

**REVIVING THE GREEN GOLD: TULSI (*OCIMUM SANCTUM*) AS A NATURAL
CANDIDATE FOR MODERN DRUG DISCOVERY****Rohit S. Raut^{1*}, Prof. Sushant S. Dhandore², Dr. Sanjay K. Bais³**

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ABSTRACT

Tulsi has an impressive range of medicinal qualities, such as immunomodulatory, cardioprotective, antimicrobial, antioxidant, anti-inflammatory, antistress, and antidiabetic effects. The plant is abundant in bioactive components that support its pharmacological effects, including apigenin, rosmarinic acid, ursolic acid, and eugenol. Various parts of Tulsi—leaves, seeds, and roots—are employed in treating ailments like cough, cold, fever, asthma, skin diseases, and metabolic disorders. Modern research supports many of its traditional claims and highlights its adaptogenic potential in combating stress and oxidative damage. Besides its medicinal importance, Tulsi is also valued in spiritual and cultural practices across India. Owing to its wide therapeutic profile, Tulsi serves as a potential source for developing safe, effective, and affordable herbal formulations in modern medicine.

KEYWORDS: Tulsi, Bioactive compound, Botanical description, Ayurvedic herb.**INTRODUCTION**

According to published research, traditional medicine has been using medicinal herbs for over a thousand years. In contemporary complementary and alternative medicine, medications are mostly derived from plants. Aromatic herbs have a multitude of physiologically active chemicals that may find use in both agriculture and medicine. *Ocimum tenuiflorum*, also called *Ocimum sanctum*, Tulsi in Hindi, Tulasi in Sanskrit, or Holy Basil in English, has earned the titles "Queen of Plants" and "Mother Medicine of Nature" due to its purported therapeutic properties. Tulsi is utilized in traditional medicine in a number of ways; aqueous Leaf extracts, either fresh or powdered from dehydration, The Tulsi leaf extracts' antibacterial properties are due to Bioactive substances like eucalyptol, camphor, and eugenol beta caryophyllene, beta-bisabolene, and alpha-bisabolene. Aqueous extracts of tulsi have been used to treat stomach issues. pains, colds, headaches, inflammation, malaria, as well as heart disease. According to scientific data, tulsi possess a variety of health-promoting properties, including anticancer, effectiveness against lipidemia, antihypertensive, antioxidative, and anti- antiviral, antifungal, antibacterial, antipyretic, and inflammatory actions, hepatoprotective, immunomodulatory,

antidiabetic, anticoagulant, anticataract, antistress, antiulcer, and antiarthritic chemopreventive, cardioprotective, prophylactic, and radioprotective.^[1]

BOTANICAL DESCRIPTION



Fig.no.1:- Aerial view of Tulsi.

Synonym:- Tulasi patra

Biological Source:- belonging to the family Lamiaceae.

Family:- Lamiaceae (Mint family)

Nursery management

Tulsi grows in warm, equatorial climates, is grown, and traveled all over the nation, particularly in India. The Holy Basil is cultivated at a height of almost 1800.0 meters and is typically grown in moist soil above sea level. According to the literature of ancient Ayurveda, details. In some parts of Asia, tulsi is widely distributed, including Africa, even though it starts in the Himalayas to the island of Andaman and Nicobar. The variation in rainfall, and a plant's medicinal qualities can be determined by the pattern of the *Ocimum sanctum* grows in moist soil.

Cultivation

The White, tiny flowers are arranged in the terminal. Spike. The pistil and the four stamens in the Lamiaceae are not Pushed beneath the corolla's upper lip while remaining above the inferior Lip. The bilabiate develops the rounds of the four achenes. It is grew best in hot, dry conditions. Circumstances, but Tulsi is extremely vulnerable to cold. If there Tulsi acts like an annual plant whenever there is a chance of frost. Tulsi can be grown indoors, but it grows best outside. Like most herbs, it thrives in an equator-facing pot Windowsill. For Tulsi, the row cover or greenhouse is perfect. Since it thrives in intense sunlight and ought to be kept To prevent a mistake, stay away from the icy drafts. It is possible to grow holy basil Under fluorescent lights in a basement.^[2]

Species of Tulsi

Ocimum americanum

Originating in Africa, *O. americanum* has sub-rectangular striated branches and a height of 15 to 60.0 cm. The leaf is glabrous, lanceolate ellipse, glandular spots, and either intact or slightly serrated. The flower has an elongated circle shape and can be pink, white, or

purplish. The fruits are mucilaginous and have pitted notelets. Three chemotypes exist for it: spicy, Floral-lemomy and camphoraceous. It is also known as mosquito plant or hoary basil. Often taken orally to treat bronchitis, immune system issues, toothaches, and diarrhea, it is also effective as a cough remedy. Additionally, *O. americanum* extract was used to flavor body, tea, and tobacco. Aroma. Insecticides derived from insects were used to combat flies, bees, mosquitoes, and other insects. From the branches and leaves.

Ocimum Basilicum

Among the *Ocimum* species that are indigenous to South America, Asia, and Africa is Sweet basil is another name for *Ocimum basilicum*. *O. basilicum* can flourish in a range of Climates and environments, from tropical areas with temperatures range of between 6.0 and 24.00 °C To humid, cool places. It also prefers warm weather. This plant belongs to the *Ocimum* species that is sold commercially.^[3]

PHYTOCHEMICAL CONSTITUENTS(PLANT DERIVED) OF TULSI

Phenols and Phenolic Acids:- Phenols and phenolic acid are examples of phenolic metabolites. Because they function as antioxidants, phenols and phenolic acid are therapeutically significant metabolites. And have anti-sickling, anticarcinogenic, and other bioactivity.

Steroids and Triterpenoids:- Triterpenoids are essential. Secondary metabolites present in Both animals and plants with substantial medicinal value. When living Bodies, triterpenoids are thought to be the fundamental component of Which produces steroids. It is commonly known that steroids Their physiological processes associated with growth-regulatingtivity in plants, as well as immune-modulating and anti-inflammatory qualities. Minor adjustments to the Steroids have the potential to cause major biological changes. *Ocimum* There are several triterpenoids and steroids in *tenuiflorum*. Which

have significant therapeutic value. E.g- Ursolic acid, B-sitosterol, and trihydroxy droxyursolic acid.

Monoterpenes

Monoterpenes are natural substances. Contained in plant essential oils, which help to the plants' flavor and fragrance, and they are important for many biological processes. A few significant monoterpenes that were reported in the *O. Tenuiflorum* Are camphene and α -pinene.^[4]

Chemical Components

Tulsi has a complex chemical makeup that includes a range of nutrients and Substances with biological

activity. Tulsi's botanical origins and inherent biochemical complexity make standardising its active constituent a challenging task. The two most prominent active The essential oil comes from ursolic acid and eugenol, which are components of tulsi leaves. The main components that have been found and extracted from tulsi are nonexistent, except for Ursolic acid. The effects of antifertility of the chemical can affect both male and female rats and mice. Ursolic acid possesses anti-estrogenic qualities, reduces sperm count, and inhibits spermatogenesis. One of the main ingredients of the essential oil is eugenol, Phenolic chemical that is isolated from the different portions of the tulsi plant.

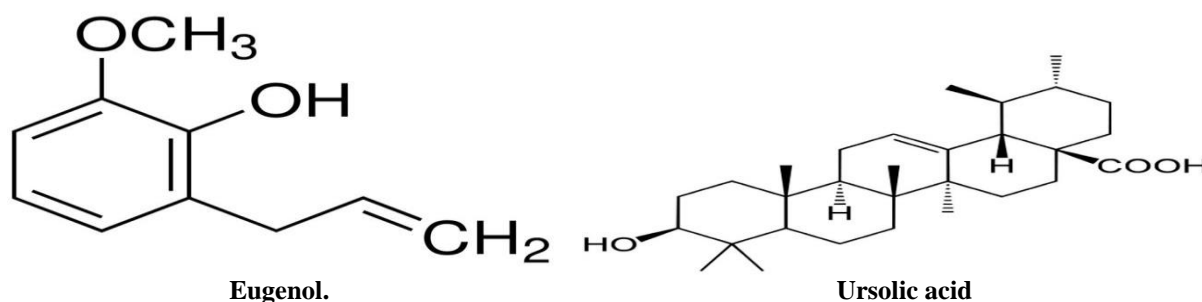


Fig.no.2:- Illustrations of the structural components of chemicals.

TULASI'S MODE OF ACTION

The tulsi plant's different sections include a variety of constituents, including Tannins, saponins, triterpenoids, and flavonoids. Eugenol is discovered to be the Its leaves contain volatile oil. Some of the components have shown a crucial Function in controlling and curing illnesses by adjusting different bio-Rational actions. The way that tulsi works is described as follows: Controlling the treatment of illness; higher levels of reactive oxygen produced Causes oxidative stress and harms macromolecules, resulting in pathological Origin. However, the antioxidant properties of tulsi plants counteract Potential for free radicals. Additionally, the plant scavenges free radicals and shields Against harm to cells. A natural substance plays a significant role. In halting bacterial growth or eliminating them by rupturing their cell Walls.^[5]

Therapeutic Qualities

Basil is stomachic, galactagogue, carminative, appetizer, and antispasmodic. It treats gastric discomfort and stomach cramps, Constipation, intestinal catarrh, vomiting, enteritis, and catarrh. It was occasionally used to treat whooping cough. As a pain reliever. Tulsi lowers blood sugar levels and has antioxidant qualities. Thus, diabetics can benefit from it. Tulsi lowers cholesterol levels overall. Patients with heart disease can thus benefit from it. Blood pressure is decreased by tulsi.

Tulsi's health benefits in everyday life

There are numerous therapeutic benefits to the tulsi plant. The leaves improve memory and act as a nerve tonic. They Encourage the bronchial tube's phlegm and

catarrhal matter to be removed. The leaves make the stomach stronger. And cause excessive sweating. When dengue fever and malaria are prevalent during the rainy season, When boiled with tea, the tender, common leaves help ward off these illnesses.^[6]

Conditions of the Respiratory System

Tulsi leaf chewing helps with the flu and colds. Boiling water with basil leaves Can be consumed as a beverage if you have a sore throat. You can gargle with this water. The herb has practical uses. In the management of respiratory conditions. A leaf decoction made with ginger and honey works well. Cure for colds, coughs, influenza, bronchitis.

Kidney Stone condition

When renal stones occur, honey and basil leaf juice, if taken It will eliminate them through the urinary tract on a regular basis for six months.

Bites of Insects

Insect stings and bites can be prevented and treated with this herb. A smidge of the juice from After a few hours, the leaves are taken again. It's also essential to apply fresh juice to the affected areas. A Fresh root paste works well for insect and leech bites as well.

Infections of the mouth

The leaves are quite effective in treating oral infections and ulcers. Chewing a few leaves will help with these Circumstances.^[7]

PHARMACOLOGICAL ACTIVITY OF TULSI

Anti-Cancer

Tulsi's anti-carcinogenic properties have been investigated on Diverse animal models utilizing a range of Carcinogens, and it was discovered to be useful in treating liver cancer. Brain, skin, bone marrow, uterus, lungs, pancreas, Bladder, leukemia, gastric ulcer, peptic ulcer, cervical Breast cancer, etc. Tulsi has potent anti-cancer properties. Consequences brought on by eugenol, ursolic acid, Ethanolic extract and oleanic acid in tulsi products. The Additionally, research revealed that the impacts against carcinogenic Gene, carcinogen modification, and deactivation of The enzymes that cause cancer, including Hydrocarbon, cytochrome b5, and cytochrome P-450 Hydroxylase. Additionally, it keeps cancer from developing.

An Antioxidant

Numerous experimental and scientific investigations have demonstrated That it shields against the harmful effects of different environmental and Chemically caused harm and destruction by raising Amount of antioxidant biomolecules in the body, including Glutathione and boost antioxidant activity. Enzymes such as glutathione, catalase, and superoxide dismutase S-transferase, which shields biological constituents by Cleaning up damage from hypoxia-induced free radicals As well as additional chemicals.

Healing of Wounds

Numerous scientists have demonstrated through their experiments Medicinal qualities of *O. sanctum*. The chilly water Extract has been shown to be highly successful in treating wounds. Tumor necrosis factor α (TNF- α) and healing on Use Wistar albino rats for the experiment. Animal used in experiments Treated with a 10% *O. sanctum* leaf extract with The healing effects of petroleum jelly were more improved than Additional therapy and also discovered that elevated levels of TNF- α (tumor necrosis factor α) treatment in *O. sanctum* Creatures. This approach is still widely used in rural areas Regions.^[8]

Mast cell, antihistaminic, and anti-anaphylactic

Stabilization Numerous studies have demonstrated that asthma treatment And associated circumstances with extracts from *O. sanctum* were Extremely successful and are still utilized to treat Respiratory disorders. As an antihistaminic, the *O. sanctum*'s antianaphylactic properties are mostly caused by Due to its suppression of inflammatory mediators, Of mast cell stabilizing potential and IgE. *O. sanctum*. The therapeutic effects of leaves are potent.^[9]

Activity against fungi

Medical science finds it challenging to control fungal infections. Due to drug resistance and disease recurrence, the pathogens that cause infections in humans and animals are common throughout the world and present significant risks. Even allopathic medications typically

only offer brief relief from these conditions, frequently with negative side effects, and they frequently last a lifetime without a full cure. Consequently, a promising substitute for the treatment of fungal infections is provided by the antifungal properties of medicinal plants. Numerous well-known fungal pathogens, including *Candida albicans*, *Aspergillus flavus* (and its production of aflatoxin B1), and *Aspergillus niger*, have been tested against extracts of *O. Sanctum*.^[10]

Anti-Diabetic

Decoctions that help lower blood sugar levels can be made from a variety of plant parts. *O. sanctum* leaf extracts have demonstrated a beneficial effect on insulin secretion through physiological mechanisms in rat experiments. Despite extensive research on *Ocimum*'s antihyperglycemic effects, the precise mode of action is still unknown.^[11]

Anti-lipidemic effectiveness

Atherosclerosis, hyperlipidemia, and other lipid-related conditions have been becoming more common over time. Studies show that *Ocimum basilicum* aqueous extract can reduce total LDL cholesterol, triglycerides, and cholesterol levels in rats suffering from acute hyperlipidemia By Triton WR-1339. Similarly, it was found that providing fresh Tulsi (*Ocimum*) to rabbits *Sanctum*) leaves for 28 days considerably reduced their levels of total cholesterol, suggesting that it may have anti-lipidemic properties.^[12]

As an agent that inhibits fertility

has been demonstrated to have anti-fertility properties, is abundant in tulsi (*Ocimum sanctum*) leaves. Because of its anti-estrogenic qualities, this activity is linked to the inhibition of female ovulation and the suppression of male fertility. Ursolic acid may be a safe and efficient method of birth control when paired with other strong anti-fertility substances.^[13]

An immunomodulatory substance

It has been discovered that *ocimum sanctum* strengthens the body's overall immune response by promoting humoral and cellular immunity. It has no negative side effects, in contrast to traditional medications like aspirin. Supplemental tulsi may help reduce osteoarthritis-related pain and inflammation. tulsi oil significantly reduces edema and arthritis symptoms, according to experimental Investigation. Edema which caused by carrageenan, the fixed oil of it has also shown strong anti-inflammatory activity. Its potential as a natural immunomodulatory and anti-inflammatory agent is highlighted by these effects, which are ascribed to its capacity to inhibit the enzymes lipooxygenase and cyclooxygenase.^[14]

Analgesic Action

The tail flick, and tail immersion tests are examples of experimental pain models where it was Found that there was no analgesic effect from *Ocimum sanctum* oil (OS). However, it Showed significant effectiveness in the

mice's acetic acid-induced writhing test in a dose-dependent manner.^[15]

Antiulcer Properties

The *O. sanctum* fixed oil showed potent antiulcer properties against ulcers when administered intraperitoneally in rats brought on by stress, ethanol (50%), histamine, serotonin. The oil's antisecretory, histamine antagonistic, and lipoxygenase inhibitory qualities are responsible for this antiulcer effect by shielding the stomach mucosa.^[16]

Action of anticoagulants

The prolonged blood clotting showed an effect of it comparable to that of aspirin (100.0 mg/kg). *O. sanctum* fixed oil (3.00ml/kg) caused time. It is thought that this oil's anti-aggregatory effect on platelets, which inhibits excessive clot formation, is the cause of its anticoagulant properties.^[17]

Activity of chemopreventive

Ocimum sanctum (OS) leaf extract is thought to induce hepatic and extrahepatic glutathione-S-transferase (GST) in mice, which mediates its chemopreventive effects. Reduced glutathione (GSH) levels in the liver, lungs, and stomach tissues increased after OS extract supplementation, suggesting improved antioxidant defense.^[18]

CONCLUSION

A wonderful medicinal plant, tulsi (*Ocimum sanctum* Linn.) is valued for its many pharmacological and therapeutic qualities. Eugenol, ursolic acid, rosmarinic acid, and flavonoids are among its bioactive components that contribute to a range of biological processes, including, such as antioxidant, antibacterial, antistress, immunomodulatory, cardioprotective, and anticancer properties. Numerous traditional uses have been confirmed by scientific studies, which have also demonstrated its adaptogenic and chemopreventive properties. Beyond its pharmacological value, tulsi has enormous potential as a source of safe, efficient, and reasonably priced natural remedies in contemporary drug discovery. Its potential to create innovative herbal products can be further unlocked by sustainable cultivation, standardization of medicinal components, and enhanced pharmacological research. Tulsi, a plant that combines the knowledge of ancient medicine with the advancements of contemporary pharmacology, hence merits the moniker "Green Gold."

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