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## Pharmacognostical and phytochemical evaluation of an important medicinal plant *Oldenlandia umbellata* L.

**Reddy BM**DOI: <https://doi.org/10.22271/phyto.2021.v10.i6d.14302>**Abstract**

The plant *Oldenlandia umbellata* L. (= *Hedyotis umbellata* (L.) Lam.) of the family Rubiaceae is an important medicinal plant with antibacterial, anti-inflammatory, antipyretic, hepatoprotective, and antioxidant properties. Proper identification of the plant and standardization of its crude herbal powder is very essential to use it as a medicine, but the *O. umbellata* is morphologically identical with different herbaceous taxa of *Oldenlandia* and *Hedyotis*. Such similarity creates confusion while collection as well as using the herb in any formulation. The present investigation provides scientific information about microscopic and macroscopic characters of stem and leaf of the *O. umbellata*, which is useful to identify the crude drug of the plant with precision. The present work also reveals different chemical constituents present in the stem and leaf of the plant. Chromo-fingerprints of stem and leaf are useful to standardize the crude drug of the plant and in determining the purity of the sample with more accuracy.

**Keywords:** Pharmacognosy, Phytochemistry, Chromo-fingerprints, Medicinal plant, Rubiaceae

**Introduction**

*Oldenlandia umbellata* L. (= *Hedyotis umbellata* (L.) Lam.) is an important medicinal plant commonly known as the Indian madder plant or Chay root plant. It belongs to the family Rubiaceae and is distributed in South India, Eastern India, and certain parts of Maharashtra. Medicinally it is a very important plant used for Asthma, Bronchitis, and other respiratory problems. The leaves are used as expectorant and febrifuge <sup>[1]</sup>. A decoction of leaves is used as a wash for poisonous bites <sup>[2]</sup>. The root bark is the source of a dye, used to impart a red color to calico, wool, and silk fabrics <sup>[3]</sup>.

The plant is commonly used in the Siddha medicine system. Various scientific studies have proved that the plant has antibacterial <sup>[2]</sup>, anti-inflammatory <sup>[4]</sup>, antipyretic <sup>[5]</sup>, hepatoprotective and antioxidant <sup>[6]</sup> (Malaya *et al.*) properties.

There are more than 500 species of *Oldenlandia* and *Hedyotis*. Among them, the herbaceous taxa appear similar and their taxonomy is quite confusing. Proper identification of the species is of prime importance to use it as a medicinal herb. Morphological, Anatomical, Pharmacognostical, and certain phytochemical characterization is very useful to recognize the right plant and standardize the crude herbal drug.

Hence present investigation has been carried out to study the Pharmacognosy and Phytochemistry of *Oldenlandia umbellata* L.

**Materials and Methods**

**Plant material:** The plant has been collected from Chunala village of Chandrapur district, Maharashtra state, India, and properly identified with the help of floras. The plant is very sturdy and found in gravels along the railway track.

**Pharmacognostical studies**

Morphological studies including size, shape, apex, margin, surface, color, and important microscopic characters like epidermal cell number, stomatal index, was carried out by using standard procedures <sup>[7]</sup>. Transverse sections of the stem and root taken by razor were dehydrated, double-stained, and observed under the microscope <sup>[8]</sup>.

**Phytochemical investigation**

Aerial parts, stem and leaf of the plant were cut, shade dried, coarsely powdered, and extracted with different organic solvents by Soxhlet apparatus.

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Phytochemical investigations were carried out by using standard biochemical protocols. Chromo-fingerprints were developed for proper and exact identification of material [9].

## Results

### Morphological observations

*Oldenlandia umbellata* L. is a perennial herb with persistent underground rootstock (Fig. 1). Branches are erect or diffuse, 10-20cm long, much branched from the base. The stem is narrow filiform light green and covered with unicellular trichomes. Leaves are sessile, opposite decussate or ternate, linear lanceolate with a single vein in the center. Both surfaces are light green and glaucous, margins are recurved and the apex is acute with a terminal spiny bristle. Stipules are interpetiolar, with many triangular based bristles. Flowers are produced in upper axial and terminal cymes having filiform peduncle. Flowers are white, minute 4mm long. Flowers show dimorphic heterostylism, i.e., two types of flowers produce on separate plants. Commonly called as "Thrum", with a short style and long anthers, and "Pin", with long style and short anthers. Capsules are 0.3cm across, hemispheric, smooth, shining, and crowned by erect calyx lobes.



Fig 1: External appearance

### Anatomical observations

Stem is Circular in outline, the epidermis is single layered followed by radially elongated hypodermis. No secondary cortex, but hypodermis seems to be adding new cells to the cortex (Fig. 2). Cortex is 6-10 layered made up of oval shaped parenchymatous cells, followed by secondary phloem and then secondary xylem. In the center, there is large parenchymatous pith. Few cells were found filled with tannins but no calcium oxalate crystals were observed.

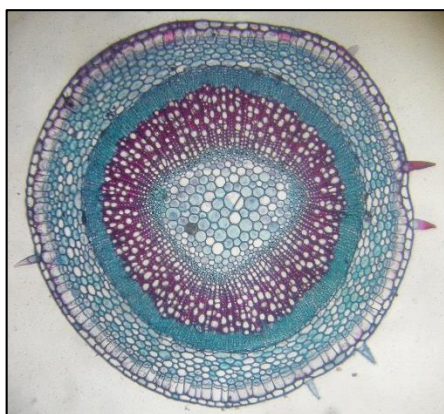


Fig 2: T.S. of Stem

Leaf looks like grass leaf (Fig. 3), the midrib is slightly elevated on the lower surface. The upper epidermis is very large and highly cuticularized. In the vascular region, the upper epidermis is followed either by a palisade layer or

directly by two layers of collenchyma, each of 4-5 cells thick. The lower portion of the leaf is made up of parenchyma. The vascular bundle is very small, conjoint collateral.



Fig 3: T. S. of Leaf

### Pharmacognostical characters

Upper epidermal Cells are very large and rhomboidal with regular arrangement (Fig. 4), whereas Cells of the lower epidermis are irregular in shape, fairly large but smaller than the upper epidermis (Fig. 5). Stomata are paracytic type and present on the lower epidermis only. Other important characters like cell dimension, stomata dimension, and stomatal index have been recorded with the help of a microscope and measuring software (Table 1).

Table 1: Micro and Macroscopic characters

Properties	Upper surface	Lower surface
Shape of epidermal cells	Rhomboidal	Irregular
Size of epidermal cells	$2.1 \times 10^3 - 7.7 \times 10^3 \mu^2$	$0.4 \times 10^3 - 2.3 \times 10^3 \mu^2$
Total number of cells/Sq mm	250	400
Stomatal complex length	Absent	30 – 44 $\mu$
Stomatal index	Absent	25

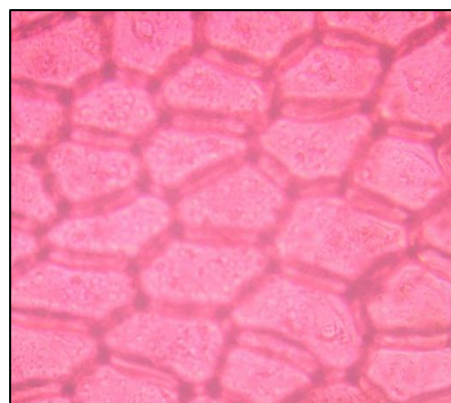


Fig 4: Upper epidermis

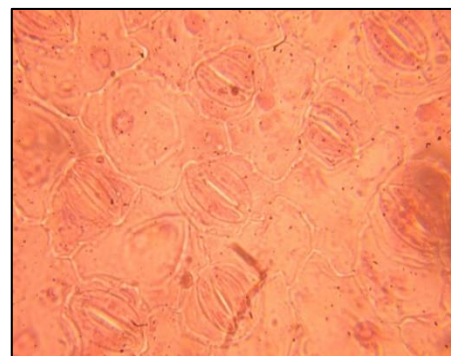


Fig 5: Lower epidermis

### Phytochemical characters

The shade dried powders of stem and leaf were extracted with different organic solvents by the Soxhlet method. The extracts were found to contain different phytoconstituents like

Flavonoids, Triterpenoids, Steroids, Alkaloids, Carotenoids, Fatty acids, Tannins, and Glycosides, etc. (Table 2). Chromo-

fingerprint specific color pattern) of stem (Fig. 6) and leaf (Fig. 7) are unique and useful.

Table 2: Phyto chemical tests

Solvent Compound	Petroleum ether		Acetone		Alcohol		Water	
	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf
Flavonoids	P	P	P	A	P	P	P	P
Triterpenoids	A	A	A	A	P	A	P	A
Steroids	A	P	A	P	A	P	—	—
Alkaloids	P	P	A	A	P	P	P	P
Carotenoids	P	P	—	—	—	—	—	—
Fatty acids	P	P	—	—	—	—	—	—
Emodins	A	A	—	—	—	—	—	—
Tanins	—	—	—	—	A	P	P	P
Anthracene glycosides	—	—	—	—	A	A	—	—
Glycosides	—	—	—	—	—	—	P	P
Saponins	—	—	—	—	—	—	P	P
Polyuronoids	—	—	—	—	—	—	A	P
Gum and Mucilage	—	—	—	—	—	—	P	P
Phlobatanins	—	—	—	—	—	—	A	A
Chlorogenic acid	—	—	—	—	—	—	P	P

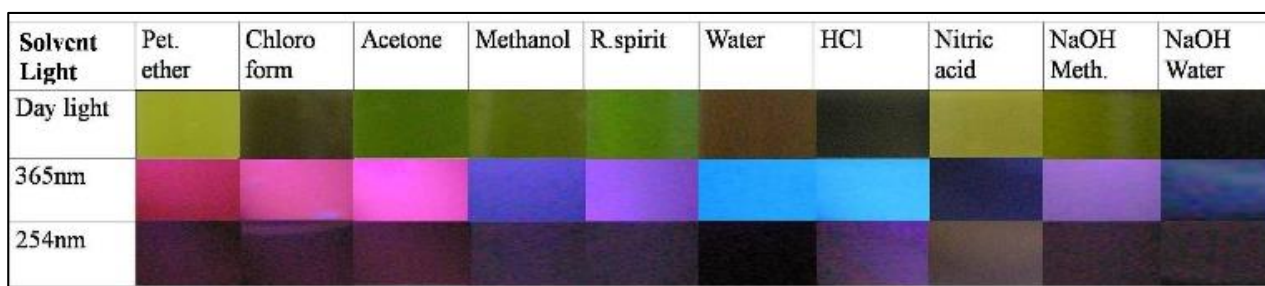


Fig 6: Chromo-fingerprint of Stem

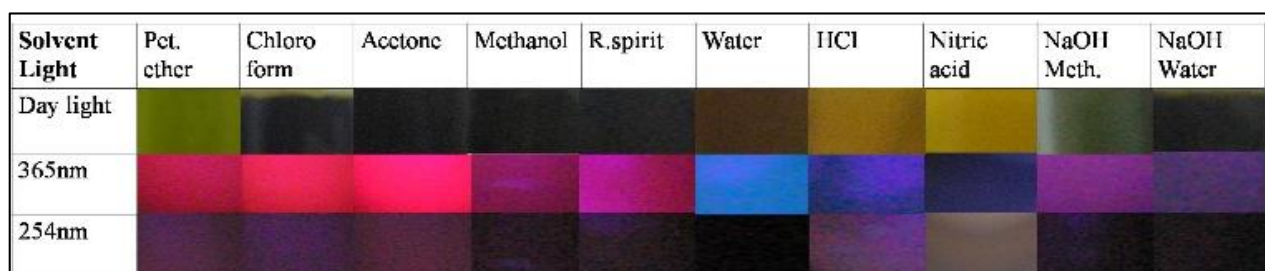


Fig 7: Chromo-fingerprint of Leaf

## Conclusion

During the present investigation, microscopic and macroscopic details of the stem and leaf of *Oldenlandia umbellata* have been studied. These characters like stem hairs, shape, arrangement, and size of leaf epidermal cells, stomata size, and stomatal index, presence of stomata only on the lower epidermis are useful to identify the crude herbal drug of the plant. The present study revealed that the stem contains Flavonoids, Triterpenoids, Alkaloids, Carotenoids, Fatty acids, Tannins, Glycosides, Chlorogenic acid, Saponins, Gum, and Mucilage. Whereas, the leaf contains Flavonoids, Steroids, Alkaloids, Carotenoids, Fatty acids, Tannins, Glycosides, Saponins, Polyuronoids, Chlorogenic acid, Gum, and Mucilage. But the chemicals, Emodins, Anthracene glycosides, Phlobatanins are absent in both stem and leaves.

The chromo-fingerprints of stem and leaf are unique and very useful to identify the crude drug. It produces a bright fluorescent pattern. The color pattern of both stem and leaf in daylight and UV-254nm is identical with slight variation in the shade. But, the pattern in UV-365nm specifically in Methanol, Rectified spirit, Water, and HCl zone shows a clear

difference between stem and leaf. It also helps in identifying the crude material and in determining the purity of the sample.

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