



(RESEARCH ARTICLE)



## Pollen characterization and medicinal importance of *Ocimum* species of Lamiaceae from Telangana region of South India

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### Abstract

Pollen morphology is one of the important tools for the taxonomic studies and helps in the identification of medicinal plants. Pollen characterization of three species of *Ocimum* viz., *Ocimum tenuiflorum*, *Ocimum gratissimum*, and *Ocimum basilicum* collected from Telangana region of South India during 2022 was carried out by using Light Microscope (LM). The pollen grains showed variations in size, shape, with amb spheroidal to ellipsoidal. All the species had hexacolpate pollen grains. The exine is subtectate and sporoderm ornamentation is reticulate with variations in heterobrochate conditions. The lumina varied from penta, hexa, polygonal to irregular form. The plants studied in the present work were known for their medicinal use having antibacterial and antiviral properties and most important in traditional system of medicine.

**Keywords:** Pollen characters; *Ocimum* species; Taxonomy; crude/raw drugs; Traditional medicine; Telangana State; South India

### Introduction

The genus *Ocimum* Linn. belongs to the Lamiaceae family comprises annual and perennial aromatic herbs and is characterized by a genetic diversity, with 65-150 species. *Ocimum* species are well known for its medicinal and spiritual properties in Ayurveda and other traditional system of medicine. The genus *Ocimum* is one of the economically important groups of aromatic herbaceous plants extensively used in pharmaceutical products, flavouring and perfumery (Khosla, 1993). Many species of *Ocimum* have been grown by local people as medicinal plants, culinary herbs and insect controlling agents (Grayer et al., 1996). All the taxa studied *O. tenuiflorum*, *O. gratissimum* and *O. basilicum* are erect, branched and aromatic herbaceous drugs. Sometimes herbal drugs are misunderstood due to morphological similarity and adulteration due to unscientific naming. In such cases pollen parameters play a very important role in judging the botanical identity. A pollen study is useful to identify various species and taxa in their respective families.

The present work deals with the pollen morphological studies of three *Ocimum* species of medicinal importance collected from Telangana region with an aim to record the pollen features which are useful for identification of the taxa that are used as crude drugs.

### Material and methods

Fresh flowers of three medicinal/drug yielding plants during their flowering periods were collected from Telangana region of South India during 2022-2023. The medicinal plants collected include *Ocimum tenuiflorum* L, *Ocimum gratissimum* L, and *Ocimum basilicum* L. Pollen slides were prepared by using Erdtmans's acetolysis technique (1960).

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### 1.1 Preparation of pollen slides by Acetolysis Technique (Erdtman, 1960)

The polleniferous material / anthers of the medicinal plants were picked with the help of a forceps into a test tube containing 70% alcohol. They were crushed with a glass rod and then filtered. The filtrate is centrifuged and to the sediment 5 ml. of Glacial acetic acid is added and centrifuged. To the sediment acetolysis mixture which is made by mixing 9 parts of Acetic anhydride and 1 part of concentrated Sulphuric acid is added. Place the tube with the mixture in a hot water bath until the pollen grains turn chestnut brown colour. Then cool the mixture and centrifuge. To the sediment 5ml. of glacial acetic acid was added and centrifuged. Then to the pollen sediment 50% glycerine was added and centrifuged. Mounting of the pollen grains was done in glycerine jelly.

Three slides were prepared for each pollen type and mounting is done in glycerine jelly. Pollen morphological characters and the medicinal importance of the *Ocimum* species were studied according to the standard literature (Erdtman 1952, 1960, Faegri K, Iversen J. 1975, Moore et al., 1991, Moore, P.D. and Webb, J.A. 1978, Punt et al., 2007 Mradu Gupta 2009, Bhoj Raj 1961, Khare CP 2007, Joshi S.G 2018). Photomicrographs of the pollen types studied was taken by using a trinocular Olympus microscope attached with a digital camera.

## Results and discussion

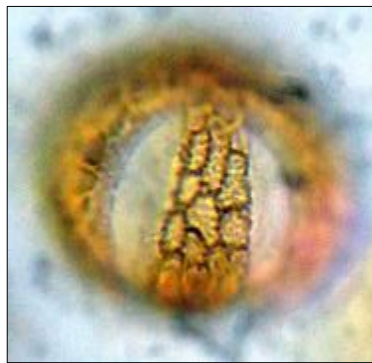
The pollen types of three *Ocimum* species viz., *Ocimum tenuiflorum*, *Ocimum gratissimum* and *Ocimum basilicum* was palynologically analysed for their morphological characters. The pollen types looked similar but varied in size and shape. The shape of the pollen types are sub-prolate (*Ocimum tenuiflorum*) and sub-oblate (*Ocimum basilicum*). Amb of the grains ranged from spheroidal to ellipsoidal. All the pollen types showed apertural pattern as hexacolpate and sporoderm ornamentation as lophoreticulate and homobrochate. The shape of the lumina varied from pentagonal, hexagonal, and to irregularly polygonal type. The detailed morphological characteristics of the three *Ocimum* pollen types studied are given below.

### 1.2 Pollen morphological characters of medicinal plants studied

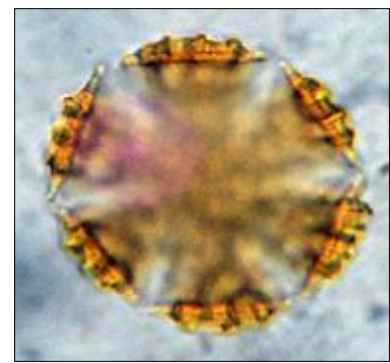
#### 1.2.1 *Ocimum tenuiflorum* L



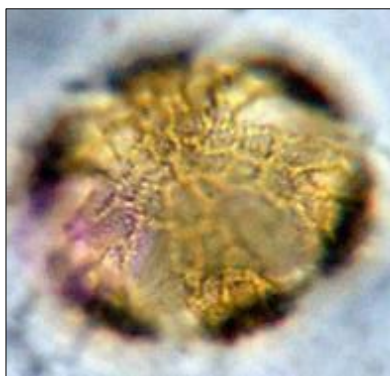
*Ocimum tenuiflorum*



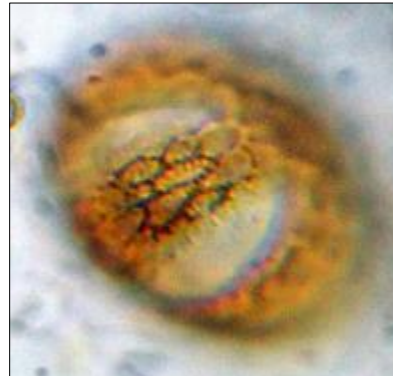
*Ocimum tenuiflorum* E.V



*Ocimum tenuiflorum* P.V



*Ocimum tenuiflorum*



*Ocimum tenuiflorum* E.V



*Ocimum tenuiflorum* P.V

**Figure 1** Photomicrographs of *Ocimum tenuiflorum* (x 1000 magnification)

Size, Shape and Symmetry: Pollen units in monads, Amb 31.5µm. in diameter, spheroidal, 27- 30 X 22.5- 26 µm. Sub-prolate, isopolar, radially symmetrical.

Apertural pattern: Hexacolpate, zonocolpate, colpi liner, 13.5mm long, 2mm wide, sides tapering, tips acute.

Pollen surface ornamentation: Exine 4.5mm thick, sexine thicker than nexine, sculpturing lophoreticulate, homobrochate, lumina irregularly polygonal, lumina with numerous free piloid elements, muri simplibaculate.

### 1.2.2 *Ocimum gratissimum* L

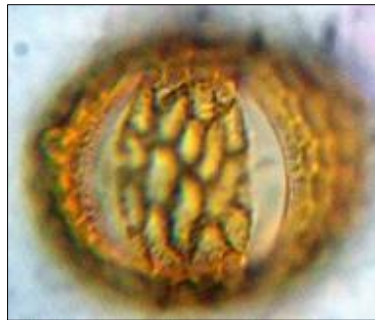
Size, Shape and Symmetry: Pollen units in monads, 53-64 µm; Amb spheroidal, 47-59 x 53-62 µm, Sub-oblate; isopolar, radially symmetrical.

Apertural pattern: Hexacolpate, Zonocolpate, colpi linear, long, tips acute.

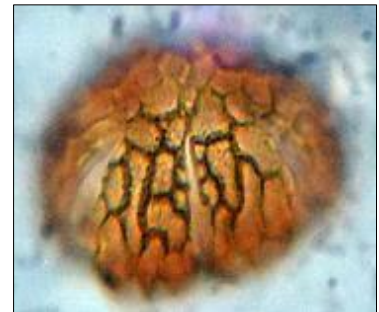
Pollen surface ornamentation: Exine 5.6 µm thick, sub-TECTATE, surface lophoreticulate, homobrochate, meshes pentapolygonal, lumina with numerous free baules/piloid elements, muri simplibaculate.



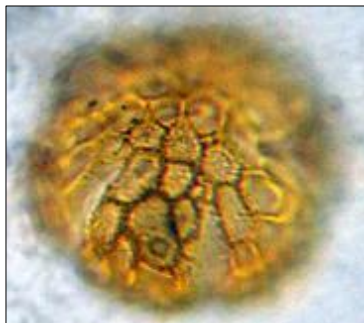
*Ocimum gratissimum*



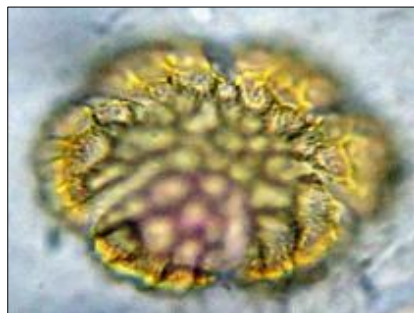
*Ocimum gratissimum* E.V



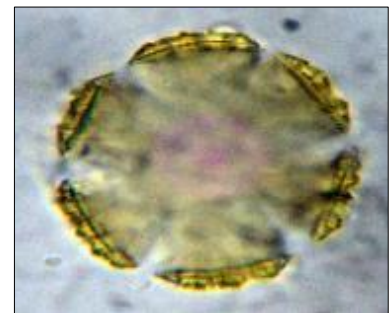
*Ocimum gratissimum* E.V



*Ocimum gratissimum*



*Ocimum gratissimum* P.V



*Ocimum gratissimum* P.V

**Figure 2** Photomicrographs of *Ocimum gratissimum*(x 1000 magnification)

### 1.2.3 *Ocimum basilicum* L

Size, Shape and Symmetry: Pollen units in monads, 53-64 µm; Amb spheroidal, 47-59 x 53-62 µm, Sub-oblate; isopolar, radially symmetrical.

Apertural pattern: Hexacolpate, Zonocolpate, colpi linear, long, tips acute.

Pollen surface ornamentation: Exine 5.6 µm thick, sub-TECTATE, surface lophoreticulate, homobrochate, meshes pentapolygonal. Lumina with numerous free baules/piloid elements, muri simplibaculate.



**Figure 3** Photomicrographs of *Ocimum basilicum* (x 1000 magnification)

### 1.3 Medicinal values of the plants collected which are extensively used in traditional system of medicine

#### 1.3.1 *Ocimum tenuiflorum* Linn

This plant is well known for its medicinal and spiritual properties in Ayurveda which includes aiding cough, asthma, diarrhea, fever, dysentery, arthritis, eye diseases, indigestion, gastric ailments etc.

- Root: The root of the tulasi plant should be crushed and boiled with turmeric powder for a few minutes, after which it should be filtered. Consuming two spoonful of this potion twice daily will cure SARS and prevent contracting of the disease.
- Seeds: Tulasi tea with honey is a good expectorant especially in cases where fever is involved.
- Leaves: The juice of the leaves is given in catarrh and bronchitis in children. Chewing the leaves relieves cold and flu. A decoction of the leaves, cloves and common salt also gives immediate relief in case of influenza.

#### 1.3.2 *Ocimum gratissimum* L

Vanabarbarika or Ramutulasi is aromatic. A strong decoction is effectual in aphthae of children and baths of fumigations prepared with it is recommended in the treatment of rheumatism and paralysis.

- Leaf: Decoction of leaves is useful in seminal weakness and is a remedy for gonorrhoea.
- Seeds: Seeds are given in headache and neuralgia.

#### 1.3.3 *Ocimum basilicum* L

- Bark: Barbar is aromatic with carminative and cooling properties. It cures disorders due to kapha and vaata. Dyspepsia, cough, constipation, bronchitis. Intermittent fevers.
- Flowers: Flowers are diuretic, carminative, stimulant and demulcent. Seeds are mucilaginous and given in infusion for gonorrhoea. Dysentery and chronic diarrhoea.
- Root: Roots are used in bowel complaints of children.
- Leaf: Leaves are useful in treatment of croup, for which the warm juice with honey is given.

## Conclusion

Generally herbal drugs are misunderstood due to morphological similarities and adulteration due to unscientific naming. Three species of *Ocimum* viz., *Ocimum tenuiflorum*, *Ocimum gratissimum*, and *Ocimum basilicum*, are aromatic herbaceous plants extensively used in pharmaceutical and traditional system of medicine. Pollen morphological studies of three species of *Ocimum* are useful for identification of the taxa that are used as crude drugs, thus pollen parameters play an important role in authentication of botanical identity.

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## Compliance with ethical standards

### *Acknowledgments*

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### *Disclosure of conflict of interest*

The authors have no conflict of interest to declare.

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