PHYTOPHARMACOLOGICAL POTENTIAL OF WOODFORDIA FRUTICOSA (DHATAKI): A REVIEW

Kapil Jangir* and Nitin Jumnani

Alwar Pharmacy College, Alwar - 301030, Rajasthan, India.

ABSTRACT

*Corresponding Author
Kapil Jangir
Alwar Pharmacy College,
Alwar - 301030, Rajasthan, India.

Woodfordia fruticosa a member of the Lythraceae family known as Dhataki, Dawai etc has been reported for its traditional uses as a medicinal plant. It is also known as herbal medicine or botanical medicine or phytomedicine or herbology and phytotherapy. The folklore medicine also advocates the use of herbs for diseases. The presence of potentially active nutrients and their multifunctional properties make Woodfordia fruticosa flower leaves, root, bark, and stem perfect candidates for the production of phytopharmaceutical products. So having this in mind this review article focuses on collecting the documentation of all the research work that is performed on Woodfordia fruticosa and is the segregation of the pharmacology, chemistry and traditional claims of the activities that are attributed to the plant.

KEYWORDS: Woodfordia fruticosa, Medicinal plant, Traditional, Dhataki, Phytochemistry.

1. INTRODUCTION

Traditional medicine is “the knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, used in the maintenance of health and in the prevention, diagnosis, improvement or treatment of physical and mental illness.”[1] Herbalism as a long tradition of use outside of conventional medicine, it is becoming more stream as improvements in analysis and quality control along with advances in clinical research show the value of herbal medicine is treating and preventing disease.[2]
1.1 Herbal medicine
Herbal medicine represents one of the most important fields of traditional medicine all over the world. Herbal medicines are used in Ayurveda, Naturopathy and Homeopathy, traditional and native American medicines. Major pharmaceutical companies are currently conducting extensive research on plant materials gathered from there in forests and other places for their potential medicinal value.\textsuperscript{[2,3,4]} Herbal medicine is the use of medicinal plants for prevention and treatment of diseases: it ranges from traditional and popular medicines of every country to the use of standardized and tritated herbal extracts.\textsuperscript{[5]}

Medicinal plants contain so many chemical compounds which are the major source of therapeutic agents to cure human diseases. Recent discovery and advancement in medicinal and aromatic plants have lead to the enhancement of health care of mankind. Various medicinal plants like Tulsi, Arjuna, Dhataki, Amla, Brahmi, etc. traditionally used for treating fever.\textsuperscript{[1,4,6,7]}

1.2 Plant profile\textsuperscript{[8,9]}

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<tr>
<th>Synonyms</th>
<th>Dhai, Dhati, Dhataki, Dawai, Dhavi</th>
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<td>Kingdom</td>
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Woodfordia fruticosa, also called Dhai, Dhataki, Fire Flame Bush is a species of plant from the Lythraceae family that. In Ayurveda this herb used to treat much disease. Its flower is analgesic antipyretic and astringent due to pitta dosha.\textsuperscript{[17]}

1.3.1 Description\textsuperscript{[9,10,11]}

A bushy shrub, with long, spreading branches, pubescent, young branchlets and leaves with numerous, small, black glands. Leaves: opposite or subopposite, grey-pubescent beneath, ovate- or linear-lanceolate. The leaves are simple, covered with white hairs, and opposite or in rings of three. Flowers: scarlet, showy, tubular on slender pedicels dilated above, born in axillary clusters. The flowers are in clusters of up to 17 on short shoots in the axils of leaves. Individual flowers are large and red-orange. The fruits are dry irregular capsules containing many smooth, small, brown seeds. Capsules: ellipsoid, membranous, included in the calyx. Seeds: cuneate-obovent, smooth. Flowers appear in February-April and fruits in April-June.

- Habitat

Open, sunny places, often on disturbed soils and on old agricultural land. Open waste land and degraded places

Regional habitat: Throughout India specially in Rajasthan, found at open, waste land and degraded places

- Distribution\textsuperscript{[9,10]}: W. fruticosa has been widely cultivated in tropical regions, usually between 0 and 300 m altitude, and grows well in brushwood, bush margins, grassy fields, and secondary forest, seasonally flooded grassy fields and sandy coasts and along

\textbf{Fig. no. 2: Woodfordia fruticosa flower.} \hspace{1cm} \textbf{Fig. no. 3: Woodfordia fruticosa leaf.}
roadsides and riverbanks, although the species cannot tolerate excessive water or heat. Aside from cultivated areas, the species was also common in thickets and roadsides in Puerto Rico and the Virgin Islands). In Madagascar, *W. fruiticosa* is widely naturalized around villages, roadsides, disturbed areas, and grassland, at altitudes up to 800 m

- **Duration**: Perennial
- **Part(s) used for medicinal purpose**: Whole plant/Specially Flower and leaves
- **Plant type / Growth Habit**: Shrub
- **Propagation**: Through rhizome and Seed

### 1.3.2 Phytochemistry

Plant contain mainly Flavanoids Beta-Sitosterol from various parts; Seeds: linoleic, oleic, palmitic and stearic acids; Flowers: octacosanol (also from stem), chrysophanol-8-O-Beta-D-glucopyranoside, cyanidin-3,5-diglucoside, glucose, tannins, hecogenin, inositol, woodfordins A,B and C; Flowers-Leaves: ellagic acid, myricetin-3-galactoside, pelargonidin-3,5-diglucoside, polystachoside; Leaves: lawson, betulin, betulinic acid, lupeol, oleanolic and ursolic acids.

### 1.3.3 Traditional uses

The flowers are very useful in dysentery, diarrhoea, fever, hemorrhoids, herpes, leprosy, burning sensation, skin diseases, internal hemorrhage, impaired hepatic function, leukorrhea, menorrhagia and considered as a safe stimulant pregnancy. The juice of its fresh flowers applied on the forehead, reduces the headache. Dried flower powder is used in ulcers and wounds to reduce the discharge and promote granulation.

Woodfordia fruiticosa flowers are an important ingredient in Ayurvedic preparations of various “Asavas” and “Aristhas”. According to the Indian systems of medicine, flowers of this plant have pungent, acrid, cooling, toxic, alexiteric properties and are used as a sedative and as an anthelmintic. These flowers are also useful in fever, thirst, blood diseases, dysentery, toothache, leprosy, leucorrhea, and menorrhagia. Charaka and Sushrutsa used sweetened decoction of flowers for fever, haemothermia, persistent dysentery; included Dhaataki in conception-promoting group of herbs. Powder of Dhaataki flowers, mixed with honey, was prescribed for leucorrhoea.
The dried flowers are an astringent tonic in disorders of the haemorrhoids, mucous membranes and in derangements of the liver and also considered a safe stimulant in pregnancy.\cite{23}

*Woodfordia fruticosa* Kurz is a widely used medicinal herb in different South East Asian countries since long back and plays a potential role in curing/treating various ailments/disorders like leprosy, toothache, leucorrhea, fever, dysentery, bowel disease.\cite{22,26}

- **Diabetes**: Decoction of flower is used to treat diabetes.
- **Anti-inflammatory**: The leaves powder used as Anti-inflammatory.\cite{26,26}
- **Anti Asthmatic**: Flower extract used to treat Asthmatic.\cite{28}
- **Rheumatism**: Flower and root are useful in treatment of rheumatism.\cite{29}
- **Laxative**: Root and stem used to treat constipation.\cite{30}
- **Immuno-mudulator**: Flower is used to enhance immunity and overall body health.\cite{31,32}
- **Anti Pyretic**: Flower and leaves used to treat fever due to pitta dosha.\cite{33,34,35,36}
- **Antibacterial activity by flower extract**\cite{37,38}
- **Hepato-protective**: Whole aerial aerial showed hepatoprotective activity.\cite{39}

**Pharmacological properties**

**Antidiabetic activity**

According to this paper the 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 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 decrease was observed in the levels of the gluconeogenic enzymes in ethanolic extract treated diabetic rats.\cite{40}

**Immune mudulatory effect**

According to this article there is 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 indicate stimulatory activity of the plant flower extract on macrophages. The flower extract also demonstrated 60% increase in bone marrow cell proliferation and offer protection towards cyclophosphamide-induced myelosuppression which represents the stimulation of bone marrow activity.\cite{41}
Antioxidant activity

Total flavonoids content and Hydrogen peroxide activity of different extracts of Woodfordia fruticosa flowers was evaluated for antioxidant activity. Experiments are performed in triplicates and results are expressed as mean values + SEM. Aqueous, hydro alcoholic and methanolic extracts of flower of woodfordia shown inhibition of DPPH, DNPH and hydrogen peroxide radicals in dose dependent manner and is comparable to it’s total flavonoids content. Results indicate that antioxidant activity is dependent on flavonoids content to the some extent.\(^\text{[42]}\)

In another study, the antioxidant capacity of crude extract and different polarity fractions of Woodfordia fruticosa flowers were assayed for their scavenging abilities against 1,1-diphenyl-2-pirclylhydrazyl (DPPH) and nitric oxide radicals, competitive β-carotene bleaching, reducing power, metal chelating ability and total phenolic content. Crude extract and polar fractions showed stronger antioxidant capacity and contained very high level of total phenolics. They exhibited strong DPPH radical scavenging, nitric oxide scavenging and reducing power, medium β-carotene bleaching and poor metal chelating capacity.\(^\text{[43]}\)

Antimicrobial

Antimicrobial activity of leaf and flower extracts of W.fruticosa evaluated against six clinically important microorganisms (four bacteria – two Gram positive, two Gram negative bacteria and two fungi). Antimicrobial screening of methanolic extract from leaf and flower parts of Woodfordia fruticosa revealed that the flower parts of the plant showed better antimicrobial activity against micro - organisms as compared to leaf part. Zone of inhibition increased along with increasing extract concentration. Maximum Zone of inhibition was observed in the flower extracts against Staphylococcus aureus (22.4 ± 0.86 mm) amongst the bacteria species and against Alternaria solani (23.5 ± 0.15 mm) amongst the fungal species. Minimum zone of inhibition was observed in the leaf extract against Micromonospora sp. (10.1 ± 0.13 mm) of bacteria (Fig. 1.C) and in fungal species, Fusarium culmorum and Alternaria solani showed nil activity in flower and leaf extracts respectively.\(^\text{[44]}\)

Antihyperlipidemic property

Potential role of methanolic flower extract of Woodfordia fruticosa in lowering lipid parameters in mice fed a high cholesterol diet was investigated in this study. Swiss albino mice were randomly divided into five groups of six and were administered either: 0.5 ml water (negative controls); 30 mg cholesterol (hypercholesterolemic animals); MEWF
(methanolic extract of Woodfordia fruticosa flowers) at 400mg/kg body weight (positive control); or the same doses of both cholesterol and the extract (test animals); Atorvastatin at 10mg/kg body weight (drug control). The effects of MEWF on the lipid profile were assessed by measuring concentrations of total cholesterol (TC), triglyceride (TG), low-density lipoprotein cholesterol (LDL-c), high-density lipoprotein cholesterol (HDL-c), and very low-density lipoprotein cholesterol (VLDL-c). Administration of cholesterol showed significant elevation (p < 0.001) of TC, LDL-c, VLDL-c, and TG concentrations, and of the TC: HDL-c ratio (p < 0.05). Administration of MEWF extract in cholesterol fed mice caused a significant decrease (p < 0.001) in the concentrations of serum TC, LDL, VLDL TGs as well as TC: HDL-c ratio when compared with cholesterol fed control mice and results were also comparable to that of drug control group. \[45\]

**Anti asthmatic**

Hiralal M et al (2014) investigate In vitro bronchorelaxant effect against histamine- and acetylcholine (1 mg/ml; independently)-induced guinea pig tracheal contraction. Extracts were evaluated for bronchoprotection (in vivo) ability against 0.1% histamine- and 2% acetylcholine-induced bronchospasm in guinea pigs at 100 and 200 mg/ml. Methanol and ethyl acetate extracts at 100 mg/ml exhibited 06.52 and 07.12% of histamine release. Methanol extract exhibited 100% bronchorelaxation and 48.83% bronchoprotection. \[46\]

**Anti-inflammatory activity**

Baravalia et al. (2012) investigated anti-inflammatory activity of methanol extract of W. fruticosa flowers. 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 pelletinduced granuloma and formaldehyde-induced analgesia in rats. 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 pelletinduced granuloma and reduced the frequency of formaldehyde-induced paw licking. These results showed that the methanol extract of W. fruticosa flowers have potent antiinflammatory compounds and justifies the traditional uses for the treatment of inflammatory conditions. \[47,48\]

**Hepato-protective effect**

Hepatoprotective activity of petroleum ether, ethyl alcohol, chloroform and aqueous extract of the flower of W. fruticosa has been reported against phenytoin induced liver damage in
rats and carbon tetrachloride induced hepatotoxicity. The methanolic extract of the flowers of W. fruticosa has been reported for hepatoprotective activity against acetaminophen induced hepatic injury in rats and diclofenac sodium induced hepatic damage in rats.\cite{49,50,51}

**Antiulcer activity**

Both chloroform and methanol extracts of W. fruticosa roots showed significant antiulcer activity in ethanol, hydrochloric acid and Diclofenac sodium induced ulcer in stomach of female wistar albino rats.\cite{52}

**Analgesic activity**

Rose et al. (2013) designed to evaluate the analgesic activity of Woodfordia fruticosa stem bark in albino rats by using chemical and thermal models of acetic acid induced writhing test and nociception hot plate method respectively. The petroleum ether, chloroform, ethanol and aqueous extracts were administered orally to the rats in their respective groups at a dose of 200mg/kg according to their body weight. Analgin was a standard drug administered to the standard group. The results of aqueous extract and alcoholic extract exhibited statistically significant (\*P <0.01 & P <0.05) analgesic activity in albino rats. The aqueous extract found to be the most potent in comparison to petroleum ether and alcoholic. Comparison with standard and test groups, aqueous extract group followed by alcoholic and petroleum ether extract exhibited significant analgesic effect in animal models. Phytoconstituents present in bark are flavonoids, steroids, glycosides and tannin. Analgesic activity of W. fruticosa stem bark may be due to presence of steroids, flavonoids or glycosides.\cite{53}

**CONCLUSION AND FUTURE PERSPECTIVE**

The data presented in this review highlights the geographical, morphological, microscopical Phytochemical characteristics of W. fruticosa. A review of traditional property, reported biological activities along with main phytoconstituents isolated in this plants have also been summarized. The present review would further help for the renaissance of other pharmacological activities on the plant and can also give a lead to take clinical studies based on present reported activities. The scientists or researchers working on this plant will be definitely benefitted from the information summarized in this article.

**Financial support and sponsorship**

Nil.
Conflicts of interest
There are no conflicts of interest.

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