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Review

BASIL (*Ocimum sanctum L.*) aromatic medicinal Plant: a review

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Abstract

Ocimum sanctum (Basil; Tulssi) is important traditional herb and used for therapeutic purpose all over the world. It has been used in traditional medicine from 3000 years, because of its miraculous healing properties. In India it is consider as the holiest herb. It is considered as assign of goddness in Hinduism. Each part of this plant is worshipped in India. It is used in numerous ailments such as insomnia, malaria, skin and digestive disorders, diarrhoea and also used in cough, cold and flu. Studies revealed its antifungal, antiviral, analgesic, bronchodilators, anti-asthmatic and anti-oxidant activites. Volatile oil, eugenol, urosolic acid, linalool, carvacrol, limatrol, sesquiterpene, methyl eugenol, estragole and caryophyllene are phytoconstituents present in *Ocimum sanctum*.

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Introduction: *Ocimum* genus consists almost thirty herb and shrub species. They all vary in Morphology, flower colour, growth patterns, chemical composition, leaves, and stems all had a lot of variation. Asia, Central and Southern America, and Africa are all home to the genus. It has Lamiaceae family. It was known as the herb of kings among the ancient Greeks. Basil is an English name of *Ocimum sanctum L.* Its common name is Tulsi or Holy basil. In India it is consider as the holiest herb. It consists of essential oil. The essential oil concentration varies among species and depends upon the cultivars, and growing conditions. Medicinal plants' biochemical components may be influenced by a variety of factors such as genotype, cropping seasons, and regional characteristics. It is cultivated all over world for its perfumery, medicinal, religious, food, ceremonial and essential oil importance. The purpose of this mini review was to look at the most important chemical ingredients and pharmacological benefits of basil in modern and traditional science. Its antidiabetic, antioxidant, wound healing, radiation protective, anti-infertility, immunomodulatory, anti-inflammatory, anti-stress antimicrobial and anticancer activities have been reported [1].

Habitat: It is native to Asia (Pakistan, India, Thailand, Iran) and grow wild in sub- tropical and tropical area of world. It is cultivated throughout Southeast Asian tropics [2].

Botanical Description: Basil is herb belong to mint family.

Kingdom: Plantae
Class: Magnoliopsida
Order: Lamiales
Family: Lamiaceae
Genus: Ocimum
Species: *O. sanctum*

It is a tall, 30 to 60 cm height. It is an aromatic plant. The branches are erect. Leaves are aromatic, simple, elliptic, opposite, oblong. Leaves are serrated and 5 cm long. Flowers small, purple to red in hue, grow in small clusters on the cylindrical spikes. At foot of each cluster of flower, few stalkless heart-shaped bracts present. The sepal cup is not hairy internally. Flowers are 5 mm long, having a bearded calyx tube on outside at base. The flower tube is hairy. The seeds are golden to reddish in colour and the fruits are tiny [3].

Temperament: Hot and Dry in 2nd order

Chemical Constituents: *Ocimum sanctum L.* has a complex chemical makeup that includes several nutrients and other biologically useful substances. Different growing, harvesting, processing, and storage circumstances have a considerable impact on the quantity of several of these elements, which is still little understood. The pharmacological and nutritional characteristics of the basil plant in its natural state. It is used traditionally for medicinal purpose and contains numerous phytochemical constituents. Volatile oil, eugenol, urosolic acid, linalool, carvacrol, limatrol, sesquiterpene, methyl eugenol, estragole and caryophyllene are phytoconstituents present in *Ocimum sanctum*.

Xylose and polysaccharides make up the sugars. Saponins, triterpenoids, flavonoids and tannins were discovered in a phytochemical analysis of *Ocimum sanctum* stem and leaves. Vitamin A, C and minerals including iron, zinc, calcium and many other phytonutrients, are all found in *Ocimum sanctum* L [4]. Volatile oil, flavonoids, terpenoids, neolignanes, and fatty acid derivatives are all abundant in basil leaves. The unsaponifiable content of basil seeds contains (18 to 20%) fixed oil, polysaccharide, mucilage, and –sitosterol. Triglycerides (94–98%), with linolenic acid (43.8%) being the most abundant basil seed. The main secondary metabolites are listed in the table 1.

Fresh Ocimum sanctum stem and leaves extract included phenolic components such as circimaritin, cirsilineol, apigenin, isothymusin and rosameric acid, and contain significant amounts of eugenol. *Ocimum sanctum* leaves contain 0.7 % volatile oil, which is made up of 71% eugenol and 20% methyl eugenol. Carvacrol and sesquiterpene hydrocarbon caryophyllene are found in oil. The flavonoids orientin and vicenin were extracted from aqueous *Ocimum sanctum* leaf extract.

Pharmacological activities:

Antidiabetic activity: *O. sanctum* has been shown to have excellent anti-diabetic effects. At doses of 250 and 500 mg/kg body weight, the anti-diabetic efficacy of O. tenuiflorum hydroalcoholic extract against streptozotocin and nicotinamide-induced diabetes in rats was shown to be considerable, and this effect was comparable to glipalamide. In both acute and long-term feeding trials, the ethanol extract of O. sanctum was demonstrated to ameliorate hyperglycaemia in alloxan diabetic rats. J M A Hannan et al. found that the ethanol extract and three partition (ethyl acetate, butanol, and aqueous) fractions of O [5]. sanctum had significant insulin-secretory effects in the rat pancreas. Acute insulin-release investigations employing isolated rat islets revealed similar results [6].

Antimicrobial activity: Antimicrobial activity has been shown in *Ocimum sanctum. Ocimum sanctum L.* extracts in ethanol, methanol, and organic solvents demonstrate extensive zones of inhibition against Staphylococci sp., *Escherichia coli*, Staphylococcus aureus, Shigella sp., and Enterobacteria sp. Staphylococci sp., P. aeruginosa, S. typhi, K. pneumoniae, C. albicans, Mycobacterium tuberculosis, and Micrococcus pyogenes are all susceptible to *Ocimum sanctum.* These findings show that OS can be an effective antibacterial agent against a wide range of microorganisms [7].

Anticancer activity: Cancer is a leading cause of death today. Surgery, radiation, and chemotherapy are all expensive cancer treatments with substantial adverse outcomes and long-term morbidity. Ocimum sanctm leaf extract reduce tumor size in mice with solid sarcoma. The anticancer efficacy of basil in the Lewis lung carcinoma animal model also supports this conclusion. Ursolic acid is an anticancer substance. O. sanctum protects DNA from damaging radiations by acting as a shield. O. sanctum is effective against a wide range of neoplastic states. Tulsi extracts also possesses anti-inflammatory and antioxidant properties, which help to inhibit the growth of some malignant cells. Tulsi's ursolic acid and curcumin have antioxidant, cyclooxygenase inhibitory anti-inflammatory and antioxidant properties. In mice, *Ocimum sanctum* boosts glutathione production and storage while also increasing glutathione-S-transferase activity by about 78 percent. Chemo preventive activity and anti-tumour growth of basil were reported in Albino mice in the Dalton Lymphoma ascites tumour model in Swiss mice. In a

DMBA (7,12 dimethylbenz[a]anthracene) triggered rat hepatocyte, crude herb consumption leads to an increase in survival time and a decrease in peritoneal ascetic fluid. By employing extract, the levels of DMBA-DNA were reduced in a dose-dependent manner. According to the researchers, O. sanctum leaf extract reduces chemical carcinogenesis by inhibiting the metabolic activation pathway in the carcinogen seed. The oil of O. sanctum is a potent chemo preventive medication for cancer. Fibrosarcoma growth in Swiss albino mice induced by20-methylcholanthrene administered subcutaneously This results in when there is an increase in the survival rate and a delay in the occurrence of tumours it was given to mice Lipid peroxidation and liver damage are the results. The amounts of enzymatic and malondialdehyde were significantly changed when Mice who had been treated with oil were compared to mice who had not been treated with oil and 20-methylcholanthrene was administered into these rats. As a result of the antioxidant qualities, the chemo preventive potential is enhanced, resulting in a significant reduction in tumour size. The radio-protective impact of administration on the salivary glands in rats was evaluated, and the activity was compared to that of a radioprotectant, amifostine. O. sanctum and amifostine administer to rats for three and six months, respectively, with positive outcomes on a high dose. The alcoholic extract of root is also effective in lung cancer cells [8].

Antifungal activity: *Aspergillus niger, Aspergillus fumigates, Cryptococcus neoformans, Candida albicans, Sporotrichum schenkii* and *Microsporum cassis* are all susceptible to Tulsi. The most effective repellent action against Sitophilus. In medical science, fungal diseases are notoriously difficult to crack. *Aspergillus flavus,* C. albicans, and aflatoxin B1 (AFB1) production, *Aspergillus niger, Curvularia lunata, Aspergillus repens, and Fusarium moniliforme* have all been tested with *Ocimum sanctum* extract. In compared to aqueous extract, ethanolic extract of *O. sanctum* had a 21-30 mm zone of inhibition against C. albicans and was less efficient. *Fusarium solani* f. sp. Melongenae has been discovered to be resistant to leaf extracts. They were also discovered to decrease *A. flavus* growth and AFB1 production. When these extracts were combined with silver, manganese and titanium ferrocyanides, the metal ferrocyanides complexes demonstrated greater antifungal activity against A. niger. Tulsi's antifungal capabilities are presently being evaluated in new studies using various dosage forms and methods [9].

Antihyperlipidemic action: The fixed oils are used to reduce lipid levels. The lipid-lowering action of *Ocimum sanctum* has been demonstrated in rats fed a high-fat diet. It normalises lipids and reduces lipid peroxidation, a process in which lipids deteriorate due to oxidation. Linoleic and Linolenic acids were mostly responsible for the impact. Another study found that giving seed oil to rabbits and fresh leaves of O. sanctum to albino rats decreases cholesterol, triglcyrides and VLDL levels while raises HDL cholesterol and total sterol content in faeces. Aqueous extract of plant was given to Streptozotocin-induced diabetic rats for 08 weeks, and a decrease in lipid profile was observed [10].

Wound healing: The wound healing ability of tulsi has also been demonstrated in rats using two different concentrations (200 and 400 mg/kg). The excise, incise, and dead space wound models were employed to conduct this research. It was discovered that Hexose amine, Ascorbic acid, Malondialdehyde and L-Hydroxyproline extracted from Ocimum have wound healing activity. Tulsi can be used as an adjunct therapy for healing of burn wound, with numerous research supporting its usage [11].

Adaptogenic/antistress activity: The Aqueous extract of OS improves athletic ability (survival time) in swimming mice and reduces stress-induced ulcers and milk-induced leucocytosis. Adaptogen reduces the severity of stress, as well as the negative effects of infection, emotional issues, sickness, and other variables. Tulsi is a well-known adaptogen. OS's alcoholic extract increases athletic endurance [12].

Antifertility activity: In female rats, benzene and petroleum ether extracts of Tulsi leaves were found to exhibit 80 percent and 60 percent antifertility efficacy, respectively. Local women in Kerala, as well as Ayurvedic physicians, have been reported to employ Tulsi leaves for antifertility purposes. Ursolic acid, one of the key ingredients of Tulsi leaves, has been reported to have antifertility properties. This action has been related to its anti-estrogenic activity, which is thought to be responsible for male spermatogenesis arrest and female ovum implantation inhibition. This compound could be a viable anti-fertility drug with no negative side effects. Tulsi leaves inhibit spermatogenesis in males by slowing the activity of Sertoli cells [8].

Cough and sore throat: The tulsi herb is a key ingredient in several Ayurvedic cough syrups. Chewing the leaves can help with colds and flu. In the case of a sore throat, boiled water of leaves is utilised to provide relief. Tulsi has been used as an inhalation for minor throat infections and coryza cough in children from ancient times with no ill consequences [8].

Anticoagulant action: The OS fixed oil (3 ml/kg) causes a lengthening in blood clotting time that is comparable to that of aspirin (100 mg/kg). This is because Tulsi oil has an anti-aggregator effect on platelets [8].

Anticataract activity: In a cataract experiment (galactosemic cataract in rats caused by 30 percent galactose, and naphthalene cataract in rabbits caused by 1 g/kg naphthalene). The cataractogenesis process was slowed. It postponed the onset and progression of cataracts [13].

Anti-anaphylactic and antihistamine activity: Sridevi et al. discovered that *Ocimum sanctum L.* has powerful anti-asthma and anti-inflammatory properties. The antihistaminic and anti-anaphylactic effect of *Ocimum sanctum L.* extract is mostly attributable to its mast cell stabilising potential, suppression of IgE, and prevention of the production of inflammatory mediators, according to findings from numerous research. Thus, the usage of *Ocimum sanctum L.* leaves demonstrated a compelling explanation for the therapeutic activities mentioned [8].

Antipyretic activity: The antipyretic activity of *Ocimum sanctum L.* fixed oil was tested in rats with pyrexia caused by the typhoid-paratyphoid A/B vaccination. The fixed oil exhibited prostaglandin inhibitory action, and possibly account for its antipyretic properties [13].

Antiarthritic activity: In rats with formaldehyde-induced arthritis, fixed oils of OS were found to diminish the diameter of the inflamed paw. The arthritic difficulties in

rats were greatly improved when fixed oils were supplied intraperitoneally daily for ten days. Carrageenan and other inflammatory mediators (e.g., serotonin, bradykinin, histamine, and PGE2) are reduced by the fixed oil, which reduces inflammation [14].

Antidote activity:

OS acted as an antidote against a variety of toxins. Dog bite, scorpion bite, snake bite, and bug bites can all be treated with OS [8].

Immunologic effect: *Ocimum sanctum* has immunologic effect. Its leaf extract was evaluated for immunologic effects in albino rats. The extract alters the humoral response. According to Godhwani et al., administration of *Ocimum sanctum* resulted in humoral immunogenic response, as measured by an increase in antibody titer in both the widal and sheep erythrocyte agglutination tests, as well as a cellular immunologic response, as measured by rosette formation and lymphocytosis [13].

Radioprotective activity: Joseph et al. 2011 studied the effect of *Ocimum sanctum* against radiations by radio iodizing salivary glands of rats and comparing its radioprotective effect to that of Amifostine, a well-known radioprotectant. In the event of oral cancer, flavonoids derived from the leaves of *O. sanctum* exhibit radioprotective activity due to their antioxidant effect on erythrocytes. Tulsi has shown promise in terms of offering radiation poisoning protection and mediating healing cycles.

At low and non-toxic dosages, flavonoids from the leaves of O. sanctum, such as vicenin and orientin, protect human lymphocytes from the clastogenic effects of radiation. When combined with WR-2721, the sanctum leaf extract protects the bone marrow and reduces its toxicity at higher concentrations [15].

Hepatoprotective activity: It enhances the excretion of harmful substances and acts as a hepatoprotective agent by working as part of the detoxifying system. The study found that when albino rats were given an alcoholic extract of the Tulsi plant, it had a hepatoprotective potential against liver injury caused by paracetamol, carbon tetrachloride, and anti-tuberculosis medications. The number of enzymes was lowered in animals when extract of *Ocimum sanctum* was applied. When albino rats were fed Tulsi extract orally for six days, the Biometry Research Unit of the Indian Statistical Institute discovered that the cold-water extract of the Tulsi plant had a hepatotonic action against paracetamol and CCL_4 induced hepatotoxicity. Tulsi extract has a substantial hepatoprotective effect when combined with silymarin [16].

Traditional and current uses: Tulsi is renowned as "the elixir of life" because it helps people live longer. In Siddha and Ayurveda system this medicine is used in variety of ailments including cough, influenza, headache, fever, colic pain, sore throat, asthma, bronchitis, common cold, fatigue, hepatic disorders, dyspepsia, skin diseases, malaria fever, earache, insomnia, diarrhoea and night blindness. The leaves are beneficial to nerves and memory. Tulsi leaves can also be chewed to treat mouth ulcers and infections. A few leaves sprinkled in drinking water or food can purify it while also killing pathogens. Holy basil is extremely beneficial to the immune system. It defends against practically all viruses, bacteria, fungus, and protozoa infections. It has also been shown in recent research to be effective in suppressing the proliferation of HIV and carcinogenic cells.

Tulsi has ulcer-healing qualities as well. It functions as a cardiac tonic, preventing heart attacks, stress, and blood pressure normalisation, as well as having blood thinning qualities. It contains anti-arthritic and anabolic properties and accelerates protein synthesis to increase muscle growth and strength. It soothes aching eyes and aids in the treatment of night blindness (Vitamin A deficiency). Tulsi juice mixed with honey is used as an eyewash to treat conjunctivitis and as an anti-conjunctivitis agent. It effects the neurochemistry of the brain as well as correcting and regulating neurotransmitter levels in the human brain. Tulsi extract helps to improve memory [16].

Tulsi is used in stress; it improves stamina and increases the body's efficient use of oxygen; it gives strengthening to the immune system; reduces inflammation; slows ageing; protects against radiation; supports the liver, heart and lungs; and it has antiviral, antibiotic, antifungal, and antioxidant effects. Its various parts are used to treat variety of ailments, including the common cold, headache, asthma, flu, colic pain, act as an antidote for snake bite. Tulsi works as an adaptogen, assist the body and mind in dealing with a variety of chemical, physical and emotional and viral stresses while also restoring physiological and psychological processes. In addition to its very precise therapeutic activities, such enormous and health-promoting potential paved the path for a broad range of applications. Tulsi's conventional medical uses are extensive, and it also contributes to the city's economic well-being, mythical importance, and holy sanctity.

Conclusion: *Ocimum sanctum* is considered in Hinduism a sacred plant and sign of goodness. Each part of this plant is worshipped. Its various parts are used to treat variety of ailments, including the common cold, headache, asthma, flu, colic pain, act as an antidote for snake bite. Tulsi works as an adaptogen, assist the body and mind in dealing with a variety of chemical, physical and emotional and viral stresses while also restoring physiological and psychological processes.

Conflict of Interest: The authors have no conflict of interest.

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Table 1. The main secondary metabolites of *Ocimum sanctum*

Part of the Plant	Phytochemicals
Leaf	Flavonoids, saponins, alkaloids, tannins, antrocyanins, phenols, sterols, terpenoids,
Stem	Phenols, Flaonoids, saponins, tannins, triterpenoids.
Seeds	Sito sterol and fatty acids.
Whole plant	Flavonoids, saponins, alkaloids, Phenols, triterterpenoids, anthrocyanins, tannins.

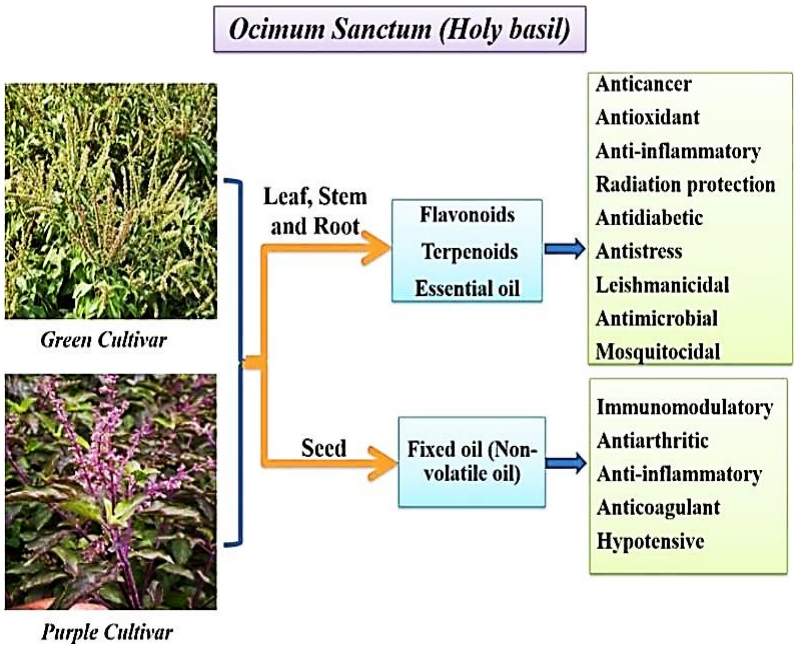

Fig 1. Secondary metabolites of *Ocimum sanctum*