Evaluation of pharmacognostic and physicochemical parameters of *Woodfordia fruticosa* Kurz. Flowers

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**ABSTRACT**

The flowers of *Woodfordia fruticosa* Kurz. (Lythraceae) are reported to have good medicinal values in traditional system of medicines. Present work deals with the pharmacognostical examination of macroscopic and microscopical characters of *Woodfordia fruticosa* Kurz. flowers including detailed anatomy of the pedicel, calyx, pollen grain, anther lobe and ovary. Powder studies showed presence of rosette and cluster crystals of calcium oxalate, annual xylem and unicellular trichome. The physiochemical properties such as loss on drying, total ash value, acid insoluble ash value, water soluble ash value solubility, melting point, pH and extractive values and of flower were carried out. The results of the study could be useful for the identification and preparation of a monograph of the plant.

**Keywords:** *Woodfordia fruticosa* flower, Pharmacognostic, Physicochemical properties

**INTRODUCTION**

The use of herbal medicines continues to expand rapidly across the world. Many people now take herbal medicines or herbal products for their health care in different national health-care settings. According to WHO, 80% of the rural population in developing countries depend on traditional medicines to meet their primary health care needs.[1] Authentication and standardization are prerequisite steps while considering source materials for herbal formulation in any system of medicine.[2]

*Woodfordia fruticosa* Kurz. belongs to the family Lythraceae, is a much branched beautiful shrub, 1-3 m high. It is the plant of tropical and subtropical regions with a long history of medicinal use. The plant is abundantly present throughout India and also in a majority of the countries of South East and Far East Asia like Malaysia, Indonesia, Sri Lanka, China, Japan and Pakistan as well as Tropical Africa.[3] The original Sanskrit name Agnijwala or Tamra-pushpi appears to be derived from the bright red colour of the flower and the bark. Locally (In Gujarat) it is known as Dhavdi.[4,5]

Pharmacognosy basically deals with the standardization, authentication and study of natural drugs. It is closely involved with allied fields, viz. phytochemistry and toxicological screening of natural products. Much of the research in pharmacognosy has been done in identifying controversial species of plants, authentication of commonly used traditional medicinal plants through morphological, histological, physicochemical and toxicological parameters, especially heavy metal estimation and radiobiological contamination in plants, prescribed by an authoritative source. The importance of pharmacognosy has been widely felt in recent time.[6]

To ensure reproducible quality of herbal medicines, proper control of starting material is utmost essential. The first step towards ensuring quality of starting material is authentication followed by creating numerical values of standards for comparison. Pharmacognostical parameters for easy identification like flower constants, microscopy and physicochemical analyses are few of the basic protocol for standardization of herals. Hence, in the present work the pharmacognostical standardization has been performed for the flower of the plant.
Yogesh Baravalia, et al.: Evaluation of pharmacognostic and physicochemical parameters of Woodfordia fruticosa Kurz. Flowers

MATERIAL AND METHODS

Collection and extraction of plant material

The fresh flowers of Woodfordia fruticosa were collected from Junagadh (Girnar region), Gujarat in the month of March 2008. The plant was compared with voucher specimen (voucher specimen No. PSN303) deposited at Department of Biosciences, Saurashtra University, Rajkot, Gujarat, India. The flowers were washed under tap water, air dried, homogenized to fine powder and stored in airtight bottles. Ten grams of dried powder was first defatted with petroleum ether and then extracted with methanol by using Soxhlet apparatus. The solvent was evaporated to dryness and the dried crude extract was stored in air tight bottle at 4°C. The percentage yield of methanol extract was 36%. The methanolic extract was used for the solubility study.

Pharmacognostic studies

Macroscopic characteristics

The plant was macroscopically examined for shape, size, surface characteristics, texture, color, consistency, odour, taste, etc.

Microscopic characteristics

Free hand sections of pedicel, calyx, sepal and ovary of fresh flower of Woodfordia fruticosa were taken. Sections were cleared with chloral hydrate and then stained with phloroglucinol and hydrochloric acid and mounted with glycerin. Same procedure was followed for microscopic characteristics of powdered material of Woodfordia fruticosa flower.

Physicochemical parameters

Physicochemical parameters were determined as per guidelines of WHO (2002). Total ash value, loss on drying, water soluble ash, acid insoluble ash, solubility, melting point, pH, analysis, petroleum ether soluble extractive, alcohol soluble extractive value and water soluble extractive value were determined.

RESULTS

Macroscopic characteristics

The full-grown Woodfordia fruticosa shrub is about 3.0 m high, having long and spreading branches with fluted stems. The flowers are bright red, innumerable, arranged in dense axillary paniculate-cymose clusters (Figure 1), with short glandular pubescent pedicels. The inflorescence is deep red, 2-15 flowered, fascicled cymes. The calyx is long (11-33 mm), striated, covered with glandular dots, with a small campanulate base and a long slightly curved bright red tube. The petals are pink, papery, slightly longer than the calyx-teeth, narrowly linear, extended at the apex to a long fine point. The fruits are small capsules, ellipsoid and membranous, usually splitting the calyx near the base, and are irregularly dehiscent. The seeds are brown, numerous, very minute, smooth, shining, angular and obovate.

Microscopic characteristics

Pedicel

A transverse section of the pedicel flower shows a single-layered epidermis, with a fairly thick cuticle. Numerous unicellular trichomes arise from this layer. The epidermis is followed by a 7-8 layered cortex, differentiated into collenchyma and parenchyma with plenty of air spaces. The primary xylem is represented by uni- or bi-seriate groups.
of 3 or 4 tracheids arranged in a ring with phloem on either side of the xylem. The rosette and cluster crystals of calcium oxalate are found in the cortex (Figure 2).

**Calyx**

A transverse section of the calyx tube is circular in outline. The cells of the upper epidermis in surface showed scattered trichomes. The calyx tube consists of several layers of ground tissue containing rosettes and cluster of calcium oxalate crystals and bounded on either side by upper and lower epidermis respectively. Anomocytic, actinocytic and anisocytic stomata are present. Vascular bundles are small, collateral and surrounded by bundle sheath. In sepals, the cells of the lower epidermis in surface view are broad, slightly irregular, thin walled in the upper region but thick walled in the basal region of the calyx. The tissue is differentiated into an adaxial palisade and an abaxial spongy parenchyma in the upper ¾ of the calyx tube (Figure 2).

**Anther lobes**

The anther lobes are tetrasporangiate and the walls separating the locules get disorganized. A transaction of a lobe shows an epidermis formed of large colourless cells followed by a fibrous layer, which appears crinkled (Figure 3).

**Pollen grains**

Pollen grains are 3-zonocolporate, oblate spheroidal shape and its surface is psilate (Figure 3).

**TS of ovary**

The ovary is bicarpellary and laterally flattened and as such appears elongated in transaction (Figure 3).

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Figure 2: Microscopic characteristics of *Woodfordia fruticosa* flower

Figure 3: Microscopic characteristics of *Woodfordia fruticosa* flower
**Powder characteristic**

The crude powder of *Woodfordia fruticosa* flower was light brown in color, slightly bitter and astringent in taste. Microscopy study of powder showed the presence of epidermis in surface view showed straight wall cells. Few cells of fibrous layer observed in powder. Cluster crystals of calcium oxalate were present in powder. Pollen grains either singly or in groups were found. Simple covering unicellular trichomes are present. Annular xylem vessels were found (Figure 4).

**PHYSICOCHEMICAL ANALYSIS**

**Proximate parameters analysis**

The result of proximate analysis of crude powder of *Woodfordia fruticosa* flower is shown in Table 1. The average values are expressed as percentage of air-dried material. The loss on drying was 8%. Total ash was 5.45%, acid insoluble ash was 0.57% and water soluble ash was 2.47%. The extractive value of crude powder was maximum in water (41.59%), followed by methanol (32.77%) and minimum was in hexane (0.71%). pH and melting point of methanol extract was 3.5 and 114°C respectively.

**Solubility test**

The methanol extract of *Woodfordia fruticosa* flowers was evaluated for solubility in 10 solvents with varied polarities. The extract was highly soluble in dimethylformamide, methanol and dimethylsulphoxide but insoluble in hexane, petroleum ether and toluene solvents (Table 2).

![Powder characteristics of Woodfordia fruticosa flower](image)

**Table 1: Determination of proximate parameters of crude powder of Woodfordia fruticosa flowers**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value (w/w)</th>
</tr>
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<tbody>
<tr>
<td>Loss on drying</td>
<td>8%</td>
</tr>
<tr>
<td>Total ash</td>
<td>5.45%</td>
</tr>
<tr>
<td>Acid insoluble ash</td>
<td>0.57%</td>
</tr>
<tr>
<td>Water soluble ash</td>
<td>2.47%</td>
</tr>
<tr>
<td>Petroleum ether soluble extractive</td>
<td>0.74%</td>
</tr>
<tr>
<td>Hexane soluble extractive</td>
<td>0.71%</td>
</tr>
<tr>
<td>Ethyl acetate soluble extractive</td>
<td>1.60%</td>
</tr>
<tr>
<td>Acetone soluble extractive</td>
<td>8.08%</td>
</tr>
<tr>
<td>Methanol soluble extractive</td>
<td>32.77%</td>
</tr>
<tr>
<td>Water soluble extractive</td>
<td>41.59%</td>
</tr>
<tr>
<td>pH of methanol extract</td>
<td>3.5</td>
</tr>
<tr>
<td>Melting point methanol extract</td>
<td>114°C</td>
</tr>
</tbody>
</table>

**Table 2: Determination of solubility of methanol extract of Woodfordia fruticosa flowers in different solvents.**

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Solubility (mg/ml)</th>
</tr>
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<tbody>
<tr>
<td>Acetone</td>
<td>6.0</td>
</tr>
<tr>
<td>Chloroform</td>
<td>3.0</td>
</tr>
<tr>
<td>Dimethylformamide (DMF)</td>
<td>119.0</td>
</tr>
<tr>
<td>Dimethylsulphoxide (DMSO)</td>
<td>109.8</td>
</tr>
<tr>
<td>Distilled water</td>
<td>34.2</td>
</tr>
<tr>
<td>Ethyl acetate</td>
<td>3.0</td>
</tr>
<tr>
<td>Hexane</td>
<td>-</td>
</tr>
<tr>
<td>Methanol</td>
<td>113.1</td>
</tr>
<tr>
<td>Petroleum ether</td>
<td>-</td>
</tr>
<tr>
<td>Toluene</td>
<td>-</td>
</tr>
</tbody>
</table>
DISCUSSION

The pharmacognostical study is a major and reliable criterion of identification of plant drugs. The pharmacognostic parameters are necessary for confirmation of the identity and determination of quality and purity of a crude drugs. [18] To ensure reproducible quality of herbal products, proper control of starting material is utmost essential.[19] Thus, in recent years there has been an emphasis on standardization of medicinal plants, and evaluation of plant drugs by pharmacognostical studies is still more reliable, accurate and inexpensive means. Pharmacognostic studies on different plants has been done by various workers.[21,23,24,30]. According to World Health Organization (WHO) the macroscopic and microscopic description of a medicinal plant is the first step towards establishing its identity and purity and should be carried out before any tests are undertaken.[9]

The flowers of *Woodfordia fruticosa* have three types of matured stoma viz. anomocytic, actinocytic and anisocytic. Stomata is the main factor responsible for the physiological activities of the plant, abnormal stoma is responsible for behavior and hormonal imbalance in plants. [17] In calyx both rosette and cluster type of calcium oxalate crystals were found; these could be used to distinguish the species.

The physical constant evaluation of the powder is an important parameter in detecting adulteration or improper handling of drugs. The percentage of active chemical constituents in crude drugs is mentioned on air-dried basis. Therefore, the loss on drying of plant materials should be determined and the water content should also be controlled. The moisture content of dry powder of *Woodfordia fruticosa* flowers was 8% which is not very high, hence it would discourage bacteria fungi or yeast growth. [18,19] The total ash is particularly important in the evaluation of purity of drugs, i.e. the presence or absence of foreign inorganic matter such as metallic salts and/or silica. [18,19] Low amount of total ash, acid insoluble ash and water soluble ash indicate that the inorganic matter and non-physiological matter such as silica is less in *Woodfordia fruticosa* flowers. The extractive values are useful to evaluate the chemical constituents present in the crude drug and also help in estimation of specific constituents soluble in a particular solvent. The variation in extractable matter in various solvents is suggestive of the fact that the formation of the bioactive principle of the medicinal plants is influenced by number of intrinsic and extrinsic factors. High alcohol soluble and water soluble extractive values reveal the presence of polar substance like phenols, tannins and glycosides, as reported by Sharma et al. (2009). [20]

CONCLUSIONS

The present study may be useful to supplement information in respect to its identification, authentication and standardization of herbal drugs. In other words, the pharmacognostic features examined in the present study may serve as tool for identification of the plant for validation of the raw material and for standardization of its formulations at herbal industrial level in the coming days.

REFERENCES