Academic Sciences International Journal of Pharmacy and Pharmaceutical Sciences

ISSN- 0975-1491 Vol 4, Issue 3, 2012

Review Article

PHARMACOLOGICAL ACTIVITIES OF STEPHANIA GLABRA, WOODFORDIA FRUTICOSA AND CISSEMPELOS PAREIRA-A REVIEW

HEMRAJ*[1], NEERAJ UPMANYU[2], AVNEET GUPTA[1], ANIL JINDAL[3], SUNNY JALHAN[3]

[1]Department of Pharmacy CMJ University Shillong, Meghalaya, India, [2] R.K.D.F. College of Pharmacy, Hoshangabad Road, Bhopal (M.P.) 462047, [3]L. R. Institute of Pharmacy, Rajgarh Road, Solan 173212. Email: shimla_pharmacy@rediff.com

Received: 3 Mar 2012, Revised and Accepted: 16 April 2012

ABSTRACT

Ayurveda is a profound and comprehensive system of health care that originated in India. This system endeavors to rationalize the all phenomena governing empirical experiences with natural products in medicine. Ayurvedic medicinal plants are validated with a view to bring their usage in the main stream. Ayurvedic medicare system has attained popularity at global level to replace the synthetic chemicals as they have shown less adverse reactions. One of the main branch of Ayurveda is 'Rasayana'. Rasayana therapy of Ayurveda is a dedicated stream of medication for immune promotive, antidegenerative and rejuvenative health care and is known for preventing the effects of ageing and improving the quality of life of healthy as well as diseased individuals. Numbers of plants have been mentioned in classical text of Ayurveda for the management of several diseases. Number of researchers have given different reports on the therapeutic activity of different kinds of Ayurvedic medicinal plants. Such studies should be brought in the knowledge of every concern man. The present study is therefore focused on the review of literature of pharmacological activities on three such Ayurvedic medicinal plants viz. *Stephania glabra*, *Woodfordia fruticosa* and *Cissempelos pareira*.

Keywords: Natural product, *Stephania glabra*, *Woodfordia fruticosa*, *Cissempelos pareira*

INTRODUCTION

Plant-derived drug occupy an important place in both traditional and modern medicine.[1,2] Ethnopharmacological and ethnobotanical knowledge are percolating down to these days among the tribal population, but much of this information is empirical at best, and lacks preclinical scientific validations[3, 4]. Chemical principles from natural sources have become much simpler and have contributed significantly to the development of new 'Rasayana' drugs from medicinal plants[5]. Biologically active compounds from natural sources have always been of great interest to scientists working on different diseases. Research to find out scientific evidence for claims of plants used for Indian Ayurvedic system of medicine has been intensified. Detailed research on the chemistry and pharmacology of therapeutic products of plant origin are much essential and this may eventually lead to the discovery of medicine that can be used in the treatment of several hazardous diseases[5]. Several plants like Oxalis corniculata as an antiinflammatory[6], *Dorstenia barteri* as an anti arthritic[7], *Paeonia lactiflora* as an antiarthritic[8] and so many others has reported for their remarkable pharmacological activities. Numbers of pharmacological activities have been reported for plant *Stephania glabra*, *Woodfordia fruticosa* and *Cissempelos pareira*.

Stephania glabra is a large climbing shrub with greenish yellowish flowers and large tubers weighing as much as 30kg. it grows at subtropical and temperate Himalayas from an altitude of 7000 ft from sea level from Sindh eastward and Khasia hills and Pegu[9].

Woodfordia fruticosa (Lythraceae) is much branched, semi deciduous, undershrub or shrub up to 1-3 m high, rarely upto 3m and found in throught India, ascending to 1500m in Himalaya and also in the gangestic plains. Plant is known as Dhataki in Sanskrit, fire flame bush in English and dhai in Hindi. The Brhat gangadhara churna is an important formulation in the dose of 3-6g which has been specified in Ayurvedic pharmacopoeia[10]. *Woodfordia fruticosa* is an important ingredient of several Ayurvedic formulations. According to Ayurveda, 'Rasayana' from the plant, is used as an Atisera, Raktapitta, Trsna, varna, and visarpa[10]. *Cissempelos pareira* (Menispermaceae) is a climbing shrub, 2 - 5m high with a thickened root. Leaves have an orbicular shape 7. 14 cm in diameter. They are membranous or leathery, veined, glabrous to densely pilose. Flowers are green, male ones in spikes, 7 - 10cm long, with a little round leaflet at the base of every flower. *Cissempelos pareira* Linn. is a very variable, lofty, slender, dioecious, perennial, climber commonly distributed throughout topical and sub topical region of India, ascending up to an altitude of 2000 m and traditionally known as Laghupatha in Ayurveda, an Indian traditional system of medicine[9,10]. By considering the pharmacological importance of these plants the present study is focused on their review of literature.

Fig. 1: showing picture of *Stephania glabra*[11]

PHARMACOLOGICAL ACTIVITY ON STEPHANIA GLABRA

Folklore uses

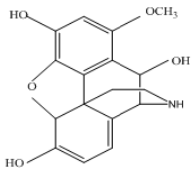
In folklore the decoction of *Stephania glabra* roxb. (Menispermaceae) is used in the treatment of diabetes, fever, gastric problem, amoebic dysentery, as an anthelmintic in rheumatic bodyache, blood dysentery, in leprosy and even as anticancer drug[12].

Antimicrobial

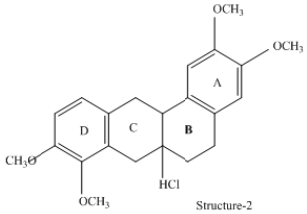
Ethanol extract of *Stephania glabra* tubers has been evaluated for their antibacterial and antifungal activities against five bacterial species namely *Staphylococcus aureus* (along with ten hospital strains), *Staphylococcus mutans, Staphylococcus epidermidis, Escherichia coli*, *Klebsiella pneumonia* and six fungal species *Aspergillus niger*, *Aspergillus fumigatus*, *Penicillum citranum*, *Microsporum gypseum*, *Microsporum canis*, *Trichophyton rubrum*, obtained from different culture media. The extracts has been found to be active against most of the tested microorganism with MIC range of 50-100µg/ml[13, 14].

Chemical Constituent

Novel morphine alkaloid named gindarudine (structure1) was isolated from the ethanol extract of stephania glabra tubers together with four alkaloid palmatine, palmatine, dehydrocorydalmine and stepharanine. Gindarudine was elucidated as 3,6-O,N-detrimethyl-10-hydroxy-1-methoxy-thebaine by means of spectroscopic data including 2D NMR studies[15].Glabradine tetrahydropalmitine (structure-2) also has been isolated from *Stephania glabra.*



Structure-1



Structure-2

Hypotensive activity

The isolated alkaloids of Stephania glabra were reported for their hypotensive activity[16].

Analgesic and antipyretic

Analgesic and antipyretic activities of Gindarudine (GN) has been reported. The reason for this activity was found to be because of the close resemblance of Gindarudine to the structure of thebaine [17].

Antihyperglycemic effect

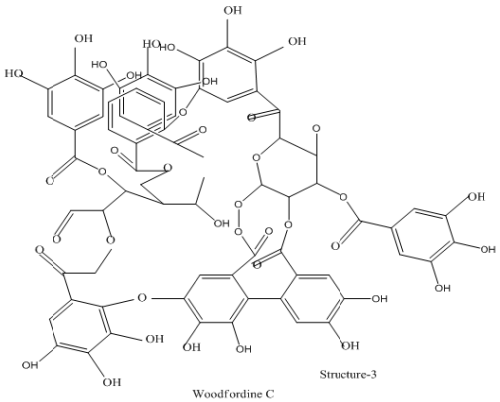
Antihyperglycemic effect of Stephania glabra tubers in alloxan induced diabetic mice was reported by using different doses of ethanolic extract [18].

Antihistaminic activity

The in vitro H^1-receptor antagonist activity of methanolic extract of tuber of Stephania glabra was reported by employing *in vitro* screening models of guinea pig ileum and goat tracheal chain preparation. Goat isolated trachea and guinea pig ileum contracted to histamine in a dose-dependent manner while chlorpheniramine blocked this effect. The methanolic extract produced significant dose-dependent H^1-receptor antagonist activity by blocking histamine-induced contraction [19].

Anthelmintic activity

The *in vitro* Anthelmintic efficacy of *Stephania glabra* along with two more medicinal plants from Northeast India against Hookworms, *Ancylostoma ceylanicum* has been reported. The concoction of rhizome pulp of *Stephania glabra* with areal roots of *Trichosanthum multiloba* and root tubers peel of *Flemingia vestita* were used. For this, adult parasites from intestine of goldenhamsters (*Mesocricentus aurants*) were collected and then exposed to various concentrations of crude extracts. These extracts at a concentration of 100mg/ml took less time for onset of paralysis in *A.ceylanicum.* Concentration of 100mg/ml of the concoction of rhizome pulp of *Stephania glabra* with areal roots of *T.multiloba* in the concentration ratio of 1:1 took lesser time for onset of paralysis. Whereas, 100mg/ml extract of peeled roots of F.vesta took very less time than the paralysis effect of mebandazole at same concentration[20].



Structure-3

Woodfordine C

PHARMACOLOGICAL ACTIVITY ON *WOODFORDIA FRUTICOSA*

Fig. 2: Showing picture of *Woodfordia fruticosa.* (Whole plant leaves and flowers.)[21]

Antimicrobial activity[22, 23, 24]

Different extracts of dried flowers of *W.fruiticosa* have been reported for their significant antibacterial activity against fourteen human pathogen. Dried flowers were extracted by using five different solvents like ethanol, methanol, chloroform, petroleum ether and water. Out of the five extracts tested, the petroleum ether extract showed significant activity when compared to Gentamicin as standard drug[22]. The *in vitro* antibacterial activity of the crude methanolic extract of *W.fruticosa* flower has been reported by comparing it with standard drug ciprofloxacin using the agar well diffusion method. The methanolic extract has been reported to be most active against *Pseudomonas pseudoalcaligenes*. The methanolic extract was reported more effective against Gram negative bacteria as compare to Gram positive bacteria[23].The petroleum ether, chloroform, diethylether and acetone extract of *Woodfordia fruticosa* leaves were evaluated against four bacterial species strains by using disc diffusion method. The extracts of petroleum ether, chloroform, diethyl ether and acetone were found to be effective against all the srains[24].

Chemical constituents

Different chemical constituents have been isolated from different parts of the plant. From the leaves and flowers, tannins, flavanoids, anthraquinon glycosides and polyphenols has been reported[25].The presence of three dimeric hydrlyzable tannins viz. Woodfordin A, B and C along with seven known hydrolysable tannins including oenothein B has been reported in the plant[26]. An amount of isoschimawalin A is present in the tannin fraction of the plant. Essential oil of *Woodfordia fruticosa* was extracted by hydrodistillation. The main components present in the essential oil of leaves are sesquiterpenoids (β-caryophyllene, γ-curcumen, gerrmacrene-D, β-selinene, elemol) and monoterpenoids (α-pinene 2, 6 dimethyl-1, 3, 5, 7 octatetraene) [27]. Besides previously reported hydrolyzable tannin oligomers (woodfordins A-D), a new hydrolyzable tannin monomer (isoschimawalin A) and five oligomers (woodfordins E-I) have been isolated from the dried flowers of *Woodfordia fruticosa* (an Indonesian crude drug, Sidowaya), and their structures were elucidated on the basis of spectra and chemical evidence. Woodfordins G and H were characterized as dimers with structures related to woodfordin B. Woodfordins I, E and F were a macrocyclic dimer, trimer and tetramer, respectively[28]. Woodfruticosin (woodfordin C), a new cyclic dimeric hydrolyzable tannin having an inhibitory activity toward deoxyribonucleic acid (DNA) topoisomerase II, has been isolated from the leaves of *Woodfordia fruticosa* Kurz (Lythraceae) along with three known flavonol glycosides and three known flavonol glycoside gallates. The structure of woodfruticosin (woodfordin C) was determined by the use of two-dimensional nuclear magnetic resonance (2-D NMR) spectroscopy including heteronuclear multiple quantum coherence (HMQC) and heteronuclear multiple bond connectivity (HMBC) techniques[29]. The structure of Woodfordin 'C' has been depicted below (structure 3)

Hepatoprotective activity

Woodfordia fruticosa posses significant hepatoprotective activity [30, 31, 32, 33, 34]. Hepatoprotective activity of petroleum ether, chloroform, ethyl alcohol and aqueous extract of the flower of *Woodfordia fruticosa* has been reported against carbon tetrachloride induced hepatotoxicity[30] and phenytoin induced liver damage in rats[31].The methanolic extract of the flowers of *Woodfordia fruticosa* has been reported for hepatoprotective activity against acetaminophen induced hepatic injury in rats[32]and declofenac sodium induced hepatic damage in rats[33].

Cardioprotective activity

Arjunarishta (Parthadyarishta) is an important Ayurvedic formulation used for cardiovascular disorders and is prepared by fermenting the decoction of specified plant materials using flowers of *Woodfordia fruticosa*[34].

Antioxidant activity

Antioxidant potential of *Woodfordia fruticosa* was confirmed by using DPPH and ABT free redial scavenging models[35, 36, 37]. For this solvent Petroleum ether, chloroform, methanol and water depending upon the increasing order of polarity were used as solvents for extraction. The extracts were tested for phytoconstituents. Solvents were subjected to preparatory HPLC. From IR LC-MS and NMR spectra gallic acid and ascorbic acids were found to be main constituents involved in free radicals scavenging activity of the plant. Among ascorbic acid and gallic acid the latter one is known to play pivotal role in this activity [37].

Role in Leukaemia

The effects and action mechanisms of woodfordin I, a macrocyclic ellagitannin dimer was investigated, on human chronic myelogenous leukemia (CML) cells. The results showed that woodfordin I was able to suppress the proliferation and induce apoptosis in CML cells. Apoptosis was evaluated by cytomorphology, internucleosomal DNA fragmentation, and externalization of phosphatidylserine. Woodfordin I treatment caused a rapid and sustained loss of mitochondrial transmembrane potential (MMP), transient generation of reactive oxygen species (ROS), transient elevation of intracellular Ca2+ concentration, and cytosolic accumulation of cytochrome c. The activation of caspase-9 and 3, but not caspase-8, was also demonstrated, indicating that the apoptotic signaling triggered by woodfordin I was mediated through the intrinsic mitochondria-dependent pathway[38].

Antiulcer activity [39, 40]

The antiulcer potential of W.fruticosa has been reported in ethanol, HCL[40] and NSAIDS (Diclofenac sodium) [40] induced ulcer in stomach of female wistar albino rats. The roots were extracted with chloroform and methanol. Both the extracts have found to have significant antiulcer activity.

Immunomodulatory activity

The *in vitro* and *in vivo* immunomodulatoy activity of ethanolic extract of the flowers of *Woodfordia fruticosa* has been reported. For this the effect of non specific immune responses in mice was examined. *In vitro* immunomodulatory activity of the extract was examined on murine peritoneal macrophage phagocytosis (using nitroblue tetrazoleum dye reduction, lysosomal enzyme activity, nitric oxide and myeloperoxidase) and on proliferation of bone marrow cells by salforhodamine 'B' (SRB) assay. The in vivo activity has shown on macrophages and bone marrow cells by using carbon clearance test and cyclophosphamide induced myelosupression respectively. The significant increase in the release of myeloperoxidase, nitric oxide, lysosomal enzyme and superoxide from macrophages along with significant increase in phagocytic index in carbon clearance test indicates stimulatory activity of the extract in macrophages. The extract was found to show 60% increased bone marrow cells proliferation and offer protection towards cyclophosphamide induced myelosuppression which represent the stimulation of bone marrow [41].

Antifirtility activity

The antifirtility activity of various extract of dried flowers of *Woodfordia fruticosa* has been reported on female albino rats. The ethanolic extract of the powder of the dried flowers was prepared by extracting successively with petroleum ether, benzene, chloroform and ethanol and also extracted individually with 50% aqueous alcohol and water. Antifertility activity of successive alcoholic, individual aqueous and individual hydroalcoholic extracts was studied in female albino rats. The results revealed that the alcoholic extract posses significant abortifacient activity, whereas aqueous and hydroalcoholic extracts hold moderate activity as compared to the control. Thus, the successive alcoholic extract showed promising abortifacient activity at 100 mg/kg body weight [42].

Antitumor activity

Woodfordin C, a macro-ring hydrolyzable tannin dimer from dried flower was reported to posses antitumor activity [43].

PHARMACOLOGICAL ACTIVITY ON *CISSEMPELOS PAREIRA*

Fig. 3: Show the pictures of *Cissempelos pareira*.[44]

Anti-inflammatory activity- [46, 47, 48, 49, 50]

1) 50% ethanolic extract of *Cissempelos preira* roots was evaluated in acute, sub acute and chronic models of inflammation. Doses of 200 and 400 mg/kg (p.o.) have shown significant anti-inflammatory activity. The percentage inhibition of inflammation in rat by using different models to induce inflammation has been depicted in table 1[46]

Table 1: Show the percentage inhibition of inflammation by using different models[46]

Percentage of Treatment in Acute Inflammation		
1.	Carrageenin induced inflammation	59.55 and 64.04%
2.	Histamine induced	15.38 and 30.77%
3.	5-HTP induced inflammation	17.78 and 31.11%
4.	PGE induced inflammation	19.23 and 30.77%
Percentage of Treatment in Sub-acute Inflammation		
1.	Formaldehyde induced inflammation	38.6 and 47.95%
Percentage of Treatment in chronic Inflammation		
1.	Cotton pallet granuloma	15.02 and 19.19%

2) 50% ethanolic extract of the aerial part of *Cissampelos pareira* (Menispermaceae) was tested for analgesic activity and anti-inflammatory by abdominal writhes and hot plate model in rats and mice, respectively. Oral administration of extract exhibited significant and dose dependent anti-inflammatory activity in the carrageenin test which was based on interference with prostaglandin synthesis as confirmed by the arachidonic acid test. In the abdominal writhing test induced by acetic acid higher dose of the plant extract had the highest analgesic activity. In the hot-plate test the best dose was reported as 100 mg/kg [47, 48].

3) Anti-inflammatory activity of the ethanolic extract of the *Cissampelos pariera* Linn leaves was studied in albino wistar rats using the carrageenin induced rat paw edema model. The ethanolic extract of *Cissampelos pariera* (400 mg/kg p.o.) inhibited carrageenin induced rat paw edema. In the result significant anti-inflammatory activity when compared with the standard drug indomethacin (10 mg/kg p. o.) and untreated control was obtained[49].

4) 50% aqueous extract of roots of *Cissempelos pareira* along with leaves of *Vitex nigundo* and *Pongamia pinnata* were evaluated for analgesic and anti-inflammatory activity on swiss albino mice and wistar rats of either sex. Activity was tested by using hot plate method, acetic acid induced writhing in mice, and carrageenin induced paw edema [50].

Antiarthritic activity

50% aqueous ethanolic extract of roots of *Cissempelos pareira* was reported to posses antiarthritic activity.[50,51]

Antioxidant activity

The alkaloidal fraction of roots of *Cissampelos pareira was* screened for *in-vitro* antioxidant activity and immunomodulatoy activity in mice. The HPTLC finger print profile was also established for the identification of extract which was found to contain 0.176 % of berberine. The extract possess strong antioxidant activity which was revealed by its ability to scavenge the stable free radical DPPH, superoxide ion and to inhibit lipid peroxidation in rat liver homogenate induced by iron/ADP/Ascorbate complex. The alkaloid fraction was found to have significant immunosuppressive activity at lower doses (25 and 50 mg/kg) while no activity was observed at higher doses (75 and 100 mg/kg).

The extract also found to reduce dose dependently the gastrointestinal transit from 46.4 and 38.7%, equivalent to 53.6 and 61.3%. However, *C. pareira* significantly reduced the lipid peroxidation and inhibited the decrease in antioxidant enzyme

levels (superoxide dismutase and catalase) on prior administration to castor oil-induced fluid accumulation. The extract of *C. pareira* had no effect on normal defecation at 25 mg kg^{-1} in mice. However, 50 and 100 mg kg^{-1} inhibited defecation by 100% in the initial 2 h and the activity was reduced to 40.0 and 73.0%, respectively, in the third hour[52].

Immunomodulatory activity

Different extracts of *Cissempelos pareira* has been evaluated by different researchers for its immunomodulatoy activity[52, 53]. Methanol extract of roots of *C. pareira* was screened for its immunomodulatoy activity in mice at five different dose levels. Stimulatory activity on DTH response was found at 200-800 mg/kg dose. Phagocytic index was also increased significantly as compared to control animals. Methanol extract was not reported to alter the humoral response to SRBCs and significantly indicated no activity on humoral immunity. Higher doses of extract also offered protection against cyclophosphamide induced myelosuppression by increasing total WBC count significantly[53].

Antiparasite activity

Cissampeloflavone was reported to possess significant activity against *Trypanosoma cruzei* and *T. bruceirhodiense* but against human KB cell line it showed less low toxicity[53].

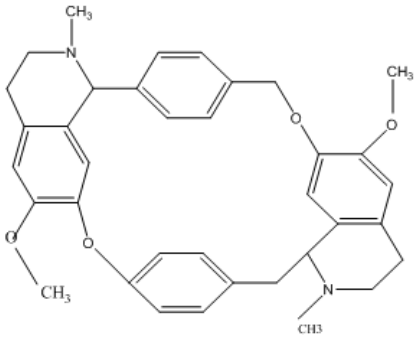
Chemical constituents

From the aerial parts of *C.pareira*, chalcone a flavone dimer was isolated and was named cissampeloflavone. Its structure was identified by NMR and MS[54]. In earlier investigations roots from Kashmere contained 0.33 % of alkaloids, mainly hyatin and bebeerine, 0.2 % essential oils, 3.4 % fixed oils and a sterol [54]. Furthermore from the roots of *C.pareira* the bisbenzoylisochinoline alkaloids hyatin, haytinin and haytidin were found. Bebeerines has been reported as main alkaloids . In the roots of *C.pareira* from Peru toxic bisbenzoylisochinoline alkaloids were investigated. Cissampareine was isolated as one of bisbenzoylisochinoline, and its chemical structure was reported as C_{37} H_{38} N_2 O_6[54]. *Cissempelos pareira* was found to contain a group of plant chemicals called isoquinoline alkaloids. Different types of benzylisoquinolne isolated from *C. pareira* have been depicted in Table No.2[55-63].

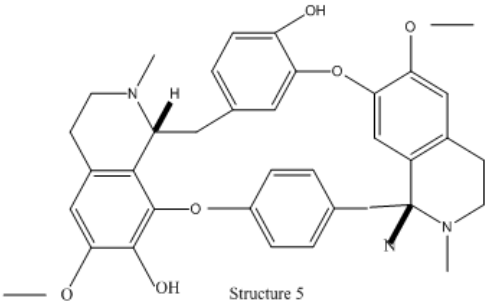
Table 2: Show names and molecular formula of different constituents of *C. pareira*

S. No.	Name	Molecular Weight	Structure	Molecular formula
1.	Curine(Bebeerines)	594	5	$C_{36}H_{38}N_2O_6$
2.	Hayatine	594	6	$C_{36}H_{38}N_2O_6$
3.	Isochondodendrine	594	-	$C_{36}H_{38}N_2O_6$
4.	Cissamampareine	606	7	$C_{37}H_{38}N_2O_6$
5.	Hyatidinine	608	8	$C_{37}H_{40}N_2O_6$
6.	Hyatinine	608	9	$C_{37}H_{40}N_2O_6$
7.	4''-o-Methylcurine	608	10	$C_{37}H_{40}N_2O_6$
8.	Insularine	620	11	$C_{37}H_{40}N_2O_6$
9.	Cycleanine	662	12	$C_{38}H_{42}N_2O_6$

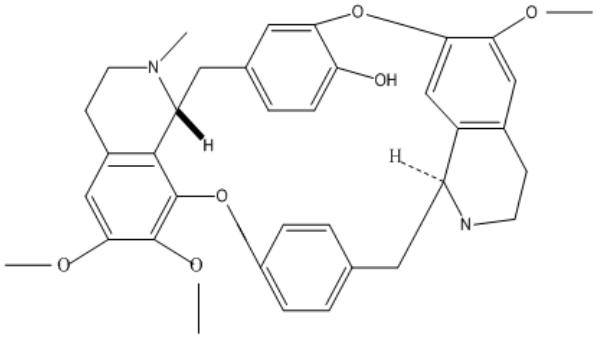
An amorphous white alkaloid 'pelosine' was studied in association with an indifferent body, deyamittin[64, 65, 66]. Cissempelosine was reported from *C.pareira* which was later on shortened as 'Pelosine' (structure 4).



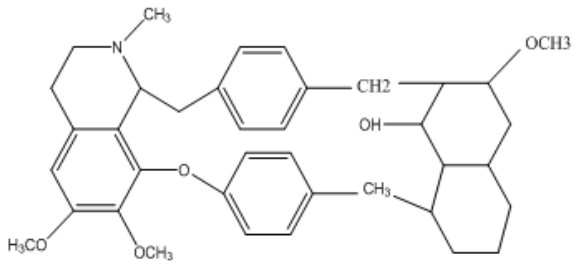
structure-4



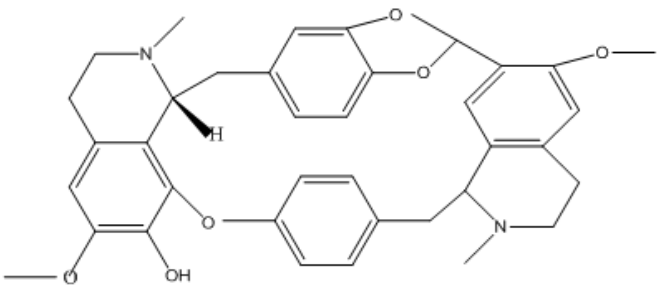
Structure 5



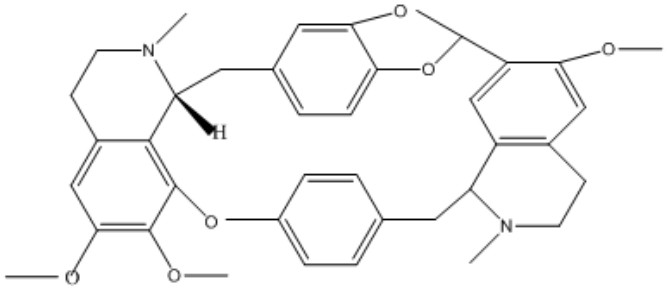
Structure-6



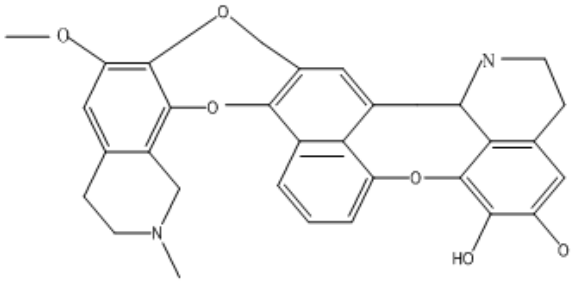
Structure-7



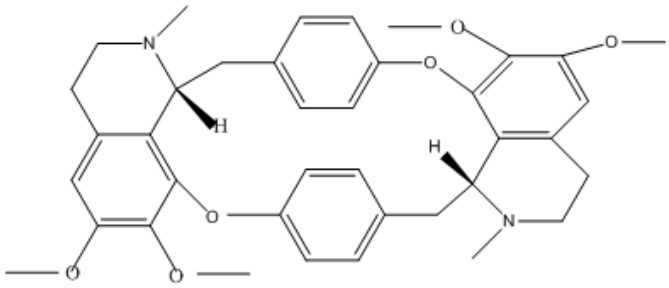
Structure-8



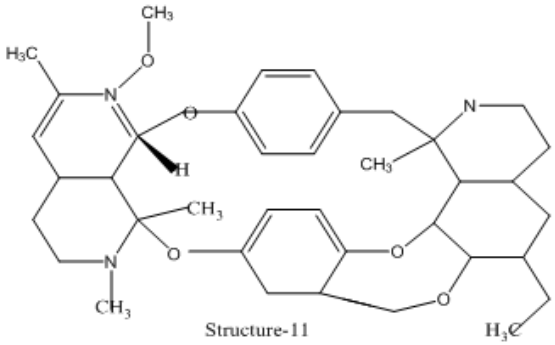
Structure-9



Structure-10



structure-12



Structure-11

Ayurvedic uses of Cissempelos pareira[67]has been depicted in table 3.

Table 3: shows Ayurvedic uses of *C.pareira.*[67]

Main Actions	Other Actions	Standard Dosage
Stop bleeding	Kills bacteria	
Balance menstruation	Prevent convulsions	Decoction: 1 cup 2-3 times daily
Relieves pain	Fights free radicals	Tincture: 2-3 ml 2-3 times daily
Reduces spasm	Prevents ulcers	Capsules: 1-2 g 2-3 times daily
Relaxes muscles	Reduces mucus	
Stop inflammation	Reduce fever	
Increase urination	Protects liver	
Lowers blood pressure	Balances hormones	

Diuretic activity

The methanolic root extract of *Cissampelos pareira* was tested for diuretic activity and its moderate diuretic activity was reported[68].

Anti-hemorrhagic effects

To establish the antihemorrhagic activity of aqueous extract from leaves of *C. pareira*, the skin of mice were injected with a mixture of extract and venom, and extract was found to produced a total inhibition of this activity. Anti-proteolytic activity was also conducted by observing the effect on casein in a test tube or on biotinylated casein in a microplate. Both procedures were unable to show any inhibitory activity[69].

Antifertility activity

C. pareira leaf extract, when administered orally, altered the estrous cycle pattern in female mice. The extract was found to prolong the length of estrous cycle with significant increase in the duration of diestrus stage and reduced significantly the number of litters in albino mice.

The analysis of the principal hormones involved in estrous cycle regulation showed that the plant extract altered gonadotropin release (LH, FSH and prolactin) and estradiol secretion. The oral LD50 of the extract was found to be 7.3 g/kg in mice[70].

Chemo preventive effects

The protective effect of *C. pareira* extract was studied against benzopyrene induced gastric cancer in mice, and the tumor incidence was found to be reduced and the mean number of tumor and the tumor multiplicity were also reported to be reduced significantly. The modulatory effect of *C.pareira* extract was also examined on carcinogen metabolizing phase I and phase II enzymes, antioxidant enzymes, glutathione content, lactate dehydrogenase, and lipid peroxidation in liver. Significant increases in the level of acid-soluble sulfhydryl (-SH) and cytochrome P450 contents and in enzyme activities of cytochrome P450 reductase, cytochrome 5 reductase, GST, DTD, SOD, catalase, glutathione (GSH) peroxidase, and GSH reductase but decreased malondialdehyde (MDA) were observed[71].

Toxicity

In a acute toxicity test, oral administration of 2 g/kg of *C. pareira* was reported to produce no mortality, no changes in behavior or any other physiological activities in mice. In subacute toxicity studies, no mortality was observed when two doses of 1 or 2 g/kg day of 50% aqueous ethanolic extract of *C. pareira* were administered p.o. for a period of 28 days in rats. No significant change was observed in the blood chemistry analysis in both sexes of animals. Hematological analysis showed no marked differences in any of the parameters examined in the control or treated group of both sexes. Pathologically, no gross abnormalities and histopathological changes were observed[72].

CONCLUSION

The present study is focused on the review of literature on *Stephania glabra*, *Woodfordia fruticosa* and *Cissempelos pareira*. Literature from various journals has been reported here. From the above literature it can be concluded that these plants are rich in medicinally important components which are responsible for various pharmacological activities. Furthermore the literature highlights their importance in the field of Ayurvedic medicine.

REFERENCES

1. Das PK, Goswami S, Chinniah A, Panda N, Banerjee S, Sahu NP, Achari B. *Woodfordia fruticosa*: traditional uses and recent findings*. J. Ethnopharmacol.* 2007; 110:189-199.
2. Akerelo O. Nature's medicinal botany. *World Health Forum* .1993; 14:390-395.
3. Baker D D, Alvi K A. Small molecule natural products: new structures, new activity. *Current Opinion in Biotechnology*. 2004; 15:576-83.
4. Altern J and Houghton PJ. The role of plants in traditional medicine and current therapy. *Complement Med*. 1995; 1(2):131-43.
5. Cox P, Balick M, Manandhar NP *et al*. Compilation of Bioactive Compounds from Ayurveda . *Sci American.* 1994; 82.
6. Sachin S Sakat, Archana R Juvekar* And Manoj N Gambhire *Invitro* Antioxidant and Antiinflammatory Activity of Methanol Extract of *Oxalis Corniculata* Linn. International Journal of Pharmacy and Pharmaceutical Sciences. Vol 2, Issue 1, 2010.
7. Omisore NOA, Adewunmi CO, Iwalewa EO et al. Antinociceptive and anti-inflammatory effects of *Dorstenia barteri* (Moraceae) leaf and twig extracts in mice. J Ethnopharmacol 2004; 95 (1) 7-12.
8. Zhong QL, Hua Zhou, Liang Liu, Zhi HJ,Yuen FW, Ying Xie, Xiong Cai, Hong Xi Xu, Kelvin C. Influence of coadministrated sinomenine on pharmacokinetic fate of paeoniflorin in unrestrained conscious rats.J Ethnopharmacol . 2005; 99: 61–67.
9. Chopra IC, Handa KL, Kapur LD. Chopra's Indigenous Drugs of India. 2nd ed. Academic Publishers Kolkata 1994.
10. The Ayurvedic Pharmacopoeia of India, part- I, volume – I, page no.32.
11. http://pt.wikipedia.org/wiki/stephania
12. Maity D., Pradhan N.,Chauhan AS.,Folk uses of some medicinal plants from North Sikkim. *Indian journal of Traditional Knowledge*.2004; 3(1):66-71.
13. SemwalDK, RawatU, Bamola A, and Semwal R. Antimicrobial Activity of *Phoebe Lanceolata* and *Stephania Glabra:* Preliminary Screening Studies. *J. Sci. Res*. 20091 (3), 662-666.
14. Vashist H. and Jindal A. Antimicrobial Activities of Medicinal Plants –Review. *International Journal of Research in Pharmaceutical and Biomedical Sciences*. 2012; 3 (1):222-230.
15. Semwal DK and Rawat U. Gindarudine a noval morphine alkaloid from *Stephania glabra*. *Chineese chemical letters*. 2009; 20(7):823-826.
16. Bhasin S, Rathor RS, Wahi AK and Kapooria SK. Hypotensive activity of an isolated alkaloid of *stephania glabra* a preliminary study. *Indian Journal of Physiology and pharmacology*. 1971; 15(2):60.
17. Samwal DK, Samwal DB, Samwal R, Jacob R Singh V,Guraspreet.Analgesic and Antipyretic Activities of Gindarudine, a Morphine Alkaloid from Stephania glabra. *Current Bioactive Compounds*. 2011; 7(3):214-217.
18. Semwal DK, Rawat U, Semwal R, Singh R, Singh GJ. Anti-hyperglycemic effect of 11-hydroxypalmatine, a palmatine derivative from *Stephania glabra* tubers. *J Asian Nat Prod Res*. 2010 12(2):99-105.
19. Khan NA, Kumar D, Bhat ZA, Kumar V, Nagpal N, and Bhujbal SS. In vitro H1-receptor antagonist activity of methanolic extract of tuber of Stephania glabra. *Bangladesh J Pharmacol*. 2010; 5: 89-91.
20. Lyndemab, LM, Tandona V, Dasac B. Anthelmintic Efficacy of Medicinal Plants from Northeast India against Hookworms: an *In Vitro* Study on *Ancylostoma Ceylanicum* . *Pharmacologyonline*. 2008; 3: 697-707.
21. http://www.flickr.com/photos/dinesh_valke/2395655001/
22. Kumaraswamy MV, Kavitha H and Satish S. Antibacterial Potential of Extracts of *Woodferdia fruticosa* Kurz on Human Pathogens. *Word Journal of medical sciences*. 2008; 3(2): 93-96.
23. Parekh J, Chanda S. In vitro Antibacterial activity of the crude methanol extract of *Woodfordia fruticosa* Flower. *Brazilian Journal of Microbiology*. 2007; 38:204-207
24. Chougale AD , Padul MV, Md Saiful Arfeen, Kakad SL. Antibacterial activity directed fractionation of *Woodfordia fruticosa* Leaves. *Journal of Medicinal Plants*.2009; 8(31):76-81.
25. Das PK, Goswami S, Chinniah A, Panda N, Banerjee S, Sahu NP, Achari B. *Woodfordia fruticosa*: Traditional uses and recent findings. *Journal of Ethnopharmacology*. 2006; 110: 189-199
26. Yoshida T, Chou T, Nitta A, Miyamoto K, Koshiura R, Okuda T .Woodfordin C, a macro-ring hydrolyzable tannin dimer with antitumor activity, and accompanying dimers from *Woodfordia fruticosa* flowers. *Chemical Pharmaceutical Bulletin* .1990; 38:1211-1217.
27. Kaur R and Kaur H. The antibacterial activity of essential oil and plant extract of *Woodfordia fruticosa*. *Archives of applied science research*, 2010;2(1): 302-309.
28. Takasai Y, Tong C, Aya N, Takuo O. Tannins and Related Polyphenols of Lythraceous Plants. III. Hydrolyzable Tannin Oligomers with Macrocyclic Structures, and Accompanying Tannins from Woodfordia fruticosa Kurz. *Chemical & pharmaceutical bulletin*. 1992; 40(8): 2023-2030.
29. Kadota S, Takamori Y, Nyein KN, Kikuchi T, Tanaka K, Ekimoto H. Constituents of the leaves of Woodfordia fruticosa Kurz. I. Isolation, structure, and proton and carbon-13 nuclear magnetic resonance signal assignments of woodfruticosin (woodfordin C), an inhibitor of deoxyribonucleic acid topoisomerase II. *Chem Pharm Bull* (Tokyo). 1990 Oct;38(10):2687-97.
30. Chandan BK , Saxena AK, Shukla S, Sharma N, Gupta, DK, Singh K, Suri J. *et. al*. Hepatoprotective activity of Woodfordia fruticosa Kurz flowers against carbon tetrachloride induced hepatotoxicity. *Journal of ethnopharmacology*. 2008; 119(2): 218-24.
31. Brinda D. and Geetha R. Evaluation of the protective efficacy of *Woodfordia fruticosa* on phenytoin induced liver damage in rats. *Journal of cell and tissue research*. 2009; 9(3): 1981-84.

32. Baravalia Y, Chanda S, Kaneria M. Hepatoprotective effect of *Woodfordia fruticosa* Kurz flowers. *Asian Pacific Journal of Tropical Medicine*. 2011;4(9): 673-9.
33. Baravalia Y, Vaghasiya Y, Chanda S, Hepatoprotective effect of *Woodfordia fruticosa* Kurz flowers on diclofenac sodium induced liver toxicity in rats. *Asian Pacific Journal of Tropical Medicine* . 2011; 4(5):342-6.
34. Lal UR, Tripathi SM, Jachak SM, Bhutani KK, Singh IP . HPLC Analysis and Standardization of Arjunarishta – An Ayurvedic Cardioprotective Formulation. Sci Pharm. 2009; 77: 605–616.
35. Kumaraswamy M V and Satish S. Free radical scavenging activity and lipoxygenase inhibition of *Woodfordia fructicosa* Kurz and *Betula utilis* Wall. African Journal of Biotechnology . 2008;7 (12):2013-2016.
36. Mihira V, Ramana KV, Ramakrishna S. and Rambabu P. Pharmanest. An International Journal of Advances In Pharmaceutical Sciences. 2011; 2 (2 - 3):158-160.
37. Lok Ranjan Bhatt and Seung Hwa Baek. Radical Scavenging Activity of Extracts and Various Fractions of Woodfordia fruticosa. Journal of Cosmetics and Public Health. 2005; 1(2): 68-70.
38. Liu MJ, Wang Z, Li HX, Wu RC, Liu YZ, Wu QY. Mitochondrial dysfunction as an early event in the process of apoptosis induced by woodfordin I in human leukemia K562 cells. Toxicol Appl Pharmacol. 2004; 194(2):141-55.
39. Chanda S, Baravalia Y, Kaneria M. Protective effect of Polyalthia longifolia var. pendula leaves on ethanol and ethanol/HCl induced ulcer in rats and its antimicrobial potency.Asian Pacific Journal of Tropical Medicine. 2011; 4(9):673-9.
40. Mihira V, Ramana KV, Ramakrishna S and Rambabu P. Evaluation of Anti-Ulcer Activity of *Woodfordia Fruticosa* Roots. An International Journal of Advances In Pharmaceutical Sciences. 2011; 2:2 – 3.
41. Shah AS, Juvekar AR. *In vitro* and *in vivo* immunostimulatory activity of *Woodfordia fruticosa* flowers on non-specific immunity. Pharma Biol. 2010; 48(9):1053-8.
42. Kushlani H,Tatke P, Singh KK, Antifertility activity of dried flowers of *Woodfordia fruticosa* kurz. Indian ournal of Pharmaceutical sciences. 2006; 68(4):512-529.
43. Yoshida T, Chou T, Nitta A, Miyamoto K, Koshiura R, Okuda T. Woodfordin C, a macro-ring hydrolyzable tannin dimer with antitumor activity, and accompanying dimers from *Woodfordia fruticosa* flowers. Chem Pharm Bull (Tokyo). 1990; 38(5):1211-17.
44. www.indianmedicinalplants.info/d6/index.htm
45. Singh A, Malhotra S, Subham R.Antiinflammatory and analgesic agents from Indian Medicinal plants. International journal of integrative biology.2008; 3 (1):57.
46. Kumar M, Shete A, Akbar Z. A Review on Analgesic: From Natural Sources. 2010; 1(2):96-100.
47. Amresh G, Zeashan H, Rao CV, Singh PN. Prostaglandin mediated anti-inflammatory and analgesic activity of *Cissampelos pareira.* Acta Pharmaceutica Sciencia. 2007; 49: 153-160.
48. Gopalakrishna B, Shukla P, Shukla P and Alok S. Screening of anti-inflammatory potential of *Cissampelos pareira* Linn leaves extract in Albino Rats. IJPSR. 2010; 1(2).
49. Bansod AS, Kagathara VG, and Somkuwar AD. Evaluation of Analgesics and Anti-inflammatory Activity of a Poly-Herbal Formulation. International Journal of Pharm Tech Research. 2, (2):1520-1527.
50. Amresh G, Singh PN, Rao V. Antinociceptive and antiarthritic activity of *Cissampelos pareira* roots. J Ethnopharmacol 2007; 111 (3): 531-536.
51. Patwardhan SK, Bodas KS, Gundewar SS. Coping With Arthritis Using Safer Herbal Options. International Journal of Pharmacy and Pharmaceutical Sciences. 2010;2(1):2-11.
52. Bafna A, Mishra S. Antioxidant and immunomodulatory activity of the alkaloidal fraction of Cissampelos pareira Linn. Sci Pharm. 2010; 78: 21–31.
53. Bafna AR, Mishra YSH. Immunomodulatory activity of methanol extract of roots of *Cissampelos pareira*. Ars Pharm. 2005; 46 (3): 253-262.
54. Ramirez I, Carabot A, Melendez P, Carmona J, Jimenez M, Patel AV et al. Cissampeloflavone, a chalcone flavone dimer from Cissampelos pareira. Phytochemistry. 2003; 64(2):645-7.
55. Mukerji B, Bhandari PR. Cissampelos pareira L. Source of a new curariform drug. Planta Medica. 1959; 3: 250-9.
56. Kupchan M, Patel AC, Fujita E. Cissampareine, a new cytotoxic alkaloid from Cissampelos pareira. Cytotoxicity of bisbenzylisoquinoline alkaloids. J Pharm Sci. 1965; 54, 4: 580-3.
57. Bhattacharji,S: Sharma,Vn: Dhar,Ml. Chemical Constituents of the Roots of Cissampelos Pareira. Bull Natl Inst .1955 : 39.
58. Yokoyama N, Kupchan SM.The Chemistry of Pharmacologically Active Alkaloids. Diss Abstr Int.1963; 24:1412.
59. Bhatnagar AK, Bhattacharji S, Roy AC, Popli SP, Dhar ML.Chemical examination of the roots of Cissampelos pareira Linn. IV Structure and stereochemistry of hyatidin. J Org Chem.1967 ;32(1): 819-20
60. Kupchan M, Patel AC, Fujita E. Cissampareine, a new cytotoxic alkaloid from Cissampelos pareira. Cytotoxicity of bisbenzylisoquinoline alkaloids. J Pharm Sci.1965; *54*(4): 580-3.
61. Bhatnagar AK, Popli SP. Chemical examination of the roots of Cissampelos pareira Linn. Structure and stereochemistry of haytidin. Experientia. 1967; 23(4): 242-3.
62. Bhatnagar AK, Bhattacharji S, Popli SP. Nuclear Magnetic Resonance Spectrum of Cycleanine. Indian J Chem. 1968; 6:125.
63. Pharmacological Screening of Some West Indian Medicinal Plants. Feng PC, Haynes LJ, Magnus KE, Plimmer JR, Sherrat HAS. J Pharm Pharmacol. 1962.14: 556.
64. Dwuma-Badhu D,Ayim JSK, Mingle CA, Tackie AN, Slatkin DJ, Knapp JE, and Schiff. Bisbenzylisoquinoline Alkaloids from Epinetrum villosum . Phytochemistry.1975; 14:2520.
65. Singh A, Duggal S, Singh J and Katekhaye S. An inside preview of Ethnopharmacology of *Cissampelos pareira* Linn. International Journal of Biological Technology. 2010; 1(1):114-120.
66. Wiggers A. Pelosine. Der.Pharmacie. 1838; 27:29.
67. Database entry for Abuta - Cissampelos pareira ABUTA. 2011 www.rain-tree.com/abuta.htm
68. Hullatti KK, Sharada MS and Kuppasth IJ. Studies on diuretic activity of three plants from Menispermaceae family. Der Pharmacia Sinica.2011; 2 (1): 129-134
69. 69.Badilla B, Chaves F, Jiménez S, Rodriguez G, Poveda LJ. Effects of an extract of *Cissampelos pareira* on the hemorrhagic and proteolytic activities from *Bothrops asper venom.* Pharmacog. Mag. 2008; 4:27-31.
70. Ganguly M, Borthakur M, Devi N, and Mahanta R. Antifertility activity of the methanolic leaf extract of *Cissampelos pareira in female albino rats*. J. Ethnopharmacol. 2007;111:688-91.
71. Amresh, G, Reddy GD, Singh PN, Rao CV. Evaluation of *Cissampelos pareira* root in rats. J. Ethnopharmacol. 2007; 3:526-531.
72. Amresh G, Rao CV and Singh PN. Toxicological screening of traditional medicine Laghupatha (Cissampelos pareira) in experimental animals. J. Ethnopharmacol. 2008; 116:454-460.