

## A Systemic Review of *Ocimum sanctum* (Tulsi): Morphological Characteristics, Phytoconstituents and Therapeutic Applications

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### ABSTRACT

Plants have been used medicinally by humans for millennia. Tulsi is one of these drugs. A plant's perfume emanates from within. It is found all over India. It is harvested around Hindu temples or places of worship. Its leaves, seeds, and roots are employed in Ayurvedic treatment. Tulsi contains a variety of nutrients and bioactive compounds. Tulsi's key chemical components are Linalool, caryophyllene, Oleanolic acid, and Rosmalinic acid. Tulsi standardisation has been used in modern science. Two active ingredients are eugenol (essential oil) and ursolic acid (acide). A diaphoretic, anti-periodic, and anti-bronchitis leaf. A decoction of the leaves can treat coughs, malaise, and colds. Not only is it moisturising. Flowers' oils can treat ringworm. Because of its antibacterial and antifungal characteristics, *Ocimum sanctum* has been used in numerous therapeutic trials. This page discusses the chemistry and pharmacology of *Ocimum* species.

**Keywords-** *Ocimum sanctum*, Pharmacological, Chemical constituents, Anti diabetic, Anti fertility.

### I. INTRODUCTION

Many plants are used to manufacture medications. Medicinal plant secondary metabolites and therapeutic oils are well known[1]. Medicinal plants have many advantages over pharmaceuticals, including low cost, high efficacy, and global access. Plants have long been used medicinally. From 4000-5000 B.C., the Chinese used herbs as medicine. From 3500 to 1600 B.C., the Rigveda first recorded the use of plants as medicine. Plant medicinal properties were examined in great depth according to Ayurveda's foundation.

Tulsi is considered sacred in India. Tulsi (*Ocimum sanctum*) is an aromatic plant in Ayurveda. It's in the Labiateae family. Several tropical and subtropical countries grow it [3]. It is found in almost every field in

India. It is a tall, slender, fragrant plant. Tulsi means "incomparable" in Sanskrit. The whole plant is a cure [4]. Tulsi comes in two kinds in India: dark or Shyama (Krishna) and light or Rama. Deo gratia è più usato in *O. canum*, *O. basilicum*, *O. kilimandscharicum*, *O. ammericanum*, *O. camphora*, and *O. micranthum* are all found in India. Toxicological studies indicated this plant to have analgesic and antibacterial properties. Tulsi is the best vitamin for animals.

Carvacrol, methylchavicol, limatol, and caryophyllene are all found in the essential oil. The seeds are rich in fatty acids and sitosterols. The roots include sitosterol and triterpenes A-C. N-Triacontanol is found in the leaves. The oil contains caryophyllene, terpinene 4-decylaldehydes, selinene, pinenes, and camphene, as well as nerol. A couple of the chemical components present in it are thymol and citral [8].

### II. SOURCES

#### *Biological source*

The Lamiaceae family includes *Ocimum* species including *Ocimum sanctum* L. and *Ocimum basilicum* [9]. To make Tulsi, you need to use both fresh and dried leaves from these plants.

#### *The origin of the location*

From the Andaman and Nicobar Islands to the Himalayas, the plant can be found growing up to 1800 feet above sea level. Malaysia, Australia, West Africa, and a few Arab countries are among the countries where it is found. It is a multi-branched, herbaceous annual plant treasured by the Hindus for its therapeutic virtues in the country of India. Plants like this one are popular with both gardeners and temple-goers. It is propagated through the use of seeds [10]. The volatile oil extracted from Tulsi is now being cultivated for its usage in commercial products.

### III. CLASSIFICATION

There are kingdoms, sub-kingdoms, superdivisions, divisions, and phylas in the taxonomic classification of plants. As a result of this, Tulsi, also known as the "Queen of Herbs," is given a particular designation. Tulsi's genus and species are readily obvious in its binomial nomenclature. Tulsi can be found in the Lamiales and Lamiaceae families of plants. Briefly, here is a classification [11-12].

#### Taxonomical Classification of Tulsi Kingdom:

Kindom	Plantae
Sub kingdom	Tracheobionta
Superdivision	Spermatopta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Lamiales
Family	Lamiaceae
Genus	Ocimum
Species	O.Sanctum

#### Morphology

It's all about how the root, stem, leaves, branches, flower, fruit and seeds of a plant look. Morphology is the study of the plant's exterior appearance. According to Tulsi plant morphology, this is how it looks[13]:



Fig 1 : *Ocimum sanctum* (Tulsi)

The root system of the *Ocimum sanctum* plant is the most significant. On the outside it is dark brown, yet on the inside it is a delicate shade of violet. With hairy and sub-Quadrangular leaves that are a dark purple to black on the outside, and a cream colour on the inside, this herbaceous, woody stem has fibrous bark and short xylem. Its aroma is modest and its stem is erect. It is elliptical or oblong or oblique or acute, entire or serrated, pubescent on both sides; the petiole is slender, 1.5-3 cm

long and hairy, with an aromatic perfume and peculiar flavour.. Pedicels of the flower are longer than the calyx, and the calyx is ovoid or campanulate, 3-4 mm bilipped; upper lips are broadly oblong or suborbicular, shortly apiculate, while lower lips that are 170 longer than upper have four mucronate teeth, the central two largest; corollas are about 4 mm long, pubescent and aromatic; having aromatic odour and pungent flavour; and a nectar-like nectar. Subglobose or broad-elliptic and slightly compressed; pale brown or reddish, with minute black marks at the thalamus, aromatic and powerful in flavour are the four nuts in this fruit. It is brown, mucilaginous, 0.1 cm long, slightly notched at the base, and has a pungent, mucus-like flavour when soaking in water[14-16].



Fig 2 : Leaves of *Ocimum sanctum*



Fig 3 : Flowers of *Ocimum sanctum*

#### Chemical Constituents

In *O.sanctum*, 1,8-cineole, 1,8-bisabolene from India, eugenol from India, Methyl eugenol from Nigeria, isocaryophyllene from Nigeria, eugenol,  $\beta$ -elemene, and linalool from India, Methyl eugeno,  $\beta$ -eugenol from Nigeria, and eugenol,  $\beta$ -caryophyllene and  $\beta$ -caryophyllene oxide from Northeastern Brazil were found to be present. *O.gratissimum*, a well-known plant in Indian herbal medicine, can be found in a variety of varieties, including the one indicated below. It is possible to make teas and infusions from the flowers and leaves of this plant, which contain a high concentration of essential oils. For its antibacterial capabilities, *O.gratissimum* may rely on its volatile oil, which has a

high concentration of thymol and eugenol. *O. kilimandscharicum* is often referred to as kapur tulusi in India. [17-19] Carbonyl, 1,8-cineole and 1,8-cineole, limonene and camphene are also discovered in the leaves' aqueous extract. Also found are endo-borneol and linalool. Tannins, saponin and steroid compounds are also detected in the plant. Carbohydrate-rich proteins and triterpene compounds are also present. For the most part, the essential oil is composed of aromatic monoterpenes, including camphor (64%) and other aromatic monoterpenoids such as limonene (8.7%) and (E)Ocimenene (6.4%) (3.0 percent). Camphor's source, *O.kilimandscharicum*, has garnered attention from scientists.

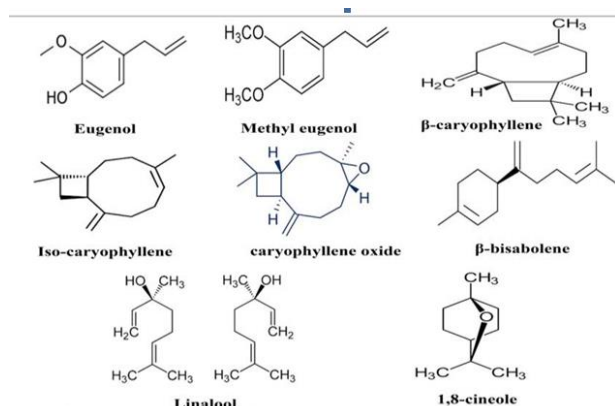


Fig 4 : Chemical Constituents of *Ocimum sanctum*

#### Prophylactic use of Tulsi

To treat gastritis and liver problems, a decoction of the leaves is utilised. Dysentery can be alleviated by giving patients fresh leaf juice. The methanolic extract of *Ocimum suave* has been shown to be effective in the treatment of persistent stomach ulcers in rats. When coupled with pepper, turmeric, and onion it is a powerful malaria prevention method. Insecticide and larvicidal properties are found in oil. Tulsi oil is mostly composed of bisabolene (13-20 percent), methyl chavicol (3-19 percent), 1,8-cineole (9-33 percent), eugenol (4-9 percent), (E)—bisabolene (4-7 percent) and terpineol (1.7-7 percent). As a mosquito deterrent, Tulsi is commonly planted in Indian gardens. A Tulsi essential oil's larvicidal power is 100%. Tulsi has also been demonstrated to have anti-malarial effects. A chemical called eugenol plays a vital role in this product's repelling properties. Ringworm can be treated with a paste made from Tulsi leaves. Tulsi removes parasites and worms from the body. A mixture of honey and tulsi extract is indicated to stimulate the parasites, thus pulling them out of their hiding spots. To remove blemishes, a paste of its leaves is applied to the face. Wrinkles can be reduced and suppleness restored by the presence of urosolic acid in the leaves[20]. Tulsi aids in keeping the skin in good health and supple. When it comes to dealing with wounds, Tulsi is an excellent choice. In the treatment of glaucoma, cataracts, chronic

conjunctivitis, and other eye conditions, the leaf juice of tulsi is combined with triphala. Tea after a meal improves digestion by increasing the flow of stomach fluids and reducing gas and bloating by chewing 3-4 leaves before a meal. Ulcers can also be avoided by using *Ocimum sanctum*. An extremely contagious and debilitating case of the common cold, complete with dizziness and fever. It reduces the amount of coughing that occurs in the lungs and nose. Tulsi leaf decoction is a typical remedy for the common cold in India. Along with the clove, it is also used to treat fever. Additionally, it has been shown to reduce uric acid levels, making it a possible anti-inflammatory agent [21-22]. Basil's leaves have been used for centuries to treat a variety of fevers. The use of tender leaves boiled in tea as a preventative against malaria and dengue fever during the rainy season is strongly recommended. Antipyretic cocktails based on the leaves cooked with powdered cardamom have been suggested as an effective home treatment for acute fevers. There are numerous cough syrups and expectorants that contain Tulsi. For bronchitis and asthma, it helps move mucus. Tulsi leaves can help alleviate the symptoms of a cold or flu. Nerve tonic and memory enhancer: The leaves. It helps remove mucus and catarrhal debris from the bronchial tube by promoting bronchial flow. Dentists recommend it as a treatment for pyorrhea and as a preventative measure. It's also used to treat eye conditions like conjunctivitis and night blindness. The leaves are used to improve memory since they are a nerve tonic[23]. It is a good source of antioxidants and provides excellent protection against the damage caused by free radicals. Oxygen free radicals, which have one or more unpaired electrons, are a natural result of the human body. Membrane lipids, proteins, DNA, and carbohydrates can be damaged by reactive oxygen species (ROS). Many diseases, including liver cirrhosis, atherosclerosis, cancer, and diabetes, have been related to this type of damage. Dietary antioxidants have long been known to have a significant impact on a wide range of diseases. Defending the human body from reactive oxygen species is a critical duty for antioxidants to play. In addition, it reduces lipid peroxidation and increases the activity of the enzyme superoxide dismutase. Antioxidative properties of eugenol and the reduction of lipid peroxidation have been linked to its presence. Oxidative stress is the hallmark of many biochemical diseases, including heart disease, and this property helps to maintain good health and reduce the risk of developing these diseases [24].

#### Anti bacterial, antiviral and antifungal activities

Almost all *Ocimum* species produce an essential oil that has antifungal, antibacterial, and antiviral properties. Diseases caused by antibiotic-resistant bacteria represent a significant therapeutic challenge. Use medicinal plants to solve this condition. Tulsi leaves have been proven to have strong antifungal effects against *Aspergillus* species [25]. In vitro

antifungal activity against *Candida* species was also demonstrated when oil from *O. gratissimum* L. was used. *Ocimum* has strong antibacterial activity against the bacteria that cause pneumonia and urinary tract infections, such as *Klebsiella*, *E.coli*, *Proteus aureus*, and *Vibrio cholerae*. According to the results of research, *O. basilicum* is an effective agent against both DNA and RNA viruses (herpes, adenoviruses, and hepatitis B virus). *O. tenuiflorum* also possesses antiviral activity against bovine herpes virus-1. It is thought that essential oils from *Ocimum* sp. have antibacterial properties since they include carvacrol, methyl eugenol, and caryophyllene [26].

#### **The anti-diabetic properties**

*O. sanctum* leaves have been shown in animal experiments to produce hypoglycemic effects [27]. Various plant parts can be used to make a decoction that lowers blood sugar levels. In rats, *O. sanctum* leaf extracts have been found to have a beneficial influence on insulin secretion via physiological mechanisms. Antiglycemic properties of *Ocimum* have been extensively researched, however the underlying mechanism is still unknown. The combination of tulsi and Neem has been shown to reduce blood sugar levels in diabetics [28].

#### **As an anticancer agent**

In many developing countries, cancer has been the leading cause of death since the 1970s. Changes in lifestyle and food choices, as well as the availability of curative therapy for many infectious diseases, have resulted in an increase in cancer-related illness and death in both industrialised and developing countries. As recognised cancer treatment treatments, surgery, radiotherapy, and chemotherapy are costly, mutilating, and have substantial side effects, as well as frequent relapses. Ayurveda has a wide array of plants that have anticancer and antitumor properties. An ethanolic extract of *O. sanctum* inhibited tumour cell proliferation and prolonged lifespan in mice with Sarcoma-180 solid tumours [29]. *O. sanctum*'s anti-cancer activities have been explored by other researchers using the Lewis lung carcinoma animal model. According to this study, ursolic acid and oleanic acid have anti-cancer potential. *Ocimum* has the ability to protect the body's DNA when exposed to harmful radiation.

#### **Anti lipidemic efficacy**

It has become increasingly common for people to be diagnosed with hyperlipidemia, atherosclerosis, and other related conditions. Aqueous extract of *O. basilicum* can diminish Triton WR-1339-induced acute hyperlipidemia in rats by decreasing total cholesterol, triglycerides, and LDL-cholesterol levels. When fresh Tulsi leaves were given to rabbits for 28 days, they were found to reduce total cholesterol levels [30].

#### **As an anti fertility agent**

High levels of ursolic acid in Tulsi leaves have been demonstrated to have an anti-fertility effect. This impact has been connected to the cessation of male

fertility and the inhibition of female ovulation because of its anti-estrogenic activity. When combined with other potent anti-fertility drugs, this compound has the potential to be a safe and effective option. Sperm production is inhibited in males by Tulsi leaves, which reduce the activity of the sertoli cells. Anti-implantation activities of *O. canum* leaves have been discovered in albino rats when tested in vitro. Ursolic acid has an anti-sterility property because of this acid. Tulsi leaves have also been found to have antiandrogenic effects. The sperm count and motility of albino rats administered benzene extract of *O. sanctum* are reduced [31].

#### **Stress relieving agents**

At some point in our lives, we've all had to deal with stress. Stress is described as the "non-specific effect of any exertion on the body." Depending on the source of the stress, it is possible to experience both physical and psychological symptoms of stress. Because stress can be harmful to the body if it gets out of hand, you should address it[32]. Depression, anxiety, immunosuppression, endocrine diseases including diabetes mellitus (DM), male impotence (IM), cognitive dysfunction (CDD), ulcerative colitis (UC) are all included in this category. You can use Tulsi to alleviate mental and physical stress, as well as boost your memory. Tulsi has an antihypoxic effect and increases lifespan when exposed to anoxic stress. Based on research, it has been found that Tulsi can help lower oxidative stress in rabbits.

Tulsi leaves are viewed as a 'adaptogen' or anti-stress agent. Recent studies have found that the leaves provide a great amount of stress alleviation. The sedative properties of Tulsi can be harnessed by eating it twice daily. In yoga, anxiety, sleeplessness, and gastrointestinal issues can be eased by long-term stress. An acute increase in corticosterone levels has been demonstrated to be reduced by the use of Tulsi leaf extracts[33].

#### **Immunomodulatory agent**

Both cell and humoral immunity are enhanced, leading to a more robust immune response. It has no detrimental effects on the body, unlike aspirin. Take this supplement to reduce pain and inflammation caused by osteoarthritis. Tulsi oil significantly reduced the symptoms of arthritis and edoema in rats exposed to Freund's adjuvant, formaldehyde, and turpentine oil in several experiments [34]. It was found that the anti-inflammatory properties of fixed oil of *Ocimum sanctum* worked effectively for rats with paw edoema produced by carrageenan or other mediators (Labiatae). *Ocimum sanctum*, which has been proven to inhibit both cyclooxygenase and lipooxygenase, can be used to reduce inflammation.

#### **Eye Disease**

*Ocimum sanctum* leaf juice and triphala can help reduce glaucoma, chronic conjunctivitis, and other eye disorders. According to folklore, three drops of tulsi oil and honey can improve one's vision.

#### Mosquitocidal activity

Mosquitocidal activities of the extract of Tulsi (hexane extract) were tested on larvae of the fourth instars of the mosquito, *Aedes aegypti*. As a result, any polysaccharides (polysaccharides) or larvae that came into contact with Tulsi seeds became permanently attached, and this caused the larvae to drown.

#### IV. CONCLUSION

To this day, no herb compares to the potency and healing properties of *Ocimum sanctum* (Tulsi). Tulsi is revered in Hinduism as a holy plant in India. Because of the herb's health advantages, our forefathers in India required that every household plant a Tulsi tree. Due to its multiple health benefits, Tulsi components must be isolated and characterised in terms of their chemical properties and bio-pharmacological actions. This plant has been found to have a wide range of medicinal characteristics, which suggests it can be utilised to treat a wide range of conditions. Future research should focus on sacred basil as a potential treatment for a number of diseases.

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