ABSTRACT
Bilwadipanchamoola one of the important component of Panchapanchamoola, have entered the catalog of endangered plants. Procuring the roots of such huge plants, which ultimately leads death of the whole plant, is not less than an offence. Hence in the present study pharmacognostical and physicochemical analysis was made to find out whether aerial parts can be used in place of roots with the reference of API. The pharmacognostical evaluation shows pitted vessels, Prismatic crystals, lignified fibres. The Physicochemical analysis shows the presence of alkaloids, coumarine glycosides. The result shows that both stem bark and root bark are having similar pharmacognostical and chemical properties.

Keywords: Bilwadi panchamoola, Pharmacognosy, Physicochemical.

INTRODUCTION

Thousands of formulations of Bilwadipanchamoola have been mentioned in the Ayurvedic classics. Increase in the demand and low supply is encouraging the marketing of counterfeit drugs, which may either lead to low therapeutic index or adverse effect. Hence the present study was focused to find out whether the other parts (stem & stem bark) of the same plants can be used, on the basis of pharmacognostical study.

Ayurveda is a life science, which rather depends upon the experimental evaluation than mere sightless following. That is why Acharya Charaka used the word Pareeksha [1] (examination) for explain Pramana word which is mostly adopted by all other Darshanikas. Hence in Ayurveda there is always a prospect to find new options.

Charak explains regarding Bilwadipanchamoola in the Shothahara Dashemani[2] There the useful part is not mentioned, maybe it is left to the āyukti of physician. One who is aware of samyoga & prayoga is known as Vaidya. The intelligent permutations and combinations will lead to success which is nothing but the āyukti. [3]
Ayurvedic pharmacopeia of India Advocates that stem bark can be used instead of Root bark when it is unavailable. In some Ayurvedic texts have mentioned that the properties of the main useful part is similar with other parts of the same plant.

**MATERIALS AND METHODS**

Collection of the drug

Stem bark of Bilwa, Agnimantha, Shyanaka, Patala & Gambhari were collected from the pharmacy of I.P.G.T. & R.A., Jamnagar. The obtained stem barks were shade dried and made in to coarse powder separately with the help of mechanical grinder.

**Macroscopical evaluation / organoleptic evaluation**

Various parameters of the plant materials such as size, shape, colour, odour and taste of the stem bark were observed and recorded.

**Microscopic evaluation:**

Microscopical examination of all the five plant stem bark powder was carried out with and without staining, by powder microscopy to determine the chemical nature of the cell wall along with the determination of the form and chemical nature of the cell contents. Microphotographs were taken using Carl Zeiss binocular microscope.

**Physico-chemical analysis**

In physical evaluation moisture content, ash values viz., total ash, acid insoluble ash, and extractive values viz., alcohol soluble extractive value, water soluble extractive values etc were determined as mentioned in API.

**Thin layer chromatography:**

TLC was performed as per the guidelines provided by API. Methanol extract of stem bark was used for spotting. TLC was performed using Toluene + Ethylacetate (7:3) solvent system.

**RESULTS**

1. Bilwa:

*Aegle marmelos* (Corr) (Fig.1.0) is a moderate sized tree (6-7.5mt), branches armed, leaves trifoliate, flowers greenish white, fruits globose, grey, rind woody, distributed in deciduous forests of India up to the altitude of 1200 m in Himalaya. It is having many pharmacological activities like hypoglycemic, spasmodenic, antiviral, cardiac stimulant etc.
Powder characters of stem bark:

In the powder microscopy of Bilwa stem bark Rectangular lignified cork cells, fibres with pointed and blunt ends, crystal fibres(Fig.1.1), lignified thick walled pitted stone cells in groups(Fig.1.4), starch grains with concentric line(Fig.1.2), prismatic crystals, scleroids(Fig.1.3 ) & reddish brown oleoresin content were seen..

Powder characters of root bark:[9]

Powder of root bark of Bilwa is having following microscopic characters - Gray to grayish brown, thick walled xylem fibres, crystal fibres, fragments of xylem vessels with bordered pits, starch grains simple 5 – 19 µ diameter, round to oval, numerous prismatic crystals of calcium oxalate.

2. Agnimantha: Premna mucronata Roxb, (Fig.2.0)is considered as substitute for Agnimanth.[10] It is a large shrub or small tree(9m), leaves sub-rhomboid, crenate, dentate, flowers medium sized, white or pink in small dichotomous axillary cymes forming rounded terminal panicles, drupes 8mm long, black when ripe. Distributed in drier part of India, in Subhimalayan tracks of Rohilkhand, Orissa, Chota Nagpur, Bihar etc. It is having Hypoglycemic and anthelmintic pharmacological properties.

Powder characters of stem bark:

In the powder microscopy of Agnimantha stem bark, Thick walled yellowish brown rectangular cells, cork(Fig.2.2), aseptate lignified fibres(Fig.2.1), lignified fibres(Fig.2.3) with rhomboidal crystals(Fig.2.4), acicular crystals, simple starch grains round to oval, yellowish brown content were seen.

Powder characters of root bark:[11]

Powder of root bark of is Agnimantha having following microscopic characters - Fragments or cork cells, small pointed asptate lignified fibres, simple pitted fibres, lignified cells packed with rhomboidal crystals of calcium oxalate, numerous simple, round to oval starch grains with narrow hilum measuring 6-11 µ in diameter.

3. Shyonaka: Oroxylum indicum vent.(Fig.3.0) A small to medium sized deciduous tree(12m) leaves large, bipinnate or tripinnate, flowers purple, fleshy, foetid, inlarge erect recemes, capsules flat, sword shaped, distributed throughout the greater part of India upto the altitude of 1200m including Subhimalayan tracts. It is having diuretic, spasmogenic, anti-inflammatory, antifungal pharmacological activities.
Powder characters of stem bark:

In the powder microscopy of Shyonaka stem bark Stone cells, lignified cork cells, fibres of phloem with narrow lumen(Fig.3.1), pitted vessels(Fig.3.3), pitted parenchyma(Fig.3.2), rod shaped crystals(Fig.3.4) were seen.

Powder characters of root bark:[12]

Powder of root bark of Shyonaka is having following microscopic characters - Groups stone cells, fragments of cork, phloem fibres with wide lumen and pointed tips, reticulate vessels and tracheids.

4. Patala: Stereospermum suaveolens (Roxb)DC. (Fig.4.0) Large deciduous tree (18m) and about 1.5m girth, bark grey or dark brown, with horizontal furrows, Leaves imparipinnate, flowers purplish yellow within, fragrant in large, capsules straight, cylindric, 30-60cm long, 1.7cm thick, with whitish specks, seeds pale yellowish, brown, with large membranous wings. Found throughout the greater part of India in mixed deciduous and sal forests. It is having anticancer, antiviral pharmacological activities.

Powder characters of stem bark:

In the powder microscopy of Patala stem bark Fragments of thin walled rectangular cork cells, single or groups of lignified thick walled oval to polygonal stone cells (Fig.4.3) having clear striations with wide lumen & pits, no of microsphenoidal & rod shaped crystals of calcium oxalate(Fig.4.2), fibres with small tapering & pointed ends scleroids(Fig.4.1), yellowish brown content cells(Fig.4.4), parenchyma cells with starch grains.

Powder characters of root bark:[13]

Powder of root bark of Patala is having following microscopic characters - Fragments of rectangular cork and phloem parenchyma cells, stone cells thick walled, cubical to rectangular, lignified stone cells having striation and wide lumen, a no of microsphenoidal crystals of calcium oxalate intact and scattered outside.

5. Gambhari: Gmelina arborea Roxb.(Fig.5.0) is a tall tree with young parts densely velvety tomentose, leaves opposite broadly ovate, or elliptic, cordate or subtruncate, flowers orange – yellow, brownish yellow, in dichotomously branched, velvety tomentose panicles of three flowered cymes drupes fleshy 1-1.5cm long, orange yellow or blackish
1-2 seeded. Found throughout India from foot of north-west Himalaya to Chittagang. It is having hypoglycemic and antiviral pharmacological activities.

Powder characters of stem bark:

In the powder microscopy of Gambhāri stem bark Cork, thin walled parenchymatous cells, fragment of a non lignified fibre, aseptate and septate fibre with wide lumen, stone cells with pitted lumen and straiations(Fig.5.3), Stone cells in groups(Fig.5.4), oval starch grains, cone shaped scleroid(Fig.5.2), cigar and prismatic crystals(Fig.5.1).

Powder characters of root bark:[14]

Powder of root bark of Gambhāri is having following microscopic characters - Stone cells, lignified stone cells in groups or isolated isodiametric, circular to squarish in shape. thick or thin walled with pitted lumen and striated walls, abundant starch grain simple and compound with central hilum, cone shaped scleriods, acicular and rod shaped prismatic crystals of calcium oxalate.

Analytical study:
Results of the analytical study of Bilvadi panchakandatwak churna are as follows

1. Organoleptic characters
   Colour : Pale yellow
   Odour : Woody
   Touch : Soft
   Taste : Bitter & astringent
   Appearance : Powder

2. Physicochemical constants :
   Details are depicted in Table.1

3. Phytochemical analysis :
   Results are tabulated in table.2

4. Thin Layer Chromatogrophy (TLC)
   Details are depicted in Table.3
photographs of stem bark

fig no 1.0 St. bark of Hitwara
fig no 2.0 St. bark of Agnimath
fig no 3.0 St. bark of Shvonaka
fig no 4.0 St. bark of Patala
fig no 5.0 St. bark of Gammhari
Photograph Showing the powder characteristics of Bilva and Agnimantha

1.1 Fiber with crystall
1.2 Starch simple & compound
1.3 sclerenchyma & fibre
1.4 fibre
2.1 Aseptate lignified
2.2 Cork in tangential view
2.3 Lignified Fibre
2.4 Rhomboidal Crystal
Photograph showing the Powder characteristics of Shyonak and Patala

Fig no 3.1 Lignified fibre with lumen

Fig no 3.2 Pitted Parenchyma

Fig no 3.3 Pitted Vessels

Fig no 3.4 Rod Shaped Crystals

Fig no 4.1 Fibres with tapering end & pointed end Sclerenchyma

Fig no 4.2 Rod Shaped Crystals

Fig no 4.3 Stone cells

Fig no 4.4 Yellowish brown cell content
### TABLE 1: SHOWING PHYSICOCHEMICAL CONSTANTS

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the Parameter</th>
<th>Results</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Foreign matter</td>
<td>Nil</td>
</tr>
<tr>
<td>2</td>
<td>Loss on Drying</td>
<td>0.19 % w/w</td>
</tr>
<tr>
<td>3</td>
<td>Total Ash content</td>
<td>8.8 % w/w</td>
</tr>
<tr>
<td>4</td>
<td>Acid insoluble ash</td>
<td>0.08 % w/w</td>
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<tr>
<td>5</td>
<td>Water soluble ash</td>
<td>2.43 % w/w</td>
</tr>
<tr>
<td>6</td>
<td>Alcohol soluble extractive value</td>
<td>8.32 % w/w</td>
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<tr>
<td>7</td>
<td>Water soluble extractive value</td>
<td>10 % w/w</td>
</tr>
<tr>
<td>8</td>
<td>pH Value</td>
<td>5.61</td>
</tr>
<tr>
<td>9</td>
<td>Particle size assessment</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Fraction of powder remained on 60#</td>
<td>15.92%</td>
</tr>
<tr>
<td>ii)</td>
<td>fraction of powder passed from 60#</td>
<td>33.68%</td>
</tr>
<tr>
<td>iii)</td>
<td>fraction of powder passed from 85#</td>
<td>38.27%</td>
</tr>
<tr>
<td>iv)</td>
<td>fraction of powder passed from 120#</td>
<td>10.72%</td>
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TABLE 2: SHOWING RESULTS OF PHYTOCHEMICAL ANALYSIS

<table>
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<th>Sl. No</th>
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<th>Results</th>
</tr>
</thead>
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<tr>
<td>1.</td>
<td>Alkaloids</td>
<td>+</td>
</tr>
<tr>
<td>2.</td>
<td>Tannin &amp; Phenolic compounds</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>Flavonoid</td>
<td>+</td>
</tr>
<tr>
<td>4.</td>
<td>Saponin Glycosides</td>
<td>+</td>
</tr>
<tr>
<td>5.</td>
<td>Coumarine glycosides</td>
<td>+</td>
</tr>
<tr>
<td>6.</td>
<td>Steroids</td>
<td>+</td>
</tr>
<tr>
<td>7.</td>
<td>Carbohydrates</td>
<td>+</td>
</tr>
<tr>
<td>8.</td>
<td>Anthicyanins</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>Terpinoids</td>
<td>+</td>
</tr>
<tr>
<td>10.</td>
<td>Protein</td>
<td>-</td>
</tr>
<tr>
<td>11.</td>
<td>Resin</td>
<td>-</td>
</tr>
<tr>
<td>12.</td>
<td>Amines</td>
<td>-</td>
</tr>
</tbody>
</table>

+ Present, - Absent.

TABLE 3: SHOWING THE RESULTS OF TLC STUDY OF BILWADI PANCHAKANDATWAK CHURNA

<table>
<thead>
<tr>
<th>TLC</th>
<th>254nm</th>
<th>366nm</th>
<th>After Anisaldehyde spray</th>
<th>After Wagners spray</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of spots</td>
<td>4</td>
<td>7</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Rf values</td>
<td>0.09</td>
<td>0.27</td>
<td>0.36 0.45</td>
<td>0.36 0.45</td>
</tr>
<tr>
<td></td>
<td>0.09</td>
<td>0.16</td>
<td>0.27 0.36 0.45 0.63 0.8</td>
<td>0.36 0.45 0.72 0.81</td>
</tr>
</tbody>
</table>

DISCUSSION

Microscopic evaluation of stem bark powder of Bilwa, Agimantha, Shyonaka, Patala and Gambhari revealed the similarity of characters when compared with root bark powder as per the references of API. The root and stem bark powder of Bilwa (Aegle...
marmelos Corr) show crystal fibers, pitted vessels, xylem vessels, starch grains with concentric line. The root and stem bark powder of Agimantha(Premna mucronata Roxb) show aseptate lignified fibres, lignified fibres with rhomboidal crystals, starch grains, rectangular cork cells. The root and stem bark powder of Shyonaka(Oroxylum indicum vent.) show Stone cells, lignified cork cells, fibres of phloem, pitted vessels. The root and stem bark powder Patala(Stereospermum suaveolens Roxb DC.) show Fragments of thin walled rectangular cork cells, single or groups of lignified thick walled oval to polygonal stone cells having clear striations with wide lumen & pits, no of microphenoidal & rod shaped crystals. The root and stem bark powder Gambhari(Gmelina arborea Roxb.) show stone cells with pitted lumen and striations, oval starch grains, prismatic crystals of calcium oxalate.

Physicochemical analysis shows the absence of foreign matter. It may be due to the careful collection by the pharmacy. Loss on drying was very minimal (0.19%) Hence the moisture content is very low which means least susceptibility for microbial growth. The pH was slightly acidic (5.61) the maximum powder (38.27%) passed through 85#.

All other parameters were found within normal limits as API guidelines. Qualitative analysis showed the presence of Alkaloids, Tannin & Phenolic compounds, Flavonoid, Saponin glycosides, Coumarine glycosides whereas, Amines, Resins, Proteins were absent.

**CONCLUSION**

The above discussion reveals that the powder characters of the stem bark and root bark of Bilwadipanchamoola are similar as per the API. Physicochemical analysis too shows the results within normal limits. Hence stem bark can be used instead of root bark when the later is unavailable. The study can serve as the reference for the future works on Bilwadipanchamoola.

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**REFERENCES:**


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