Morpho-anatomical studies of roots of three species of Menispermaceae

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Abstract: Different genera of Menispermaceae are being used by herbal manufacturers in formulations of the drug Patha. The important sources of Patha are roots of Cissampelos pareira Var. hirsuta, Cyclea peltata and Stephania japonica. The detailed Pharmacognostic evaluation of the roots of these three species have been carried out. The morphological characters of the dried roots were studied. The roots of the three species were anatomically studied, results presented.

Keywords: Patha, Cissampelos pareira, Cyclea peltata, Stephania japonica.

INTRODUCTION

Various genera of family Menispermaceae are commonly known as Patha in Ayurveda have been used for the treatment of fever, urinary problems and skin infections. The important plants are Cissampelos pareira Var. hirsuta Linn. (DC.), Cyclea peltata Lam and Stephania japonica Thunb. (Yoganarasimhan, 2002). All the three species are native to southern India. Cissampelos pareira Var. hirsuta is found very common in semidry forests of tropics, Cyclea peltata in Western Ghats and Deccan region where as Stephania japonica occurs in wet deciduous to semi evergreen forests of tropical temperate Asia.

Various alkaloids and different pharmacological activities of these plants were reported; bisbenzylisoquinoline alkaloids, cissamperine with tumor inhibitor activity (Kupchan, et al., 1965, 1973), tetrandrine (Rojansonthorn, et al., 1970), tropolisoquinoline alkaloids such as pareurubine A and B with antileukemic activity (Morita, et al., 1993), azafluranthe alkaloids (Morita, et al., 1993). These were isolated from roots of Cissampelos pareira Var. hirsuta. Root extracts were tested for antibacterial activity (Perez et al., 1994), antimalarial activity (Gessler et al., 1994), diuretic activity (Caceres, et al., 1987), hypoglycemic activity (Tripathi, et al., 1979) and anticonvulsant activity (Adesina, et al., 1982). A few ethnobotanical reports on treatment of fever (Singh, et al., 1994), gastrointestinal tract disorders (Caceres, et al., 1990) were investigated. General Pharmacognostical study of Cissampelos pareira Var. hirsuta was carried out by Prasad, et al., (1962; Bapulal, 1982, Morita, 1993).

Five bisbenzylisoquinoline alkaloids, cycleapeltine, cycleadrine, cycleaurine, cycleanorine, and cyclebornine chloride, were isolated from Cyclea peltata (Kupchan, et al., 1973). Antiplasmodial and cytotoxic activities of bisbenzylisoquinoline alkaloids (Angerhofer, et al., 1999) and antilithic activity (Christina, et al., 2002) were reported. (Anonymous, 1951).

Various pharmacologically important alkaloids were reported from roots of Stephania japonica, such as tertiary phenolic biscochlorine type alkaloid stepheline (Tomita, et al., 1963), hasubananine (Watanabe, 1963), and water soluble quaternary base Cyclanoline (Tomita, et al., 1964). The root extract was tested for its multidrug resistance modulator effect (Hall, et al., 1997).

Since no anatomical details are available to distinguish the roots of the three species, this work was undertaken to establish the morphoanatomical characters of the roots.

MATERIALS AND METHODS

Plant Material: Roots of Cissampelos pareira Var. hirsuta were collected from dry deciduous forests of Chamundi hills, Mysore. Cyclea peltata and Stephania japonica roots were collected from evergreen forests of Madikere and herbarium specimens were deposited in Department of Botany (voucher specimen no. KKH-001/2006, KKH-002/2006 and KKH-003/2006 respectively), University of Mysore herbarium. Both fresh and formalin fixed roots were used for the studies.

Transverse section of the roots measuring approximately 10 µm were prepared and stained with Safranin O and Fast green FCF. The roots were macerated by conventional Jeffery's method (Johnson, 1940), for the description of detailed anatomical characters of root tissues. Fine powder of dried roots was suspended in lactophenol with a few drops of Iodine solution for observation of
starch and calcium oxalate crystals.

OBSERVATION AND RESULTS

Morphological Characters: Roots of Cissampelos pareira Var. hirsuta (Fig. 1b) are 6 to 12 cm long, narrow, cylindrical to fusiform, more or less tortuose, and slightly hard and woody. The outer bark is brownish to dark grey and central woody region is light yellow in colour, with comparatively thick cork. The surface shows minute pits and long wavy vertical branched fissures or cracks. Dried root powder is light gray with faint odor and bitter taste.

The primary roots of Cylca peltata (Fig. 2b) are 10 to 75 cm long cylindrical, unbranched and uniformly thick. The outer skin is smooth and thin with gray or light brown color and older roots show vertical cracks. Dried root powder is dark gray to brown in color with characteristic odor and very bitter taste.

The roots of Stephania japonica (Fig. 3b) are branched, fairly long up to 3 meters long. Secondary roots are formed at regular intervals. Roots are of even thickness from 0.3 cms. to 0.5 cms. Dried roots have characteristic vertical grooves throughout the length. Dried root powder is dark gray with characteristic odor and bitter taste.

Anatomical Characters: Transverse sections and macerate of roots of all the three species were studied, and compared giving more importance to the distinguishing characters. The details of the study have been given in Table No. 1 and 2.

RESULTS AND DISCUSSION

Roots of Cissampelos pareira Var. hirsuta, Cylca peltata and Stephania japonica of Menispermaceae are sold in the herbal market under the name Patha. Though these three plants belong to same family, they can be taxonomically distinguished based on the floral arrangements, but in herbal market where dried roots are sold it becomes difficult to distinguish them. Hence diagnostic characters are evolved based on morphological and anatomical characters of the drug (roots).

Cissampelos pareira Var. hirsuta can be identified by nature of vascular strips, here number of vascular strips is more compared to other two species and vascular bundles are smaller.

The major distinguishing character of Cylca peltata is its wedge shaped vascular strips which are quite different from Cissampelos pareira Var. hirsuta and

Stephania japonica.

Stephania japonica can be easily identified by the presence of patches of stone cells in the cortex, which is absent in other two species. Here vascular strips do not meet at the centre, where as in other two species some of the major vascular bundles meet at the centre.

These data are required for the identification procedure to meet the quality control standards demanded by health legislation. Even though some sophisticated chemical or molecular methods are available for identification of the proper plant material, such methods are very costly. Morphological and anatomical identification is simplest among the qualitative methods. Hence it becomes a useful tool to determine characteristics of the plant material to avoid falsification and adulteration of the drug sold in the market.

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REFERENCES


Anonymous. 1951. Pharmacognosy of Ayurvedic drugs of Travancore-Cochin, Series I, Central research institute, Trivendrum.

Bupalal Vaidya. 1982. Some controversial drugs in Indian medicine, Chukhamba, Orientalia publication, Delhi.


**FIGURES**

Fig. 1
a: Field photograph of *Cissampelos pareira Var. hirsuta*.

b: Dried root of *Cissampelos pareira Var. hirsuta*.

c: Herbarium sheet.

Fig. 2
a: Field photograph of *Cyclea peltata*.

b: Dried root of *Cyclea peltata*.

c: Herbarium sheet.

Fig. 3
a: Field photograph of *Stephania japonica*.

b: Dried root of *Stephania japonica*.

c: Herbarium sheet.

Fig. 4
a: Cortex and vascular region.

b: Pith region.

c: Tracheids of root of *Cissampelos pareira Var. hirsuta*.

e: Xylem vessel.

Fig. 5
a: Transverse section of root of *Cyclea peltata*.

b: Cortex and vascular region.

c: Pith region.

d: Tracheids of root of *Cyclea peltata*.

e: Xylem vessel.

Fig. 6
a: Transverse section of root of *Stephania japonica*.

b: Vascular region.

c: Cortex region with patches of stone cells.

d: Tracheids and vessels of root of *Stephania japonica*.
Table No. 1: Anatomical details of the roots of three species.

<table>
<thead>
<tr>
<th>Characters</th>
<th>Cissampelos pareira</th>
<th>Cyclea peltata</th>
<th>Stephania japonica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortical region</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td>133-200 μm</td>
<td>200-250 μm</td>
<td>400-600 μm</td>
</tr>
<tr>
<td>Cork</td>
<td>Paranchymatous</td>
<td>Paranchymatous</td>
<td>Paranchymatous</td>
</tr>
<tr>
<td></td>
<td>5-6 layered</td>
<td>6-8 layered</td>
<td>10-12 layered</td>
</tr>
<tr>
<td>Cork cambium</td>
<td>Single layered</td>
<td>Indistinct</td>
<td>Indistinct</td>
</tr>
<tr>
<td>Stone Cells</td>
<td>Absent</td>
<td>Absent</td>
<td>Numerous</td>
</tr>
<tr>
<td>Stellar region</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vascular bundles</td>
<td>Radiating, 7-8 in</td>
<td>Wedge shaped, 6-8 in</td>
<td>Uniform, 6-8 in</td>
</tr>
<tr>
<td></td>
<td>number, larger ones</td>
<td>number, most of them</td>
<td>number, none of them</td>
</tr>
<tr>
<td></td>
<td>meet at the center.</td>
<td>meet at the center.</td>
<td>meet at the center.</td>
</tr>
<tr>
<td>Phloem</td>
<td>Present at the</td>
<td>Semicircular mass at the peripheral ends of</td>
<td>Semicircular mass at</td>
</tr>
<tr>
<td></td>
<td>peripheral region of the vascular bundle.</td>
<td>vascular bundle.</td>
<td>the peripheral ends of</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>vascular bundle.</td>
</tr>
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</table>

Table No.2: Details of macerated tissues of three species

<table>
<thead>
<tr>
<th>Macerated tissue</th>
<th>Cissampelos pareira</th>
<th>Cyclea peltata</th>
<th>Stephania japonica</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length (μm)</td>
<td>Breadth (μm)</td>
<td>Nature</td>
</tr>
<tr>
<td>Fibers</td>
<td>228-740</td>
<td>10-22</td>
<td>Long with narrow lumen</td>
</tr>
<tr>
<td>Tracheids</td>
<td>239-610</td>
<td>16-22</td>
<td>Broader lumen with bordered pits</td>
</tr>
<tr>
<td>Vessels</td>
<td>120-414</td>
<td>20-65</td>
<td>Cylindrical</td>
</tr>
</tbody>
</table>
Fig. 6