

## STUDY OF SOME ANATOMICAL CHARACTERS IN *OCIMUM AMERICANUM* L. (LAMIACEAE)

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### ABSTRACT

*Ocimum americanum* L. is a medicinal and aromatic herb with white or pale lilac flowers in six flowered whorls in 5-10 cm long racemes and having strong citrus smelled aroma.

For easy identification of it from other close genera of Lamiaceae, some anatomical characters are significant, including stem, petiole anatomy and leaf architectural features. Stem shows barrel shaped arched epidermal cells with 2-celled uniseriate non-glandular trichomes, heterogeneous pericycle. Vessels in radial multiples of 2 or solitary, oval circular and single rowed medullary rays. Petiole in its middle region with single median shallow crescent with ends widely placed and without perivascular sclerenchyma. Vessels in radial multiples of 2-4 with 1-vascular bundle in each wing. Leaves are gland dotted, entire or finely serrulated showing pinnate eucamptodromus major venation pattern. Secondary veins acute narrow, intersecondary and intramarginal veins absent. The angle of origin of tertiary vein on exmedial and admedial side is RR, percurrents absent. The other minute details are also studied.

Key words: Anatomy, Leaf architecture, Petiole.

### Introduction

*Ocimum americanum* L. is a medicinal and aromatic herb belonging to family Lamiaceae with strong citrus smelled aroma, 15-35 cm high, diffuse; branches arise from woody root stock, 4-angled, pubescent, leaves 1.0–3.5 x 0.6–2 cm, ovate, gland dotted, apex acute, base cuneate, margins entire or finely serrulate, flowers white or pale lilac in 6-flowered whorls in 5-10 cm long racemes; bracts up to 0.1 cm long, hairy; calyx campanulate 0.3 cm long in flower, enlarged in fruits, hairy below outside; corolla 0.6 cm long, lips ovate-oblong, upper lip shorter than lower lip. Nutlets subglobose, ovoid, brown, sub-trigonus. It is distributed throughout India. (Flowers and Fruits: June–October)

The leaves are used for flavoring sauces, soups etc. The seeds are considered diuretic and tonic, and are used in the preparation of cooling drinks. A decoction of the plant is taken for coughs, that of leaves for dysentery, it is also used as a mouthwash for relieving toothache, Singh *et. al.* (1983)

For easy identification of it from other close genera of Lamiaceae, some anatomical characters are significant, including stem, petiole anatomy and leaf architectural features which are not worked out earlier. They can also prove very useful in pharmacognostic identification.

## **Material and Methods**

Plant material is collected from various fields near Amravati. The identification was checked with reference to flora of Maharashtra. The fresh and as well as material fixed in F. A. A. was used for anatomical studies.

The freehand and microtome sections of young stem and petiole were taken for studying their anatomy, and they were stained in safranin and dehydrated following the usual method of Johansen (1940). To study the leaf architecture, the mature leaves were cleared by treating them with 5% aqueous sodium hydroxide, followed by treatment of 2% acetic acid. Terminology of Hickey (1973, 1979) is followed for describing leaf architecture. The photographs are taken with digital Kodak camera, and camera lucida sketches were made using Olympus compound microscope.

## **Observations**

### **Internal Structure of young Stem in transection (Plate II, Figs. 1–5)**

Transectional outline quadrangular with prominent ribs at 4-corners with deep notches in between. 2-celled uniseriate non-glandular trichomes present on raised hair bases. Epidermis 1-layered, cells barrel-shaped, with outer and inner walls arched or slight angular. Cuticle moderate thick. Hypodermis 1-3 layered, collenchymatous, discontinuous at shallow portions; interrupted by chlorenchyma. Inner cortex narrow, 3-5 layered, parenchymatous. Cells regular, thin-walled, more or less even, horizontally slight elongated. Endodermis indistinct. Pericycle heterogeneous with alternate

close patches of 3-4 cells high sclerenchyma separated by 1-2 cells broad-parenchyma. Vascular cylinder with outer continuous ring of phloem, 4-5 cells high; xylem inner to cambium traversed by 1-rowed medullary rays. Vessels in radial multiples of 2 or solitary, oval-circular in outline. Older xylem with solitary vessels. Pith 12-17 layered wide, homogeneous, parenchymatous.

### **Internal Structure of young petiole (Plate III, Figs. 6–10)**

Transectional outline through middle region, roundish abaxially, shallowly depressed in central region adaxially, margin regular. Adaxial and abaxial epidermis –1– layered, discontinuous at few places, cells larger, roundish, and rectangular, outer and inner walls roundish, cuticle thick. Multicellular uniseriate, non-glandular trichomes present.

Hypodermis – indistinct, discontinuous at few places, collenchymatous, 1-layered adaxially, 1-layered abaxially and 2-3 layered under wings; cells smaller, inner larger, uneven sized. Ground tissue broad, parenchymatous, enclosing small intercuticular spaces; cells polygonal, roundish, 3-4 layered adaxially, 8-layered abaxially; inner layers compact and chlorenchymatous patches below wings.

Pattern of vascular configuration in middle region – displaying single median shallow crescent with simple widely placed ends, xylem directed towards adaxial concave side, phloem towards abaxial side of crescent, vessels circular in outline, in radial multiples of mostly 4. Apical and basal regions–exhibiting similar median

vascular patterns as in middle region. Perivascular sclerenchyma – absent. Collateral, additional accessory vascular bundles in wings 1-each located below hypodermis; xylem adaxially faced; perivascular sclerenchyma absent; vessels in radial multiples of 3; in middle region of petiole 1-per wing; in apical region and in basal region – wing bundles absent.

Total visual count of vessels in median vascular crescent of middle region about 60 approximately.

Regarding other quantitative features of petiole, the cross-sectional area is  $1120 \times 800 \mu$ . Distance between abaxial and adaxial sides to vascular crescent  $320\mu$  and  $240\mu$  respectively.

#### **Leaf Architecture (Plate IV, Fig. 11–16)**

The basic axes of orientation in the leaf is apical. The leaf organization is simple. With respect to leaf shape and size, the length of whole leaf is 1.0 – 3.5 cm and width is 0.6–2 cm. The lamina is symmetrical; base is symmetrical, form is ovate; apex is acute and base is cuneate. The margin is entire or finely serrulate.

Leaf texture is chartaceous. The glands are present on the lamina and the petiole is normal.

Type of venation is pinnate Camptodromous and Eucamptodromous. Primary vein ( $1^0$ ) is thick; its course is straight and unbranched. Secondary veins ( $2^0$ ) are present. The angle of divergence is acute narrow and nearly uniform. Secondary veins are moderate. The course is curved uniformly. Intersecondary and intramarginal veins absent. The angle of origin of tertiary vein on exmedial and admedial side is RR, percurrents absent. The highest vein order of the leaf is  $5^0$ . Quaternary veins ( $4^0$ ) are thin, their course is orthogonal, quinary veins ( $5^0$ ) are thin, their course is orthogonal.

The marginal ultimate venation looped. Veinlets simple, curved, branched once or none. Areoles are well developed completely closed meshes, of relatively consistent size and shape, arrangement is oriented and shapes are quadrangular, pentagonal. Elements of tooth architecture are non-glandular. Accessory veins are looped.

#### **Plate I: External View**



*Ocimum americanum* L.

Plate II: Stem

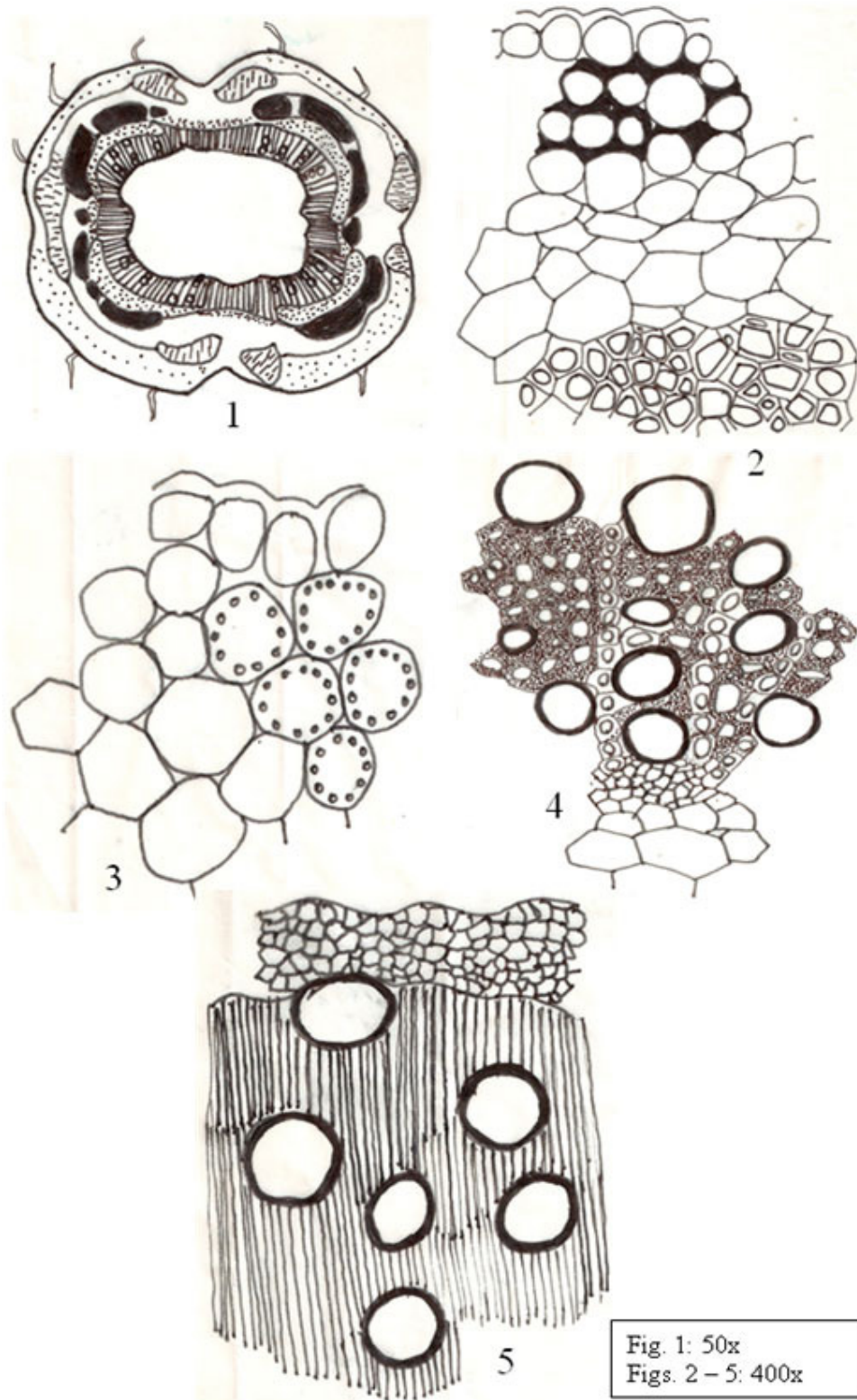
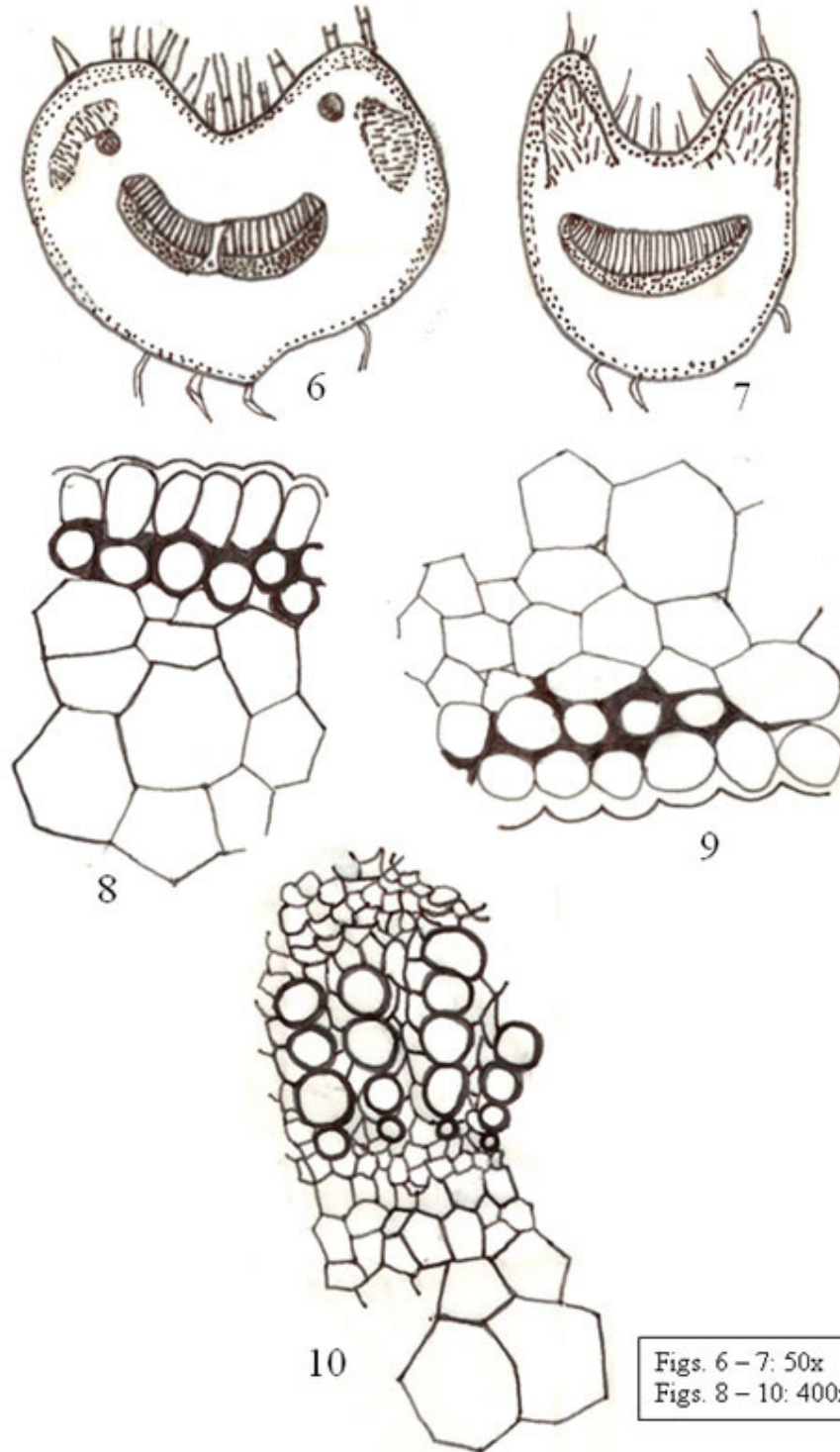
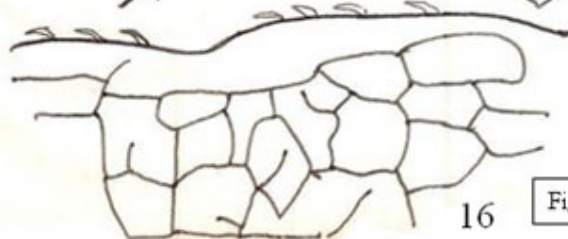
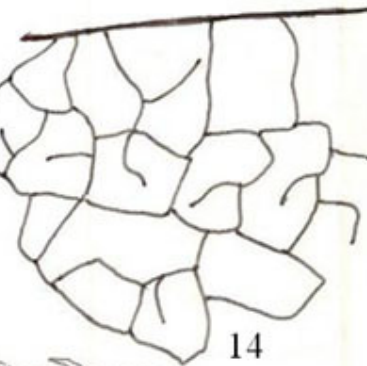
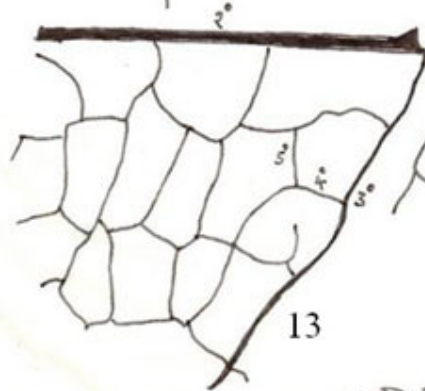
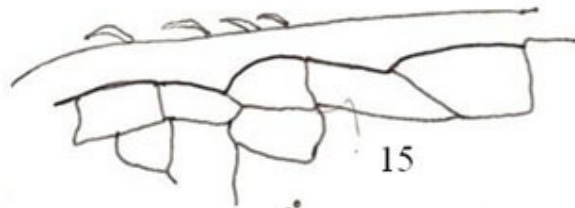


Fig. 1: 50x  
Figs. 2 - 5: 400x

**Plate III: Petiole**



**Plate IV: Leaf Architecture**



Figs. 13 – 16: 50x

## **EXPLANATION OF FIGURES**

### **Plate I: Plant with inflorescence.**

#### **Plate II: Stem**

- Fig. 1 – Diagrammatic cross-section of young stem showing different regions.
- Fig. 2, 3 – Parts of stem in cross-sectional view, magnified showing epidermis, hypodermis, cortex, perivascular sclerenchyma and chlorenchyma.
- Fig. 4 – Part of vascular region with vessels and pith
- Fig. 5 – Semi-diagrammatic view of part of older stem showing vascular region with phloem and solitary vessels.

#### **Plate III: Petiole**

- Fig. 6 – Diagrammatic cross-section oriented with adaxial side upwards, passing through middle region of petiole showing median vascular crescent and vascular bundles in wings.
- Fig. 7 – Same through apical region showing absence of vascular bundles in wings.
- Fig. 8 – Part of petiole in cross-sectional view through middle region, magnified showing adaxial epidermis, hypodermis and ground tissue.
- Fig. 9 – Part of petiole in cross-sectional view through middle region, magnified showing abaxial epidermis, hypodermis and ground tissue.
- Fig. 10 – Part of median crescent magnified showing vessels in radial multiples.

#### **Plate IV: Leaf Architecture**

- Fig. 11 – Leaf showing morphological parameters.
- Fig. 12 – Cleared whole leaf showing major venation pattern and leaf architectural features (x 3).
- Figs. 13, 14 – Leaf architectural features showing areolation and minor venation pattern from portion of cleared leaf.
- Fig. 15, 16 – Marginal ultimate venation.

## Discussion

Internally young stem shows barrel shaped, arched epidermal cells, with 2-celled uniseriate non-glandular trichomes, heterogeneous pericycle, vessels in radial multiples of 2 or solitary, oval-circular and single rowed medullary rays.

Transection of petiole in its middle region, shows single median shallow vascular crescent with ends widely placed and without perivascular sclerenchyma. Vessels in radial multiples of 2-4 with 1-vascular bundle in each wing. Total visual count of vessels in median crescent is 60 approximately. Leaves are gland dotted, entire or finely serrulate showing pinnate eucamptodromous major venation pattern.

Study of microscopical characters with main focus on laminar transectional structure and trichomes along with

phytochemical studies of this species was carried out by Sarma & Babu (2011) finding presence of epidermis, parenchymatous cells, collateral vascular bundle, lateral vein, glandular trichomes and multicellular unbranched trichomes.

These anatomical characters are constant and reliable hence having taxonomic value for identification and on basis of which *Ocimum americanum* L. can be identified from other close genera of Lamiaceae.

## Conclusion

The correlation of studied anatomical characters play important role in easy identification of *Ocimum americanum* and also useful as important criteria for pharmacognostic identification.

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