ORIGINAL RESEARCH ARTICLE
PHYTO-PHARMACOGNOSTICAL STUDY OF MUNDI (SPHAERANTHUS INDICUS LINN.)

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Abstract:
Mundi (Sphaeranthus indicus Linn.) is a popularly used drug in the texts of Ayurveda. Whole plant is used in therapeutic conditions like krimi, apachi, yoniroga etc. Hence phyto-pharmacognostic standardization forms the base to start any research. Aims and objectives: Present study was aimed to record macro-microscopic and phytochemical study of Mundi (Sphaeranthus indicus Linn.)Methods: Authentified, matured, fresh plants were collected and both macro-microscopic characters were documented. Chemical study included physico-chemical screening, preliminary phytochemical test and HPTLC. Results: Pharmacognostic study of leaf showed anisocytic and anomocytic stomata on upper and lower surface respectively and stem part showed unicellular, multicellular, glandular, eglandular types of trichomes. Physicochemical standards and presence of protein, flavanoids, triterpenoid compounds as secondary metabolites, serve as qualitative data related to this drug. Conclusion: The results obtained will prove as standard reference for identification and distinguish it from any admixture.

Keywords: Mundi, Sphaeranthus indicus, phyto-pharmacognostic, vein-islet number HPTLC

Introduction:
Sphaeranthus indicus Linn. (Asteraceae), known as Mundi is a prostrate or procumbent, tomentose or villous annual herb growing in drying moist ground ascending up to 5,000 feet on Himalaya. It is 30-45 cm tall with winged stem. Heads are terminal and 0.6-2 x 0.5 – 1.5 cm in size and globose or ovoid in shape. Achenes are nearly 1 mm long, oblong, obconical, angled, subcompressed and almost glabrous1 (Fig. 1). Though, it is not classified under Charaka Dashemani2, Sushruta and Vagbhata considered it under surasaadi gana3. It has been identified with some specific synonyms like alambusha, kadmbapushpi, bhukadamba, kulahala4 to describe the head inflorescence of this plant. The whole plant is used as tonic, deobstruent, alterative and aphrodisiac while flowers are specifically suggested to use as alterative, cooling agent and tonic5. The aerial parts have shown number of phytoconstituents as essential
oils, glycosides, eudesmanolides, sesquiterpenes, phenolic glycosides, sesquiterpene lactones, flavonoid n-pentacosan, stigmasterol, β-sitosterol, hentriacontane, β-D-glucoside of hentriacontane, n-triacontanol, sphaeranthine etc. Steam distillation of fresh flowering herb yields an essential oil containing methyl chavicol, α-ionone, d-cadinene, p-methoxycinnamaldehyde as major constituents. In Ayurveda, it has been advised specially in problems of krimi, apachi, galaganda, guhyaroga, yoni vyapath etc. It is used as an ingredient of some important Ayurvedic formulations like shwadamshtradi ghrita, chandanaadi taila, amritaadi taila, parushaka ghirta, tritiyasarpī guda etc. Materials and methods:

Collection of the sample

Fresh, matured plants of Sphaeranthus indicus Linn. were collected in the month of January from their natural habitat. The collected samples were identified and authenticated with the help of different floras and databases. The plants were cleaned under running water to remove adherent soil and dirt. Herbarium specimen was prepared (Herbarium No. 74066) and was stored in Pharmacognosy department of the Institute for future reference. For the histological profile the plant was preserved in a solution of FAA (70% ethyl alcohol, Glacial acetic acid, and Formalin in the ratio of 90:5:5. For physico-chemical study rest of the sample was shade dried and coarsely powdered (60 mesh) and preserved in an airtight container.

Pharmacognostic evaluation:

Pharmacognostic evaluation was carried-out by following available standard guidelines. 

Macroscopic evaluation

The texture, colour, odour and taste of the samples were recorded.

Microscopic evaluation

Free-hand sections were taken, stained with phloroglucinol followed by HCl and iodine respectively to test the lignification of cell wall and to check the starch grains. The surface preparation of leaves was done by scraping method whereas the quantitative microscopy was done as per available standard guidelines.

Physicochemical evaluation

Whole plant powder was analyzed for parameters such as loss on drying, ash value, acid insoluble ash, water and methanol soluble extracts. Preliminary phytochemical screening

Both aqueous and methanolic extract of the sample was tested to detect the presence of secondary metabolites like protein, carbohydrate, tannin, saponin, flavonoids, phenols, alkaloids and triterpenoids as per the guidelines mentioned under API. 

High performance thin layer chromatography

Methanolic extract of the sample was taken for this study. The solvent system used for HPTLC was Toluene: Ethylacetate: Diethyl amine: Methanol: Chloroform:: 10:6:2:2:1.

Results

Macroscopic characters: Stem pieces were flattened with toothed wings and longitudinal wrinkles. They were externally brownish green and internally grey in colour. The fracture was fibrous fracture with bitter taste. Leaves were glandular pubescent, 1.2 – 10 x 0.7 – 3.5 cm in size and elliptic-oblong or ovate-oblong in shape with dentate or serrate margin. They were slightly aromatic in odour with bitter taste. (Figure: 1)

Microscopic characters:

Stem: The outline of transverse section exposed enveloping of both glandular and eglandular type of trichomes at places and a central region occupied by pith. It exhibited a layer of epidermis composed of rectangular cells followed by a layer of hypodermis comprised of comparatively larger cells. Below this, comparatively larger parenchymatous cells of...
cortex traversed with air sac. The Vascular bundles were capped with discontinued sclerenchymatous fibers. Collateral type of vascular bundle was present. Phloem elements were followed by xylem elements from periphery to centre. Each bundle was separated by 3-8 celled wide medullary rays. Starch grains were distributed over the parenchyma cells of cortex and pith. (Figure: 2)

Leaf: The outline of the section exhibited dorsiventral nature of leaf with glandular as well as non-glandular trichomes. It revealed that trichomes were uniseriate, multicellular and thick walled. In midrib region, both upper and lower epidermis was followed by a layer of hypodermis and few layers of chlorenchyma cells. Chlorenchyma cells were more prominent towards the lamina portion. Vascular bundle was found in between the ground tissue. In lamina portion, upper epidermis was followed by 1-2-layered palisade parenchyma cells, continued to spongy parenchyma and lower epidermis. Both glandular and eglandular trichomes were present on upper and lower epidermis. Trichomes found were uniseriate, unicellular to multicellular in nature. Starch grains and prism of calcium oxalate crystals were scattered in ground tissue portion. (Figure: 3)

Surface preparation exposed the anisocytic type of stomata on upper surface while anomocytic type of stomata on lower surface. The quantity of stomata was more on lower surface. Traces of glandular trichomes were also seen with surface preparation. The details of stomatal number and stomatal index of both surfaces and vein-islet number are given with table no. 1.

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**Figure No. 1: Macroscopic appearance**

![Twig with Inflorescence](image1.jpg) ![Showing Shape and Size](image2.jpg)
Figure: 2. Stem Microscopy

Outline of TS of Stem

Epidermis, Hypodermis and Cortex
Multicellular Uniseriate Trichome
Air sac in Cortex
Sclerenchyma
Phloem elements
Xylem elements
Parenchyma cell of Pith
Figure: 3. Leaf Microscopy
Table Number: 1. Stomatal index of a leaf
Mean ± Standard Deviation
Stomatal Number (Upper Surface) 19.28 ± 2.28
Stomatal Number (Lower Surface) 51.28 ± 3.90
Stomatal Index (Upper Surface) 24.85 ± 2.47
Stomatal Index (Lower Surface) 30.00 ± 1.41
Vein-islet Number 23.00 ± 2.00

Physicochemical Parameters: The result obtained after physico-chemical parameters are shown in table number: 2. The presence or absence of primary and secondary metabolites exposed is given with table number: 3. The HPTLC plate under various wavelengths observed are shown in figure number:4 and the Rf values revealed from HPTLC are shown in table number: 4.

Table No. 2; Physico-chemical constants of the drug.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss on drying (% w/w)</td>
<td>6.5</td>
</tr>
<tr>
<td>Ash value (% w/w)</td>
<td>12</td>
</tr>
<tr>
<td>Acid insoluble ash (% w/w)</td>
<td>3.2</td>
</tr>
<tr>
<td>Methanolic soluble extractive (% w/w)</td>
<td>3.5</td>
</tr>
<tr>
<td>Water soluble extractive (% w/w)</td>
<td>5</td>
</tr>
</tbody>
</table>

Table No. 3; Preliminary qualitative analysis of the plant extract

<table>
<thead>
<tr>
<th>Secondary metabolites</th>
<th>Aqueous extract</th>
<th>Methanolic Extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tanin</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Saponin</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Flavanoids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Phenols</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Triterpenoids</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table No. 4; Showing Rf value

<table>
<thead>
<tr>
<th>S.No.</th>
<th>UV 254 nm</th>
<th>UV 366 nm</th>
<th>White light</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Color</td>
<td>Rf</td>
<td>Color</td>
</tr>
<tr>
<td>1.</td>
<td>Green</td>
<td>0.84</td>
<td>Blue</td>
</tr>
<tr>
<td>2.</td>
<td>Pale green</td>
<td>0.90</td>
<td>Pink</td>
</tr>
<tr>
<td>3.</td>
<td>-</td>
<td>-</td>
<td>Pink</td>
</tr>
</tbody>
</table>

Rf- Retention factor
Discussion: Mundi (*Sphaeranthus indicus* Linn.) is a popularly known weed available in fields. The drug is known since the time of Charaka and Sushruta having wide therapeutic utility. Aerial parts of the plants are used mainly in medicinal preparations. It is very important that a system of standardization must be established for every plant medicine in the market to assure its quality and prevent spurious market adulteration. Morphological authentication is not sufficient to ensure the quantitative consistency of bioactive compound responsible for the therapeutic effects.

Pharmacognostical evaluation of Mundi (*Sphaeranthus indicus* Linn.) along with physico-chemical value, qualitative tests and HPTLC provided specific parameters that would be useful in identification and authentification of the drug with genuine status.

Macroscopic characters revealed the characteristic feature of stem pieces which were flattened with toothed wings and longitudinal wrinkles. Presence of hairs and aromatic odour are useful in identification of the plant macroscopically. Collateral vascular bundle and presence of glandular and eglandular trichomes are specific findings of the stem microscopy. Whereas distribution of anisocytic and anomocytic stomata on upper and lower surface of a leaf respectively are specific features in its identification.

The physico-chemical parameters help in judging the purity and quality of the drug. The drug powder was evaluated for its physicochemical parameters like loss on drying, total ash, acid insoluble ash and different extractive values. Loss on drying indicates the presence of moisture content of the drug which was found to be 6.5%. The total ash is particularly important in the evaluation of purity of drugs, the presence or absence of foreign inorganic matter such as salts or silica and it was 12%. Presence of secondary metabolites like flavanoids, triterpenoids, proteins further help in identifying its chemical constitution at that particular maturity and time of collection. HPTLC findings indicate quantitative estimation of these chemical constituents.

Screening of separate parts for phytochemical parameters can be done. A detailed screening of new compounds exposed from future research with their pharmacokinetics would certainly aid to pharmaceutical and medical science.
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