Available online at www.ijpsdr.com

International Journal of Pharmaceutical Sciences and Drug Research 2015; 7(4): 315-320

Review Article

ISSN: 0975-248X
CODEN (USA): IJPSPP

Dhawa (*Woodfordia fruticosa* (L.) Kurz.): A Versatile Medicinal Plant

Seema Rani*, Khaleequr Rahman, Mohd. Younis, Sadiya Noorul Basar

Department of Ilmul Saidla, National Institute of Unani Medicine, Bangalore, Karnataka, India

ABSTRACT

Woodfordia fruticosa is an important medicinal plant used in traditional system of medicine since the time immemorial. It belongs to the family Lythraceae. Many organic constituents like tannins, phenols, steroids/terpenoids, carbohydrates, resins and inorganic ones including iron, aluminum, calcium, magnesium, potassium etc., have been isolated from this species in recent times. Extracts and metabolites of this plant, particularly those from flowers and leaves, possess useful pharmacological activities. Flowers are *qabiz* (astringent), *mubarrid* (refrigerant), *habisud dam* (haemostatic), *qatil kirme shikam* (anthelminthic), *mujaffif* (dessicative), *mundamil qurooh* (enhance wound healing) *musakkin atsh*, *musaffi khoon* etc. It is commonly used to cure *ishaal* (diarrhoea), *kasrate tams* (menorrhagia), and *bawaseer damvia* (bleeding piles). *Aabzan* (sitz bath) with decoction of this drug is useful for *khuroojul miqad* (prolapse of anus) and *sailanur rehem* (leucorrhoea). The bark is also pungent, acrid, cooling, toxic, alexatric, antihelmintic, antidysentric, and uterine sedative. The bark is used in thirst, dysentery, leprosy, erysipelas and diseases of the blood. Antitumor, DNA inhibitory, immunomodulatory, antioxidant, aniproliferative, antihyperglycemic, anti-inflammatory, analgesic, cytotoxic, antibacterial, hepatoprotective, antimicrobial and anti-ulcer activities were found in various parts of this plant. Ethnopharmacological activities, chemical component and related pharmacological effects reveal that the plant *Woodfordia fruticosa* is an important medicinal plant having versatile beneficial pharmacological effects.

Keywords: Lythraceae, Pharmacological studies, Phenols, Steroids/terpenoids, Traditional medicine, *Woodfordia fruticosa.*

INTRODUCTION

Woodfordia is a genus of two species well known in many parts of Asia as a medicinal plant. It belongs to the family Lythraceae. The generic name of the plant honors E. James Alexander Woodford (1771-1837), a botanist and physician who was the first to successfully grow *Woodfordia* to flowers under glass. [1]

The genus contains two species *W. fruticosa,* widely distributed in Asia and *W. uniflora* restricted to African continent. Species name *fruticosa* is derived from the Latin *frutex* meaning "a shrub". [2] Though the plant is endemic to India, it is included in the IUCN Red List of 'Threatened Species' with status of lower risk/least concern (IUCN 2.3). [3]

Taxonomy [4]

Kingdom: Plantae
Phylum: Tracheophyta
Class: Magnoliopsida
Order: Myrtales
Family: Lythraceae

Botanical name: *Woodfordia fruticosa* (L.) Kurz. [1]

Synonym: [5-7] *Woodfordia floribundosa* Salisb., *Lythrum fruitcosum* Linn. *Grislea punctata* Buch-Ham. ex Sm., *Lythrum fruticosum* L. (Basionym), *Woodfordia*

***Corresponding author: Dr. Seema Rani,**
Department of Ilmul Saidla, NIUM, Kottegepalya, Magadi main road, Bangalore-560091, Karnataka, India;
E-mail: seema.malik786@gmail.com
Received: 21 May, 2015; **Accepted:** 23 June, 2015

floribunda Salisb., *Woodfordia fruticosa* var. punctata (Buch.-Ham. ex Sm.) Koehne.

Vernacular names [6, 8-11]

English: Fire flame bush, *Shiranji tea*; Persian: *Gule dhawa*; Urdu: *Dhawa ke phool*; Sanskrit: *Agniwala, Dhataki, Madaniyahetu, Dhoorandarah;* Hindi: *Dawi, Dhaulo, Dhaatki ke phool, Santha, Thawi ;* Kannada: *Bela, Tamprapushpi;* Tamil*: Dhattari, Jargi, Velakkal;* Telugu*: Dhataki, Gaddaisinka, Jargi, Serinji.*

Plant description: It is a large beautiful tree, about 10 ft long. Its leaves are broad and sharp from both ends. Fruit are shiny and smooth after ripening. Gum exudates from the fruit which is honey like clear yellow in colour. It is stickier than gum acacia (*babul*) obtained in the month of *Cheet* (June). Flowers are scarlet or bright red in colour, abundantly found in the month of May and June. [11-12]

Botanical description: It is a shrub native to Asia and Africa, with spreading branches. Flowers are clustered, red coloured with red colices, appear in axillary paniled cymes. [8] Leaves 2-4 inch, opposite and subopposite usually rounded or cordate at the base, usually grey, pubescent beneath, sometimes quite glabrous; Calyx 1/3-1/2 inch, bright red, petal scarcely longer than the calyx teeth; Fruits capsule, two celled, two valved and completely enclosed; Seeds light brown, very minute, oblong, very numerous, entirely glaborous not exhibiting at any period of its development the smallest trace of a papilla. [13]

Habitat: A tree found in south India (*dakkin*), eastern parts of Ravi in Himalaya up to 1400 meters altitude, upper part of Godawari, Mel ghat and in Rajputana areas. However it is widespread throughout north India rather scarce in south India. It is also commonly found in lower valleys of Garhwal Himalaya and different parts of India. [12]

Parts used: Leaves and fruits [13] flowers, [13-14] gum [13]

***Mizaj* (Temperament):** Cold 2° and Dry 2° [12]; Cold 2° and Dry 3° [15]

***Afaal* (Functions):** Flowers are *qabiz* (astringent), *mubarrid* (refrigerant), *habisud dam* (haemostatic), *qatil kirm shikam* (anthelminthic), *mujaffif* (dessicative), *mundamil qurooh* (enhance wound healing) [12] *musakkin atsh*, *musaffi khoon*. [12-13] Dried flowers are also used as *qabiz* (astringent), *qabize amaa* (constipating), *dafae taffun* (antibacterial), *dafae pechis* (antidysentric), *dafae humma* (febrifuge), *muharrik* (stimulant), styptic, *musakkine rahem* (uterine sedative) etc. [14]

The bark also has *dafae pechis* (antidysentric), *qatil kirm shikam* (antihelminthic), *mubarrid* (cooling) and *musakkine rahem* (uterine sedative) properties.

***Dawai istemal* (Therapeutic use):** Flower kills and expels the intestinal worms, increase appetite and cures premature ejaculation. It is *lateef* by *ajza* and so relieves the thirst, purifies the blood, beneficial in menorrhagia and piles as documented.

It is given with *jaiphal* and *qand* in stomach disorders and with honey for paediatric diarrhoea. *Gule dhawa* 17.5 g, macerated and extract obtained is prescribed for pile. It heals the burns if its ash is applied locally on wound. [12]

It is used to cure *ishaal* (diarrhoea), *kasrate tams* (menorrhagia) and *bawaseer damvia* (bleeding piles). *Abzan* (Sitz bath) with decoction of this drug is useful for *khuroojul miqad* (prolapse of rectum) and *sailanur rehem* (leucorrhoea). [13] Its fruit eliminates the *badi* action of food, abolishes the *safraa* (bile) and *balgham* (phlegm). The root increases the release of *safraa* (bile) and act as an appetizer.

***Muzarrat* (Adverse effect):** Excess production of phlegm. [14]

***Musleh* (Corrective):** *Zanjabeel khushk* (*Zingiber officinale*) [6] *aab anar* (*Punica granatum* juice) [16]

***Badal* (Substitute):** *Gule pista* (*Pistacia vera*) [6]

***Mashoor murakkabaat* (Important compounds)**: [13, 16] *Safoofe sailan, majoone zanjabeel*

***Miqdare khuraq* (Dose):** 4g [16]

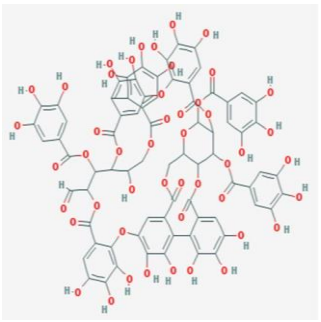

Fig. 1: Chemical structure of woodfordin C

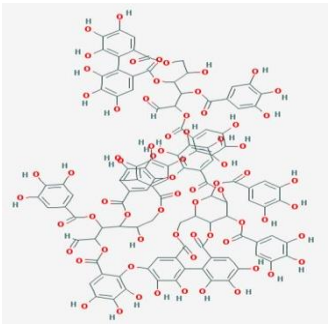

Fig. 2: Chemical structure of woodfordin D

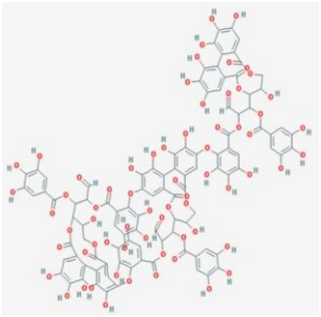

Fig. 3: Chemical structure of oenothein A

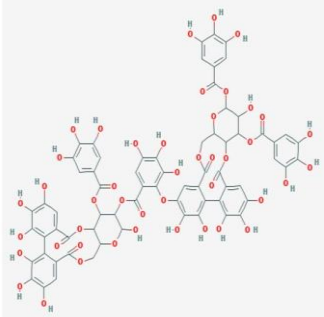

Fig. 4: Chemical structure of oenothein B

Phytochemical constituents: Polyphenols-ellagic acid, polytachoside and myricetin-3-galactoside, anthocyanins pelargonidine-3, 5-diglucoside and cyaniding 3, 5-diglucoside; octacosanol, chrysophanol-8-o-beta-d-glucopyranoside, beta-sitosterol, hecogenin, mesoinositol, flavone *i.e.* glycosides-quercetin-3-rhamnoside, naringenin-7-glucoside and kaempferol have been reported from flowers. A high proportion of ellagic acid and polyphenols have been detected in the leaves and flowers. [9, 11, 14]

The flowers contain 24.1%, leaves contain 12-20%, and bark contains 20-27% of tannins. Dimeric hydolyzable tannins-woodfordins a, b and c, and trimeric tannins woodfordin d and oenothein a and b have been isolated from dried flowers. A new tannin monomer,

isoschimawalin and five oligomers-woodfordin e, f, g, h and i have also been isolated. [17]

Weersaooriya MK and Yatawara HP purified the invertase (beta-fructofuranosidase, EC 3.2.1.26) from the flowers. [18] Oenothein-b, Quercertain-3-o-α-l-arabinoside quercertain-3-o-6''-β-d-galactopyranoside and myrecetein-3-0 arabino pyranoside were isolated from leaves. Malvidin, pentose, glycosides, quercetin, kaempferol-3-glycoside, hecogenin, carotene, carbohydrates, insulin, 3 mannitol, lawsone, aspartic acid, protein, riboflavin, citric acid, punicaline, estrone etc were also isolated from flower. [19] Ellagic acid, polystachoside, myricetin-3-galactoside and pelargonidine-3, 5-diglucoside isolated from leaves and flowers, cyaniding-3, 5-diglucoside isolated from flowers, octosanol, b sterol and chrysaphanol-8-o-b-d-glucopyranoside isolated from flowers. [17] Octacosonol and sitosterol is isolated from its stem. [20]Kadota *et al*., isolated woodfruticosin (woodfordin C) from the leaves. [21] Apart from this tannins/phenols, steroids/terpinoids, carbohydrates and resins, iron, aluminum, calcium, magnesium, potassium are also present in flower. [13]

Pharmacological activities: Various pharmacological activities of different parts of *dhawa* plant have been evaluated which showed positive and beneficial effects. Some important activities are as follow:

Antitumor activity: Woodfruticosin an inhibitor of DNA topoisomerase II (topo-II), was isolated from methanol extract of *Woodfordia fruticosa* Kurz (Lythraceae) and studied for *in vitro* and *in vivo* antitumor activities in comparison with (ADR) and etoposide. The inhibitory activity against DNA topo-II shown by Woodfruticosin was much stronger than that shown by etoposide or adriamycin. Woodfruticosin strongly inhibited intracellular DNA synthesis but not RNA and protein synthesis. However woodfruticosin had a weaker growth inhibitory activity against various human tumor cells than etoposide or adriamycin, but showed remarkable activity against PC-1 cells and moderate activity against MKN45 and KB cells. Furthermore, Woodfruticosin had *in vivo* growth inhibitory activity against subcutaneously inoculated colon. Results indicate that Woodfruticosin exhibits antitumor activity through inhibition of topo-II. [22] Yoshida *et al*., also found that nobotanin G and H were also obtained from woodfordin C, a macrocyclic dimer from *Woodfordia fruticosa*, exhibited marked host-mediated antitumor activities. [23] In another study Yoshida *et al*., isolated two new antitumor trimeric hydrolyzable tannins, woodfordin D and oenothein A, from the dried flowers of *Woodfordia fruticosa*, and their macrocyclic structures, which have a novel constituent unit (woodfordinoyl group) connecting the monomers, have been elucidated on the basis of spectral and chemical evidence. Oenothein A was also isolated from the leaves of *Oenothera biennis*. [24]

DNA inhibitory activity: In a study carried out by Kadota *et al*., confirms the inhibitory activity of Woodfruticosin (woodfordin C) a new cyclic dimeric hydrolyzable tannin isolated from the leaves of *Woodfordia fruticosa* toward deoxyribonucleic acid (DNA) topoisomerase II, along with three known flavonol glycosides and three known flavonol glycoside gallates. They determined the structure of woodfruticosin (woodfordin C) 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. [25]

Immunomodulatory activity: Shah *et al*., investigated the effect of ethanol extract of *W. fruticosa* flowers on non-specific immune responses in mice and *in vitro* immunomodulatory activity of the extract on murine peritoneal macrophage phagocytosis (nitroblue tetrazolium dye reduction, lysosomal enzyme activity, nitric oxide and myeloperoxidase) and on proliferation of bone marrow cells by sulforhodamine B assay, while the *in vivo* potential on macrophages and bone marrow cells was evaluated by using carbon clearance test and cyclophosphamide-induced myelosuppression, respectively. They found 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 indicating stimulatory activity of the extract on macrophages. The extract also demonstrated 60% increase in bone marrow cell proliferation and offer protection towards cyclophosphamide-induced myelosuppression. [26]

Antioxidant activities: Nitha *et al*., evaluated the preventive and curative effect of methanolic extract of *Woodfordia fruticosa* flowers on thioacetamide induced oxidative stress in rats in 100 and 200 mg/kg dose. Various serum enzymes like aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase and lactate dehydrogenase were studied. The antioxidant status of liver and kidney were evaluated by the parameters like catalase, glutathione peroxidase, glutathione reductase, glutathione-S-transferase, reduced glutathione and malondialdehyde. Histopathological changes of liver tissue were also evaluated. Extract showed significant prevention and reversal of elevation of serum aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase and lactate dehydrogenase and tissue malondialdehyde levels in the experimental models. Hepatic and renal reduced glutathione, glutathione-S-transferase, glutathione reductase, glutathione peroxidase, and catalase levels were remarkably increased by the treatment with the extract in both the experimental models. In the case of glutathione reductase the hepatic and renal levels were decreased by the treatment with the extract. [27] Sequential extracts of *Woodfordia fruticosa* flowers with varying polarity

solvents; petroleum ether, chloroform and methanol also showed DPPH free radical scavenging activity. [19]

Aniproliferative activity: Anand *et al*., studied the effect of methanolic extract of *W. fruticosa* flowers on hepatocellular carcinoma. The effect was tested by following the serum parameters like AFP, ALP, LDH, bilirubin; tissue level of GSH, CAT, MDA, histopathology of liver and immunohistochemical analysis of vascular endothelial growth factor. Antiproliferative effect of the ex was studied in human hepatoma plc/prf/5 cells by MTT assay. The chemotherapeutic drug, 5-flurouracil (5-fu) was used as positive control. Their study validated the potential chemo-preventive efficacy of the said extract. Researchers commented that potential antioxidant and chemopreventive activities of the extract may be due to free radical scavenging and antiproliferative effect of extract. [28]

Antihyperglycemic activity: Verma *et al*., studied that ethanolic extract of *W. fruticosa* flowers (250 and 500 mg/kg) significantly reduced fasting blood glucose level and increased insulin level after 21 days treatment in streptozotocin induced diabetic rats. The extract also increased catalase, superoxide dismutase, glutathione reductase, glutathione peroxidase activities significantly and reduced lipid peroxidation. Glycolytic enzymes showed a significant increase in their levels while a significant reduction was observed in the levels of the gluconeogenic enzymes in ethanolic extract treated diabetic rats. The extract also has a favourable effect on the histopathological changes of the pancreatic beta-cells. Their results suggest that *W. fruticosa* possess potential antihyperglycemic effect by regulating glucose homeostasis and antioxidant efficacy in streptozotocin-induced diabetic rats. [29]

Anti-inflammatory and analgesic properties: Anti-inflammatory and analgesic properties of methanol extract of *Woodfordia fruticosa* flowers was studied by Kumaraswamy *et al*. Two doses (400 and 600 mg/kg) were evaluated for the anti-inflammatory activity against the carrageenan, histamine, dextran, serotonin and formaldehyde-induced rat paw edema, cotton pellet-induced granuloma and formaldehyde-induced formaldehyde-induced paw licking response in rats. The results of the anti-inflammatory study showed that the extract produced significant (p<0.05) decrease in paw volume in different models of paw edema. The extract also inhibited the formation of granuloma in cotton pellet-induced granuloma and reduced the frequency of formaldehyde-induced paw licking. These results showed that the methanol extract of *Woodfordia fruticosa* flowers have potent anti-inflammatory compounds and justifies the traditional uses for the treatment of inflammatory conditions and pain. [30]

Cytotoxic activity: Cytotoxic activity of methanolic extract of *Woodfordia fruticosa* flowers was tested using *artemia salina* (brine shrimp) bioassay. In cytotoxicity study, extract caused 73% mortality of brine shrimp larvae after 24 h at a concentration of 1000µg/ml. It shows that *Woodfordia fruticosa* flowers have weak cytotoxic activity. [31]

Antimicrobial activity: The dried flowers were extracted with deferent solvents *viz*., petroleum ether, chloroform, methanol, ethanol and water using soxhlet apparatus. Dry residue was dissolved in respective solvents (1:10 w/v) and tested for antibacterial activity against fourteen human pathogenic bacteria *i.e*. *Escherichia coli, Klebsiella pneumonia, Proteus mirabilis, Pseudomonas aeruginos, Salmonella paratyphi A*, *Salmonella typhi, Salmonella typhimurium, Shigella flexneri, Shigella sonnei*, *Staphylococcus aureus*, *Streptococcus faecalis* and isolates of *Citrobacter sp*., *Salmonella paratyphi* B and *Shigella boydii*. The results revealed that among five solvents tested, petroleum ether extracts showed significant antibacterial activity when compared with gentamicin for human pathogens. [32] Dabur and co worker also evaluated the anti-bacterial activity of n-hexane, chloroform, acetone, methanol and water extract of *W. fruticosa* against *Aspergillus fumigates*, *A. flavus*, *A. Niger, Candida albicans, Salmonella typhi*, *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus*, *Bacillus cereus*, *K. aerogenes*, *P. vulgarism,* and *Sh. boydis*. *W. fruticosa,* showed activity against all the bacterial species used in their study with MIC in a range of 150-500µg/ml. Researcher conclude that has moderate antibacterial activity. [34] Ethanolic extracts of *Woodfordia fruticosa* was also found effective against MDR *S. aureus* by Dubey and co-worker. [34] Kaur and Kaur studied the antimicrobial activity of essential oil and plant extracts of *Woodfordia fruticosa*. The main components present in the essential oil of leaves were sesquiterpenoids (β-caryophyllene, γ-curcumene, germacrene-D, β-selinene, elemol); and monoterpenoids (α-pinene, 2, 6 dimethyl 1, 3, 5, 7 octatetraene). The essential oil was most active against *Pseudomonas aeruginosa* and *Bacillus subtilis*. While the hexane extract of plant was found to be most active against *Pseudomonas aeruginosa.*

Hepatoprotective activity: Baravalia *et al*., evaluated the protective effect of methanol extract of *Woodfordia fruticosa* flowers against experimentally induced liver toxicity with diclofenac sodium in rats. Various biochemical parameters like alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, total protein, albumin, blood urea nitrogen from serum; total protein, glutathione levels, catalase and glutathione peroxidase activities from liver were studied; histopathologic changes of liver were also evaluated. They found that plant extract effectively reduced the elevated levels of serum alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase and blood urea nitrogen and enhanced the reduced total protein, albumin along with hepatic glutathione, catalase, glutathione peroxidase activity. The histopathological analysis suggested that extract decreased the degree of liver fibrosis induced by diclofenac. [35]

Preventive and curative activity oxidative stress: A Nitha *et al*., evaluated the preventive and curative effect of *Woodfordia fruticosa* flowers on thioacetamide induced oxidative stress in rats. In this study two of methanolic extract of *W. fruticosa* (100 mg/kg and 200 mg/kg) were used to study the antioxidant activity in experimental rats. Single dose of 100 mg/kg was administered to the rats in all groups except the normal control. Various serum enzymes like aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase and Lactate dehydrogenase were studied. The oxidant status of liver and kidney were evaluated by the glutathione peroxidase (GPx), glutathione reductase (GR), S-transferase (GST), reduced glutathione (GSH) and malondialdehyde (MDA). Histopathological changes of liver tissue were also evaluated. Extract significantly prevented and reversed the elevation of the serum AST, ALT, ALP, LDH, and tissue melandialdehyde levels in both experimental models. Hepatic and renal GSH, GST, GR, GPx and catalase levels were remarkably increased by the treatment with the extract in both the experimental models. In the case of MDA the hepatic and renal levels were decreased by the effects of this study demonstrates the protective and curative of MEWF and thus supports the use of this plant in traditional medicine for of the treatment of liver disorders. [27]

Anti-ulcer activity: Anti-ulcer activity of chloroform and methanolic extract of root of *Woodfordia fruticosa* was investigated by Mihira and co-worker in diclofenac sodium induced gastric ulcer and compared with ranitidine in female wistar albino rats at concentrations of 150 mg/kg. The anti-ulcer activity of standard ranitidine, chloroform and methanolic extracts of roots were 4.83+0.91, 5.44+0.59 and 3.86+1.16 respectively. Researchers found that methanolic extract was the most potent anti ulcer drug in comparison to chloroform extract and standard. [36]

Use of various parts of *Woodfordia fruticosa* in traditional system of medicine and experimentally proved pharmacological activities can be attributed to its chemical constituents. Its flower used as astringent, refrigerant, haemostatic, anthelminthic, dessicative, enhance wound healing, etc. It is commonly used to cure diarrhoea, menorrhagia, bleeding piles etc. Sitz bath with decoction of flower is useful for prolapse of anus and leucorrhoea. The bark is used as pungent, acrid, cooling, toxic, alexatric, antihelmintic, antidysentric, uterine sedative etc, and used in dysentery, leprosy, erysipelas and diseases of the blood. Antitumor, aniproliferative, immunomodulatory, antioxidant, antihyperglycemic, anti-inflammatory and analgesic, cytotoxic, antibacterial, hepatoprotective, antimicrobial, anti-ulcer activities has been proven for various parts of this plant. This scrupulous and explicable review considerably approve that the plant *Woodfordia fruticosa* has versatile pharmacological activities and therapeutic potential.

REFERENCES

1. Graham SA. Systematics of *Woodfordia* (Lythraceae). Systematic Botany 1995; 20[4]:482-502.
2. Charters ML. Fruticosa: California Plant Names: Latin and Greek Meanings and Derivations. A Dictionary of Botanical and Biographical Etymology. Available at URL: http://www.calflora.net/botanicalnames/pageF.html [Accessed on 21-11-13].
3. *Woodfordia fruticosa.* IUCN Read List of Threatened Species. Available at URL: http://www.iucnredlist.org/search [Accessed on 21-11-2013].
4. *Woodfordia fruticosa.* Global Biodiversity information Facility. Available at URL: http://www.gbif.org/species/6708992 [Accessed on 21-11-13].
5. *Woodfordia fruticosa* (L.) Kurz. Medicinal Plants of Bangladesh. Available at http://www.mpbd.info/plants/woodfordia-fruticosa.php
6. Pullaiah T. Encyclopedia of world medicinal plants, Vol.1, Regency publications, New Delhi, 2006, pp. 97, 339, 1350-51, 2072.
7. Taxon: *Woodfordia fruticosa* (L.)Kurz. Available at [URL:http://www.arsgrin.gov/cgibin/npgs/html/taxon.pl4 2056 [Accessed on 22-11-2013].
8. Das PK, Goswami S, Chinniah A, Panda N, Banerjee S, Sahu NP, Achari B. *Woodfordia fruticosa*: Traditional uses and recent findings. Journal of Ethnopharmacology 2007; 110(2):189-199.
9. Deshpande DJ. A Handbook of Herbal Remedies 1st edition, Agrobios Publications, Jodhpur, 2011, pp. 129-30.
10. Khare CP. Indian Medicinal Plant: An Illustrated Dictionary. 1st edition, Raj Kamal Electric Press, New Delhi, 2007, pp.718.
11. Kirtikar KR, Basu BD. Indian Medicinal Plants with Illustrations. Vol.7, Oriental Enterprises, Dehradun, 2003, pp. 489-92, 3514-19, 1496-99.
12. Ghani N. Khazainul Advia. Vol. 1st, Idara Kitab ul Shifa, New Delhi, 1971. pp. 700, 701.
13. Anonymous. Standardization of Single Drugs of Unani Medicine. Part 2, Central Council of Research in Unani Medicine, New Delhi, 1987, pp. 126-131.
14. Nabi MG. Makhzan Mufradat wa Murakkabat. Central Council of Research in Unani Medicine, New Delhi, 2007, pp. 49, 56, 204, 219.
15. Hakeem MAH. Mufradat Azeezi. Central Council of Research in Unani Medicine, New Delhi, 2009, pp.83.
16. Anonymous. Medicinal Plants in Folklores of Northern India. Central Council of Research in Unani Medicine, New Delhi, 2009, pp. 76, 113-114, 517.
17. Rastogi RP, Mehrotra BN. Compendium of Indian Medicinal Plants. Vol-1, Central Drug Research Institute, Lucknow, 1999, pp. 14, 61, 67, 276, 710.
18. Weersaooriya MK, Yatawara HP. Purification and Properties of Invertase from the Flowers of *Woodfordia fruticosa*. Indian J Biochem Biophys. 2002; 39(5):347-50.
19. Finose A, Devaki K. Phytochemical and Chromatographic Studies in the Flowers of *Woodfordia fruticosa* (L) kurz. Asian Journal of Plant Science and Research 2011; 1 (3): 81-85.
20. Mishra P, Mishra D, Awasthi A, Arnold R**.** Physio-Chemical Analysis and Chemo-Profiling of Ayurvedic Single Drugs of Herbal Origin-*Woodfordia fruticosa* (Linn.) Kurz. Science Secure Journals 2013; 2 (1):16-21.
21. Lal UR, Tripathi SM, Jachak SM, Bhutani KK, Singh IP. HPLC Analysis and Standardization of Arjunarishta-An Ayurvedic Cardioprotective Formulation. Scientia Pharmaceutica 2009; 77 (3):605.
22. Kuramochi-Motegi A, Kuramochi H, Kobayashi F, Ekimoto H, Takahashi K, Kadota S, Takamori Y, Kikuchi T. Woodfruticosin (woodfordin C), a New Inhibitor of DNA to Poisomerase II. Experimental Antitumor Activity. Biochem Pharmacol. 1992; 44(10):1961-5.

23. Yoshida T, Chou T, Haba K, Okano Y, Shingu T, Miyamoto K, Koshiura R, Okuda T. Camelliin B, and Nobotanin I, Macrocyclic Ellagitannin Dimers and Related Dimers, and their Antitumor Activity. Chem Pharm Bull. 1989; 37(11):3174-6.
24. Yoshida T, Chou T, Matsuda M, Yasuhara T, Yazaki K, Hatano T, Nitta A, Okuda T. Woodfordin D and Oenothein A, Trimeric Hydrolyzable Tan nins of Macroring Structure with Antitumor Activity. Chem Pharm Bull 1991; 39(5):1157-62.
25. Kadota S, Takamori Y, Nyein KN, Kikuchi T, Tanaka K, Ekimoto H. Constituents of the Leaves of *Woodfordia fruticosa* Kurz. 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 1990; 38(10):2687-97.
26. Shah AS, Juvekar AR. *In vitro* and i*n-vivo* Immunostimulatory Activity of *Woodfordia fruticosa* Flowers on Non-specific Immunity. Pharm Biol. 2010; 48(9):1066-72.
27. Nitha A, Ansil PN, Prabha SP, Wills PJ, Latha MS. Preventive and Curative Effect of *Woodfordia fruticosa* Kurz Flowers on Thioacetamide Induced Oxidative Stress in Rats. Asian Pacific Journal of Tropical Biomedicine 2012; S757-S764.
28. Nitha A, Prabha SP, Ansil PN, Latha MS. Antiproliferative Effect of *Woodfordia fruticosa* Kurz. Flowers on Experimentally Induced Hepatocellular Carcinoma in Rats and in Human Hepatoma Cell Line. Journal of Pharmacy Research 2013; 6(2): 239-248.
29. Verma N, Amresh G, Sahu PK, Rao ChV, Singh AP. Antihyperglycemic Activity of *Woodfordia fruticosa* (Kurz) Flowers Extracts in Glucose Metabolism and Lipid Peroxidation in Streptozotocin-Induced Diabetic Rats. Indian J Exp Biol 2012; 50(5):351-8.
30. Ghante MH, Bhusari KP, Duragkar NJ, Jain NS, Warokar AS. Broncho-protective, Bronchodilatory and Anti-Inflammatory Activity of Ethanolic Extract from *Woodfordia fruticosa* (Kurz.) Flowers. Indian Journal of Pharmaceutical Education and Research 2012; 46(2):168-73.
31. Baravalia Y, Vaghasiya Y, Chanda S. Brine Shrimp Cytotoxicity, Anti-inflammatory and Analgesic Properties of *Woodfordia fruticosa* Kurz Flowers. Iranian Journal of Pharmaceutical Research 2012; 11(3): 851-861.
32. Kumaraswamy MV, Kavitha HU, Satish S. Antibacterial Potential of Extracts of *Woodferdia fruticosa* Kurtz. on Human Pathogens. World Journal of Medical Sciences 2008; 3(2):93-96.
33. Dabur R, Gupta A, Lavekar GS. Antimicrobial Activity of Some Indian Medicinal Plants. Afr J Tradit Complement Altern Med. 2007; 4(3): 313–318.
34. Dubey D, Sahu MC, Rath S, Paty BP, Debata NK, Padhy RN. Antimicrobial Activity of Medicinal Plants Used by Aborigines of Kalahandi, Orissa, India against Multidrug Resistant Bacteria. Asian Pacific Journal of Tropical Biomedicine 2012; S846-S854.
35. Baravalia Y, Vaghasiya Y, Chanda S. Hepatoprotective Effect of *Woodfordia fruticosa* Kurtz. Flower on Diclofenac Sodium Induced Liver Toxicity in Rats. Asian Pac J Trop Med. 2011; 4(5):342-6.
36. Mihira V, Ramana KV, Ramakrishna S, Rambabu P. Evaluation of Anti-Ulcer Activity of *Woodfordia fruticosa* Roots. Pharmanest 2011; 2(2-3):158-60.

Source of Support: Nil, Conflict of Interest: None declared.