

A Review on Ocimum Gratissimum

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Abstract- A well-known plant called *Ocimum Gratissimum* is employed in the Indian medical system. *Ocimum Gratissimum* is used in traditional medicine to treat a variety of illnesses, including cancer, diabetes, inflammation, diarrhea, pain, and fungal and bacterial infections. The current investigation of the phytochemicals, essential oils, and therapeutic properties of *Ocimum Gratissimum*. The pharmacological activities of *Ocimum Gratissimum* and its bioactive compounds include antioxidant, anti-inflammatory, anti-cancer, hepatoprotective, anti-diabetic, antihypertensive, antimicrobial capabilities. *Ocimum Gratissimum* has potent curative and disease-preventing properties. Due to its antibacterial, antioxidant, and ability to strengthen the antioxidant system, *Ocimum Gratissimum* is beneficial at treating a variety of diseases. *Ocimum Gratissimum*'s pharmacological properties, more research, and a human clinical trial to determine safe and efficient doses for treating a variety of disorders, more research is required. The food, cosmetic, and folk medicine industries have all used *Ocimum Gratissimum*.

Keywords: - Essential Oil, *Ocimum Gratissimum*, Pharmacological Activity, Traditional Uses.

INTRODUCTION

SYNONYM: - Clove basil, African basil, and in Hawaii as wild basil.

SCIENTIFIC NAME: - *Ocimum Gratissimum* L.

GEOGRAPHICAL SOURCE: - *Ocimum Gratissimum* is native to tropical Africa, India and South East Asia

GEOGRAPHICAL LOCATION: - *Ocimum Gratissimum* is a perennial and odoriferous shrub found in tropical regions such as Brazil, India, Vietnam, Rwanda, Nigeria, Nweke Cameroon, Togo, In Côte d'Ivoire, Kenya, Benin and South Africa [1]



Fig 1: - *Ocimum Gratissimum* L.[2]

Tulsi is regarded as the "Golden Cure" of Ayurveda and offers a wide range of therapeutic advantages. The plant is revered in India and is present in every home there. Fresh or dried leaves can be used in cooking and to treat illnesses. The Vana Tulsi needs to be protected from frost and can be cultivated as an annual in locations with high temperatures. *Ocimum* species is a rich source of various phytochemicals including tannins, phenolic acids, anthocyanins, phytosterols, and policosanols. These phytochemicals have the potential to significantly impact human health. The economic importance of *Ocimum* is also evident; *Ocimum* oil and its constituents and derivatives are used as flavoring agents throughout the world in food, pharmaceutical, herbal, perfumery, and flavoring industry [3].

Scientific Name	Common Name
<i>Ocimum Tenuiflorum</i>	Krishna Tulsi
<i>Ocimum Gratissimum</i>	Vana Tulsi
<i>Ocimum sanctum</i>	Rama Tulsi
<i>Ocimum Bassilisum</i>	Kapoor Tulsi

Tab. 1:- Types of Tulsi [2]

TAXONOMY

Scientific Name	<i>Ocimum gratissimum L.</i>
Family	Lamiaceae
Class	Magnoliopsida
Kingdom	Plantae
Division	Magnoliophyta
Genus	<i>Ocimum</i>
Species	<i>O. gratissimum L.</i>
Rank	Species
Order	Lamiales
Higher Classification	Basil

Tab. 2:- Taxonomical classification^[4,5]

HABIT AND DISTRIBUTION

Ocimum Gratissimum grows in disturbed regions surrounding settlements, coastal scrubland, lakeshores, savannas, submontane forest, and along roadside and stream margins at elevations ranging from sea level to 2300 m. In domestic gardens, it is also grown as an ornamental and hedge plant. It typically grows in plains, valleys, and dry and wet deciduous forests in India. It is classified as a widespread and relatively common herb in the Lesser Antilles, frequently naturalizing in open wet environments at lower and middle elevations. It spreads as a weed of roadsides, wastelands, and pastures across islands in the Pacific^[6]. Tropical Africa, India, and South East Asia are the original habitats of *Ocimum Gratissimum*. In China, South America, the Caribbean, Australia, New Zealand, and China, it is farmed and naturalized. on numerous islands in the Pacific and Indian Oceans. On several islands in the Pacific and Caribbean, it is regarded as invasive^[7].

MORPHOLOGY



Fig 2: - Morphology of *Ocimum Gratissimum*

In biology, morphology is the study of a plant's size, form, and structure as well as the interactions between each of its individual parts. The phrase describes the fundamental biological characteristics of a plant's shape and spatial organization.

Basil is a fragrant herbaceous plant whose scientific name is *O. gratissimum*. Additionally, it stands 1-3 cm tall, has an upright stem spherical, quadrangular branch, and woody at the base^[8].

FLOWER

Greenish-yellow, in simple or branched rather short racemes, floral axis quadrangular, densely hairy. Style bifid, upper calyx purple, rest of the corolla and stamens white, anthers yellow. At the base of flowers is a sessile, oval bract of 3-12 mm long and 1-7mm wide^[7].

STEM

The stem is rounded quadrangular highly branched, woody at base, rigid and with epidermis peeling off in strips at the base^[8].

LEAVES

The leaves are simple opposite decussate and carried by a pubescent petiole of 2- 5cm long. The blade is elliptical to oval, 1.5-2.5cm long and 0.6-1.2 cm wide. The margin is coarsely separated^[7].

FRUIT

The fruit consist of 4 small sub- globular dry nutlets, 1.5 mm long, rough, brown. The fruits are formed of spherical capsules of about 2 mm in diameter. *Ocimum gratissimum* is a sub-woody, erect, abundantly branched herbaceous plant. It measures 1 to 2 meters (up to 3 m) high. It has a strong aromatic smell^[7].

SEED

Outer pericarp not become mucilaginous in water. Basil produces small seed which are reddish black in color. *Ocimum gratissimum* seeds (OGSs) were investigated in several studies as a suspending agent or a disintegrant. On the contact with water, a mucilaginous layer is formed surrounding the seeds due to its capability of excellent water uptake, demonstrating the swelling power of OGSs^[8].

CULTIVATION

SOIL CONDITION

The optimal conditions for growing rich loam are well-drained, slightly acidic soil with a pH range of 5.5 to 6.5. The lowest and maximum temperatures for growth is 17°C and 39.2°C, respectively. Stronger vegetative growth is encouraged by well-drained soil, and root rot and stunted growth are potential effects of standing water^[9].

CLIMATE

It thrives in settings with humidity and rainfall that are relatively high. Long days and mild temperatures have been found to be favourable for plant growth and oil production. Up to 900 meters above sea level, it can grow. The plant can tolerate frost and drought to a certain extent. Despite producing little oil, plant can be grown in partially shaded environments^[9].

PROPAGATION

Tulsi is propagated through seeds. Seeds will deteriorate over several generations as a result of the extensive cross-pollination. As result, for future crops, growers must use fresh seeds from pedigree stock [9]. Planting time The nursery can be raised in the third week of February and transplanting is generally done in the middle of April^[9].

LAND PREPARATION

The ground has been beautifully levelled and divided into sections of manageable size. It is desirable to add 15 t/ha of farmyard manure and recommended fertilizers as a base dose when preparing the soil, and the soil should be thoroughly mixed^[9].

TRANSPLANTING

In Lucknow, New Delhi, and Indore, respectively, seedlings are transplanted at spacings of 40 cm, 50 cm, and 50 cm to obtain high yields of herbage and oil. These seedlings are four to five leaves old and six weeks old. The patches are irrigated shortly after implantation. The seedlings will have done a good job of establishing themselves by the time the second irrigation is given. At this time, inferior plants are also replaced, and gaps are filled to create a consistent plant stand^[10].

IRRIGATION

Tulsi requires a different quantity of watering according on the season and the moisture level of the soil. The summer requires three irrigations each month, although none are required during the rainy season, in contrast to other seasons where irrigation should be carried out as needed. Each year, 12 to 15 irrigations are required. To maintain a high amount of soil moisture, apply mulch. But before harvesting, watering must be halted. Check the irrigation water for contaminants, if at all possible, and take the appropriate safety measures to prevent contamination^[10].

PESTS

It is found that Tulsi has a few ailments and insect pest infestations. Pest animals Leaf rollers: The leaves are attached to the underside, folded lengthwise backward, and then woven together. The adult and nymph *Cochlochila bullita*, sometimes known as the Tulsi lace wing, eat leaves and younger stems, often gregariously, and then leave behind their excrement, rendering the plant unfit for human eating. Feeding initially causes the leaves to curl, but soon the entire plant dried up^[10].

HARVESTING

Tulsi should be harvested carefully to prevent contamination of any kind. Following harvest, thoroughly clean any surface that comes into contact with the plant. In order to get the most output of essential oils and better quality oil, the crop must be harvested when it is fully bloomed^[9].

PROCESSING

The harvested produce may be allowed to wilt for 4-5 hours on the field to reduce moisture content and bulkiness. However, oil quality and quantity don't start to deteriorate until 6 to 8 hours after harvest. If you wait any longer, however, the production and quality of your oil could significantly decline. It has been established that steam distillation is superior to hydro distillation and hydro cum steam distillation^[9].

EXPECTED YIELD

Per acre, two to three harvests per year can provide about 5 tonnes of fresh herbage. Oil yield varies according to kind, season, and provenance. One hectare can provide 10-23 kg of oil, and the total herb contains 0.1-0.23% essential oil^[10].

DRUG INTERACTION

Medication that slows blood clotting (Anticoagulant / Antiplatelet drugs) interact with African basil.

DRUG-HERB INTERACTION

Pharmaceuticals, when in the presence of other compounds, can undergo a change in pharmacodynamic or pharmacokinetic profiles which influences their physiological response owing to the larger quantity of compound present in an herbal preparation which is often unidentified the likelihood of an interaction is much greater than that of single active ingredients.

PHARMACOKINETIC INTERACTION

By altering the absorption, distribution, metabolism or elimination of a drug to the plasma concentration can be shifted outside of therapeutic activity or toxicity. Pharmacodynamic Interaction: -Potentiation (additive or synergistic) or antagonization of compound can occur with the addition of a decreasing the potency of the physiological effect respectively^[10].

PHARMACOLOGICAL ACTIVITY

ANTINOCICEPTIVE ACTIVITY

Ugbogu OC (2021): - Studied that *O gratissimum* is used to treat painful diseases in conventional medicine. The hot plate test and formalin test were used to examine the antinociceptive effects of *O gratissimum* essential oil and two of its active ingredients (eugenol and myrcene) on neurogenic and inflammatory pain in murine pain models. The essential oil of *O gratissimum*, at a dose of 40 mg/kg, as well as its active ingredients, eugenol and myrcene, at a dose of 10 mg/kg, successfully lessened animal pain in the first and second stages of the formalin test^[1].

ANTI-DIABETIC ACTIVITY

Ugbogu OC (2021): - Studied that The aqueous extract of leaves is used to lower glycemia in type 1 diabetes. Research has also been done on the immunological functions and immunological responses in nicotine-induced macrophages (10 mM) as well as the immunomodulatory activity of *O gratissimum* extract. After the injection of a 10 g/mL aqueous extract of the plant, nicotine-induced NO generation and iNOS II expression were significantly decreased. By inhibiting

Th1 cytokines in nicotine-treated macrophages and inducing Th2 responses, the plant's aqueous extract showed protective effects on mice peritoneal macrophages^[1].

ANTI-PROTOZOAL ACTIVITY

Ugbogu OC, Rajan D et.al. (2021 & 2020): - Tested by In vitro tests were performed on *O gratissimum* leaves and stems to see how well they inhibited *Trypanosoma brucei* and *Plasmodium falciparum* in the pre- and full blooming stages. *Trypanosoma brucei*'s growth was inhibited to the greatest extent, indicating possible antiprotozoal properties. The survival duration of the parasite (*Trypanosoma brucei*) was found to be influenced by the extract concentration in an in vitro and in vivo investigation, with lower (25 and 12.5 mg/ml) concentrations lasting longer than higher (100, 75, and 50 mg/mL) concentrations. They discovered that after a four-day suppressive period, the essential oil of *O gratissimum* extracted in test animals has significant antimalarial activity. Live assault at doses of 200, 300, and 500 mg/kg, the plant's essential oil extract demonstrated maximum efficacy. Malaria treatment and control may be medically beneficial when using *O gratissimum*'s essential oil extract^[11].

WOUND –HEALING ACTIVITY

Rajan D (2020): - Studied that *O gratissimum* can perform as a potent natural wound care agent since it restored cell activity and guarded against UV C-induced inhibition of cell proliferation and migration of skin cells. According to resistant to the antibacterial effects of a formulation containing 2% *O gratissimum* and honey as a surfactant. It was revealed that *Ocimum* oil's antibacterial action is influenced by the surfactant's overall electrical charge at the time of production. The outstanding antibacterial properties of the 2% *Ocimum* oil in honey formulation and the known ability of honey to promote wound healing point to the possibility of using the 2% *Ocimum* oil in honey formulation as a topical antiseptic for wounds^[11].

ANTI-INFERTILITY ACTIVITY

Rajan D (2020): - Studied that In the treatment of erectile dysfunction, *Ocimum Gratissimum* was seen to affect the penile and testicular tissues in rats. However, when given in two doses of 250 mg and 500

mg for 14 days and 28 days, the methanolic and oil extracts of *O. gratissimum* leaves had no adverse effects on the male rats' ability to reproduce. Researchers have studied the anticancer efficacy of an aqueous extract of *O. gratissimum* due to its antioxidant capabilities after treating human osteosarcoma cells with the extract, adding to the growing body of knowledge on the plant and its role in cancer treatments. Anticancer activities from plant bioactive components have been documented.

ANTIOXIDANT PROPERTY

Aflabi CA, Abdel Tawwab Metal (2018 & 2007): - carried by The medicinal advantages of *Ocimum Gratissimum* have been attributed to its anti-inflammatory and antioxidant characteristics. Its leaf extracts have been shown to contain anti-oxidant vitamins like ascorbic acid and alpha- tocopherol. Previous studies have demonstrated that phenols and flavonoids guard against the cellular damage brought on by oxidative stress. The antioxidant and anti-inflammatory properties of flavonoids and phenols [12,13].

BIO-PESTICIDES

Monga S (2017): - Evaluate that When employed on *Tuta absolute*, *Ocimum Gratissimum* essential oils at a concentration of 1 L/mL had a repulsive and harmful fumigation effect. The combination of modified montmerillonite clay and *O. gratissimum* essential oil resulted in a mortality rate of 100-95%, which declined after 30 days as it had lost its insecticidal function by 60% and persisted for about 7-80 days. The adult form of *Tribolium castaneum* is susceptible to the cinnamic acid esters isolated from *O. gratissimum* at 26.92 mg/mL concentrated [14].

ANXIOLYTIC ACTIVITY

Prabhu K S, Monga S et.al (2017 & 2009): - Studied that Anxiety is a mental illness that affects people of all ages, including children and the elderly, and is characterized by unpleasant behavior and internal turmoil. The latency of tonic and tonic-clonic seizures as well as death were found to be increased by 200 and 400 mg/kg of methanol or petroleum ether extract, which is a component of benzodiazepines and other allopathic medications that non-selectively target gamma-aminobutyric acid (GABA) receptors and are frequently used to treat anxiety [2,14].

ANTI-CANCER ACTIVITY

Prabhu K S, Monga S et.al (2017 & 2009): - Evaluated that Researchers have added to the growing body of knowledge on the plant and its potential role in the treatment of cancer by examining the anticancer efficiency of an aqueous extract of *O. gratissimum* due to its antioxidant properties after treating human osteosarcoma cells with the extract. Mice induced with mahlavu cells demonstrated that 12.5–300 g/mL extract of *O. gratissimum* decreased basement membrane disintegration, angiogenesis, and matrix metalloproteinases (MMP-2 and MMP-9) activities. Treatment with *O. gratissimum* at 200 mg/kg caused tumour growth to decrease through modulation of the ERK signalling pathway and aerobic glycolysis, and increasing cell apoptosis. In turn, this prevented the growth of tumours and breast cancer. Both *O. Basillium* and *O. gratissimum* when human Breast cancer cells were treated with both *O. Gratissimum* Through the stimulation of the mTOR/Akt/AMPK signalling pathway, it was discovered that *O. gratissimum* had a decreased cystotic and apoptotic impact on the MCF-7 human breast cancer cell line [2,14].

ANTI-MICROBIAL ACTIVITY

Agarwal P (2010): - Tested that The antibacterial activity of different extracts from the leaves of *Ocimum Gratissimum* was tested against *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi* and *Salmonella typhimurium*, pathogenic bacteria that cause diarrhea. These extracts evaluated include cold-water extract (CWE), hot water extract (HWE) and steam distillation extract (SDE). Only SDE has inhibitory effects on selected bacteria and the minimum inhibitory concentration ranged from 0.1% for *S. aureus* to 0.01% for *E. coli* and *S. typhimurium* [15].

ANTI-FUNGAL ACTIVITY

Amadi JE (2010): - Studied that The development of more effective and less toxic antifungal agents is required for the treatment of dermatophytosis. Plants and their preparations have been used as medicines against infectious diseases. Extracts of *Ocimum Gratissimum* leaves were investigated for in vitro antifungal activity, using agar dilution technique against dermatophytes. The extracts (hexane, chloroform fractions, the essential oil and eugenol) produced antifungal activities against *Microsporum*

canis, *M. gypseum*, *Trichophyton rubrum* and *T. mentagrophytes* [16].

ANTI-BACTERIAL ACTIVITY

Nakamura CV (2008): - Tested that The essential oil (EO) of *Ocimum Gratissimum* inhibited *Staphylococcus aureus* at a concentration of 0.75 mg/ml. The minimal inhibitory concentrations (MICs) for *Shigella flexneri*, *Salmonella enteritidis*, *Escherichia coli*, *Klebsiella sp.*, and *Proteus mirabilis* were at concentrations ranging from 3 to 12 mg/ml. The endpoint was not reached for *Pseudomonas aeruginosa* (≥ 24 mg/ml) [17].

ANTI-DIARRHEAL ACTIVITY

Obiora KA (1999): - Studied that The aqueous extract of the leaves of *Ocimum Gratissimum* was screened for antidiarrheal effects. The extract inhibited castor oil-induced diarrhea in rats as judged by a decrease in the number of wet faeces in the extract-treated rats. Phytochemical tests revealed the main constituents as tannins, steroids, triterpenoid and carbohydrates. These findings suggested that the aqueous extract of the leaves of *O. gratissimum* might elicit an anti-diarrhoeal effect by inhibiting intestinal motility, partly via muscarinic receptor inhibition [18].

DOSE

Clinical trials are lacking to provide dosing recommendation for African basil. Take 10-12 Tulsi Leaves, tea spoon of grated ginger and 7-8 dried kalimirch [19].

Traditional medicine uses the clove basil plant, or *Ocimum Gratissimum*, to treat a wide range of conditions, including cancer, diabetes, inflammation, anaemia, diarrhoea, pains, and bacterial and fungal infections [20].

All continents currently include this perennial, odoriferous shrub, which normally may Its juice is used to alleviate giddiness, headaches, colds, and cough, and its infusions are regarded as tonic and pectoral in Cameroon. It is advised for the treatment of diarrhoea in Nigeria, as well as for the treatment of respiratory conditions and anthelmintic use. Along with treating pneumonitis, it was also used to treat headaches, fevers, ophthalmic, and skin issues. Togo uses the plant's infusion to treat cough (antitussive). Its leaves have a fresh juice that is antidiarrheic and

antidysentery properties [21]. In the Benin Republic, dystopias, pelvic pains, colic, candidoses, digestive dysmenorrhoea, emesis, haemorrhoids (piles), and diarrhoea are all treated with the aqueous maceration of the plant's pulp or aerial sections. Hepatitis, cough, asthma, and wound infections are all treated using its stem decoction. This variety of basil's widespread usage in medicine is supported by previous research that demonstrate its an aesthetic, anti-stress, anti-inflammatory, anthelmintic, antidiarrheal, anti-mutagenic, anti-ulcerative, gastroprotective, hepatoprotective, sedative, and fungicidal characteristics.

O. gratissimum is an antiseptic that is widely used in the manufacturing of toothpaste, mouthwash, and topical treatments. *O. gratissimum* shown that the plant extract may be utilized as a therapeutic resource for patients suffering from acquired immunodeficiency syndrome (AIDS) and the human immunodeficiency virus (HIV) (AIDS). It functions as a febrifuge. Good wash for tonsillitis and sore throats, as well as a component in number of malaria remedies. Animals and humans with gastrointestinal helminths can both benefit from the usage of the plant extract [19].

SIDE EFFECT

Tulsi has eugenol, which is also found in cloves and balsam of Peru. While small amounts of eugenol can prevent toxin-induced damage in the liver, too much of it can cause liver damage, nausea, diarrhea, rapid heartbeat and convulsions [22].

PREGNANT WOMEN SHOULD AVOID TULSI

Basil or Tulsi is a fragrant herb that comes from the Lamiaceae family of mint plants can impact expecting mothers and their embryos. It can also lead to miscarriage, according to the TOI report it can lead to uterine contractions which can be dangerous [19].

DIABETIC PATIENTS

Tulsi may help maintain blood sugar levels, according to numerous studies, however if someone is already taking medicine, they should avoid using Tulsi in their diet. It may result in the sugar level dropping too low, according to reports. Tulsi can affect fertility: According to TOI, a study by the NCBI on animals shown that Tulsi can affect fertility in both genders. Studies have demonstrated that Tulsi may reduce

sperm count and reduce the weight of reproductive organs like the testicles, adrenal glands, prostate, uterus, and ovary^[19].

BLOOD-THINNING PROPERTIES

Tulsi has properties that can thin the blood in our bodies. Although it has proven to be a great home remedy for people who do not want to take allopathy medicines, people who are already on anti-clotting medications should avoid having this herb^[19].

CAN CAUSE LIVER DAMAGE

Tulsi has lots of eugenols present in it. Eugenol is also found in cloves and balsam of Peru. But did you know over-consumption of eugenol can cause liver damage, nausea, diarrhea, rapid heartbeat, and convulsions?^[19].

NOT GOOD FOR YOUR TEETH

The scientific reason behind not chewing tulsi leaves is that it has mercury which can stain your teeth and can lead to discoloration of your teeth. It's suggested to gulp it down rather than chewing it. According to Times of India report, Tulsi leaves are acidic in nature and your mouth is alkaline, which can cause your teeth enamel to wear off^[19].

TOXICOLOGY

Equivocal findings regarding toxic effect of orally administrate *O. gratissimum* on hematological parameter (eg. Red blood cell, hemoglobin, platelet and neutrophil counts) have been reported in animal studies; the effect on human blood is unknown. The essential oil was reportedly non-toxic in mice, with a high acute median lethal dose^[23].

CONCLUSION

Ocimum's value in pharmacology has led to its long-standing use in Ayurveda. Holy basil, often known as basil, is a key component of many Ayurvedic recipes. It is regarded as a sort of "elixir of life" in Ayurveda and is thought to encourage lifespan. It is a cough elixir, and chewing the leaves after meals aids with digestion. Numerous pharmacological activities, including antimicrobial, antifungal, antibacterial, antiviral, antimalarial, anaesthetic, antiprotozoal, and anthelmintic agents, are present in *O. gratissimum*. Additionally, it contains anti-diabetic, antifertility,

anti-inflammatory, and anti-stress properties. Effectively treating breast cancer is another application for it. *Ocimum Gratissimum* has been suggested as a treatment for insect bites, ophthalmic skin conditions, upper respiratory tract infections, diarrhoea, and fever. An exhaustive summary of recent research on the phytochemistry and therapeutic applications of *Ocimum Gratissimum* has been provided in this review.

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