Abstract

The trade name ‘Chirata’ refers to both Swertia chirayita (Roxb. ex Flem.) Karsten. (Gentianaceae) and Andrographis paniculata (Burm.f) Nees (Acanthaceae). This ambiguous trade name gives room for fraudulent activities. The plant Swertia chirayita has already been studied by many authors. However, the basic vascular structures of stem have been misinterpreted in Pharmacognosy books and also in the Indian Herbal Pharmacopoeia. In the present investigation, exomorphic and endomorphic features of Swertia chirayita have been critically studied and the correct usage of the scientific terms and distinguishing structural features have also been highlighted, which would be useful in identification and authentication of this plant.

Key words: Swertia chirayita, chirata, exomorphic, endomorphic, identification, authentication

Introduction

The genus Swertia belongs to the family Gentianaceae, which comprises of about 250 species throughout the world and about 32 species occur in India, including Swertia chirayita (Roxb. ex Flem.) Karsten. In early days, the European practitioners in British India had appreciated the value of Chirata. Later on, this plant was recognised in the British and United States Pharmacopoeiae. This plant species is ranked ‘Endangered’ among threatened plants of India. The whole plant is used in Folk, Ayurveda, Siddha, Unani, Homoeopathy and in Modern medicine. It is credited with tonic, febrifuge, alterative, carminative, expectorant, laxative, stomachic, anthelmintic and anti-diarrhoeal properties. It is employed in drug formulations prescribed for the treatment of toxic fever, malarial fever, urinary disorders, bronchial asthma, bilious affections, burning of the body, constipation, diarrhoea, dyspepsia, flatulence and skin diseases.

The market sample of this raw drug is generally mixed with other species of Swertia, of which Swertia angustifolia Buch.-Ham ex D. Don and Swertia alata Royle are most common. The whole herb of Andrographis paniculata (Burm.f) Nees (Acanthaceae) is often sold in the name of Chirayita. Andrographis paniculata is often substituted for or confused with Swertia chirayita.

Materials and Methods

Proper identification and authentication of plants, particularly medicinal plants at species level is a most important prerequisite, as they are predominantly used in the manufacturing of life saving medicines. Medicinal plants and their plant parts can be identified primarily using Exomorphic (external or macro-morphological) features such as size, shape, surface features (external markings) etc. In addition to the exomorphic features, organoleptic characters are also equally valued in the identification of drug plants/plant parts. In the present study, the exomorphic or macroscopic features of Swertia chirayita was studied initially. Later on, the organoleptic characters (sensory characters) were noted down and are furnished in a tabular form (Table-1).

Taxonomists often value endomorphic (anatomical and histological) features for solving taxonomic problems. Anatomical characters are of great value in establishing
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Published work. Therefore, in the present study, all the above-mentioned parameters have been worked out with a view to bring out a comprehensive structural data on this drug plant, which can be used to distinguish this genuine drug plant from its allied species in its crude form.

EXOMORPHIC FEATURES AND ORGANOLEPTIC CHARACTERS

The data available on the macroscopic features and organoleptic characters of the whole plant of *S. chirayita* were collected and reviewed. They are furnished in a tabular form along with the personal observations (Table–1; Plate–1, figure D).

ENDOMORPHIC FEATURES

In cross sectional view, the whole plant (root, stem and petiole) of *S. chirayita* shows following structural features.

<table>
<thead>
<tr>
<th>Exomorphic features</th>
<th>Organoleptic characters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Occurrence</strong></td>
<td>The dried raw drug sold in the market consists of bundles of long, more often leafless stems topped with flowering or fruiting branches, with a short tapering root.</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>Root: 5–10 cm long, up to 1.25 cm in diameter; Stem: 60–125 cm long, about 6 mm in diameter; Leaves: 3.5–10.0 x 1.5–4.0 cm.</td>
</tr>
<tr>
<td><strong>Shape</strong></td>
<td>Root – oblique, twisted and gradually tapering; Stem – cylindrical/sub-cylindrical at base and 4-angled upwards; Leaves – opposite decussate, broadly ovate or lanceolate, glabrous, obtuse or cordate at base, acuminate at apex, margin entire, usually with 3–7 prominent lateral veins.</td>
</tr>
<tr>
<td><strong>Surface</strong></td>
<td>Root: bears few rootlets or their remnants, which are pointed and hard; Stem: smooth; Leaves: glabrous.</td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>External surface of root: light brown; Stem: rusty brown or purplish brown at base, greenish yellow or dark green in the upper region; Leaves: fresh dark green; dried leaves upper surface reddish brown, lower surface pale greenish brown.</td>
</tr>
<tr>
<td><strong>Internal surface of root</strong>: Yellowish grey or brownish with a hollow or spongy centre; Stem: grey or grayish white with a central pith; Leaves: grayish brown.</td>
<td></td>
</tr>
<tr>
<td><strong>Odour</strong></td>
<td>The drug is odourless.</td>
</tr>
<tr>
<td><strong>Taste</strong></td>
<td>All parts of the plant (from root to tip) are very bitter.</td>
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<tr>
<td><strong>Fracture</strong></td>
<td>Root: short, complete and splintery; Stem: short, incomplete, breaks with a tick sound; Leaves: short, complete, breaks with tick sound.</td>
</tr>
<tr>
<td><strong>Texture</strong></td>
<td>Root: uneven due to irregularly broken surface and rough; Stem: uneven and rough; Leaves: smooth.</td>
</tr>
<tr>
<td><strong>Peculiarities, if any.</strong></td>
<td>The stem forms the major portion of the drug. It has smooth outer surface with shining rusty brown or purplish green colour, a large continuous pith and intensely bitter taste.</td>
</tr>
</tbody>
</table>
spherical papillae. The outer part of the cortex consists of polyhedral collenchyma cells with wide air chambers. The inner part of the cortex consists of radially aligned rectangular cells. The vascular cylinder is thick and hollow. Outer phloem is fairly wide and occurs in continuous cylinder of uneven thickness. The secondary xylem elements occur in short, radial parallel lines. Primary xylem cylinder is less prominently seen. Under polarized light, an irregularly shaped discontinuous cylinder of pith fibres is seen. Pith is wide, homogeneous and parenchymatous. At certain places, the pith region is hollow due to disintegration of cells.

Matured stem is 4.25–4.5 mm in diameter. There is a distinct layer of epidermis followed by heterogeneous cortex. The outer cortex has collenchymas cells with wide, rectangular air chambers; the inner cortex is narrow, comprising of 4 or 5 layers of parenchyma cells with wide rectangular air chambers. Inner to the cortex, there is a thin and continuous

Stem: The young stem has thin epidermal layer followed by a wide heterogeneous cortex. In some of the epidermal cells, the outer tangential walls developed into prominent and phloem rays. There is no clear demarcation in the transition zone of the cortex into phloem.

Secondary xylem is centrally located, solid and wide. The central core consists of narrow mass of irregularly lobed xylem tissue. Outside the central core of xylem tissue occurs wide parenchymatous tissue, in which small nests of xylem elements are scattered. Enclosing the parenchymatous tissue with scattered xylem masses and central core lobed xylem strand occurs fairly thick, closed cylinder of xylem cylinder. Within this cylinder, the xylem elements occur in small clusters or in radial multiples and sometimes they are solitary. Xylem includes fairly wide vessels and thick walled lignified fibres. The vessel elements are abundant, especially in the peripheral zone. The vessels are 35–42.5 µm in diameter (Plate-2).
zone of secondary phloem (outer phloem or external phloem) with radial files of phloem elements.

It exhibits initial stage of secondary growth. Secondary xylem cylinder is thick and continuous. It has angular, wide, thick walled vessels which are either in clusters or in short radial multiples. The diameter of the vessels ranges from 20 to 40 µm. The primary xylem occurs along the inner circumference of the secondary xylem cylinder comprising less distinct short radial rows of xylem elements. Inner to the primary xylem cylinder, occurs a wide cylinder of inner phloem or medullary phloem with uneven thickness. The inner phloem is divided into thick masses by short partition segments of thick walled cells. These partition segments are radial extensions of thick walled pith cells. These thick walled cells are fibres since they have lignified walls with wide lumen; the lignification is confirmed by examining the cells under polarized light. Major portion of the pith is homogenous and parenchymatous. The pith cells are angular, thin walled and compact (Plate - 3).

Petiole: In cross sectional view, the decurrent petiole (winged petiole) is broadly V-shaped with wide adaxial concavity and three wide prominent abaxial ridges. The midrib/median ridge is 1075–1750 µm horizontally and 1000–1725 µm vertically. The midrib comprises of thin epidermal layer with small, semicircular, thin walled cells. The ground tissue is parenchymatous and homogeneous; the cells are angular, thin walled and compact. The vascular system is multistranded. A wide, arc or bowl shaped median vascular strand and three slightly smaller arc shaped lateral vascular strands either side of the petiole and a smallest, less prominent marginal vascular strand on either side of the petiole are seen. The vascular strands are bicolateral;
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Swertia chirayita has been described as Amphiphloic siphonoste; this term is misnomer for two reasons. The vascular cylinder of matured stem is not a stele according to the original definition of stele. Second, the two phloem zones are to be referred to as outer normal secondary phloem and inner medullary or intraxylary phloem.

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Plate 4. Transverse section of Petiole of *Swertia chirayita*.
*A* - petiole in cross sectional view seen under polarised light,
*B* - central portion of the petiole showing median vascular tissue and ground tissue - a close up view.

REFERENCES