Pharmacognostical Evaluation of *Dendrophthoe falcata*

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ABSTRACT

This study presents a detailed pharmacognostical study of the leaves and stems of *Dendrophthoe falcata* Linn (Loranthaceae), an important plant in the Indian system of medicine. The leaves and stems were studied using procedures of light, confocal microscopy, WHO recommended physico-chemical determinations, and authentic phytochemical procedures. The physicochemical, morphological and histological parameters presented in this paper may be proposed as parameters to identify and establish the authenticity of *D. falcata*.

Keywords: *Dendrophthoe falcata*, microscopy, standardization, pharmacognosy, adulterants

INTRODUCTION

*Dendrophthoe falcata* Linn (Loranthaceae), is an important plant in the Indian system of medicine. It is a parasitic shrub that grows on a variety of host plants namely mango, jack and other trees¹. The plant has been used as an aphrodisiac, astringent, narcotic, and in diuretic².

Chemically the plant has been found to be rich in phenols and flavonoids; viz., catechins, gallic acid, ellagic acid, chebulinic acid, quercetin, kaempferol, rutin and quercetrin³.

*D. falcata* has been used traditionally in the treatment of pulmonary tuberculosis, asthma, menstrual disorders, swellings, wounds, ulcers, strangury, renal and vesical calculi and vitiated conditions of *kapha* and *pitta*⁴. In Nepal, the leaf along with *Urtica doica* is made into a paste and used to treat bone fractures⁵.

In spite of the numerous medicinal uses attributed to this plant, however, there is no pharmacognostical report on the leaf or stem of the plant to determine the anatomical and other physicochemical standards required for quality control of the crude drug. Hence, the present investigation includes morphological and anatomical evaluation, determination of physicochemical constants and the preliminary phytochemical screening of the different extracts of *D. falcata*.

MATERIALS AND METHODS

Plant material

The stem and leaves of *Dendrophthoe falcata* were collected from Manipal, India in the month of August 2009. The plant was identified by Dr. Gopalakrishna Bhat, Taxonomist, Poorna Prajna College, Udupi, Karnataka. A voucher specimen (PP 564) has been deposited in the Department of Pharmacognosy, Manipal College of Pharmaceutical Sciences (Manipal, India).

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Macroscopic and microscopic analysis

The macroscopy and microscopy of the plant were studied according to the method of Brain and Turner ⁶. For the microscopical study, cross sections were prepared and stained as per the procedure of Johansen⁷. The micropowder analysis and leaf constants was done according to the official method⁸-10.

Physicochemical analysis

Physicochemical values such as percentage of ash values and extractive values and loss on drying were performed according to the official methods¹¹,¹².

Preliminary phytochemical screening

Preliminary phytochemical screening was carried out by using standard procedures described by Kokate¹³ and Harborne¹⁴.

RESULTS

Macroscopic characteristics

Leaf

The macroscopy of leaf revealed that leaf is simple, opposite or alternate, 16cm in length and 8 cm in width, ovate or obtuse at the apex with cordate base, very coriaceous, dark green with very prominent pinnate venation; main laterals are visible above and often more distinct below; leaf is glabrous, petiolate with entire margin, astringent in taste with odour like that of tea leaves.

Stem

Stem showed small twigs of aerial branches ranging from 2 mm to 2.5 cm in thickness with bulged nodes with two opposite leaves; the bark of stem is thin, dark brown and specked with lighter brown uniformly distributed lenticles; the wood reddish-brown after removal of thin bark; stem slightly rough to touch; fracture irregular and fibrous, astringent taste with no distinct odour.
Leaf

The transverse section of leaf of *D. falcata* shows an isobilateral nature. The section is broadly divided into lamina and midrib region (Fig-1). The lamina of the leaf shows three distinct region viz, upper epidermis, lower epidermis and mesophyll. The upper epidermis is single layered with more or less rectangular cells covered by a thick cuticle.

The mesophyll is differentiated into palisade and spongy parenchyma. The palisade parenchyma is made up of two-three layers of compactly arranged, radially elongated cells. The spongy parenchyma is multilayered and loosely arranged with intercellular spaces. Vascular strands are found in the upper layer of the spongy parenchyma. Sclereids are found to be isolated or in groups. Prismatic calcium oxalate crystals are also seen in this region. Lower epidermis is similar to that of upper epidermis.

The epidermal layers of the lamina are continuous in the midrib region. Strips of collenchyma appear below the upper and above the lower epidermis. This is, followed by the cortical parenchyma which contains abundant tannins. Sclereids similar to that of the spongy mesophyll are scattered either single/y or in groups in the cortical parenchyma region. Prominent collateral vascular bundles occupy the center portion of the midrib with xylem towards the dorsal surface associated with a patch of collenchyma and phloem towards the ventral surface. Surface preparation revealed the presence of paracytic or rubiaceous type of stomata.

Powder characteristic of the leaf revealed the presence of paracytic stomata, lignified stone cells, vessels, prismatic calcium oxalate crystals and yellowish to brown colour patches of tannins. (Fig- 3)

Stem

A transverse section of stem is circular in outline. The outer cork consists of few layers of dark brown, irregular parenchymatous cells, the inner cork is made up of few layers of radially arranged in regular rows of lignified parenchymatous cells. Cortex consisting of many layers of tangentially elongated and rounded cells interspersed with a well developed belt of sclereids in groups of 2 to 4; many cells of cortex, especially those of outer few layers contain tannins ranging in colour from yellow, orange to dark brown; groups of pericyclic fibres appear outside phloem; phloem seen in several thin patches around the well developed xylem. Xylem occupies more or less 1/3 of the T.S and is traversed regularly by 1 to 4 seriate radially elongated lignified medullary ray cells and consists of well developed vessels, xylem fibres, tracheids and xylem parenchyma. Medullary ray cells are interrupted by small groups of sclereids; pith occupies the central part of the stem, consists of thin walled, rounded or polygonal lignified parenchymatous cells; small groups of sclereids also seen in this region, prismatic crystals present in association with sclereids and medullary ray cells. (Fig-2)

Powder characteristic of the stem revealed the presence of vessel with simple pitted thickenings, groups of sclereids containing prismatic crystals and fragments of parenchyma cells containing tannins. (Fig-4)

Preliminary phytochemical screening

Preliminary phytochemical screening mainly revealed the presence of carbohydrates, alkaloids (leaf), phytosterols, fixed oils and phenolic compounds (Table-1 & 2)

Physicochemical constants

Ash values of a drug give an idea of the earthy matter or the

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**Table 1. Preliminary phytochemical screening of leaf powder of *D. falcata***

<table>
<thead>
<tr>
<th>Test</th>
<th>Petroleumether</th>
<th>Benzene</th>
<th>Chloroform</th>
<th>Acetone</th>
<th>Ethanol</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phytosterols</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Fixed oils and fats</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Saponins</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phenoliccompounds</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

**Table 2. Preliminary phytochemical screening of stem powder of *D. falcata***

<table>
<thead>
<tr>
<th>Test</th>
<th>Petroleumether</th>
<th>Benzene</th>
<th>Chloroform</th>
<th>Acetone</th>
<th>Ethanol</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Carbohydrates</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phytosterols</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Fixed oils and fats</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Saponins</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phenoliccompounds</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

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**Table 3. Ash values of the leaf and stem powder of *D. falcata***

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Leaf</th>
<th>Stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ash</td>
<td>9.65 %w/w</td>
<td>2.5 %w/w</td>
</tr>
<tr>
<td>Acid insoluble ash</td>
<td>1.3 %w/w</td>
<td>0.35 %w/w</td>
</tr>
<tr>
<td>Water soluble ash</td>
<td>4.89 %w/w</td>
<td>1.95 %w/w</td>
</tr>
<tr>
<td>Sulphated ash</td>
<td>13.99 %w/w</td>
<td>2.0 %w/w</td>
</tr>
</tbody>
</table>

**Table 4. Extractive values of the leaf and stem powder of *D. falcata***

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Leaf</th>
<th>Stem</th>
</tr>
</thead>
<tbody>
<tr>
<td>water soluble extractive</td>
<td>27.12 %w/w</td>
<td>13.7 %w/w</td>
</tr>
<tr>
<td>ethanol soluble extractive</td>
<td>5.84 %w/w</td>
<td>4.6 %w/w</td>
</tr>
</tbody>
</table>

**Table 5. Leaf constants of *D. falcata***

<table>
<thead>
<tr>
<th>Parameters</th>
<th><em>D. falcata</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomatal No.</td>
<td>100</td>
</tr>
<tr>
<td>Upper epidermis</td>
<td>150</td>
</tr>
<tr>
<td>Lower epidermis</td>
<td>14.5</td>
</tr>
<tr>
<td>Somatall index</td>
<td></td>
</tr>
<tr>
<td>Upper epidermis</td>
<td>13.1</td>
</tr>
<tr>
<td>Lower epidermis</td>
<td>14.5</td>
</tr>
<tr>
<td>Vein islet No.</td>
<td>2-4</td>
</tr>
<tr>
<td>Vein termination No.</td>
<td>5-6</td>
</tr>
</tbody>
</table>

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Microscopic characteristic

**Leaf**

The transverse section of leaf of *D. falcata* shows an isobilateral nature. The section is broadly divided into lamina and midrib region (Fig-1). The lamina of the leaf shows three distinct region viz, upper epidermis, lower epidermis and mesophyll. The upper epidermis is single layered with more or less rectangular cells covered by a thick cuticle.

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Powder characteristic of the leaf revealed the presence of...
inorganic composition and other impurities present along with the drug. The ash values (Table-3) of the powdered _D. falcata_ leaf and stems revealed a high concentration of sulphated ash.

The extractive values are primarily useful for the determination of exhausted or adulterated drug. The water soluble extractive (Table-4) was high in _D. falcata_. Moisture content was found to be 12.81 % w/w (leaf) and 14.55 % w/w (stem).

**Leaf constants**

The leaf constants viz. the vein islet number, vein termination number and stomatal index are presented in Table-5.

**CONCLUSION**

As there is no pharmacognostic anatomical work on record of this traditionally much valued drug, the present work was taken up with a view to lay down standards which could be useful to detect the authenticity of this medicinally useful plant. Macro and micro morphological standards discussed here can be considered as identifying parameters to substantiate and authenticate the drug.

**ACKNOWLEDGEMENT**

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**REFERENCES**


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