



## A MINE OF MEDICINAL USES: *OCIMUM SANCTUM*, THE HOLY BASIL

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### ABSTRACT

The medicinal plants are rich in secondary metabolites, which are potential sources of drugs and essential oils of therapeutic importance. One such plant of interest is *Ocimum sanctum* (Lamiaceae). Traditionally used since the times of ancient civilization in India and called as the “Queen of Herbs”. It contains 7.0% eugenol, carvacrol (3%) and eugenol-methyl ether (20%). It also contains caryophyllin, ursolic acid, rosmarinic acid, thymol, methyl chavicol, citral, carvacrol,  $\beta$ -caryophyllene. It has been observed that eugenol and the essential oils possessed membrane stabilizing properties on synaptosomes, erythrocytes and the mast cells which account for the therapeutic potentials of Tulsi in management of neurological, inflammatory and allergic disorders. It was also pharmacologically evaluated and found to reduce raised blood sugar, cholesterol and triglyceride levels and activities of GPT, GOT, LDH and alkaline phosphatase in blood serum and thereby it is therapeutically used as cardioprotective, antidiabetic, hepatoprotective and hypolipidemic agent. There even more therapeutic uses of the holistic herb which are briefly discussed in this review.

**Keywords:** *Ocimum sanctum*, Eugenol, Cardioprotective, Antidiabetic, Holistic.

### INTRODUCTION

In present pharmaceutical field, plants form the major sources for medicines, as the large number of drugs in use are obtained from plants, like vasicine from *Adhatoda vasica*, Boswellic acid from *Boswellia serrata*, momordicosides from *Momordica charantia*, Levodopa from *Mucuna pruriens*, phyllanthin from *Phyllanthus amarus*, Terestrosins from *Tribulus terrestris* etc.

The medicinal plants are rich in secondary metabolites, which are potential sources of drugs and essential oils of therapeutic importance. Medicinal plants are widely used in various ailments, because of their safety besides being economical, effective and their easy availability [1]. According to a survey (1993) of World Health Organisation (WHO), the practitioners of traditional system of medicine treat about 80% of patients in India, 85% in Burma and 90% in Bangladesh [1,2].

A large majority of Indian population is treated by traditional systems such as Ayurveda, Unani and siddha

systems of medicine. Ayurveda, the Indian indigenous system of medicine has been an integral part of Indian culture. In Ayurveda, drugs are in general called as “Aushadha” or “Bhesaja” which means that it cures pain and sorrowful experiences. The plant sources of drugs are called “Aushadhi”. Plant drugs form the lion’s share of traditional drugs.

Globally, the early part of the 20<sup>th</sup> century brought an evolution of the pharmaceutical industry. With the progress of chemical techniques, crude drugs came to be replaced by pure chemical drugs and the developed countries witnessed a decline in popularity of medicinal plant therapy. However, during the recent part the interest has swung again and there is a resurgence of interest in study and use of medicinal plants.

One such plant of interest is *Ocimum sanctum* (Lamiaceae). Known to the Ayurvedic medical tradition as tulsi, it has been called the “Queen of Herbs” since the times of ancient civilization in India.

In Ayurveda, Tulsi (*Ocimum sanctum L.*) has been documented for its therapeutic activities and termed as Dashemani shwasaharni (antiasthmatic) and anti-kaphic drugs (Kaphaghna) [3]. It is cultivated for religious and medicinal purposes, and also for its essential oil.

Essential oil extracted from Tulsi is mostly used for medicinal purposes and in the formulation of herbal cosmetics, and is widely used in skin preparations due to its anti-bacterial activity. For centuries, the dried leaves of Tulsi have been mixed with stored grains to repel insects [4].

#### ACTIVE COMPOUNDS IN TULSI

Tulsi leaves contain bright, yellow coloured and pleasant volatile oil (0.1 to 0.9%). The oil content of the drug varies depending upon the type, the place of cultivation and season of its collection. The oil is collected by steam distillation method from the leaves and flowering tops. It contains approximately 7.0% eugenol, carvacrol (3%) and eugenol-methyl ether (20%). It also contains caryophyllin, ursolic acid, rosmarinic acid, thymol, methyl chavicol, citral, carvacrol,  $\beta$ -caryophyllene [5]. Seeds contain fixed oil with good drying properties.

The plant is also reported to contain alkaloids, glycosides, saponins, tannins, an appreciable amount of vitamin C, and traces of maleic acid, citric and tartaric acid.

#### Eugenol

Eugenol (1-hydroxy-2-methoxy-4-allylbenzene) (Fig.2), which is the major constituent of the essential oil (steam distilled from fresh leaves of *Ocimum sanctum L.*), is responsible for the therapeutic potential of the essential oil and it is a phenolic compound [6,7].

Several investigations in experimental animals have been carried out using the extracts of Tulsi leaves to establish the pharmacological actions of Eugenol, essential oils extracted from Tulsi leaves on central nervous system, reproductive system, immune system, gastric system, blood biochemistry etc [6, 8-16]. It has been observed that eugenol and the essential oils possessed membrane stabilizing properties on synaptosomes, erythrocytes and the mast cells which account for the therapeutic potentials of Tulsi in management of neurological, inflammatory and allergic disorders [6]. It was also found to reduce raised blood sugar, cholesterol and triglyceride levels and activities of GPT, GOT, LDH and alkaline phosphatase in blood serum and thereby it is therapeutically used as cardioprotective, antidiabetic, hepatoprotective and hypolipidemic agent. Eugenol was also reported to possess vasorelaxing action on rabbit arterial tissue indicating its therapeutic importance as a vasodilator [17]. The antiulcerogenic action of eugenol and essential oil extracted from Tulsi leaves helps in the treatment of gastric ulcer [6,13].

*O.sanctum* is also used in immunological disorders associated with immunosuppression as eugenol and essential oils have been shown to be immunostimulant [6]. Lowering of uric acid level by extract of Tulsi leaves and eugenol claims the therapeutic potential of *O.sanctum* in treatment of rheumatoid arthritis [6,14]. The essential oils extracted from Tulsi leaves also possessed antimicrobial properties like anti-fungal, anti-viral, anti-bacterial (inhibited in-vitro growth of *E. coli*, *B.anthraxis* and *P. aeruginosa*), anti-tubercular ( inhibited in-vitro growth of *M.tuberculosis*) activities.

#### THERAPEUTIC USES OF OCIMUM:

The following reported activities of *O.sanctum* show that it is a potent herbal remedy for lot more disorders.

##### 1. Chemoprotective activity:

*O.sanctum* plant extract has been shown to protect against chemically induced oral cancer and the development of skin papillomas in rodents [18].

##### 2. Hypoglycemic activity:

Tulsi leaf powder was fed at 1% level in normal and diabetic rats for a period of one month shown hypoglycemic and hypolipidemic effect in diabetic rats [19].

##### 3. Anti-hyperlipidaemic activity:

Two weeks treatment of diabetic rabbits with *O.sanctum* Seed oil showed no significant hypoglycemic effect. Results showed that OSSO has hypocholesterolaemic and antioxidant effects but it didn't have anti-diabetic effect [20].

##### 4. Anti-lipidperoxidative activity:

Aqueous extracts of *O.sanctum* inhibited hypercholesterolemia-induced erythrocyte lipid peroxidation activity [21].

##### 5. Anti-oxidant activity:

Administration of ethanolic extract of *O.sanctum* attenuates the alterations induced by noise exposure [22].

##### 6. Anti-ulcer activity:

The fixed oil of *O.sanctum* was found to possess significant anti-ulcer activity against aspirin, indomethacin, alcohol, histamine, reserpine, serotonin and stress induced ulceration in experimental animal models [23].

##### 7. Cardiovascular activity:

Chronic oral administration of *O.sanctum* augments cardiac endogenous antioxidants and prevents isoproterenol-induced myocardial necrosis in rats [24].

##### 8. Effect on nervous system:

*O.sanctum* could be a probable herbal remedy for noise induced biogenic amine alterations [8, 25].

### **9. Effect on reproductive system:**

Feeding Tulsi leaves along with the normal diet in adult male Wistar rats decreased in sexual behavioral score [26].

### **10. Hepatoprotective activity:**

Hepatoprotective activity of *O.sanctum* leaf extract against paracetamol induced hepatic damage in rats has been reported [27].

### **11. Hypotensive activity:**

*O.sanctum* fixed oil produced hypotensive effect in anaesthetized dog, which seems to be due to its peripheral vasodilatory action. The oil increased blood-clotting time and percentage increase was comparable to aspirin and could be due to inhibition of platelet aggregation [28].

### **12. Analgesic activity:**

Analgesic activity of the alcoholic extract of the leaves of *O.sanctum* has been observed in both, glacial acetic acid-induced writhing and radiant heat-induced tail flick test [8]. Recent studies suggest that Tulsi may be a COX-2 inhibitor, like many modern pain killers, due to its high concentration of eugenol.

### **13. Anthelmintic activity:**

The essential oil of *O.sanctum* showed potent anthelmintic activity in the *Caenorhabditis elegans* model [29].

### **14. Anti-amnesic and nootropic activity:**

When compared to control, scopolamine and aged groups of mice, *O.sanctum* whole plant extract decreased transfer latency and increased step down latency significantly [30].

### **15. Anti-bacterial activity:**

*O.sanctum* fixed oil showed good antibacterial activity against *Staphylococcus aureus*, *Bacillus pumilus* and *Pseudomonas aeruginosa* [23].

### **16. Anti-cataract activity:**

Aqueous extract of *O.sanctum* possess potential anti-cataract activity against selenite-induced experimental cataractogenesis [31].

### **17. Anti-fertility activity:**

Treatment of albino rats with a benzene extract of *O.sanctum* leaves for 48 days decreased total sperm count, sperm motility, and forward velocity [32].

The leaves of *O.sanctum* were found to possess abortifacient effect in women [33-35]. *O.sanctum* has also got antifertility effect [10, 35-38]. The benzene and petroleum ether extracts of leaves of Tulsi have been reported to produce 80% and 60% antifertility activity respectively in female rats [35,36]. In Kerala the local women as well as the Ayurvedic physicians have been reported to use the leaves of Tulsi for antifertility effect [35]. In male rats benzene extract of Tulsi leaves was

found to reduce spermatogenesis by means of retarding the sertoli cell activity without affecting the germ cells [10].

The major constituent of the Tulsi leaves found to possess antifertility effect in rats of both sexes and in male mice was Ursolic acid .Ursolic acid because of its anti-estrogenic effect reduces spermatogenesis and causes a decrease in sperm counts.

### **18. Anti-inflammatory activity:**

The fixed oil of *O.sanctum* (Labiatae) was found to possess significant anti-inflammatory activity against carrageenan -and different other mediator- induced paw edema in rats [39].

### **19. Anti-stress activity:**

Hydroalcoholic extract of *O.sanctum* protected the rats from chronic restraints stress induced changes in the myocardium [40]. The reduction in corticosterone level caused by chronic exposure to noise stress was prevented by the treatment of animals with *Ocimum sanctum* extract [41]. Ayurvedic tradition classifies tulsi as an adaptogenic herb, capable of increasing the body's resistance to stress and disease.

### **20. Anti-thyroid activity:**

The effects of *O.sanctum* leaf extract on the changes in the concentrations of serum T3, T4 were investigated in the male mouse. *Ocimum sanctum* leaf exhibited anti-thyroidic and anti-oxidative properties [42].

### **21. Anti-toxic effect:**

Oral administration of *O.sanctum* extract provided protection against HgCl<sub>2</sub> induced toxicity in Swiss albino mice [43].

### **22. Anti-tussive activity:**

Aqueous and methanolic extracts of *O.sanctum* exhibited anti-tussive effect by central action probably mediated both opioid system & GABA-ergic system [44].

### **23. Immunomodulatory activity:**

*O.sanctum* modulates the humoral immune responses by acting at various levels in the immune mechanisms such as antibody production, release of mediators of hypersensitivity reactions, and tissue responses to these mediators on the target organs [45].

### **24. Lens aldose reductase inhibiting activity:**

*O.sanctum* offered maximum aldose reductase inhibiting activity followed by *Curcuma longa*, *Azadirachta indica* and *Withania somnifera* [46].

### **25. Radioprotective activity:**

Aqueous extract of *O.sanctum* used for ameliorating <sup>131</sup>Iodine-induced damage to the salivary glands [47].

### **26. Wound-healing activity:**

Aqueous extract of *O.sanctum* Possessed significant wound healing and antioxidant activities, which

may be useful in the management of abnormal healing such as keloids and hypertrophic scars [48].

**27. Ethnoveterinary activity:**

The whole plant is used in treatment of glossitis, ulcers, maggots in wounds, anthrax, pneumonia, tympanitis, pain in abdomen, constipation, stoppage of urination, liver fuke, loss of appetite, stomach pain, dog bite, cold and cough, cannabis poisoning, opacity of cornea, swelling of lungs, tachycardia, sprains and sore eyes. The leaves are used in treatment of bleeding, cough

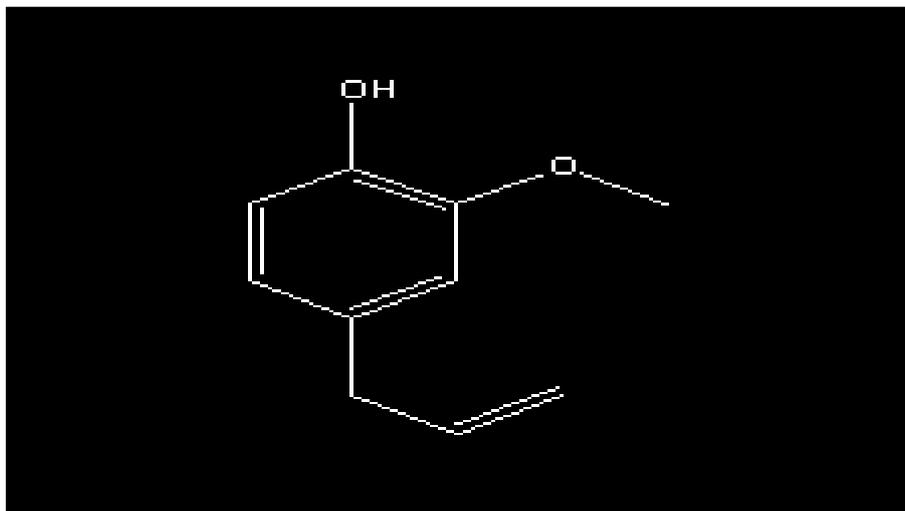
and cold, eye diseases, udder infection and wound healing in ruminants [49].

*O.sanctum* treatment significantly prevented hypoperfusion-induced functional and structural disturbances [50]. The leaf extract protected mice against haloperidol-induced catalepsy and protective effects are comparable with standard drugs, scopolamine and ondansetron [51]. It is also used as an Antidote for sanke bites and scorpion stings.

**Fig.1. Flowering twig of *O.sanctum***



**Fig.2. EUGENOL**



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