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Characteristic Features and Comparative analysis of essential oil composition of selected species of *Ocimum sanctum* L. through GCMS

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Research Article

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Abstract

Background: The main aim of this research is to provide a literature of the *Ocimum* plant, to know the significance of the *Ocimum* species carried out by pharmacognostical study and experimental design for GC-MS.*Ocimum* are very important for their therapeutic potentials. Among the most important aromatic herbs for its enormous medicinal properties.

Methods: An extreme Attention has been put on those literature reports wherein the utilization of Tulsi and their pharmacognostical study has been done by performing morphological and microscopic leaf and experimental design by using essential oil by GC-MS instrumentation method

Results: The utilization of these characteristics would be important for the drug discovery scientist to develop a specific formulation of the crude drug, which will be a magical therapeutic agent in the future, with the many advantageous. GC-MS chromatogram of the *Ocimum sanctum*, *Ocimum canum* and *Ocimum gratissimum* oil showed major peaks and has been identified after comparison of the mass spectra with NIST library, indicating the presence of three phytocomponents. From the results GC-MS study suggested that anethole which is well reported antimicrobial compound is more in *O. canum* (2.66%) in comparison to *O. sanctum* (1,28%) but absent in *O. Gratissimum*. The results indicated that the antimicrobial activity is more in *O. canum* due to presence high amount of anethole in comparison to *O.Gratissimum*, and *O. Sanctum.* The GC-MS study suggested that anethole which is well reported antimicrobial compound is more in *O. canum* (2.66%) in comparison to *O. sanctum* (1,28%) but absent in *O. Gratissimum*.

Conclusion: The result showed that microscopic character of *O. canum*, with the characteristic GC MS analysis of the extracts, to identify different species of the *ocimum* plant. *Ocimum sanctum* L. and further experiments are required for better exploitation of essential oil for its commercial purposes.

Background

Ocimum sanctum L., commonly known as holy basil, Among the plants known for medicinal values, plants of genus Ocimum belonging to family Lamiaceae Ocimum are very important for their therapeutic potentials. among the most importantaromatic herbs for its enormous medicinal properties, such as anticancerous, antidiabetic, spasmolytic, carminative, cardioprotective, anthelmintic and diaphoretic actions. *Ocimum sanctum* possesses various biological activities such as analgesic, antipyretic, antidiabetic, hepatoprotective, hypolipidemic, immuno-modulatory, and anti-inflammatory. It observed that some of its phytoconstituents such as eugenol, linoleic acid, luteolin, β-sitosterol prevent skin, liver, oral and lung cancers through increasing the anti-oxidant activity, inducing apoptosis, altering the gene expression, and inhibiting metastasis. It has been observed that *Ocimum sanctum* leaves showed inhibition of growth of tumor cells. It is assumed that *Ocimum sanctum* would be an effective medicine so far in inhibiting the all kinds of cancer. [1-4]

Ocimum sanctum is used as a traditional medicine and possesses various biological activities because of the active components present in the plant such as eugenol, linoleic acid, oleic acid, rosmarinic acid, ocimarin, isorientin, orientin, aesculectin, aesculin, chlorgrnic acid, galuteolin, gallic acid, citronellal, camphene, sabinene, dimethylbenzene, ethylbenzene, vitamin C, and calcium.[5–7]

Methods

Collection, identification and authentication of selected plants

A Collection of all three types of tulsi leaves named Rama Tulsi (*Ocimum sanctum*), Krishna Tulsi (*Ocimum canum*) and Vana Tulsi (*Ocimum gratissimum*)of the genus *Ocimum* were collected from the local area of haryana India. Identification of this was confirmed by Dr. RS Jayasomu, Head, Raw material Herbarium and Museum Division (RHMD), NISCAIR, New Delhi, where a voucher sample (Ref.No. NISCAIR/RHMD/Consult/-2016/3000-27-2) has been deposited. For further studies in Pharmacognostical manner, Phytochemical analysis and Extraction, leaves were collected, shade dried and converted them into fine powdered form

Pharmacognostical Study

The pharmacognostical study has been done by performing morphological and microscopic analysis of Leaf as per WHO guidelines.

Microscopic Studies

Transverse section (TS) of leaf and powder characteristics were identified with (Phloroucinol + HCL) reagents such as chloral hydrate and glycerine to study the cells, fibre, xylem vessels, starch grains, and calcium oxalate crystals. Permanent slide of TS of Leaf was prepared to observe the presence and arrangement of cellular structures as per the procedure of Johansen[8] and the representative figures were taken with the help of microscopic image camera.

Experimental Design for GC-MS

GC-MS analysis of the Rama Tulsi (*Ocimum sanctum*), Krishna Tulsi (*Ocimum canum*) and Vana Tulsi (*Ocimum gratissimum*) essential oil was performed using below given instruments information.

Thermo Trace 1300GC coupled with Thermo TSQ 800 Triple Quadrupole MS.

For GC - THERMO TRACE 1300 GC

For MS - THERMO TSQ 8000

- Software used: XCalibur 2.2SP1 with Foundation 2.0SP1
- Column: BP 5MS (30m X 0.25mm, 0.25µm)
- Column Makeup: 5% Phenyl Polysilphenylene-siloxane
- Injector: S (Split)
- Injection volume:2.0µL
- Split Ratio: 20:1
- Injector temp: 250˚C
- MS transfer line temp:230˚C
- Ion source temp: 230˚C
- Mass Range :40-700
- Carrier Flow:1.0ml/min
- Oven Program:

Initial Temp: 50˚C Hold time: 1.0 min

Temp 1: 220˚C Hold Time: 5.0 min

Rate: 5˚C/min

- Detector: MS TSQ 8000
- Library used: NIST 2.0

Microscopical evaluation

The powder Microscopy of selected varieties of Tulsi such as, Rama Tulsi (***Ocimum sanctum***), Krishna Tulsi (***Ocimum canum***) and Vana Tulsi (***Ocimum gratissimum***) were done and evaluated for the characterization of the drug through below given pictures in their respective sequence. These pictures are critically evaluated with the specific microscopic features.

Gas Chromatography-Mass Spectrometry analysis

A Perkin-Elmer gas chromatograph (model 8700), with flame ionization detector (FID) was used for the chemical analysis of the Rama Tulsi (*O. sanctum*), Krishna Tulsi (*O.canum*) and Vana Tulsi (*O. gratissimum*) essential oil. The temperatures of the injector and detector were set at 220 and 290°C, respectively. The column thermostat temperature was started from 80°C and raised to 220°C at the rate of 4°C min-1, whereas initial and final temperatures were held for 3 and 10 min, respectively. The carrier gas was helium with a flow of 1.5 mL min−1. A sample of 1.0 µL was injected (split ratio 100:1). For quantification purposes a built-in data-handling program of the equipment (Perkin-Elmer) was used. The essential oil composition was reported as a relative percentage of the total peak area[12-14].

Results And Discussion Gc-ms Analysis

The hydro-distillation of essential oil from leaf extract of *Ocimum sanctum* L. yielded pale yellow aromatic oil. GC-MS chromatogram of the *Ocimum sanctum*, *Ocimum canum* and *Ocimum gratissimum* oil showed major peaks and has been identified after comparison of the mass spectra with NIST library, indicating the presence of three phytocomponents. From the results. The GC-MS study suggested that anethole which is well reported antimicrobial compound is more in *O. canum* (2.66%) in comparison to *O. sanctum* (1,28%) but absent in *O. Gratissimum*. The results indicated that the antimicrobial activity is more in *O. canum* due to presence high amount of anethole in comparison to *O. Gratissimum*, and *O. Sanctum.*

Conclusion

The summarized information has been focused to the microscopic character of *O. canum*, with the characteristic GC MS analysis of the extracts, to identify different species of the *ocimum* plant. The retention time of each chemical constituent is reported for future identification of the plant and their variant. In the future it will be a source of literature to identify variant plant species for the quality production of the plant. *Ocimum sanctum* L. and further experiments are required for better exploitation of essential oil for its commercial purposes.

List Of Abbreviations

OS = *Ocimum. sanctum*

O. = *Ocimum Genus*

COX-1 = Cyclooxygenase-1

COX-2 = Cyclooxygenase-2

VEGF = Vascular endothelium growth factor

WHO = World Health Organization

COPD = Chronic obstructive pulmonary disease),

IBD = Inflammatory bowel syndrome

DMBA= 7, 12- dimethylbenz(a)anthracene

VEGFR-3 = Vascular Endothelial Growth Factor Receptor 3

VLA-4 = Very Late Antigen-4

Declarations

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

No human participants were involved in this paper and no new data were collected; thus, ethical approval was not required.

CONSENT FOR PUBLICATION

All authors consent to publication in the journal.

AVAILABILITY OF DATA AND MATERIALS

All relevant data are within the paper and its Supporting Information files.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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AUTHORS' CONTRIBUTIONS

PS contributed to manuscript conception, design, planning and writing in all areas of the manuscript and contributed to manuscript conception, design, planning and writing of literature pertaining to pharmacognosy and phytochemistry related components. KU contributed to conception and design and critical revisions of content. All authors have approved the paper to be published.

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Tables

Tables 1-3 and Characterizations are available in the Supplementary Files.

Figures

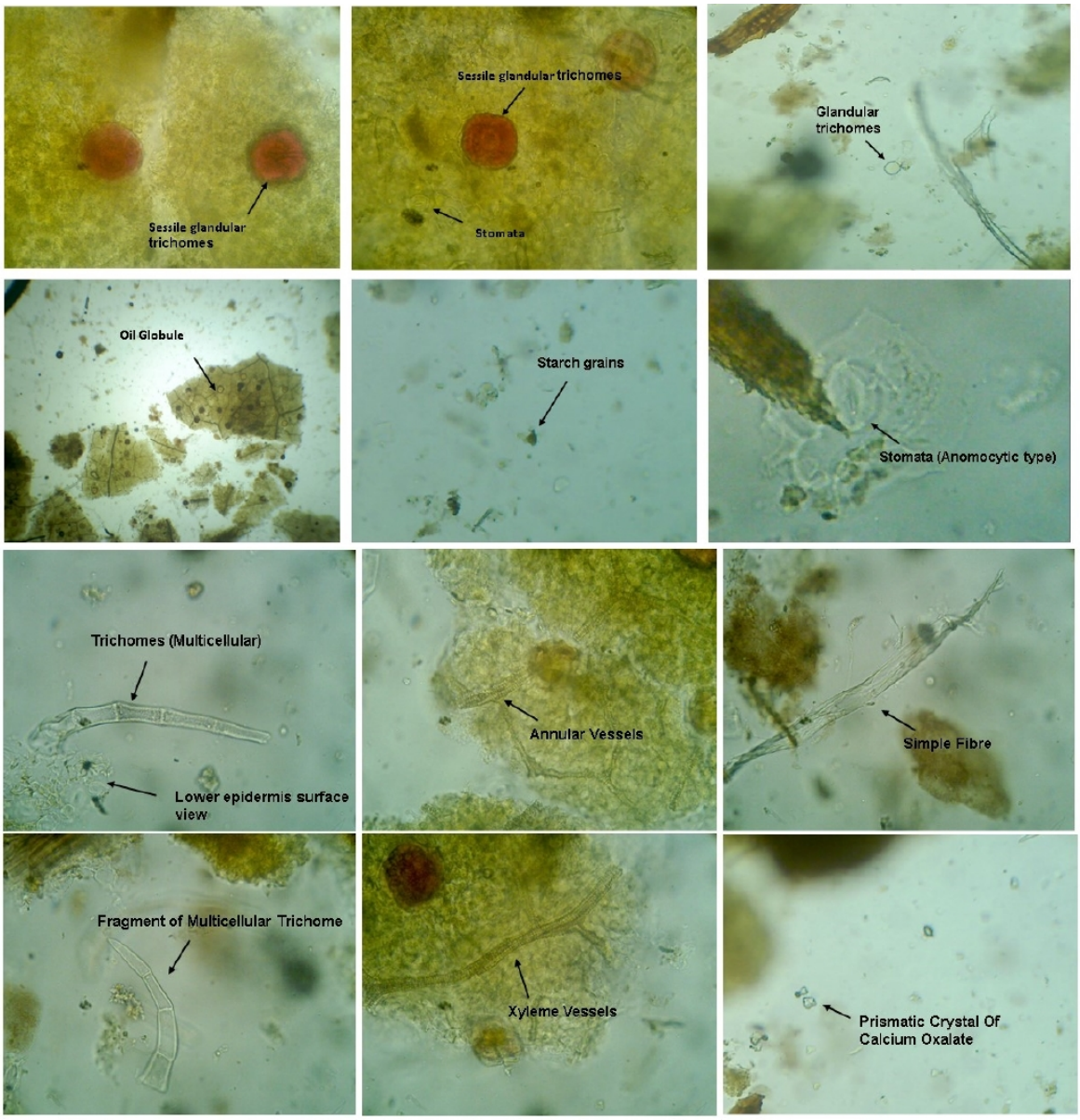


Figure 1

Powder Microscopy of Rama Tulsi (Ocimum sanctum)

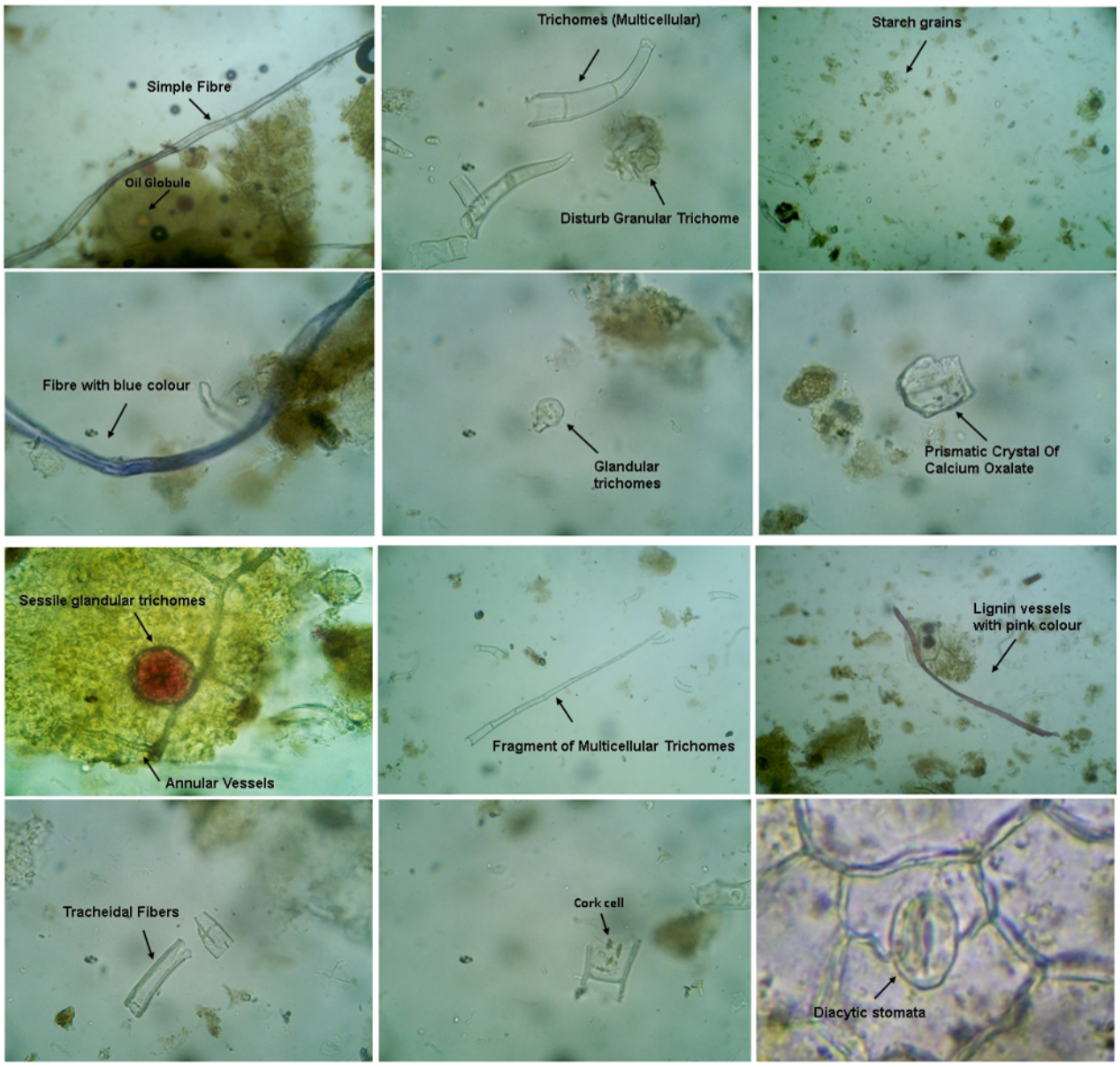


Figure 2

Powder Microscopy of Krishna Tulsi (Ocimum canum)

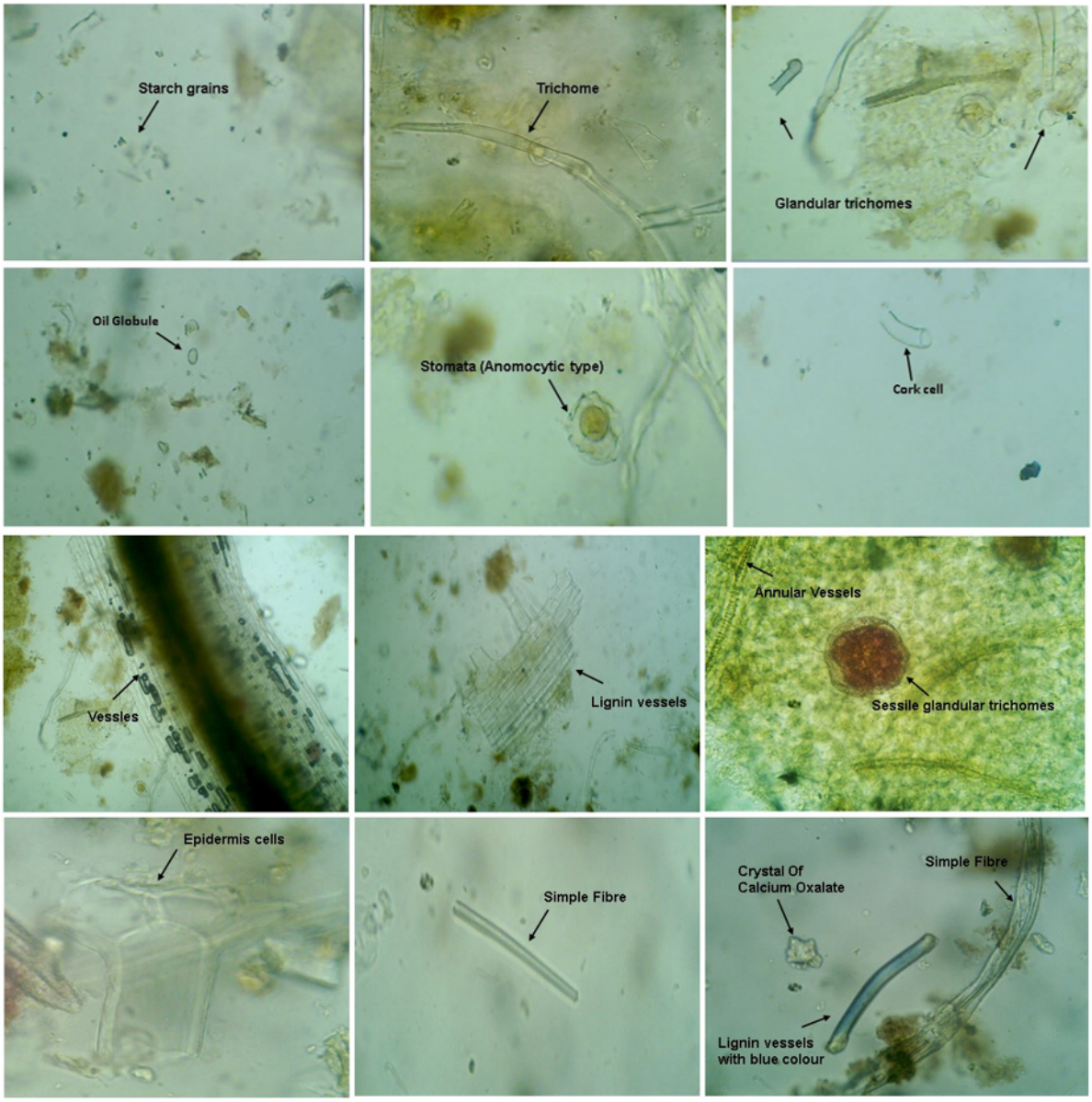


Figure 3

Powder Microscopy of Vana Tulsi (Ocimum gratissimum)

Supplementary Files

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