-29]
		a) 36,37-dihydroxyhenpentacontan-4-one	
		b) Triacontanol	
	Long chain compounds	c) 36,47-dihydroxyhenpentacontan-4- one	[30]
		a) 27-cyclohexyl-heptacosan-7-0l	
		b) 16-hydroxy-26-methylhepta-cosan-2-One	
		Aliphatic alcohol	
Stems	Saponins	a) Tetra-contanol- C ₄₀ H ₈₂ O	[32]
		b) 4-methoxyheptatriacont-1-en-10-ol (C ₃₈ H ₇₆ O)	
		c) β-sitosterol	
		a) Pentatriacontane	[29,33]
		b) 6- penta-tri-acontanone	
		c) Hexa-triacontane	
d) Tritriacontane			
Leaves &	Saponins	a) 20-hydroxy ecdysone	[25]
		b) Quercetin-3-O-β-D-galactoside	

Stems		Bisdesmosidic triterpenoid-saponins	[26]
Leaves	Compound of volatile oil	a) P-benzoquinone; b) Hydroquinone c) Spathulenol d) Nerol e) α -ionone f) Asarone g) Eugenol	[34]
Seeds	Sapogenin Saponin-A Saponin-B	Sapogenins along with oleanolic acid D-Glucuronic acid β -D-galactopyranosyl ester of D-Glucuronic acid a) Oleanolic acid b) Amino acid c) Hentriacontane a) 10-tricosanone b) 10-octacosanone c) 4-tritriacontanone	[35] [33,36] [33,36]
	Cyclic chain aliphatic fatty acid (I)		[37]
	Fatty acid composition	Lauric, Myristic, Palmitic, Stearic, Arachidic Behenic, Oleic and linoleic acid	[38]
	Oleanolic acid glycosides	a) α -L-rhamnopyranosyl-(1 \rightarrow 4)-(β -D-glucopyranosyluronic acid)-(1 \rightarrow 3)-oleanolic acid b) α -L-rhamnopyranosyl-(1 \rightarrow 4)-(β -D-glucopyranosyluronic acid)-(1 \rightarrow 3)-oleanolic acid-28-O- β -D-glucopyranoside c) α -L-rhamnopyranosyl-(1 \rightarrow 4)-(1 \rightarrow 3)-oleanolic acid-28-O- β -D-glucopyranosyl-(1 \rightarrow 4)- β -D-glucopyranoside	[39]
Roots	Saponins Saponins	Ecdysterone Ecdysone Oleanolic acid	[40-41] [27-29] [29-35]
	Aliphatic acid	a) n-Hexacos-14-enoic acid (NI-III) b) Strigmasta-5, 22-dien-3- β -ol (NI-I) c) Trans-13-docasenoic acid (NI-II) d) n-hexacosanyl n-decanate (NI-IV) e) n-Hexacos-17-enoic acid (NI-V) f) n-Hexacos-11-enoic acid	[42]
Fruits	Saponin-C and D		[29,43]
Gall & normal tissues	a) Carbohydrates b) Proteins c) Phenols d) Enzymes		[44]

Pharmacological properties

Achyranthes aspera possess analgesic, antipyretic, anti-obesity, anti-spasmodia, anti-allergic, anti-arthritis, anti-carcinogenic, anti-ulcerogenic, anti-dandruff, antidepressant, anti-fertility, anti-inflammatory, anti-arthritis, anti-microbial anti-oxidant, anti-parasitic, anti-spasmodic, anti-viral, bronchoprotective,

cardiovascular, diuretic, hepatoprotective, hypoglycemic, hypolipidemic, immunomodulatory, nephro-protective, prothyroidic, renal disorder, spermicidal, wound healing anti-oedematous and anti-diarrhoeic activities [9,11,45-48]. Various pharmacological and biological experiments are performed with the *A. aspera* and it shows both positive and negative results and these are summarized in table 2 and table 3 respectively.

Table 2: Positive results of pharmacological and biological activities of *Achyranthes aspera* Linn

Activities	Plant part	Extracts	Methods/ Parameters studied	Experimental subject/object	Standard/Compound	References
Anti-asthmatic	WP	AL	DLC, LPO, SOD, GSH, TP and Histology	Wistar rats	Dexamethasone/ Toluene-Di-Isocyanate	[49]
Analgesic and Anti-pyretic	LF	MET	Hot plate and brewer's yeast induced method	-	Aspirin	[50]
Analgesic	SD LF	AL	Hot plate and Writhing test Hot plate, tail flick and acetic acid induced writhing response method	Mice Male albino rats	Pentazocin Aspirin	[51] [52]
	LF	ETH	Tail Flick Response Method, Hot Plate Method and Formalin Test	Wistar albino mice	Pentazocine and Aspirin	[53]
Analgesic and CNS depressant	AP	MET	Acetic Acid-Induced Writhing Test, Thiopental sodium induced sleeping time determination, Hole cross test, Open field test	Swiss Albino mice	Diclofenac sodium (50mg/kg)	[54]
Anthelmintic	St	MET, AQ	Anthelmintic activity	PP	Albendazole	[55]
Anti-cataract	LF	AQ	Lens opacity, TP, LH, LPO, Inhibition of Cu ²⁺ induced lipoproteinindiene formation, Ca ²⁺ -	Fresh goat eyeballs	Vitamin E and Glucose 55 mM (compound)	[56]

			ATPase activity, SOD, CAT, GSSH, GPx, GSH			
Anti corrosion	LF	H ₂ SO ₄	Gravimetric technique	Steel	0.5 M H ₂ SO ₄	[57]
Antipyretic		Achyranthine isolated compound	Dilation of the blood vessels, Blood pressure	Rats	-	[58]
	LF	MET	Brewer's yeast- induced pyrexia	Rats	-	[59]
Anti-obesity	SD	As a Obeloss drug powder	Triglycerides, cholesterol, weight, body mass index, arm circumference, thigh circumference, hip circumference, chest circumference, nape of neck, abdomen circumference	Humans	-	[60]
	SD	ETH	α -Amylase and Pancreatic Lipase Inhibitory activity, Triacylglycerol level, and Obesity determination	Male Swiss albino mice	-	[61]
Anti-allergic		PE	Milk induced leukocytes and milk induced eosinophilia	Mice	-	[62]
Anti-arthritis		ETH	Carrageenan and Freund's complete adjuvant model	Mice and rats	-	[63]
Anti-carcinogenic	LF	MET	Epstein-Barr virus early antigen	Raji cells	12-O-tetradecanoylphorbol-13-acetate	[64]
	LF	BUT, HEX, PE, CH, AQ	Toxicity analysis, T cell count, Tail length	Swiss albino mice	Mineral oil	[65]
	RT	AQ, MET	MTT, DNA Fragmentation, Apoptosis, Assessment of Morphological Alterations, Anti-proliferation Assay	NRK-52E cell line	-	[66]
	WP	ETH	ALT, AST, GGT, Bilirubin, GPx, GST, GSH, LPO, SOD, CAT, Histology	Swiss albino rats (liver)	CCl ₄ and N-nitrosodiethylamine	[67]
Anti-dandruff	LF	MET	-	-	-	[68]
Anti-depressant	LF	MET	Forced swimming and tail suspension tests	Mice and rats	Desipramine hydrochloride	[69]
Anti-diabetic	WP	ETH	BSL, triglyceride, TC and Histology	Wistar albino rats	Alloxan	[70]
	LF	ETH	Blood glucose level	Rats	Streptozotocin/ Glibenclamide	[71]
	AP	AQ	Glucose, glycogen, plasma Insulin, Glycosylated hemoglobin, Glucokinase, Glucose-6-phosphatase, Glucose-6-phosphate dehydrogenase, TP, GSH, LPO	Wistar strain of albino rats	Alloxan/ Glibenclamide	[72]
Anti feedant and insecticidal	LF	HEX, CH, EA	Insecticidal and antifeedant Activity	<i>Epilachna Beetle, Henosepilachna vigintioctopunctata</i>	-	[73]
Anti-fertility	RT	ETH	Sperm motility, sperm count, lipids, cholesterol, hydroxymethyl glutaryl CoA reductase, glucose 6 phosphatase dehydrogenase, malic enzyme, 17 β hydroxysteroid dehydrogenase, Δ^5 -3 β hydroxysteroid dehydrogenase	Male albino rats	-	[74]
	LF	MET	Abortifacient, estrogenicity, pituitary weight and lipid profile	Female Wistar rats	-	[75]
	RT	CH, ETH	Post coital anti-fertility testing, estrogenic and antiestrogenic activity Histology	Female albino rats	Ethinly estradiol	[76]
	St	BEN, CH	Laparotomy	Swiss albino mice	-	[77]
		Ash	Fecundity, fertility, developmental time, ovarioles number	<i>D. melanogaster</i> flies	-	[78]
	RT	ETH	Post coital anti-fertility testing, estrogenic and antiestrogenic activity	Albino Wistar rats	Ethinyl estradiol	[79]
Antiovolatory & Anti-implantation	RT	ETH	Strous cycle phases determination, anti-implantation activity	Virgin female rats	-	[80]
Anti-		Achyranthine a	Carrageenan-induced paw	Albino rats	Betamethasone,	[81]

inflammatory and Anti-arthritis		isolated compound	edema, granuloma pouch, formaldehyde and adjuvant induced arthritis		Phenylbutasone	
	RT	AL	Carrageenan-induced paw edema method cotton pellet granuloma test	Wistar rats	-	[82]
	LF	ETH, HEX, EA	carrageenan induced paw oedema	Wistar rats	Indomethacin	[83]
	LF	MET	Histology, Disease Activity Index, MPO and MDA	Wistar albino rats, Mice	Sulfasalazine 5-ASA	[84]
	LF	AQ	Carrageenan-induced paw edema	Swiss albino mice	Diclofenac	[85]
	WP	AL	Hind paw oedema and cotton pellet granuloma models	Swiss albino male rats	Diclofenac sodium	[86]
	LF	MET, CH, EA, HEX, BUT, AQ	Rate paw edema, In vitro anti-inflammatory activity and Carrageenan induced hind paw edema	Male Wistar rats	Baicalin Piroxicam gel	[87-88]
	SD LF	AL	Chronic inflammatory and Acute inflammatory studies	Wistar Albino rats or Swiss mice	Diclofenac	[51]
Anti-lithiatic	RT	AQ	Thermogravimetric analysis (TGA), differential thermal analysis (DTA), SEM, XRD, FTIR	-	-	[89]
Anti-microbial	LF SD	AQ, ETH	Cup plate method/ cup diffusion method	EC, SA, CA	Ofloxacin, Amikacin, Norfloxacin, Roxithromycin, Gentamycin	[90]
	LF	MET	Agar well diffusion method	SA, BS	Ciproflaxocin	[91]
	LF	Silver nano particles of AQ extract	Agar well diffusion assay method	PA, SA, EC, CA	Piperacillin	[92]
	LF	MET	HPLC, Agar diffusion method, challenge test and Parrallel streak method	EC, SA	Amikacin and fluconazole	[93]
	LF	MET, ETH	Agar well diffusion method	CA, CT, CK CKE, CG, CGL, CN, AN, AF, AFL, RO	Ketoconazole and Itraconazole	[94]
	RT	ETH, ACT, EA	Paper disc diffusion	BS, SA, ST, EC, PA, SAB	Ampicillin	[95]
	WP	AQ, ETH	Dilution method	BAC, SAL, EC	-	[96]
		MET, CH	Dilution method	BAC, CIT KLB, SAL, EC	-	[97]
	St	HEX, CH, EA, MET	Agar well cut diffusion technique	SA	-	[97]
	RT IF	HEX, EA	Agar well cut diffusion technique	EC	-	[97]
		HEX, CH, EA, MET	Agar well cut diffusion technique	SA, EC	-	[97]
	LF	HEX, CH, MET	Agar well cut diffusion technique	SA	-	[97]
	LF	CH, EA, MET	Agar well cut diffusion technique	EC	-	[97]
	LF	PE, EA, CH, MET, ETH	MIC, Disc-diffusion assay	PA, PM, EF.	Ampicillin	[98]
	St	PE, EA, CH, MET, ETH	MIC, Disc-diffusion assay	PA, PM	-	[98]
	LF	ETH	Agar well-diffusion assay and MIC	PA, SA, ML, EC	Streptomycin	[99]
	SD	MET, EA, PE, ACT	Disc diffusion method, MIC	XC, EC, KP, BSB, SL	Nalidixic acid	[100]
	SD	ETH, CH	-	EC, BS, PA	-	[101]
	St	PE, CH, MET,	Agar well-diffusion method, well plate assay	SA, SP, EC, ST, PF,, AFL, AN, MG, TR, TM	Tetracycline, Chloramphenicol, Ketoconazol	[102]
	RT	AQ				
	AP	MET, EA, AQ	MIC	PM, PV, SA, ML, BC, CS, MS, KP, ST, SF, VP, PA, BP, SE, EC, SC	-	[103]
		MET	Well method	EC, BC, AB, SA, PA, KP, PM, SAL	-	[8]
	WP	Isolated saponnin	Microdilution	SA	-	[104]
	LF	AQ, ETH	Agar diffusion method and MIC	BS, SA, PA,	Ciproflaxocin	[105]
	RT	ETH	Disc diffusion method	BS, BP, PV AFL, CN	Clotrimazole	[106]
	AP					

	LF	MET, EA, AQ, CH	Disc diffusion method	EC, PA, KP, BS, ML, SA	-	[107]
	SD	Volatile oil	Disc diffusion method	SA, SP, BS, ML, PA, EC, ST, PV, CA, AN, AFL, CG, TM	-	[108]
	LF IN	PE, EA, AQ, BEN, CH, ETH	MIC	EC, BC, SE, SF, PA	-	[48]
	LF	AQ, ETH, HEX	Well and disc diffusion method.	EC, PM, ST, Ea, AN	Streptomycin Chloramphenical, Fluconazole Gentamycin	[109]
	LF	MET	Disc diffusion test, MIC	SA, SI, EC, KP, SA, SAG, SDY, DC	-	[110]
	RT, St	PE, CH, MET, AQ	Plate assay method	BS, KLB, EC, SH, FU, HT	-	[111]
	LF	CH, MET	Agar diffusion method	BS, SP, EC, KP, PA	Ampicillin	[112]
Anxiolytic	LF	MET	Hole board, Elevated plus maze, Light/dark exploration and open field test	Male Swiss Albino Mice	-	[113]
	LF	MET	Hole board, Open field, Elevated plus maze and Light/dark exploration test	Male Swiss albino mice	Diazepam	[114]
	LF	ETH	Neuropharmacological study, Rota-rod performance, Actophotometer and Open field test	Wistar albino mice	Diazepam (2 mg/kg i. p.)	[115]
Anti-oxidant	IF, RT	PE, BEN, CH, EA, ETH, AQ	TAC, DPPH, FRAP	-	Ascorbic acid, gallic acid, FeSO ₄	[116]
	LF	MET, AQ	DPPH and superoxide scavenging activity	-	Ascorbic acid	[117]
	LF RT	MET	DPPH	-	Ascorbic acid	[118]
	LF St	HEX, CH, EA, MET	DPPH	-	Ascorbic acid	[97]
	LF	ETH	DPPH, Hydroxyl radical scavenging, FRAP	-	Ellagic acid,	[119]
	LF	MET, AQ	DPPH, FRAP, DNA damage inhibition efficiency	pBR322 plasmid DNA	-	[91]
	RT	HEX, PE, EA, ETH, CH, AQ	DPPH, Hydroxyl Radical Scavenging Activity	-	BHT, Ascorbic acid	[120]
	LF	ETH	DPPH, Hydroxyl radical scavenging activity, β -Carotene-linoleic acid, FRAP	-	Ascorbic acid	[99]
Anti-plasmodial	St LF RT SD	ETH	<i>In vitro</i> antiplasmodial assay, Chemical injury to erythrocytes	<i>Plasmodium falciparum</i>	Chloroquine	[121]
Antiprotease level increment	RT	AQ	Serum anti-trypsin activity,	<i>Labeo rohita</i> (fish)	-	[122]
Anti-ulcer	RT	MET	Acid neutralizing capacity, NaOH required, ulcer index	Wistar albino rats	Ranitidine	[123]
	LF	AQ	Gastric acid, LPO and Nitrous oxide scavenging activity	Rats	Ranitidine/ Aspirin	[124]
Anti-viral	RT	MET and oleanolic acid (isolated compound)	MTT assay, Antiviral plaque, Dose-response, virucidal, Viral penetration, Time response assay, PCR, ELISA	African green monkey kidney cells; HSV-1, HSV-2	-	[125]
Cardio-vascular	SD	Isolated saponins	Contraction of hearts	Heart of Frog, Pig and Rabbit	Pronethanol	[126]
		Isolated saponins	Activity of phosphorylase	Rat heart	Adrenaline bitartrate	[127]
		Achyranthine	Blood pressure, heart rate,	Dogs and frogs	-	[128]
Diuretic	SD	AQ	K ⁺ , Na ⁺ , Cl ⁻ , bicarbonate, creatinine, urea and pH	Goats	Furosemide	[129]
	WP	MET	Lipschitz Method	Male Wistar albino rats	Furosemide 100mg/kg	[130]
	SD	ETH	TB, TP, ALT, AST, ALP, Histology	Male Wistar albino rats	CCl ₄ / Furosemide	[131]
	RT	AQ	Ca ⁺ , Phosphorous, Creatinine, Urea, Kidney Weight	Male albino Wistar rats	Ethylene glycol/ Furosemide	[132]
	SD	Isolated saponin	-	Male albino rats	-	[133]
Gastro-protective/ anti-ulcer	LF	ETH	pH, Gastric volume, Total and free acidity, Ulcerative index, Ulcer grading	Rats	Omeprazole (10mg/kg p. o.)	[134]
Hepato-protective	AP	MET	SGOT, SGPT, ALP, TB	Albino rats	Rifampicin	[135]
	SD	ETH	TB, TP, ALT, AST, ALP and	Male Wistar albino	Silymarin/ CCl ₄	[136]

	LF	ETH	Histology SGOT, SGPT, ALP, TP, TC TB, Triglycerides, urea, Histology	rats Male Wistar albino rats	Paracetamol/ Silymarin	[137]
	AP	MET	SGOT, SGPT, ALP, TB, TC, TP, Albumin	Wistar albino rats	Paracetamol/ Silymarin,	[138]
	LF	ETH	AST, ALT, ALP, SOD, TP, TB, LPO, GSH, GST,	Male albino Wistar rats	20% Ethanol/ Silymarin	[139]
Hypo- glyceamic	WP	AQ, MET	Blood glucose level	Rabbits	Alloxan	[140]
	St LF	ETH	Glucose tolerance, glucose, LPO, Hydroperoxide, CAT	Male Swiss albino mice	Alloxan/ Metformin	[141]
Hyper- triglycerdemia	RT	Ardhabilva Kvatha Curna	Lipid profile	Albino rats		[142]
Hyper- lipidemic	WP	Isolated Saponin	Lipid profile and atherogenic index	Wistar rats	Orlistat	[143]
	LF	AQ	TC, VLDL, LDL, PL, Triglycerides, Free fatty acids, HDL, HMG, Lipoprotein lipase, SOD, CAT, GSH, LPO	Male Wistar rats	-	[144]
Hypo- lipidemic	SD	AQ	TC, Lipid profile, Triglycerides, Phospholipids	Male albino Wistar rats	Anjali, Idhayam oil	[145]
		AL	TC, phospholipid, triglyceride and total lipids	Rats	Triton as a compound	[146]
Immuno- modulatory	SD		Hemagglutination, TP, Albumin, Globulin, Anti-proteases, RNA/DNA ratio	Catla catla (fish)	Chicken red blood cells (antigen)	[147]
Larvicidal	LF	Saponin isolated	Larvicidal bioassay	AA, CQ	-	[148]
	St, LF	Extracted essential oil MET, AQ	Attractant/repellent, Oviposition attractant/deterrent assay Larvicidal, Insecticidal, Repellent activity	AA, CQ AA, MC	- Temephos	[149] [150]
	St	HEX	Screening, Larvicidal bioassay	AA	-	[151]
Nephro- protective	WP	MET	Urea, Uric acid, Creatinine, γ -GT, ALP, ACP, LDH, NAG and Cathepsin-D	Male albino rats	Lead acetate	[152]
	RT	AQ	ALP, LDH, Creatinine, Urea, Urine microscopy, Histology	Male Wistar rats	Ethylene glycol/ Cystone	[153]
Prothyrodic	LF	AQ	LPO, SOD, CAT, TP, glucose, thyroid hormones	Male Wistar rats	-	[154]
Spermicidal	RT	Isolated active protein	Sperm immobilization and revival test, Plasma membrane integrity, Agglutination reaction, 5' nucleotidase, Toxicity evaluation	Male rats	Nonoxynol-9	[155]
	RT	Isolated active protein	Sperm motility and count, AST, ALT, lipid, TC, HMG, 3 β -HSD, 17 β - HSD, glucose-6-phosphate dehydrogenase, testosterone, TP	Male Swiss albino mice	Gossypol	[156]
	WP	BEN	-	Mice	-	[157]
	RT	ETH	Sperm mortality	-	-	[158]
	RT	HE (1:1), HEX, CHL, EA	Immobilization assay, EC ₅₀ , Sperm revival and viability, Nuclear chromatin decondensation (NCD) test, vaginal contraceptive, 5'- nucleotidase	Humans and Rats	-	[159]
	RT	HE (1:1)	Sperm motility and count, Δ^5 , 3 β - HSD, 17 β -HSD, TC, CAT, LPO, SGOT, SGPT, Histology, Testosterone	Male Wistar Rats	-	[160]
Thermolytic	LF	MET	Brine-Shrimp Lethality (BSL) Bioassay, determination of Thrombolytic activity	Human blood	Streptokinase	[161]
Wound healing	LF	AQ, ETH	Excision and incision wound model	Wistar rats	Nitrofurazone	[117]
	LF	ETH, AQ	Area of wound measured	Albino rats	Soframycin	[162]
	LF	MET	Burn, Immuno-compromised and Diabetic wound model	Swiss Albino mice, Sprague Dawley rats	Himax ointment	[46]
	Lf	Met	Excision, Incision, and Dead space wound model, Histology	Albino mice of either sex	Povidine iodine	[163]
	Lf	Met	Wound contraction and epithelization time, Linear incision wound model, Histology and Total DNA content	Albino rats	1% silver sulphadiazine cream	[164]

Abbreviations

[17] β -HSD-[17] β -hydroxysteroiddehydrogenase; 3 β -HSD-3 β -hydroxysteroiddehydrogenase; AA-*Aedes*aegypti; AB-*Acinetobacterbaumanii*; AC-*Aspergilluscarneus*; ACP-AcidPhosphatase; ACT-Acetone; AF-*Aspergillusfumigates*; AFL-*Aspergillusflavus*; AL-Alcohol; ALP-AlkalinePhosphatase; ALT-AlanineTransferase; AN-*Aspergillusniger*; AP-ArialPart; AQ-Aqueous; AST-AspartatreTransferase; BAC-*Bacillus*; BC-*Bacilluscereus*; BEN-Benzene; BP-*Bacilluspumilis*; BS-*Bacillusubtilis*; BSB-*Bacillusubtilisand*; BUT-Butanol; CA-*Candidaalbicans*; CAT-Catalase; CG-*Candidaguilliermondi*; CGL-*Candidaglabrata*; CH-Chloroform; CI-*Cinobacteria*; CIT-*Citrobacter*; CK-*Candidakrusei*; CKE-*Candidakefyr*; CN-*Cryptococcusneoformans*; CQ-*CulixQuinquefasciatus*; CS-*ClostridiumSporegenes*; CT-*Candidatropicalis*; DC-*Dermatophiluscongolensis*; DLC-DifferentialLeukocyteCount; DPPH-[1,1]-diphenyl-[1,2]-picrylhydrazyl; Ea-*Enterobacteraerogenes*; EA-Ethyl-acetate; EC-*Escherichiacoli*; EF-*Enterococcusfaecalis*; ETH-Ethanol; FRAP-Ferricreducingantioxidantpower; FU-*Fusariumsp*; GSH-ReducedGlutathione; GST-Glutathione-S-transferase; HDL-HighDensitylipoprotein; HEX-Hexane; HMG-HMG-CoAredutase; HSV-Herpesimplexvirus; HT-*Heterobardionsp*; KLB-*Klebsiella*; KP-*Klebsiellapneumonia*; LDH-Lactatedehydrogenase; LDL-Lowdensitylipoprotein; LF-Leaves; LH-lipidhydroperoxides;

LPO-LipidPeroxidation; MC-*Mastomyscoucha*; MDA-Malondialdehydelevel; MET-Methanolic, MG-*Microsporiumgypseum*; MIC-MinimumInhibitoryConcentration; ML-*MicrococcusLuteus*; MPO-Myeloperoxidase; MS-*MycobacteriumSmegmatis*; MTT-; 3-([4,5]-Dimethylthiazol-2-yl)-[2,5]-DiphenyltetrazoliumBromide; PA-*Pseudomonasaeruginosa*; PE-Petroleumether; PF-*Pseudomonasfluorescence*; PM-*ProteusMirabilis*; PO-*proteusorganism*; PP-*Pheretimaposthuma*; PR-*Panicilliumrubrum*; PV-*ProteusVulgaris*; RO-*Rhizopusoryzae*; RT-Roots; SA-*Staphylococcus aureus*; SAB-*Salmonellaabony*; SAG-*Sagalactiae*; SAL-*Salmonella*; SC-*SaccharomycesCerevisie*; SD-Seeds; SDY-*S.dysgalactiae*; SE-*StaphylococcusEpidermilis*; SF-*ShigellaFlexneri*; SGOT-SerumGlutamicoxaloacetictansaminase; SGPT-Serumglutamicpyruvictansaminase; SH-*Shigella*; SI-*Staphylococcusintermedius*; SL-*Sarcinalutea*; SOD-SuperoxideDismutase; SP-*Streptococcuspyogens*; ST-*Salmonellatyphimurium*; St-Stems; TB-TotalBilirubin; TC-TotalCholesterol; Temephos-O,O,O',O'-tetramethylO,O'-thiodiphenylenephosphorothioate; TM-*Trichophytonmentagrophytes*; TP-TotalProtein; TR-*Trichophytonrubrum*; TV-*Tricodermavibriae*; VLDL-VeryLowdensitylipoprotein; VP-*VibrioParahaemolyticus*; WP-WholePlant; XC-*Xanthomonascampetris*; γ -GT- γ glutamyl-transferase.

Table 3: Negative results of pharmacological and biological activities of *Achyranthes aspera* Linn

Activity	Plant parts	Extract	Methods/ Parameters studied	Experimental model	Standard/ Compounds	References
Anti-microbial	LF	AQ	Agar well diffusion	CA, CT, CK, CKE CN, CG, CGA, AN, AF, AFL, RO	Ketoconazole (30mg) and Itraconazole (30mg)	[94]
		ETH	Agar well diffusion	CG		
		MET	Agar well diffusion	AFL, RO, CGA		
	WP	AQ, ETH	Dilution method	EC, CI, KLB, PO	-	[96]
		MET, CH	Dilution method	KLB, PO		
	St	HEX, EA	Agar well cut diffusion technique	EC	-	[97]
	Lf	EA	Agar well cut diffusion technique	SA		
	St	PE, EA, CH, MET, ETH	MIC, Disc-diffusion assay	EF	Ampicillin	[98]
	SD	Volatile oil	Disc diffusion method	TV, PR	-	[108]
	LF	AQ MET	Agar well diffusion, MIC, MBC	SA, SP, EC, PA, PV	-	[165]
	HEX	Agar well diffusion method, MIC, MLC	CA, AN	-	[166]	
	LF	MET	Well diffusion method	KP, PA, EC	Vancomycin, Ciproflaxocin,	[91]
	AQ	Well diffusion method	SA, KP, BS, PA, EC	Cotrimoxazole, Chloromphenicol, Piperacillin		
Anti-fertility	LF	AQ	Agar diffusion method	SA, SP	Ampicillin	[112]
	RT	PE, AQ	Post coital anti-fertility testing,	Female albino rats	Ethinly estradiol	[76]
Antioxidant	RT	CH	DPPH	-	Ascorbic acid	[97]
Eye irritation potential	LF	AQ	Hen's Egg Test	Hen's Egg and Rabbits	SDS and NaOH	[167]
Acute toxicity	LF	MET	Chorioallantoic Membrane, Acute Eye Irritation Test			
	LF	MET	Cage side observations, daily food and water intake, daily body weight and daily mortality record	Albino Swiss Mice	-	[168]

Abbreviations

AF-*Aspergillusfumigates*; AFL-*Aspergillusflavus*; AN-*Aspergillusniger*; AQ-Aqueous; BS-*Bacillusubtilis*; CA-*Candidaalbicans*; CG-*Candidaguilliermondi*; CGA-*Candidaglabrata*; CH-Chloroform; CI-*Cinobacteria*; CK-*Candidakrusei*; CKE-*Candidakefyr*; CN-*Cryptococcusneoformans*; CT-*Candidatropicalis*; DPPH-[1,1]-diphenyl-[1,2]-picrylhydrazyl; EA-Ethyl-acetate; EC-*Escherichiacoli*; EF-*Enterococcusfaecalis*; ETH-Ethanol; HEX-Hexane; KLB-*Klebsiella*; KP-*Klebsiellapneumonia*; LF-Leaves; MLC-minimum bactericidalconcentration; MET-Methanol; MIC-

MinimumInhibitoryConcentration; MLC-Minimumlethalcount; PA-*Pseudomonasaeruginosa*; PE-Petroleumether; PO-*proteusorganism*; PR-*Panicilliumrubrum*; PV-*ProteusVulgaris*, RO-*Rhizopusoryzae*; RT-Roots; SA-*Staphylococcus aureus*; SD-Seeds; SP-*Streptococcuspyogens*; St-Stems; TV-*Tricodermavibriae*; WP-WholePlant.

Ethnobotanical uses

A. aspera is widely used to treat various kinds of ailments. Various traditional ethnobotanical uses of the medicinal herb are summarized in table 4.

Table 4: Traditional ethnobotanical uses and folk remedies of *Achyranthes aspera* Linn

Plant part	Process	Diseases	References
Whole plant	Juice of plant	Dysentery Boils, Diarrhea, Haemorrhoids, Rhematic problems, Skin problems.	[11]
	Plant ash mixed with mustered oil and a pinch of salt.	Tooth powder for teeth.	[11]
	Fumes of plant mixed with <i>Smilax ovalifolia</i> roots.	Improve appetite and cure various gastric disorders.	[9]
	Decoction of this plant	Diuretic in renal problem, general anasarca, Beriberi, Pneumonia	[169-171]
Root	Plant Powder taken twice a day with lukewarm water or milk	Rheumatism and Blindness in cattle	[172]
	Plant Ash twice a day with honey	Cough	[173]
	Juice taken thrice a day	Toothache	[171]
	Plant powder (Two teaspoonful) taken once at night	Stomachic and digestive Astringent and bowel complaints	[173- 175]
	Decoction of roots	Pneumonia, Stomach problems	[9]
	Root powder with water until the patient vomits and again onciouness	Snake bite	[9]
	A fresh piece	As tooth bursh	[9]
	Roots Infusion in water taken thrice a day	Mild astringent	[170]
	Root powder given in water.	Used as antidode for snake bite.	[9]
	Urena lobata and Bark of Psidium guajava mixed with root juice	Dysentery, Diarrhea	[9]
	Powder taken daily with water	Leprosy	[176]
	Paste taken daily with water	Antifertility	[177]
	Root ashes mixed with water	Cough, ascites, anasarca	[70]
	Powder taken twice a daily	Bleeding in delivery	[178-179]
Black papper mixed with an equal volume of root powder, ived in three parts and gives in three times.	Diarrhea	[9]	
Stem	Fresh stem	As a tooth brush	[9]
Leaves	Crushed leaves rubbed on back.	Strained back cure.	[9]
	Seven leaves crushed and taken as a single dose twice a week.	Dog bite.	[9]
	Juice takes every third hour	Diarrhea	[9]
	A paste of leaves	Rabies, nervous disorders, hysteria, insect and snake bite.	[11]
	Juice mixed with opium taken with water two times	Syphilitic sores, Gonorrhoea, Bowel complaint, pile, boil, stomach, skin eruption	[170-171]
Seeds	Decoction of powdered leaves taken twice day	Early stages of diarrhea and dysentery	[170, 179]
	Jiggery or black peppery and garlic mixed with fresh leaves and ade pills taken twice a day	Antiperiodic	[170, 179]
	Raw seeds taken with water	Expectorants, Brain Tonic, Bleeding piles	[170]
Flowers	Flowers paste taken daily	Menorrhagia	[171]
	Paste as external use	Snakes and reptiles bites	[170]
Fruits	Unripe fruits taken three times daily	Respiratory problems	[171]

CONCLUSION

From the above literature, it is concluded that *A. aspera* Linn. possess many chemical constituents that are responsible for various pharmacological and biological activities. *A. aspera* also exhibits multiple ethnobotanical uses, so *A. aspera* is a vital medicinal herb.

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CONFLICT OF INTEREST

Authors have no conflict of interest.

REFERENCES

- Holm G, Herbst V, Teil B. Brogenkunde. IN: Plant Med 1998; 67:263-9.
- Sivasankari K, Janaky S, Sekar T. Evaluation of photochemical in select medicinal plants of the caesalpinia species. Indian J Sci Technol 2010; 3:0974-6846.
- Edeoga HO, Okwu DE, Mbaebie BO. Phytochemical constituents of some Nigerian medicinal plants. Afr J Biotechnol 2005; 4(7):685-8.
- Korwar PG, Beknal AK, Patil BS, Halkai MA, Kulkarni U, Hariprasanna RC, et al. A study on phytochemical investigation of *Drynariaquercia* Linn rhizome. Int J Pharm Sci Res 2010; 1(12):148-58.
- Sutar N, Garai R, Sharma UM, Goyal P, Yadav G. Pharmacognostic studies of the *Achyranthes aspera* leaves. Int J Compr Pharm 2011; 5(10):0976-8157.
- Dey A. *Achyranthes aspera* L: phytochemical and pharmacological aspects. Int J Pharm Sci Rev Res 2011; 9(2):013.
- Dwivedi S, Dubey R, Mehta K. *Achyranthes aspera* Linn. (Chirchira): a magic herb in folk medicine. Ethno Botanical Leaves lets 2008; 12:670-6.
- Neeta SR, Jyoti B, Singh A, Kaur P. Antibacterial potential of *Achyranthes aspera* Linn. procured from Himachal Pradesh, Punjab and Haryana, India. Res J Chem Sci 2011; 1(8):80-2.
- www.mmh-mms.com
- http://www.ebbd.info
- Srivastav S, Singh P, Mishra G, Jha KK, Khosa RL. *Achyranthes aspera*-an important medicinal plant: a review. J Nat Prod Plant Resour 2011; 1(1):1-14.
- Fern K. *Achyranthes aspera*. Plants for a Future; 1996.
- Krishnaveni A1, Thaakur SR. Pharmacognostical and preliminary phytochemical studies of *Achyranthes aspera* Linn. Anc Sci Life 2006; 26(1-2):1-5.
- Jadav HR, Galib R, Prajapati PK, Harisha CR. Pharmacognostical study on flowers and fruits of Apamarga (*Achyranthes aspera* Linn.). Int J Green Pharm 2013; 7:136-9.
- Bir SS, Sidhu. Cytological observations in weed flora of orchards of Patiala district, Punjab. Recent Res Pl Sci 1979; 7:261-71.
- Morton JK. Chromosome numbers and poly-ploidy in the flora of the cameroon mountain. Opera Bot 1993; 121:159-72.

17. De Lange PJ, Scofield RP, Greene T. *Achyranthes aspera* (Amaranthaceae), a new indigenous addition to the flora of the Kermadec Islands group. *New Zealand J Bot* 2004; 42:167-73.
18. Bir SS, Sidhu M. Cyto-palynological studies on weed flora of cultivable lands of Patiala district (Punjab). *J Palynol* 1980; 16:85-105.
19. Kumar A. Polyploidy in *Achyranthes aspera* and *Chrysanthemum leucanthemum*. *Acta Bot Indica* 1982; 10:141-2.
20. Sharma V, Chaudhary U, Singh R, Agarwal A. *Achyranthes aspera*: phytochemical estimation. *Am J Pharmtech Res* 2013a; 3(2):242-51.
21. Sharma V, Agarwal A, Chaudhary U, Singh M. Phytochemical Investigation of various extracts of leaves and stems of *achyranthes aspera* linn. *Int J Pharm Pharm Sci* 2013b; 5(1):317-20.
22. Banerji A, Chintalwar GJ, Joshi NK. Isolation of ecdysterone from Indian plants. *Phytochem* 1971; 10:2225-6.
23. Laddha KS, Ghosh D. Isolation of 20-Hydroxyecdysone from Indian medicinal plant *achyranthes aspera* and development of simple HPLC analysis. *Nat Prod* 2005; 1(1-2):10-3.
24. Kapoor VK, Singh H. Isolation of betaine from *Achyranthes aspera* Linn. *Indian J Chem* 1966; 4(10):461-3.
25. Kunert O, Haslinger E, Martin, Schmid, Reiner J, Bucar F, et al. Three saponins steroids and a flavanol glycoside from *Achyranthes aspera*. *Monatsh Chem* 2000; 131(2):195-204.
26. Michl G, Abebe D, Bucar F, Debella A, Kunert O, Schmid MG, et al. New triterpenoid saponins from *Achyranthes aspera* Linn. *Helv Chim Acta* 2000; 83(2):359-63.
27. Batta AK, Rangaswami S. Crystalline chemical components of some vegetable drugs. *Phytochem* 1973; 12:214-6.
28. Misra TG, Singh RS, Pandey HS, Prasad C. An aliphatic dihydroxyketone from *Achyranthes aspera*. *Phytochem* 1991; 30(6):2076-8.
29. Rastogi RP, Mehrotra BN. Compendium of indian medicinal plants. Central Drug Research Institute, Lucknow and National institute of science communication and information resources, New Delhi; 2004; 5(11):7-8.
30. Misra TG, Singh RS, Pandey HS, Prasad C, Singh BP. Two long chain compounds from *Achyranthes aspera*. *Phytochem* 1993; 33(1):221-3.
31. Gariballa Y, Iskander GM, Daw El Beit A. Investigation of the alkaloid components in the Sudan Flora III. *Fitoterapia* 1983; 54:269-72.
32. Misra TN, Singh RS, Pandey HS, Prasad C, Singh S. Isolation and characterization of two new compounds from *Achyranthes aspera* Linn. *Indian J Chem* 1996; 35B(6):637-9.
33. Ali M. Chemical investigation of *Achyranthes aspera* Linn. *Oriental J Chem* 1993; 9(1):84-5.
34. Rameshwar RD. Essential oil constituents of *Achyranthes aspera* leaves. *Indian Perfum* 2007; 51(1):33-4.
35. Khastgir HN, Gupta PS. The sapogenin from seeds of *Achyranthes aspera* Linn. *J Indian Chem Soc* 1985; 35:693-4.
36. Hariharan V, Rangaswami S. Structure of saponines A and B from the seeds of *Achyranthes aspera*. *Phytochem* 1970; 9:409-14.
37. Chauhan AS, Rawat GS, Singh CP. Phytochemical study of *Achyranthes aspera* Linn. *Asian J Chem* 2002; 14(2):1059-61.
38. Daulatabad CD, Ankalgi RF. Minor seed oils II: fatty acid composition of some seed oils. *Fette Seifen Anstrichm* 1985; 87(5):196-7.
39. Rameshwar RD, Akito N. Three oleanolic acid glycosides from the seeds of a *Achyranthes aspera*. *Nat Prod Commun* 2007; 2(7):727-30.
40. Banerji A, Chadha MS. Insect moulting hormone from *Achyranthes aspera*. *Phytochem* 1970; 9:1671.
41. Ikan R, Ravid U, Trosset D, Shulman E. Ecdysterone: an insect moulting hormone from *Achyranthes aspera* (Amaranthaceae). *Cell Mol Life Sci* 1971; 27(5):504-5.
42. Sharma SK, Vasudeva N, Ali M. A new aliphatic acid from *Achyranthes aspera* Linn. *Roots Indian J Chem* 2009; 48B:1164-9.
43. Seshadri V, Batta AK, Rangaswami S. Structure of two new saponins from *Achyranthes aspera*. *Indian J Chem Sect B Org Chem Incl Med Chem* 1981; 20B(9):773-5.
44. Shekhawat NS, Ramawat KG, Arya HC. Carbohydrate, Proteins, Phenols and enzymes (PPO, PRO & IAA oxidase) in gall and normal tissues of *Achyranthes aspera* L. *Curr Sci* 1978; 47(20):780-1.
45. Dwivedi S, Dubey R, Mehta K. *Achyranthes aspera* Linn. (Chirchira): a magic herb in folk medicine. *Ethnobot Leaflets* 2008; 12:670-6.
46. Barua CC, Begum SA, Talukdar A, Pathak DC, Sarma DK, Bora R. Wound healing activity of methanolic extract of leaves of *Achyranthes aspera* Linn. using *in vivo* and *in vitro* model-a preliminary study. *Indian J Anim Sci* 2010; 80(10):969-72.
47. Sharma V, Singh R, Chaudhary U. Curative efficacy of *Achyranthes aspera* against various pathogenic microbial strains. *Int J Drug Dev Res* 2013c; 5(1):392-401.
48. Sharma V, Singh R, Paliwal R, Chaudhary U, Agarwal A. MIC values of inflorescence and leaves extracts of *Achyranthes aspera* against usual pathogenic bacterial strains. *Asian J Pharm Clin Res* 2013d; 6(1):185-7.
49. Goyal BR, Mahajan SG, Mali RG, Goyal RK, Mehta AA. Beneficial effect of *achyranthes aspera* linn. in toluene-di-isocyanate induced occupational asthma in rats. *Global J Pharmacol* 2007; 1(1):06-12.
50. Sutar NG, Sutar UN, Sharma YP, Shaikh IK, Kshirsagar SS. Phytochemical investigation and pharmacological screening of leaves of *Achyranthes aspera* L. as analgesic and antipyretic. *Biosci Biotechnol Res Asia* 2008; 5(2):841-4.
51. Mehta FA, Patel BG, Pandya SS, Ahir KB, Patel SB. Antinociceptive and anti-inflammatory activity of *Achyranthes aspera* L. extracts. *Pharmacologyonline* 2009; 3:978-85.
52. Kumar H, Singh D, Kushwaha SKS, Gupta AK. Comparison of leaf and root extracts *Achyranthes aspera* for its analgesic activity. *Der Pharm Lett* 2009; 1(2):193-8.
53. Bhosale U, Yegnanarayan R, Prachi P, Zambare M, Somani RS. Antinociceptive evaluation of an ethanol extract of *Achyranthes aspera* (agadha) in animal models of Nociception. *Int J Phytomed* 2010; 2:440-5.
54. Alam MA, Slahin N, Uddin R, Hasan SMR, Akter R, Kamaluddin, et al. Analgesic and neuropharmacological investigations of the aerial part of *achyranthes aspera* linn. *S J Pharm Sci* 2008; 1(1-2):44-50.
55. Bharathi NM, Sravanthi V, Sujeeth S, Kalpana K, Santhoshi P, Pavani M, et al. *In-vitro* anthelmintic activity of methanolic and aqueous extracts of *achyranthes aspera* Linn. (Amaranthaceae) Stems. *Int J Pharm Sci* 2013; 3(2):181-4.
56. Umamaheswari M, Sundaram D, Thirumalaiswamy S, Varadharajan S, Jagannath P, Arumugam M. Anticataract and antioxidant activities of *Achyranthes aspera* Linn. against glucose-induced cataractogenesis using goat lenses. *J Nat Prod Plant Resour* 2012; 2(1):153-61.
57. Nwosu FO, Nnanna LA, Okeoma KB. Corrosion inhibition for mild steel in 0.5 M H₂SO₄ solution using *Achyranthes aspera* L. leaf extract. *Afr J Pure Appl Chem* 2013; 7(2):56-60.
58. Neogi NC, Garg RD, Rathor RS. Preliminary pharmacological studies on achyranthine. *Indian J Pharm* 1970; 32:43-6.
59. Goli VT, Macharla SP, Gowrishankar NL, CH Dhanalakshmi, Bhaskar J, Bhaskar KV. Anti-pyretic activity of *Achyranthes aspera* Linn. *pharmanest. Int J Adv Pharm Sci* 2011; 2(2-3):204-6.
60. Mangal A, Sharma MC. Evaluation of certain medicinal plants for antiobesity properties. *Indian J Traditional Knowledge* 2009; 8(4):602-5.
61. Rani N, Sharma SK, Vasudeva N. Assessment of antiobesity potential of *achyranthes aspera* linn Seed. *Evidence-Based Complementary Altern Med* 2012; 1-7.
62. Datir SB, Ganjare AB, Nirmal SA, Bhawar SB, Bharati DK, Patil MJ. Evaluation of anti-allergic activity of the various extracts of the aerial part of *Achyranthes aspera* Var. *Porphyristachya* (Wall. Ex MOQ.) Hook. F. *Pharmacologyonline* 2009; 3:921-5.
63. Gokhale AB, Damre AS, Kulkarni KR, Saraf MN. Preliminary evaluation of anti-inflammatory and anti-arthritis activity of *S. lappa*, *A. speciosa* and *A. aspera*. *Phytomed* 2002; 9(5):433-7.
64. Chakraborty A, Branter A, Mukainaka T, Nobukuni Y, Kuchide M, Konoshima T, et al. Cancer chemopreventive activity of *Achyranthes aspera* leaves on epstein-barr virus activation and two-stage mouse skin carcinogenesis. *Cancer Lett* 2002; 177(1):1-5.

65. Geetha P, Narayanan KR, Murugesan AG. Screening the anticancerous efficacy of *Achyranthes aspera* Linn. using animal model swiss albino mice. J Biomed Sci Res 2010; 2(4):231-5.
66. Arora S, Tandon C, Tandon S. Evaluation of the cytotoxic effects of CAM therapies: an *in vitro* study in normal kidney cell lines. Sci World J 2014; 1-11.
67. Kartik R, Rao CV, Trivedi SP, Pushpangadan P, Reddy GD. Amelioration effect against N-nitrosodiethylamine and CCl₄-induced hepatocarcinogenesis in Swiss albino rats by whole plant extract of *Achyranthes aspera*. Indian J Pharmacol 2010; 42(6):370-5.
68. Kumar PS, Sucheta S, Umamaheswari A, Deepa VS. *In vitro* and *in vivo* evaluation of anti-dandruff activity of formulated polyherbal hair oil. J Pharm Res 2010; 3(12):2956-8.
69. Barua CC, Talukdar A, Begum SA, Buragohain B, Roy JD, Borah RS, et al. Antidepressant-like effects of the methanolic extract of *Achyranthes aspera* Linn. in animal models of depression. Pharmacologyonline 2009; 2:587-94.
70. Zambare M, Uma A, Bhosale, Somani RS, Yegnanarayan R, Talpate KA. Effect of Treatment with *Achyranthes aspera* (Agadha) ethanol extract on various hematological and biochemical parameters in alloxan induced diabetic rats. Int J Pharm Front Res 2011; 1(1):42-52.
71. Kumar AS, Gnananath K, Gande S, Goud ER, Rajesh P, Nagarjuna S. Anti diabetic activity of ethanolic extract of *Achyranthes aspera* leaves in streptozotocin induced diabetic rats. J Pharm Res 2011; 4(7):3124-5.
72. Vidhya R, Gandhi GR, Jothi G, Radhika J, Brindha P. Evaluation of antidiabetic potential of *Achyranthes aspera* Linn. on alloxan induced diabetic animals. Int J Pharm Pharm Sci 2012; 4(5):577-80.
73. Jeyasankar A, Premalatha S, Elumalai K. Antifeedant and insecticidal activities of selected plant extracts against *Epilachna* beetle, *Henosepilachna vigintioctopunctata* (Coleoptera: Coccinellidae). Adv Entomol 2014; 2(1):14-9.
74. Sandhyakumary K, Body RG, Indira M. Impact of feeding ethanolic extract of *Achyranthes aspera* Linn. on reproductive function in male rats. Indian J Exp Biol 2002; 40:1307-9.
75. Shibeshi W, Makonnen E, Zerihun L, Debella A. Effect of *Achyranthes aspera* L. on fetal abortion, uterine and pituitary weights, serum lipids and hormones. Afr Health Sci 2006; 6(2):108-12.
76. Vasudeva N, Sharma SK. Post-coital antifertility activity of *Achyranthes aspera* Linn Root. J Ethnopharmacol 2006; 107(2):179-81.
77. Pakrashi A, Mookerji N, Basak B. Effect of chromatographic fractions of the plant *Achyranthes aspera* Linn. on fertility in female albino mice. J Reprod Fertil 1975; 43(1):127-8.
78. Prasad BRG, Pathak P. Analysis of *Achyranthes aspera* (ash) on reproductive fitness of *Drosophila melanogaster*. Int J Pharm Appl 2011; 2(4):225-30.
79. Vasudeva N, Sharma SK. Estrogenic and pregnancy interceptory effects of *Achyranthes aspera* Linn. root. Afr J Trad CAM 2007; 4(1):7-11.
80. Bodare RD, Birje KN, Bansode DL, Deshmukh AJ, Inamdar II, Mane AB, et al. Antioviulatory and antiimplantation effect of ethanolic extract of root of *Achyranthes aspera* Linn. in the female rat. J Cell Tissue Res 2013; 13(2):3775-8.
81. Neogi NC, Rathor RS, Shrestha AD, Banerjee DK. Studies on the anti-inflammatory and anti-arthritic activity of *Achyranthes*. Ind J Pharm 1969; 1(3):37-47.
82. Kumar SV, Sankar P, Varatharajan R. Anti-inflammatory activity of roots of *Achyranthes aspera*. Pharm Biol 2009; 47(10):973-5.
83. Jay AN, Patel J, Semuel MR, Shabaraya AR. Antiinflammatory activity of fractionated extracts of *Achyranthes aspera* Linn leaves. J Appl Pharm Sci 2011; 01(08):188-90.
84. Ramachandran S, Tamarbha GS. Evaluation of intestinal anti-inflammatory effect of methanolic extract of *Achyranthes aspera* leaves on inflammatory bowel disease in wister albino rats. World J Pharm Pharm Sci 2013; 2(5):3436-48.
85. Bhosale UA, Yegnanarayan R, Pophale P, Somani R. Effect of aqueous extracts of *Achyranthes aspera* Linn. On experimental animal model for inflammation. Ancient Sci Life 2012; 31:202-6.
86. Vetrichelvan T, Jegadeesan M. Effect of alcohol extract of *Achyranthes aspera* L. on acute and subacute inflammation. Phytother Res 2003; 17(1):77-9.
87. Khuda F, Iqbal Z, Khan A, Zakiullah, Nasir F, Shah Y. Anti-inflammatory activity of the topical preparation of *Valeriana wallichii* and *Achyranthes aspera* leaves. Pak J Pharm Sci 2013; 26(3):451-4.
88. Khuda F, Iqbal Z, Khan A, Zakiullah, Shah Y, Ahmad L, et al. Evaluation of anti-inflammatory activity of selected medicinal plants of khyber pakhtunkhwa, Pakistan. Pak J Pharm Sci 2014; 27(2):365-8.
89. Diana KJ, George KV. *In vitro* studies on antilithiatic property of *Achyranthes aspera* L. var. *aspera* Hook f. J Pharm Res 2012; 5(8):4366-70.
90. Girigaon YH, Yogini RK. A comparative antimicrobial activity of Apamarga (*Achyranthes aspera* Linn.) patra and beeja. Int J Res Ayurveda Pharm 2012; 3(6):876-8.
91. Priya CL, Kumar G, Karthik L, Rao KVB. Phytochemical composition and *In vitro* antioxidant activity of *Achyranthes aspera* Linn. (Amaranthaceae) leaf extracts. J Agri Technol 2012; 8(1):143-56.
92. Peter TA, Usha M, Naveen S. Sunlight induced rapid synthesis and kinetics of silver nanoparticles using leaf extract of *Achyranthes aspera* L. and their antimicrobial applications. Adv Mat Lett 2013; 4(10):779-85.
93. Thilagavathi G, Kannaiah T. Application of prickly chaff (*Achyranthes aspera* Linn.) leaves as herbal antimicrobial finish for cotton fabric used in healthcare textiles. J Nat Prod Resour 2008; 7(4):330-34.
94. Elumalai EK, Chandrasekaran N, Thirumalai T, Sivakumar C, Therasa SV, David E. *Achyranthes aspera* leaf extracts inhibited fungal growth. Int J Pharm Tech Res 2009; 1(4):1576-9.
95. Shendkar CD, Chandrachud PS, Lavate SM, Kunchiraman BN, Deshpande NR. Comparative evaluation of *Achyranthes aspera* Linn. parts by antibacterial activity. J Pharm Res 2012; 5(1):102-3.
96. Patil U, Sarma MC. Study of antibacterial effect of apamarga (*Achyranthes aspera*) on multi drug resistant clinical isolates. Int J Res Ayurveda Pharm 2013; 4(2):262-5.
97. Beaulah AG, Sadiq MA, Santhi RJ. Antioxidant and antibacterial activity of *Achyranthes aspera*: an *in vitro* study. Ann Biol Res 2011; 2(5):662-70.
98. Pandey R, Sambasivarao Y, Gurumurthy. Antibacterial activity of medicinal plants against pathogens from extracts of *Achyranthes aspera*. Med Aromat Plants 2013; 2(5):1-3.
99. Pandey G, Rao CV, Gupta SS, Verma KK, Singh M. Antioxidant and antibacterial activities of leaf extract of *Achyranthes aspera* Linn. (Prickly Chaff Flower). Eur J Med Plants 2014; 4(6):695-708.
100. Dash BK, Sen MK, Alam MK. *In vitro* inhibitory activity of *Achyranthes aspera* L. seed against some test bacteria. Am J Life Sci 2013; 1(3):113-6.
101. Prasad SHKR, Swapna NL, Anthonamma K, Madanprasad RD. Antimicrobial activity of *Achyranthes aspera* and *Aerva lanata* leaf and callus extracts. Biosci Biotechnol Res Asia 2009; 6(2):887-91.
102. Khara N, Thakur Y, Bhati A. Diversity in antimicrobial activity of some medicinal plants of High Altitude area: *Achyranthes aspera*, *Thalictrum foliolosum*, *Valeriana wallichii*, *Hedychium spicatum*, *Woodfordia fruticosa*, *Acorus calamu*, *Eupatorium cannabinum*. Asian J Plant Sci Res 2012; 2(5):638-42.
103. Parmar KA, Prajapati SN, Chauhan VV, Patel CR. Preliminary phytochemical, pharmacognostical and microbial screening of *Achyranthes aspera* (amaranthaceae). J Nat Prod Plant Resour 2013; 3(1):15-7.
104. Sharma S, Shrivastava PN, Saxena RC. Antimicrobial activity of saponins isolated from *Achyranthes aspera* against *Staphylococcus aureus*. Asian J Chem 2006; 18(4):2766-70.
105. Gupta RN, Viswas K, Pathak M, Parihar SS, Gupta A. Antibacterial activities of ethanolic extracts of plants used in folk medicine. Int J Res Ayurveda Pharm 2010; 1(2):529-35.
106. Kumar SS, Perumal P, Boopathy D, Mukherjee PK, Suresh B. Comparative microbiological activities of ethanolic extracts of

- roots and aerial parts of *Achyranthes aspera* linn. *Anc Sci Life* 2003; 22(4):140-5.
107. Ashokkumar P, Rajkumar, Kanimozhi M. Phytochemical screening and antimicrobial activity from five Indian medicinal plants against human pathogens. *Middle East J Sci Res* 2010; 5(6):477-82.
 108. Rama Mohan Reddy T, karunakar B, Vidyasagar PG. Seed volatile oil analysis and *In vitro* antimicrobial activity of potential medicinal herb: *Achyranthes aspera* (Willd). *Int J Pharm Tech* 2011; 3(1):1860-6.
 109. Narendhiran S, Saravanan L, Arun J, priyadharshini N, Sundari G, Swetha S, et al. Preliminary screening of aqueous and solvent extracts from *Achyranthes aspera* its antibacterial and antifungal activity. *Int J Res Biol Sci* 2014; 4(1):16-9.
 110. Kalayou S, Haileselassie M, Gebre-egziabher G, Tiku'e T, Sahle S, Taddele H, et al. *In-vitro* antimicrobial activity screening of some ethnoveterinary medicinal plants traditionally used against mastitis, wound and gastrointestinal tract complication in Tigray Region, Ethiopia. *Asian Pac J Trop Biomed* 2012; 2(7):512-22.
 111. Kaur M, Thakur Y, Rana RC. Antimicrobial properties of *achyranthes aspera*. *Anc Sci Life* 2005; 24(4):168-73.
 112. Arunkumar S, Muthuselvam M, Rajasekaran R. Analysis of phytochemical constituents and antimicrobial activity of some Southern India medicinal plants. *J Pharm Res* 2010; 3(8):1841-3.
 113. Khan MTJ, Ahmad K, Alvi MN, Amin NU, Mansoor B, Saeed MA, et al. Antibacterial and irritant activities of organic solvent extracts of *agave americana* linn., *albizzia lebbek* benth. *achyranthes aspera* linn. and *abutilon indicum* linn-a preliminary investigation. *Pak J Zool* 2010; 42(1):93-7.
 114. Barua CC, Talukdar A, Begum SA, Handique AK, Handique GK, Roy JD, et al. Impact of *Achyranthes aspera* L. on protein profile in impaired wound models. *Indo Global J Pharm Sci* 2011; 1(1):13-24.
 115. Bhosale UA, Yegnanarayan R, Pophale PD, Zambare MR, Somani RS. Study of central nervous system depressant and behavioral activity of an ethanol extract of *Achyranthes aspera* (Agadha) in different animal models. *Int J App Basic Med Res* 2011; 1:104-8.
 116. Sharma V, Chaudhary U, Singh R, Janmeda P. Evaluation of quantitative and antioxidant activity of *Achyranthes aspera* roots and inflorescences. *Asian J Pharm* 2014; 8(1):1-7.
 117. Edwin S, Jarald E, Edwin DL, Jain A, Kingler H, Dutt KR, et al. Wound healing and antioxidant activity of *achyranthes aspera*. *Pharm Biol* 2008; 46(12):824-8.
 118. Deshmukh JYVN, Shewale VV, Narkhede MR, Aurangabadkar VM. *In vitro* antioxidant activity of *Achyranthes aspera* L. *J Pharm Res* 2009; 2(9):1402-3.
 119. Kumar A, Kumari NS, Bhargavan D. Evaluation of *In vitro* antioxidant potential of ethanolic extract from the leaves of *Achyranthes aspera*. *Asian J Pharm Clin Res* 2012; 5(3):146-8.
 120. Anand M, Selvaraj V, Alagar M. Phytochemical screening and evaluation of (In vitro) antioxidant activity of *Achyranthes aspera* linn. root extract. *Int J Pharm Pharm Sci* 2014; 6(2):197-9.
 121. Inbaneson SJ, Ravikumar S, Suganthi P. *In vitro* antiplasmodial effect of ethanolic extracts of coastal medicinal plants along palk strait against *plasmodium falciparum*. *Asian Pac J Trop Biomed* 2012; 2(5):364-7.
 122. Rao YV, Chakrabarti R. Enhanced anti-proteases in *Labeo rohita* fed with diet containing herbal ingredients. *Indian J Clin Biochem* 2004; 19(2):132-4.
 123. Deshmukh VN, Nehete JY, Shewale VV, Raghav NA, Gawande VT. Gastric antiulcer activity of *Achyranthes aspera* L. roots in pylorus ligated rats. *Global J Pharmacol* 2011; 5(3):143-6.
 124. Gopinath P, Kumar MC, Kumar SM. Antiulcer and antioxidant potential of aqueous extracts of *Annona squamosa* and *Achyranthes aspera* in aspirin plus pyloric ligation model in rat. *J Biotechnol Biomater* 2012; 2(6):320.
 125. Mukherjee H, Ojha D, Bag P, Chandel HS, Bhattacharyya S, Chatterjee TK, et al. Anti-herpes virus activities of *Achyranthes aspera*: an indian ethnomedicine, and its triterpene acid. *Microbiol Res* 2013; 68(4):238-44.
 126. Gupta SS, Bhagwat AW, Ram AK. Cardiac stimulant activity of the saponin of *Achyranthes aspera* (Linn.). *Indian J Med Res* 1972; 60(3):462-71.
 127. Ram AK, Bhagwat AW, Gupta SS. Effect of the saponin of *Achyranthes aspera* on the phosphorylase activity of rat heart. *Indian J Physiol Pharmacol* 1971; 15(3):107-10.
 128. Neogi NC, Garg RD, Rathor RS. Preliminary pharmacological studies on achyranthine. *Indian J Pharm* 1970; 32(2):43.
 129. Jahan N, Ahmad R, Hussain F. Evaluation of diuretic activity of *Achyranthes aspera* (Chirchita) in Goats. *Pakistan Vet J* 2002; 22(3):124-7.
 130. Srivastav S, Singh P, Jha KK, Mishra G, Srivastava S, Karchuli MS, et al. Diuretic activity of whole plant extract of *Achyranthes aspera* Linn. *Eur J Exp Biol* 2011; 1(2):97-102.
 131. Sutar N, Kumar AD, Mishra SK, Goyal P, Mishra SS. Diuretic activity of *Achyranthes aspera* leaves extract. *Int Res J Pharm* 2012; 3(4):216-8.
 132. Chandaka M, Brainard PJ, Raj GP, Raj KR, Nishanth J, Reddy TA. Anti urolithic activity of aqueous extract on roots and seeds of *Achyranthes aspera* on ethylene glycol induced kidney stones in male albino rats. *Int J Adv Pharm Sci* 2012; 3(3-4):186-95.
 133. Gupta SS, Verma SCL, Ram AK, Tripathi RM. Diuretic effect of the *Achyranthes aspera* (apamarga). *Ind J Pharmacol* 1972; 4(4):208-14.
 134. Das AK, Bigoniya P, Verma NK, Rana AC. Gastroprotective effect of *Achyranthes aspera* linn. Leaf on rats. *Asian Pac J Trop Med* 2012; 5(3):197-201.
 135. Bafna AR, Mishra SH. Effect of methanol extract of *Achyranthes aspera* linn. On rifampicin induced hepatotoxicity in rats. *Ars Pharm* 2004; 45(4):343-51.
 136. Manjunatha BK, Abhilash N, Hegde V, Suchitra MN, Vidya SM. Hepatoprotective potency of *achyranthes aspera*: an *in-vivo* study. *Int J Pharm Phytopharmacol Res* 2012; 1(6):387-90.
 137. Chaitanya AKD, Challa SR, Reddy AM. Hepatoprotective effect of biherbal ethanolic extract against paracetamol-induced hepatic damage in albino rats. *J Ayurveda Integr Med* 2012; 3(4):198-203.
 138. Kumar SVS, Chandrika G, Mahesh K, Meghanath PVS. Hepatoprotective activity of *Achyranthes aspera* linn against paracetamol induced toxicity. *Int J Pharm Pharm Sci* 2012; 4(5):299-302.
 139. Sudha A, Srinivasan P, Manikandaselvi S, Thinagarbabu R. Protective effect and antioxidant role of *Achyranthus aspera* L. against ethanol-induced oxidative stress in rats. *Int J Pharm Pharm Sci* 2012; 4(3):280-4.
 140. Akhtar MS, Iqbal J. Evaluation of the hypoglycaemic effect of *Achyranthes aspera* in normal and alloxan-diabetic rabbits. *J Ethnopharmacol* 1991; 31(1):49-57.
 141. Talukder FZ, Khan KA, Uddin R, Jahan N, Alam MA. *In vitro* free radical scavenging and anti-hyperglycemic activities of *Achyranthes aspera* extract in alloxan-induced diabetic mice. *Drug Discov Ther* 2012; 6(6):298-305.
 142. Kabir MS, Hamid K, Bulbul L, Khatun Z, Alam MZ, Chakma P. Effect of ardhabilva kvatha curna-An ayurvedic formulation on lipid profile after chronic administration. *Agric Biol J N Am* 2010; (5):812-6.
 143. Latha BP, Vijaya T, Reddy IRM, Ismail M, Rao SD. Therapeutic efficacy of *Achyranthes aspera* saponin extract in high fat diet induced hyperlipidaemia in male wistar rats. *Afr J Biotechnol* 2011; 10(74):17038-42.
 144. Venkatalakshmi P, Valli NV, Sangeetha S. Hypolipidemic effect of *Achyranthes aspera* on High fat diet induced atherogenic rats. *Res J Pharm Biol Chem Sci* 2012; 3(3):75-84.
 145. Krishnakumari S, Priya K. Hypolipidemic efficacy of *achyranthes aspera* on lipid profile in sesame oil fed rats. *Anc Sci Life* 2006; 25(3-4):49-56.
 146. Khanna AK, Chander R, Singh C, Srivastava AK, Kapoor NK. Hypolipidemic activity of *Achyranthes aspera* linn. In normal and triton induced hyperlipemic rats. *Indian J Exp Biol* 1992; 30(2):128-30.
 147. Rao VY, Chakrabarti R. Stimulation of immunity in Indian major carp *Catla catla* with herbal feed ingredients. *Fish Shellfish Immunol* 2005; 18:327-34.
 148. Bagavan A, Rahuman AA, Kamaraj C, Geetha K. Larvicidal activity of saponin from *Achyranthes aspera* against *aedes aegypti* and *culex quinquefasciatus* (Diptera: Culicidae). *Parasitol Res* 2008; 103:223-9.

149. Khandagle AJ, Tare VS, Raut KD, Morey RA. Bioactivity of essential oils of *Zingiber officinalis* and *Achyranthes aspera* against mosquitoes. *Parasitol Res* 2011; 109:339-43.
150. Chalannavar RK, Hurinanthan V, Singh A, Venugopala KN, Gleiser RM, Bajinath H, *et al.* The antimosquito properties of extracts from flowering plants in South Africa. *Trop Biomed* 2013; 30(4):559-69.
151. Kumar S, Wahab N, Mishra M, Warikoo R. Evaluation of 15 local plant species as larvicidal agents against an Indian strain of dengue fever mosquito, *Aedes aegypti* L. (Diptera: Culicidae). *Front Physiol* 2012; 3(104):1-6.
152. Jayakumar T, Sridhar MP, Bharath Prasad TR, Ilayaraja M, Govindasamy S, Balasubramanian MP. Experimental studies of *Achyranthes aspera* (L) preventing nephrotoxicity induced by lead in albino rats. *J Health Sci* 2009; 55(5):701-8.
153. Aggarwal A, Single SK, Gandhi M, Tandon C. Preventive and curative effects of *Achyranthes aspera* Linn extract in experimentally induced nephrolithiasis. *Indian J Exp Biol* 2012; 50:201-8.
154. Tahiliani P, Kar A. *Achyranthes aspera* elevates thyroid hormone levels and decreases hepatic lipid peroxidation in male rats. *J Ethnopharmacol* 2000; 1(3):527-32.
155. Anuja MM, Nithya RS, Swathy SS, Rajamanickam C, Indira M. Spermicidal action of a protein isolated from ethanolic root extracts of *Achyranthes aspera*: an *In vitro* study. *Phytomed* 2011; 18(8-9):776-82.
156. Anuja MNMK, Nithya RNSA, Rajamanickam C, Madambath I. Spermatoxicity of a protein isolated from the root of *Achyranthes aspera*: a comparative study with gossypol. *Contracept* 2010; 82(4):385-90.
157. Pakrashi A, Bhattacharya N. Abortifacient principles of *Achyranthes aspera* L. *Indian J Exp Biol* 1977; 15(10):856-85.
158. Paul D, Bera S, Jana D. *In vitro* determination of the contraceptive spermicidal activity of a composite extract of *Achyranthes aspera* and *Stephania hernandifolia* on human semen. *Contracept* 2006; 73(3):284-8.
159. Paul D, Debasis D, Ali KM, Chatterjee K, Nandi DK, Ghosh D. Comparative study on the spermicidal activity of organic solvent fractions from hydroethanolic extracts of *Achyranthes aspera* and *Stephania hernandifolia* human and rat sperm. *Contracept* 2010; 81(4):355-61.
160. Paul D, Mallick C, Ali KM, Nandi DK, Ghosh D. Duration dependent effect of hydro-ethanolic extract of leaf of *S. hernandifolia* and root of *A. aspera* on testicular androgenic and gametogenic activity: An approach for male herbal contraceptive development. *Int J Appl Res Nat Prod* 2010; 2(4):1-10.
161. Hossain MJ, Khaleda L, Chowdhury AMMA, Arifuzzaman M, Al-Forkan M. Phytochemical screening and evaluation of cytotoxicity and thrombolytic properties of *achyranthes aspera* leaf extract. *IOSR J Pharm Biol Sci* 2013; 6(3):30-8.
162. Ghosh PK, Gupta VB, Rathore MS, Hussain I. Wound-healing potential of aqueous and ethanolic extracts of apamarga leaves. *Int J Green Pharm* 2011; 5(1):12-5.
163. Gupta N, Jain UK. Wound healing potential of methanolic extract of leaves of *Achyranthes aspera* linn. *Der Pharm Sin* 2011; 2(2):256-62.
164. Fikru A, Makonnen E, Eguale T, Debella A, Mekonnen GA. Evaluation of *In vivo* wound healing activity of methanol extract of *Achyranthes aspera* L. *J Ethnopharmacol* 2012; 143(2):469-74.
165. Taye B, Giday M, Animut A, Seid J. Antibacterial activities of selected medicinal plants in traditional treatment of human wounds in ethiopia. *Asian Pac J Trop Biomed* 2011; 1(5):370-5.
166. Mathur A, Sing R, Yousuf S, Bhardwaj A, Verma SK, Babu P, *et al.* Antifungal activity of some plant extracts against clinical pathogens. *Adv Appl Sci Res* 2011; 2(2):260-4.
167. Deshmukh GR, Kumar KH, Reddy PVS, Rao BS, Kumar CVS. Evaluation of eye irritation potential of aqueous leaf extract of *achyranthes aspera* by *in vitro* and *in vivo* method. *ISRN Toxicol* 2012; 1
168. Sadashiv PS, Krishna AR. Acute toxicity study for *Achyranthes aspera* leaves. *J Pharm Res* 2011; 4(7):2221-2.
169. Dwivedi SN. Herbal remedies among tribals of sidhi district of Madhya Pradesh. *J Econ Tax* 2004; 28(3):675-86.
170. Nadkarni KM. *Indian Materia medica*, Vol-I, 3rd ed. Bombay popular prakashan; 2005. p. 21-2.
171. Rangari VD. *Pharmacognocny and phytochemistry Part II*, 1st edition, Carrer publication; 2006. p. 179-80.
172. Jain SK, Tarafdar CR. Medicinal plant lore of the sandals. A review of P. O. Boddings's work. *Econ Bot* 1970; 24(3):241-75.
173. Chopra RN. *Indigenous drug of India*, Calcutta; 1933.
174. Gopalanchari R, Dhar ML. Studies in the constitution of the saponin from the seeds of *Achyranthes aspera*: Part 1-identification of the sapogenins. *J Sci Indust Res* 1985; 17(B):276-8.
175. Quisumbing E. *Medicinal Plants of the Philippines* Tech Bull, Phillips Dep. *Agri Natur Res*, 16, Manila, Philippine Islands: Manila Bureau of Printing; 1951.
176. Rao RR. Ethnobotany of Meghalaya: medicinal plants used by khasi and garo tribes. *Econ Bot* 1981; 35(1):4-9.
177. Malhi BS, Trivedi VP. Vegetable antifertility drug of India. *Quert crude Drug Res* 1972; 12(3):1922-8.
178. Dwivedi SN. Ethnobotanical studies and conservational strategies of wild and natural resources of rewa district of madhya pradesh. *J Econ Tax Bot* 2003; 27(1):233-4.
179. Dwivedi SN, Shrivastava S, Dwivedi S, Dwivedi A, Dwivedi S, Kaul S. Relivance of medicinal herbs used in traditional system of medicine, *Farmavita Net*; 2007.