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## Phytoconstituents, traditional medicinal uses and bioactivities of Tulsi (*Ocimum sanctum* Linn.): A review

**Rakesh Kumar Joshi, William N Setzer and Joyce Kelly da Silva**

### Abstract

*Ocimum sanctum* is found throughout India and is cultivated near Hindu houses and temples. The leaves, seeds and root of this plant have been used in Ayurvedic medicine. The chemical composition of Tulsi is highly complex, containing many nutrients and other biological active compounds. Due to its inherent botanical and biochemical complexity, Tulsi standardization has, so far, eluded modern science. Perhaps the best known of many active compounds that have been identified and extracted are eugenol (in the essential oil) and ursolic acid. Many scientific studies have indicated that *Ocimum sanctum* has anti-stress, antioxidant, hepatoprotective, immunomodulating, anti-inflammatory, antibacterial, antiviral, antifungal, antipyretic, antidiuretic, antidiabetic, antimalarial and hypolipidemic properties with a wide margin of safety. In Ayurvedic medicine, Tulsi is being used either alone or in combination with others in various clinical conditions like anxiety, chronic cough, bronchitis, fever, snake and scorpion bites.

**Keywords:** *Ocimum sanctum*, essential oil, antioxidant activity

### 1. Introduction

The Indian Himalaya is home to more than 8000 species of vascular plants <sup>[1]</sup> of which 1748 are known for their medicinal properties <sup>[2]</sup>. Higher plants have played key roles in the lives of tribal peoples living in the Himalaya by providing forest products for both food and medicine. Numerous wild and cultivated plants have been utilized as curative agents since ancient times, and medicinal plants have gained importance recently not only as herbal medicines, but also as natural ingredients for the cosmetic industry. Plants have been used by mankind from prehistoric times to get rid of suffering and curing ailments. The folk medicines of almost around the world rely chiefly on herbal medicine even today. The therapeutic uses of plant are safe and economical and effective as their ease of availability <sup>[3, 4]</sup>. *Ocimum sanctum* L. (syn. *O. tenuiflorum* L.) has been extensively used in the Ayurvedic system of medicine for various ailments including capability of lowering plasma glucose <sup>[5]</sup>. There are about 160 species in the *Ocimum* genus broadly dispersed over the warm regions of the globe. *Ocimum sanctum*, *Ocimum gratissimum* (Ram tulsi), *Ocimum canum* (dulal tulsi), *Ocimum basilicum* (Ban tulsi), *Ocimum killimandscharicum*, *Ocimum americanum*, *Ocimum camphora* and *Ocimum miranthum* are examples of known important species of genus *Ocimum* that grow in the different parts of world and are known to have medicinal properties <sup>[6-8]</sup>. Tulsi is a Sanskrit word which means "the incomparable one" and has a very special place in the Hindu culture. Several medicinal properties have been attributed to the Tulsi plant not only in Ayurveda and Siddha but also in Greek, Roman and Unani systems of medicine <sup>[9]</sup>. In traditional systems of medicine the Indian medicinal plants have been used in successful management of various disease conditions like bronchial asthma, chronic fever, colds cough, malaria, dysentery, convulsions, diarrhea, arthritis, emetic syndrome, skin diseases, insect bites etc and in the treatment of gastric, hepatic, cardiovascular and immunological disorders etc <sup>[10-15]</sup>. *Ocimum sanctum* Linn. (Tulsi) commonly known as holy basil in English or sacred basil in Hindi, in Sanskrit it is known as Vishnu priya, Divya and belongs to the family Lamiaceae (labiateae). As its Latin name implies it considered a very sacred plant. It is high in sattva imparting the quality of lightness and spiritual clarity. An excellent herb for lifting the heaviness of fevers, cough and cold etc. Tulsi is a prophylactic shrub growing to about 75 cm. It is commonly found near temples and home and is worshiped daily by Hindus <sup>[16]</sup>.

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## 2. Chemical constituents

A survey of the literature has revealed in *O. sanctum*, the presence of methyl eugenol,  $\beta$ -caryophyllene [17-18], methyl eugenol, (E)-caryophyllene, eugenol and,  $\beta$ -elemene [19], methyl chavicol, and linalool [20] from India;  $\beta$ -bisabolene, 1,8-cineole and methyl chavicol [21] from Poland; methyl eugenol and isocaryophyllene [22] from Nigeria; eugenol,  $\beta$ -caryophyllene and caryophyllene oxide [23] from Northeastern Brazil; eugenol,  $\beta$ -elemene and  $\beta$ -caryophyllene [24] from Cuba; methyl chavicol, camphor and  $\beta$ -caryophyllene [25] from Australia (Fig.1). In other species, *O. gratissimum* is a well-known plant used in the Indian herbal medicine. The flowers and the leaves of this plant are rich in essential oils, so it is used in the preparation of teas and infusions. The volatile oil of *O. gratissimum* contains mostly thymol and eugenol, those are probably responsible for its reported antimicrobial activity [26]. *O. kilimandscharicum* is known as Kapur tulsi. Aqueous extract of leaves contain camphor, 1,8-cineole, limonene, trans-caryophyllene, camphene, 4-terpeneol, myrtenol,  $\alpha$ -terpineol, *endo*-borneol and linalool. It also contains flavonoids, tannins, saponins, sterols, carbohydrates, proteins and triterpenoids. Its essential oil contains oxygenated monoterpenes (95.8%), like camphor (64.9%), limonene (8.7%), camphene (6.4%) and (*E*)- $\beta$ -ocimene (3.0%) [27]. *O. kilimandscharicum* attracted attention as a source of camphor [28].

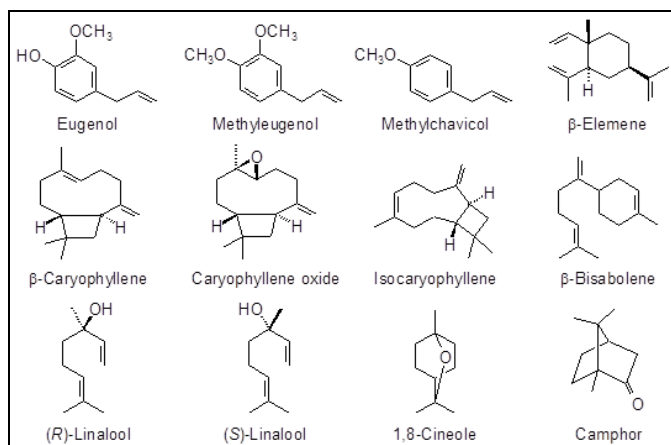


Fig 1: Major compounds present in *Ocimum sanctum*

## 3. Traditional, medicinal and bioactive uses

### 3.1. Traditional uses

Literature survey revealed that Tulsi has been used traditionally in Ayurveda and Siddha systems of medicine for prevention and cure of common cold, headache, cough, influenza, earache, fever, colic pain, sore throat, bronchitis, asthma, hepatic diseases, malarial fever, as an antidote for snake bite and scorpion sting, flatulence, migraine headaches, fatigue, skin diseases, wound, insomnia, arthritis, digestive disorders, night blindness and diarrhoea. The leaves are good for nerves and to sharpen memory [29]. Holy Basil is also good for boosting up the immune system. It protects from nearly all sorts of infections from viruses, bacteria, fungi and protozoa. Recent studies show that it is also helpful in inhibiting the growth of HIV and carcinogenic cells [30]. In India plants have been traditionally used for human and veterinary health care and also in the food and textile industry. Most of the local food resources known to indigenous peoples were undocumented with respect to nutritional literature, trade, cosmetics and perfumes: but India has held a special position in the area of herbal medicines *Ocimum sanctum* has been

used for various purposes. For example leaves, flowers, stem, root, seeds etc. are known to have potential pharmacological activity such as expectorant, analgesic, anticancer, hepatoprotective, hypotensive, hypolipidemic and antistress agent. It also plays a significant role in treatment of fevers, arthritis, convulsions, bronchitis etc, in traditional medical practices [31-34].

### 3.2. Medicinal uses and bioactivities

**3.2.1. Eye care:** The leaf juice of *Ocimum sanctum* along with triphala is used in Ayurvedic eye drop preparations recommended for glaucoma, cataract, chronic conjunctivitis & other painful eye diseases. In daily routine, one may use about three drops of tulsi oil along with honey and it is supposed to improve eye sight [35].

**3.2.2. Malaria fever:** Decoction of the root of tulsi plant is given as a diaphoretic in malarial fevers. Ayurvedic preparations containing *Ocimum sanctum* L., *Allium sativum*, *Piper nigrum* and *Curcuma longa* have been shown to possess anti-malarial activity against *Plasmodium vivax* and *Plasmodium falciparum* [35].

**3.2.3. Used as a heart tonic:** Affinity of *Ocimum sanctum* for *rasa dathu* (refers to the primary waters of the body. The word *rasa* means sap, juice, or liquid. In the physical body, *rasa* refers directly to the plasma, or non cellular portion of the blood; the lymph, and interstitial fluids) helps to increase circulation through the heart where there is congestion from high *vatta* (In Ayurveda, one of the three doshas, condensed from the elements air and space. It is the principle of kinetic energy in the body, is concerned with the nervous system and with circulation, movement and pathology and is eliminated from the body through defecation) and *kapha* (In Ayurveda, one of the three doshas, condensed from the elements water and earth. It is the principle of stabilizing energy, governs growth in the body and mind, is concerned with structure, stability, lubrication, and fluid balance and is eliminated from the body through the urine). Eugenol from *Ocimum sanctum* has been reported to possess the vasorelaxing action on rabbit arterial tissue indicating its therapeutic importance as a vasodilator. Methyl eugenol was identified as the major constituent of *Ocimum sanctum* oil and probably accounted for the observed larvicidal action of the oil [36-38].

**3.2.4. Skin care:** In case of ring worm or other related diseases such as leucoderma paste of tulsi leaves is applied on the affected area to cure these ailments. In case of *chicken pox* tulsi leaves are taken externally with saffron to treat the disease [39, 40].

**3.2.5. Insecticidal activity:** Tulsi extract and essential oil have also been found to possess insecticidal and larvicidal activity against mosquitoes [35].

**3.2.6. Anti-diabetic potential:** Aqueous decoction of whole the plant lowers the blood sugar levels and is said to control diabetic mellitus. The ethanolic extract of tulsi leaves lead to marked lowering of blood sugar in normal glucose fed hyperglycaemic and streptozocin induced diabetic rats [33, 39, 40].

**3.2.7. Anti-tubercular activity:** Tulsi also has anti-tubercular activity & inhibits in vitro growth of *Mycobacterium tuberculosis* [35].

**3.2.8. Anti-stress activity:** Literature survey revealed that the plant extracts exhibit anti-stress activity by improving sorbitol dehydrogenase assay (SDH) level in albino rats [35, 41, 42].

**3.2.9. Anti fertility effect:** The leaves of *Ocimum sanctum* L. are said to have abortifacient in women and sanctum has also ant fertility effect. The local women of Kerala and the ayurvedic physician have been reported to use tulsi leaves for ant fertility effect [32]. Benzene extract of leaves, in a male rat model, has been found to reduce spermatogenesis, retarding stromal cells activity without affecting the germ cells [41]. Ursolic acid, a major constituent of the tulsi leaves, possesses anti-fertility effects in rats of both sexes, due to anti-estrogenic effects as well as reduction of spermatogenesis and decreased sperm counts [35]. There are several other pharmacological effects such as hepatoprotective, anti-inflammatory (oral and topical), antiulcer, anti-hyperlipidemic, antiviral, antimicrobial activities that have also been attributed to ursolic acid [42].

**3.2.10. As an antidote:** Tulsi have been recommended for use as antidote for dog bite, scorpion bite and insect bite in traditional system of medicine [35, 44, 45].

**3.2.11. Anti fertility effect:** The leaves of *Ocimum sanctum* L. are said to have abortifacient in women & sanctum has also ant fertility effect. The local women of Kerala & the ayurvedic physician have been reported to use tulsi leaves for ant fertility effect [32].

#### 4. Conclusions

Tulsi is a traditional herb used in India, it has diverse healing properties and considered as adaptogenic. Many varieties of tulsi species are available, among them three species were selected for evaluation of antimicrobial activity. Survey of literature showed that *Ocimum sanctum* has an esteemed status as an herb with diverse pharmacological activities. Additionally crude extracts of various parts of the plants have been utilized for medicinal applications from time immemorial; nevertheless modern approaches to drug development may explore bioactivities, pharmacotherapeutics clinical trials, mechanism of action, safety evaluation after proper standardization and clinical trials. The multidimensional uses of Tulsi as well as cultivation of this plant in Uttarakhand will be very effective to check migration and provide employment for local people.

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