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A REVIEW BIOLOGICAL ACTIVITY OF ACHYRANTHES ASPERA LINN AND PHYTOCONSTITUENTS

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ABSTRACT

Herbal medicines are widely used since time immemorial indicating that herbs are a growing part of modern, high-tech medicine. India has an ancient heritage of traditional herbal medicine for safety and effectiveness. A lot of literature reviews about Achyranthes aspera Linn has been published previously. From the review of the literature on this plant we found that this plant is known for systems of medicine in the treatment of cancer, leprosy, asthma, fistula, piles, arthritis, wound, insect and snake bite, dandruff, hepatitis, renal disorders, dermatological disorders, Neuropharmacological disorders, gynaecological disorders, gonorrhoea, malaria, fever, cough, diabetes, pyorrhoea, dysentery, opthalmia, rabies, hysteria, toothache etc. A. aspera is widely studied for its medicinal properties and reported to have antimicrobial, larvicidal, antifertility, anticanerous, immunostimulant, hypoglycaemic, hypolipidemic, anti-inflammatory, antioxidant, diuretic, anti-obesity, cardiac stimulant, antihypertensive, anti-anasacra, analgesic, antipyretic, Anti-Spermicidal antinoiceptive, prothyrodic, antispasmodic, anxiolytic and hepatoprotective. And also the new (hidden) pharmacological actions of *Achyranthes aspera* phytoconstituents using *in-silico* tool like PASS online.

KEYWORDS: Achyranthes aspera L, Biological Activity for Human Disease and Phytochemistry and PASS online.

1. INTRODUCTION

Nature has been a source of medicinal agents for thousands of years and since the beginning of mankind. Medicinal plant is an integral part of human life to combat the sufferings from

the dawn of civilization. It is estimated that more than 80,000 of total plant species have been identified and used as medicinal plants around the world.[1] Over the past twenty years, interest in medicinal plants has grown enormously from the use of herbal products as natural cosmetics and for self-medication by the general public to the scientific investigations of plants for their biological effects in human beings.[2] Therefore, people are encouraging indigenous production and processing of these medicinal plants to use in different cultures and religion for the treatment of various diseases.[3] Achyranthes aspera L. (Amaranthaceae) is distributed as weed throughout India, tropical Asia and other parts of the world. Ayurvedic, Yunani practitioners and Kabirajes use different parts of the plant of seeds, roots and shoots are the most important parts which are used medicinally. The most important of these bioactive constituents of plants are sterols alkaloids, tannins, saponins, sapogenins, cardiac glycosides, ecdysterone, flavonoids and phenolic etc. that are responsible for protecting the plants from microorganisms, insects and other natural pests. The review reveals that wide numbers of phytochemical constituents have been isolated from the plant which possesses activities like to treat leprosy, asthma, fistula, piles, arthritis, wound, insect and snake bite, renal and cardiac dropsy, kidney stone, diabetes, dermatological disorders, Neuropharmacological disorders, gynaecological disorders, gonorrhoea, malaria, pneumonia, fever, cough, pyorrhoea, dysentery, rabies, hysteria, toothache etc. The plant is a popular folk remedy in traditional system of medicine throughout the tropical Asian and African countries. The plant is reported to be used as antimicrobial, larvicidal, antifertility, immunostimulant, hypoglycaemic, hypolipidemic, anti-inflammatory, antioxidant, diuretic, cardiac stimulant, antihypertensive, anti-anasacra, analgesic, antipyretic, antinoiceptive, prothyrodic, antispasmodic and hepatoprotective. This review incorporates different aspects of A. aspera cited from the existing literature emphasizing on its phytochemistry and pharmacology.[4] In recent years, many virtual screening tools have been developed that employ different molecular representations (2D and 3D) and the matching algorithm and have different speed and accuracy characteristics. A number of virtual screening strategies have been advocated for natural products based drug discovery in search of new lead substances using *in-silico* techniques based upon following integrated approaches to identify promising lead compounds: (1) creation of 3D structure database of NPs with description of their biological activities obtained from their in vitro screening extracted from different ethno pharmacological sources; (2) selection of biologically active material on the basis of hits found by docking in the database of natural product 3D structures; (3) parallel screening of unstudied natural substances.[5] But most of these strategies have been confined to ethnic

biological activity only and also require 3D structures database of targets and ligands which is not accessible in many cases. Although 3D molecular shape is clearly crucial for ligand binding, it has been reported previously that some 2D methods can still give better virtual screening performance than 3D shape-based approaches.[6,7,8] Therefore, in this regard, an effort has been made to explore more comprehensive pharmacological profile of *Achyranthes aspera* Linn. Using a computer software PASS (Prediction of Activity Spectra for Substances) online. Several contemporary studies suggest the pharmacological importance of *Achyranthes aspera* Linn**.** But all these pharmacological uses evaluated either on the basis of traditional uses or serendipity, hence the hidden potential of *Achyranthes aspera* is still unexplored. Therefore, the present study was planned with an objective to explore the new (hidden) pharmacological actions of *Achyranthes aspera* phytoconstituents using *in-silico* tool like PASS online.

Fig. 1: Achyranthes Aspera.

2. MEDICINAL USES

Apamarga (Achyranthes aspera) has been used as diuretic in the treatment of dropsy in Ayurvedic medicine.[9] The leaves are used in dermatological disorders.[10] The plant is used in gynaecological disorders by the ethnic people.[11-12] The paste of the roots is applied to external genitalia to induce labour pains.[13] It is also useful to treat cough, renal dropsy, fistula, scrofula, skin rash, nasal infection, chronic malaria, impotence, fever, and asthma, piles and snake bites.[14] The root is reported to have application in infantile diarrhoea and cold[15] and dry leaves are employed against asthma.[16] It was recommended in menstrual disorder.[17] Roots are used as astringents to wounds, in abdominal tumour and stomach pain.[18] Unani doctors and local kabiraj use the stem, leaves and fruits as a remedy for piles, renal dropsy, pneumonia, cough, kidney stone, skin eruptions, snake bite, gonorrhoea, and

dysentery etc.[19] The plant is used in diabetes mellitus, renal and cardiac dropsy.[20] The whole plant decoction is diuretic, ecbolic and useful for treating renal dropsy. The juice of the plant is used in opthalmia and dysentery. The paste made from the roots with buttermilk is taken internally as an anti-fertility drug. The paste of grinded inflorescence with water applied to external genitalia to induce abortion. To terminate pregnancy, the decoction of the fresh roots is introduced into the vagina.[13] The boiled root decoction is given after menstruation to induce sterility in women.[21] The plant is used in bleeding, renal complications, scorpion and snakebite.[22] The juice of the plant is used in the treatment of boils, diarrhoea, dysentery, haemorrhoids, rheumatic pains, itches and skin eruptions, pyorrhoea and toothache, diarrhoea and dysentery, rabies, nervous disorders, hysteria, insect and snake bites.[23]

3. PHYTOCHEMICAL STUDIES

3.1.*PASS (Prediction of Activity Spectra for Substances)* (Online)

In-silico methodology was used as reported by.[24,25] In brief, a wide literature search was carried out using various databases to gather information regarding already reported bioactive metabolites from *A. aspera*. Thereafter biological activity spectrum of phytoconstituents was obtained by using an internet based modified PASS (online). The updated software has the ability to predict 6400 types of biological activity. The predicted activity spectrum in PASS was presented with the list of activities with probabilities «to be active» P_a and «to be inactive» P_i. Being probabilities, the P_a and P_i values varied from 0.000 to 1.000. The list of predicted activities is arranged in a descending order of P_a-P_i values. The PASS prediction results were interpreted and used in a flexible manner; (i) only activities with $P_a<P_i$ were considered as possible for a particular compound; (ii) if $P_a>0.7$, the chance to find the activity experimentally was high; (iii) if $0.5<P_a<0.7$, the chance to find the activity experimentally was less, but the compound was probably not so similar to known pharmaceutical agents; (iv) if $P_a<0.5$, the chance to find the activity experimentally was less, but the chance to find a structurally novel compound i.e., NCEs was more.

*3.2.*Chemical constituents

Betaine, achyranthine, hentriacontane, ecdysterone, achyranthes saponins A, B, C, D are the major chemical constituents found in A. aspera. The seeds of Apamarg contains αLrhamnopyranosyl-(1→4)-(β-Dglucopyranosuluronic acid)-(1→3)-Oleanolic acid, αLrhamnopyranosyl-(1→4)-(β-Dglucopyranosyluronic acid)–(1→3)- Oleanolic acid,-28-O-

β-Dglucopyranoside and α-Lrhamnopyranosyl-(1→4)-(β-Dglucopyranosyluronic acid)-(1→3)-oleanolic acid-28-O-β-Dglucopyranosyl-(1→4)-β-Dglucopyranoside.[26] Ethanolic extracts of the roots of Achyranthes aspera Linn. Isolated a new aliphatic acid and it has been identified as n-hexacos-14-enoic acid.[27] This compound reported for the first time from any natural and synthetic source, certain other compound were also isolated and identified as strigmasta-5, 2-dien3-β-ol, trans-13-docasenoic acid, n-hexacosanyl n decaniate, nhexacos-17-enoic acid. Rameswar isolated chemical compounds of the volatile oil from Achyranthes aspera leaves.[28]

4. PHARMACOLOGICAL STUDIES

Biological Activity of Achyranthes Aspera

The methanolic extracts of leaves of Achyranthes aspera has shown different activities against 22 microorganisms (bacterial and fungal).[29] A. aspera shows antiviral activity against Papaya viruses. In addition to these A. aspera shows various biological activities.[30]

7.1 Antiviral and Anti-carcinogenic: The in vitro assay the methonolic extract of A. aspera leaves (100 µg) revealed significant inhibitory effects on the Epstein-Barr virus early antigen induced by the tumour promoter 12-O-tetradecanoylphorbol-13-acetate in Raji cells. The fraction containing mainly non-polar compounds showed the most significant inhibitory activity (96.9% and 60% viability). In the in vivo two stage mouse skin carcinogenesis test the total methanolic extract possessed a pronounced anti-carcinogenic effect. The total extract and the fraction are believed to be valuable antitumor promoters in carcinogenesis.[31]

7.2 Lavicidal: Root extract was found to have pronounced insect molting hormonal activity.[32] Ethanol crude extract showed high larvicidal activity on the tick larvae against Boophilis microplus.[33] Larvicidal saponins from leaf extracts have been tested against Aedes aegypti and Culex quinquefasciatus.[34] Ethyl acetate leaf extract was found to be active against Aedes subpictus mosquito larvae.[35] The plant was mentioned to have activity in controlling mosquito larvae.[36] Bioactivity of essential oils of leaf and stem extracted by steam distillation were found to be active larvicidal against Aedes aegypti and Culex quinquefasciatus.[37] Leaf extracts of the plant have been reported to be active against Aedes aegypti.[38]

7.3 Antifertility: The plant has been reported extensively as an antifertility agent.[39] Whole plant extracts has shown abortifacient effect in mice with maximal activity was in the benzene extract.[40] The aerial parts of the plant were reported to prevent pregnancy in adult female rats.[41] The extracts of leaves, roots, and seeds of the plant have been used for control of fertility, in placental retention, and in postpartum bleeding.[42] The benzene extract of the stem bark shows abortifacient activity in the rat.[43] The ethanol extract of the root was found to be reproductively toxic and had spermicidal action in vitro and in vivo studies.[44] In vitro contraceptive spermicidal activity of composite extract of A. aspera and Stephania harnandifolia on human semen has been reported.[45] Root of A. aspera was found to contain a protein showing spermatotoxicity when administered orally to Swiss male albino mice.[46] The 58kDa Achyranthes protein (AP) was isolated and studied in vitro for spermicidal action.[47] Post-coital antifertility activity of the roots has been reported.[48] The roots were found to have estrogenic and pregnancy interceptory activity.[49] Effect of A. aspera on fetal abortion, uterine and pituitary weights, serum lipids and hormones has been reported1. Alkaloidal fraction of A. aspera showed antifertility effect on male albino rats (Rattus norvegicus) on dose dependent manner.[50]

7.4 Anti-asthmatic: Apamarga A. aspera Antardhooma Bhasma on cases of Tamaka Shwasa bronchial asthma was found to be effective.[51] Effect of the plant on bronchial asthma was reported. Toluene diisocyanate (TDI) induced occupational asthma in Wister rats were found to be protected by ethanolic extract of the plant[52] indicating its Broncho protective activity.

7.5 Anti-spasmodic: The plant was reported to have anti-spasmodic property.[53]

7.6 Diuretic: While discussing Cystone®-a vegetable diuretic, the plant has been mentioned.[54] Antagonistic effect of A. aspera on uterine contractility induced by oxytocin was reported.[55] Saponins from the plant have shown diuretic activity. The active compound responsible for the plant's diuretic property is achyranthine, marketed as Cystone®, a polyhedral formulation. Effect of Cystone® on glycolic acid-induced urolithiasis in rats was investigated.[56]

7.7 Renal disorders: Mineralization of urinary stones (calculi) like calcium oxalate, calcium carbonate and calcium phosphate were found to be inhibited by A. aspera.[57] Methanolic extracts were found to prevent lead induced nephrotoxicity in albino rats.[58] Efficacy of

the roots of the plant was tested on calcium oxalate crystal nucleation and growth in vitro and on oxalate induced injury in NRK-52E (rat renal tubular epithelial) cells.[59] As an approach to antilithiasis, Inhibitory effect of hydroalcoholic extract of the plant on crystallization of calcium oxalate in synthetic urine was studied.[60]

7.8 Antileprotic: Effect of A. aspera in the treatment of leprosy has been studied. The plant was also reported for its effectivity against lepromatous leprosy.[61]

7.9 Anti-fistula-in-ano and piles: A. aspera is one of the ingradient of Ksharsutra- an Ayurvedic para-surgical measure is used in the treatment of fistula-in-ano. Ksharsutra can be used as a nonoperative treatment of high rectal fistula. The plant juice and ash were mentioned to be used to treat bleeding piles.[62]

7.10 Anti-arthritic: Anti-arthritic activity of Achyranthine from A. aspera has been reported.[63] Ethanolic plant extract has shown anti-arthritic activity.[64] The plants efficacy in rheumatoid arthritis was also reported.[65]

7.11 Anti-dandruff activity: Methanolic leaf extract of A. aspera as a constituent of a polyhedral hair oil (PHO) showed anti-dandruff activity.[66]

7.12 Neuropharmacological activity: Methanol extract of the plant was reported to have neuropharmacological (central nervous system depressant) activity.[67] Anxiolytic[68] activity were reported. The plant was screened in vitro for anti-hypertensive effect.[69]

7.13 Anti-snake venom activity: Anti-snake venom activity of the plant has been reported experimentally supporting its widespread ethnic use against poisonous bite.[70]

7.14 Cardiac activity: Cardiac stimulant activity of the saponin of A. aspera seed has been observed when it was found to cause increase in force of contraction of isolated and intact hypo dynamic heart.[71] Leaf decoction was reported for cardiovascular toxicity.[72] Achyranthine, the water-soluble alkaloid showed lowering of blood pressure, depression of heart and increase in rate and amplitude of respiration in anaesthetized dogs.[73] Effect of saponin of A. aspera on phosphorylase activity of rat heart was noted. In tropical West Africa, the plant was found to have activity on cardiovascular system.[74]

7.15 Anti-hepatitis: Efficacy of the plant was tested as an ingredient of a formulation in patients of acute viral hepatitis.[75]

7.16 Analgesic, antipyretic and ant nociceptive: Methanolic plant extract and leaf and root extract showed analgesic activity. Leaves were reported to be analgesic, antipyretic and anti-nociceptive.[76]

7.17 Prothyrodic: Leaf extracts were reported to have prothyroidic and antiperoxidative properties. In rats, the plant extract induced changes in thyroid hormone concentration and decrease hepatic lipid peroxidation.[77]

7.18 Anthelmintic activity: The crude extract from leaves was preliminary screened for anthelmintic activity when tested against earthworms (Pheretima posthuma).[78]

7.19 Anti-obesity: The plant was clinically investigated against obesity and showed positive results.[79]

7.20 Spermicidal Activity: Extracts from roots of Achyranthes aspera have been reported to possess spermicidal activity in human and rat sperm, as studied by.[80] Study was made on hydroethanolic, n-hexane and chloroform extracts, which were found to be most effective for sperm immobilization, sperm viability, acrosome status, 5'-nucleotidase activity and nuclear chromatin decondensation. Vasudeva N 2006 was reported the ethanolic extract of the root of Achyranthes aspera shows post coital antifertility activity in female albino rats. According to their study, the extract exhibited 83.3% anti-implantation activity when given orally at 200 mg/kg body weight.[81]

7.21 Hepatoprotective Activity: 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.[82]

7.22 Nephroprotective Activity: Methanolic extract of the whole plant of Achyranthes aspera was shown to produce nephroprotective activity against lead acetate induced nephrotoxicity in male albino rats, as reported by Jayakumar.[83]

7.23 Antidiabetic Activity: The ethanolic extract of A. aspera seed exhibited significant hypoglycaemic activity in streptozotocin induced diabetic rats. M. S. Akhtar & J. Iqbal studied the aqueous and methanolic extracts of the powdered whole plant, which shows hypoglycaemic activity. Blood glucose levels of normal and Alloxan induced diabetic rabbits were determined after oral administration of various doses.[84]

7.24 Anti-inflammatory: An alcohol extract of A. aspera, 375 and 500 mg/kg was tested in carrageenan induced hind paw oedema and cotton pellet granuloma models in male albino rats. The alcoholic extract showed a maximum inhibition of rat paw oedema of 65.38% and 72.37% after 3 h. In a chronic test the extract exhibited 40.03% and 45.32% reduction of the granuloma weight in the sub-acute cotton pellet granuloma model.[85]

7.25 Immuno modulatory: The indigenous Indian fish Labeo rohita was fed with a diet containing 0.01%, 0.1% and 0.5% of A. aspera seeds. The fish immunized with heat-killed Aeromonas hydrophila were experimentally infected with living Aeromonas hydrophila then. In the A. aspera treated groups the mortality was less against controls up to the day after infection. Super oxide anion production, serum bactericidal activity, lysozyme, serum protein and albumin/globulin ratios became enhanced in Achyranthes-treated groups. The authors came to the conclusion that A. aspera stimulates immunity and increases resistance against the infection in this fish.[86]

7.26 Antimicrobial Activity: M. T. J. Khan et al. 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.[87] S. H. K. R. Prasad et al. studied the various extracts of the leaves and callus of the plant also shows antimicrobial activity.[88] P. Saravanan et al. reported the solvent leaf extracts were tested for antibacterial and antifungal activities against E. coli, P. aeruginosa, P. vulgaris, S. aureus, and Klebsiella species.[89] T. N. Misra et al. reported 17-pentatriacontanol as a chief constituent isolated from essential oil of the shoots of plant, the oil shows antifungal activity against Aspergillus carneus.[90] S. Sharma et al. 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.[91]

7.27 Anti-parasitic Activity: Ethyl acetate extracts of A. aspera have been proved to contain anti-parasitic activity by Zahir et al. It has been studied that dried leaf, flower and seed extract of A.aspera are active against the larvae of cattle tick Rhipicephalus (Boophilus) microplus (Acari: lxodidae), sheep internal parasite Paramphistomum cervi.[92]

7.28 Anti-allergic: Datir et al. reported that the petroleum ether extract (200 mg/kg, i.p.) of the plant shows significant antiallergic activity in both milk induced leucocytosis and milk induced eosinophilia in mice thus the anti-allergic activity of A. aspera may be due to the presence of steroids. Thus, these steroids present in the plant may be responsible for the anti-allergic activity.[93]

7.29 Wound Healing Activity: S. Edwin et al. 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.[94]

7.30 Anti-oxidant Activity: S. Edwin et al. 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.[95] The plant exhibited good antioxidant effect by preventing the formation of free radicals in the two models studied. T. Malarvili & N. Gomathi reported antioxidant activity on seeds of the plant. Achyranthes aspera is well documented for the presence 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.[96]

7.31 Hypolipidemic Activity: A. K. Khanna et al. investigated the alcoholic extract of A. aspera, at 100 mg/kg dose lowered serum cholesterol (TC), phospholipid (PL) triglyceride (TG) and total lipids (TL) levels by 60, 51, 33 and 53% respectively in triton induced hyperlipidaemia 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 absorption of cholesterol.[97]

7.32 Veterinary: A. aspera was reported to have diuretic activity in goats[98] and diarrhoea preventive activity in piglets.[99] Therapeutic efficacy of herbal preparation involving the plant in induced hepatopathy in sheep was tested.[100]

5. RESULTS

Reported pharmacological uses of *Achyranthes aspera*

In present study we have gathered the data available on pharmacological uses of *Achyranthes aspera* using PUBMED (Table 1).

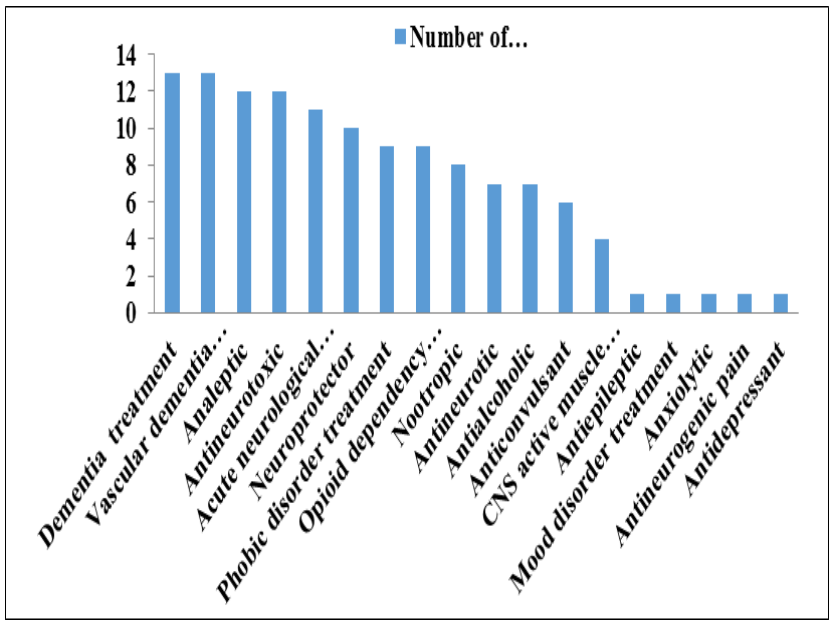
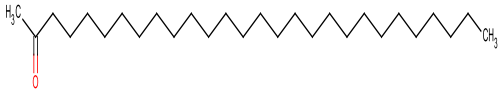
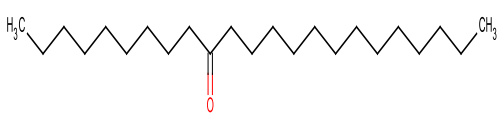
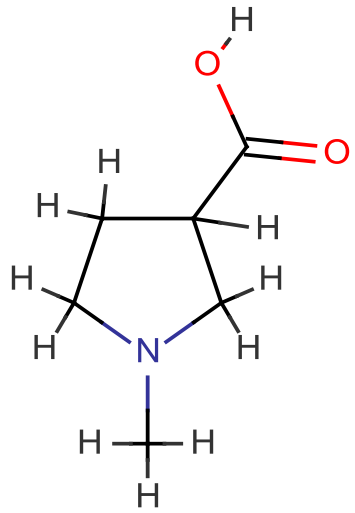
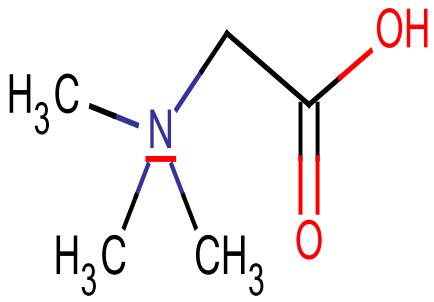
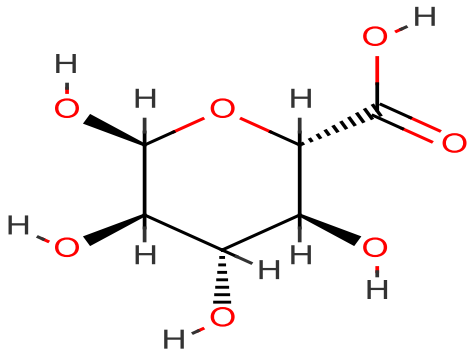
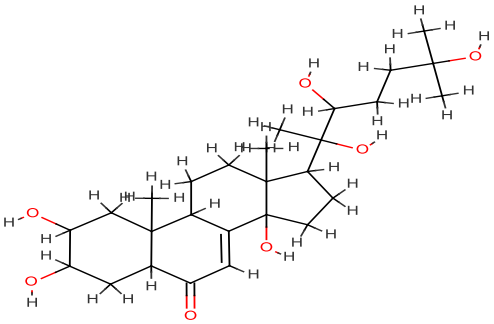
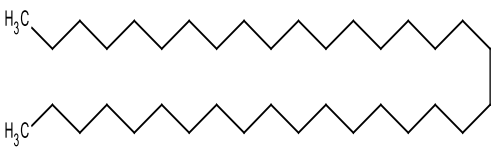


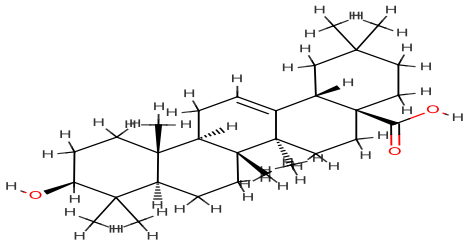
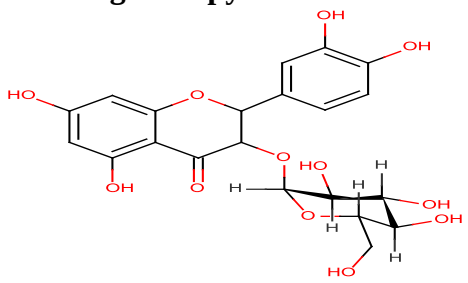
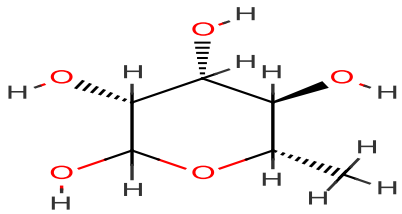
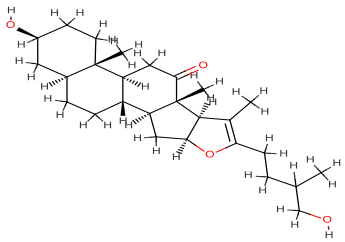
FIG 2: Analysis of Phytoconstituents and Predicted Novel Pharmacological Uses.

Table 1: In-Silico Predictions For Achyranthes Aspera Linn. Phytoconstituents.

S. No.	Compound name and structure	Predicted effects
1.	**2-octacosanone** 	0.859 0.017 Phobic disorders treatment 0.591 0.078 Nootropic 0.522 0.015 Antitoxic 0.505 0.110 Antineurotic 0.424 0.049 Dementia treatment 0.373 0.007 Amyotrophic lateral sclerosis treatment 0.380 0.054 Psychostimulant 0.382 0.064 Antinociceptive 0.262 0.014 Cerebrovascular disordes treatment 0.286 0.074 Opioid dependency treatment 0.223 0.046 CNS active muscle relaxant 0.231 0.066 Antiparkinsonian, tremor relieving 0.238 0.119 Antineurogenic pain 0.216 0.135 Antialcoholic 0.293 0.392 Myasthenia Gravis treatment
2.	**3-Tritriacontanone** 	0.859 0.017 Phobic disorders treatment 0.671 0.053 Antineurotoxic 0.424 0.049 Dementia treatment 0.381 0.028 Antiparkinsonian, rigidity relieving 0.489 0.143 Nootropic 0.380 0.054 Psychostimulant 0.382 0.064 Antinociceptive 0.312 0.038 Vascular dementia treatment 0.302 0.030 Amyotrophic lateral sclerosis treatment 0.447 0.178 Neuroprotector 0.309 0.122 Analeptic 0.223 0.046 CNS active muscle relaxant 0.262 0.155 Anticonvulsant 0.298 0.232 Acute neurologic disorders treatment 0.293 0.392 Myasthenia Gravis treatment
3.	**10-Tricosanone** 	0.876 0.012 Phobic disorders treatment 0.708 0.039 Antineurotoxic 0.584 0.081 Nootropic 0.450 0.037 Psychostimulant 0.450 0.037 Dementia treatment 0.527 0.121 Neuroprotector 0.413 0.019 Antiparkinsonian, rigidity relieving 0.407 0.045 Antinociceptive 0.323 0.019 Amyotrophic lateral sclerosis treatment 0.332 0.029 Vascular dementia treatment 0.353 0.092 Analeptic 0.306 0.057 Opioid dependency treatment 0.344 0.099 Anticonvulsant 0.392 0.151 Acute neurologic disorders treatment 0.267 0.031 CNS active muscle relaxant 0.270 0.048 Antiparkinsonian, tremor relieving 0.335 0.291 Myasthenia Gravis treatment

4.	**Achyranthine** 	0.838 0.008 Antineurotoxic 0.779 0.047 Phobic disorders treatment 0.690 0.021 Acute neurologic disorders treatment 0.641 0.060 Antineurotic 0.577 0.006 Dementia treatment 0.593 0.024 Anticonvulsant 0.618 0.069 Neuroprotector 0.488 0.005 Antiparkinsonian, tremor relieving 0.511 0.032 Analeptic 0.486 0.016 Myasthenia Gravis treatment 0.464 0.005 Vascular dementia treatment 0.547 0.098 Nootropic 0.451 0.022 Antinociceptive 0.399 0.023 Antiparkinsonian, rigidity relieving 0.383 0.053 Psychostimulant 0.363 0.041 Antiparkinsonian 0.343 0.033 Opioid dependency treatment 0.378 0.083 Psychotropic 0.318 0.038 Antiepileptic 0.284 0.043 Amyotrophic lateral sclerosis treatment 0.281 0.069 Antidepressant 0.289 0.079 Anxiolytic 0.278 0.073 Mood disorders treatment 0.242 0.039 CNS active muscle relaxant 0.231 0.049 Antidepressant, Imipramine-like 0.224 0.180 Cognition disorders treatment
5.	**Betaine** 	0.923 0.004 Phobic disorders treatment 0.789 0.017 Antineurotoxic 0.725 0.030 Nootropic 0.376 0.080 Dementia treatment 0.338 0.043 Antiparkinsonian, rigidity relieving 0.341 0.100 Antinociceptive 0.249 0.057 Antiparkinsonian, tremor relieving 0.391 0.235 Neuroprotector 0.362 0.222 Myasthenia Gravis treatment 0.225 0.123 Amyotrophic lateral sclerosis treatment 0.213 0.345 Acute neurologic disorders treatment
6.	**D-glucuronic acid** 	0.754 0.023 Neuroprotector 0.612 0.004 Dementia treatment 0.567 0.005 Antinociceptive 0.501 0.004 Vascular dementia treatment 0.526 0.118 Antineurotoxic 0.441 0.052 Myasthenia Gravis treatment 0.347 0.017 Inotropic 0.366 0.064 Dermatologic 0.312 0.012 Psychosexual dysfunction treatment 0.465 0.201 Phobic disorders treatment 0.303 0.092 Psychostimulant 0.372 0.162 Acute neurologic disorders treatment 0.453 0.246 Autism spectrum disorders treatment

		0.222 0.024 Cerebrovascular disordes treatment 0.207 0.177 Opioid dependency treatment 0.232 0.224 Ovulation inhibitor 0.249 0.268 Intermittent claudication treatment 0.237 0.267 Antiperspirant 0.220 0.259 Antiinflammatory, ophthalmic 0.229 0.275 Chemosensitizer 0.295 0.354 Antibacterial activity enhancer 0.298 0.411 Antiinflammatory, pancreatic 0.210 0.337 Vasodilator, cerebral 0.283 0.446 Fertility enhancer
7.	**Ecdysterone** 	0.984 0.003 Antiischemic, cerebral 0.837 0.003 0.753 0.013 Acute neurologic disorders treatment 0.512 0.032 Analeptic 0.415 0.022 Chemopreventive 0.425 0.049 Dementia treatment 0.331 0.030 Vascular dementia treatment 0.210 0.099 Inotropic 0.221 0.165 Membrane permeability enhancer 0.298 0.380 Myasthenia Gravis treatment
8.	**Hentriacontane** 	0.924 0.004 Phobic disorders treatment 0.812 0.012 Antineurotoxic 0.724 0.033 Antineurotic 0.539 0.011 Dementia treatment 0.530 0.005 Antiparkinsonian, rigidity relieving 0.599 0.078 Neuroprotector 0.499 0.010 Membrane permeability enhancer 0.492 0.027 Psychostimulant 0.478 0.014 Antinociceptive 0.497 0.034 Analeptic 0.419 0.008 Vascular dementia treatment 0.457 0.052 Anticonvulsant 0.517 0.117 Nootropic 0.403 0.008 CNS active muscle relaxant 0.474 0.101 Acute neurologic disorders treatment 0.384 0.016 Antiparkinsonian, tremor relieving 0.423 0.078 Myasthenia Gravis treatment 0.363 0.024 Opioid dependency treatment 0.323 0.019 Amyotrophic lateral sclerosis treatment 0.289 0.036 Inotropic 0.267 0.032 Antidepressant, Imipramine-like
9.	**Hexatriacontane** 	0.924 0.004 Phobic disorders treatment 0.812 0.012 Antineurotoxic 0.724 0.033 Antineurotic 0.539 0.011 Dementia treatment 0.593 0.067 Antineoplastic (head/neck cancer) 0.530 0.005 Antiparkinsonian, rigidity relieving 0.599 0.078 Neuroprotector

		0.492 0.027 Psychostimulant 0.478 0.014 Antinociceptive 0.497 0.034 Analeptic 0.419 0.008 Vascular dementia treatment 0.457 0.052 Anticonvulsant 0.517 0.117 Nootropic 0.403 0.008 CNS active muscle relaxant 0.474 0.101 Acute neurologic disorders treatment 0.384 0.016 Antiparkinsonian, tremor relieving 0.423 0.078 Myasthenia Gravis treatment 0.363 0.024 Opioid dependency treatment 0.323 0.019 Amyotrophic lateral sclerosis treatment 0.289 0.036 Inotropic 0.264 0.021 Psychosexual dysfunction treatment 0.267 0.032 Antidepressant, Imipramine-like 0.217 0.020 Huntington's disease treatment
10.	**Oleanolic Acid** 	0.878 0.001 Antinociceptive 0.806 0.004 Antitoxic 0.588 0.005 Dementia treatment 0.480 0.004 Vascular dementia treatment 0.510 0.124 Nootropic
11.	**Quercetin-3-o-b-D-galactopyranoside** 	0.888 0.004 Antineurotoxic 0.850 0.003 Antitoxic 0.830 0.013 Neuroprotector 0.591 0.005 Dementia treatment 0.539 0.004 Inotropic 0.496 0.003 Severe acute respiratory syndrome treatment 0.481 0.014 Antinociceptive 0.377 0.015 Vascular dementia treatment
12.	**Rhamnose** 	0.816 0.014 Neuroprotector 0.722 0.002 Dementia treatment 0.509 0.127 Antineurotoxic 0.483 0.191 Phobic disorders treatment 0.271 0.019 Psychosexual dysfunction treatment 0.238 0.129 Opioid dependency treatment 0.241 0.139 Psychostimulant 0.287 0.245 Acute neurologic disorders treatment
13.	**Sapogenin** 	0.626 0.004 Dementia treatment 0.370 0.069 Membrane permeability enhancer 0.315 0.124 Antinociceptive 0.239 0.071 Inotropic 0.208 0.055 Growth stimulant 0.320 0.331 Myasthenia Gravis treatment 0.237 0.460 Antineurotoxic

14.	**Tritriacontane** 	0.924 0.004 Phobic disorders treatment 0.812 0.012 Antineurotoxic 0.724 0.033 Antineurotic 0.539 0.011 Dementia treatment 0.530 0.005 Antiparkinsonian, rigidity relieving 0.599 0.078 Neuroprotector 0.492 0.027 Psychostimulant 0.478 0.014 Antinociceptive 0.497 0.034 Analeptic 0.466 0.021 Antitoxic 0.419 0.008 Vascular dementia treatment 0.457 0.052 Anticonvulsant 0.517 0.117 Nootropic 0.403 0.008 CNS active muscle relaxant 0.415 0.034 Muscle relaxant 0.474 0.101 Acute neurologic disorders treatment 0.384 0.016 Antiparkinsonian, tremor relieving 0.423 0.078 Myasthenia Gravis treatment 0.363 0.024 Opioid dependency treatment 0.323 0.019 Amyotrophic lateral sclerosis treatment 0.289 0.036 Inotropic 0.267 0.032 Antidepressant, Imipramine-like 0.217 0.020 Huntington's disease treatment

6. DISCUSSION AND CONCLUSION

In conclusion in present study we have found many novel pharmacological effects predicted by the PASS online software like vascular dementia treatment, neuroprotective effect, antialcoholic, anti-neurogenic pain (effective in neuropathic pain), analeptic, phobic disorder treatment and opoid dependency treatment effects. Most of the predictions were relevant with the central nervous system disorders and interestingly very few activities like nootropic, anxiolytic, antidepressant, and anticonvulsant effects have been reported till date. Therefore it is concluded that the *Achyranthes aspera* Linn could be useful in many neurological diseases/disorders. Achyranthes aspera is proved to be a multipurpose medicinal agent, thus instrumental in curing large number of ailments. Its study paves the way for further attention and research to identify the active compounds responsible for the plant biological activity. The plant was found to be very useful in ethno medicine to treat sexual and gynaecological disorders like menstrual problems, gonorrhoea, impotence etc. The species is a potent anti-fertility agent and abortifacient which was supported by experiments. Spermicidal activity of the plant can be used to generate male contraceptives. This property can be exploited in contraception and control population explosion in third world countries. Naturally occurring polyploids and different gametophytic and sporophytic ploidy levels have made the species an interesting cytological sample. Widespread ethnic use of the plant against snakebite makes

it a potent anti-venomous plant. Antitumor and cytotoxic potential are the exciting aspects of the plant. The plant is a potent immunostimulant too. Several investigators have reported the plant as a valuable antibacterial, antifungal, larvicidal and active against other plant pathogens.

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