

# The effectiveness of marigold, cochingrass and lilac as mosquito repellent

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## Abstract:

Mosquito vector disease is a major problem of human and animal health. The amount of dengue, zika, chikungunya, yellow fever, and malaria is gradually increased. People are mostly preferred natural insect repellent because of synthetic repellent or chemical insect repellent are harm to human skin and sensitive of children's skin. In this review the natural studied include *Tagetes* belonging to family Asteraceae, *Cymbopogon citratus* belonging to family Poaceae, and *Lavandula angustifolia* belonging to family Lamiaceae. Mosquitocidal effects of ethanolic extract of flowers of *Tagetes erecta* and its chloroform and petroleum ether soluble fractions against the larvae of *Culex quinquefasciatus* have been investigated. The attacks of insects including mosquitoes, black flies, fleas, and ticks are avoided because to citronella 3 oil's ability to repel them. It is used on humans and their clothing – as a liquid or an oil. The best option is typically citronella oil because it is a safe, natural alternative to pharmaceutical insect repellents like DEET. both linalool and *L. angustifolia* oil have ascaricidal activity. In a study investigating the effect of *L. angustifolia* oil and linalool on *Psoroptes cuniculi*, ascaricidal activity was not only related to direct contact with the mites but also when the volatiles were inhaled.

**Abstract:** Natural mosquito repellent, marigold, cochingrass, lavender.

## Introduction

A Mosquito borne disease are the major problem of human and animal health. The Disease include Malaria, Filariasis, Yellow fever, Zika virus, Japanese encephalitis<sup>(1-4)</sup>. West Arboviruses can be transmitted by hematophagous (blood-feeding) insects and blood from viraemic patients, which becomes a concern for blood donation in endemic areas<sup>(5)</sup>. Arthropod vectors, including mosquitoes, are a major source of transmission for Arbovirus. Arthropods are extremely dangerous vectors of pathogens and parasites, which may affect large no of people within a community, population or region. Arboviruses that cause diseases in humans and other animals are members of the five viral families: Bunyaviridae, Togaviridae, Flaviviridae, Reoviridae and Rhabdoviridae. In the Togaviridae family, the Alphavirus genus is the largest, with about 40 members. Arbovirus of the Flavivirus genus (Flaviviridae) which is transmitted from monkeys in the jungle to humans and then from human to human by mosquitoes. Flavivirus which is the virus caused Dengue, Zika virus, yellow fever transmitted by *Aedes aegypti* virus, Chikungunya. Lime disease<sup>(6)</sup>. The Alphavirus genus is represented by the chikungunya virus, the Mayaro virus and the East Equine Encephalitis virus, Mosquitoes, *Anopheles Meigen*, *Culex L.* and *Haemagogus L.* (Diptera: Culicidae) like every bugs has three body parts: a head, a thorax, and abdomen. Male mosquitoes life span are 10 days or less than 10 days, while females can live up to about six to eight weeks. The stringer in the proboscis of only female mosquitoes allows them to suck blood, which is rich in protein and amino acids, serves as their supplement for growing mosquito eggs. Female mosquitoes, which are specifically attracted to CO<sub>2</sub>, detect it by using their olfactory sensillum located on their antenna. When a mosquito detects and encounters CO<sub>2</sub> molecules, an electrical impulse is sent to the insect's brain. The presence of CO<sub>2</sub> attracts mosquitoes and serves as a cue that humans are around. About 3.3 billion people – 1/2 of the world's population – are at risk of contracting malaria. In 2008, there were more than 247 million cases and more than 1 million deaths caused by malaria mainly in African children. Human malaria is caused by infections by unicellular protozoan parasites *Plasmodium falciparum*, *P. vivax* *P. malariae* and *P. ovale* Stephens which are transmitted by about 20 *Anopheles* spp. Another important disease is dengue haemorrhagic fever which is a viral infection caused by several Flavivirus spp. (Flaviviridae) whose most important vector is *Aedes (Stegomyia) aegypti* L. Dengue and 50 million people contract the disease per year. Around 500 000 dengue patients, most of whom are children Each year, 7 require hospitalisation, and approximately 2.5% of those affected pass away <sup>(7)</sup>. Another serious tropical disease which threatens about 1 billion people in 80 countries is filariasis or elephantiasis. This disease already affects an estimated 120 million people and severely incapacitates and deforms 40 million people worldwide. Filariasis is caused by infections by several roundworm species of which *Wuchereria bancrofti* Cobbold (Filariidae: Onchocercidae) is the most important and is transmitted by the bites of the common house mosquito *Cx. pipiens* L. complex, *Cx. quinquefasciatus* Say, *Aedes* and *Anopheles* spp. yellow fever is the most significant yellow fever mosquito vector is *Ae. Aegypti*. Despite the fact that effective vaccines, each year, there are about 30 000 deaths related to yellow fever out of an estimated 200 000 cases of the illness. In public health initiatives which aim to limit or eradicate these and other tropical diseases, mosquito vector control methods such as repellence figure prominently among those which are employ dengue haemorrhagic fevers threaten an estimated 2.5 billion people – 2/5 of the global populace and an estimated to humans<sup>(1)</sup>. Zika virus (ZIKV) is a positive sense RNA flavivirus primarily transmitted the mosquito *aedes aegypti*, *aedes africanus*, and *aedes hensili* of family flavivirudae<sup>(8,9)</sup>.

## Natural Insect Repellent

However, the only safe way to control these diseases is to control mosquito vector populations and prevent mosquito bites. Insect repellents are known to play an important role in preventing the mosquito vector, deterring an insect from flying to, landing on or biting human and animal skin. Synthetic chemical repellents are substances that are frequently employed as insect repellents. Which

are not safe for humans, especially children, domestic animals because they may cause skin irritation, hot sensation, rashes, allergy or unpleasant odour. Many people prefer to use a repellent from natural origin, natural product or herbal product and the demand for natural repellent is gradually increasing. Natural insect repellents, particularly those made from herbal essential oils, are harmless for people and the environment and are said to be effective against adult mosquitoes. There are numerous plants and derived products have been investigated and described as potentially natural sources of mosquito repellents due to their eco-friendly and biodegradable nature. Citronella, cedar, eucalyptus, geranium, lemongrass, peppermint, and marigold flowers are among the plants whose essential oils are most commonly used in plant-based insect repellents currently available on the market. Marigold flowers may also have some potential as a mosquito repellent<sup>(10)</sup>.

### **Tagetes erecta (marigold)**

#### **1. Taxonomical Nomenclature<sup>(11-13)</sup>.**

<b>Kingdom</b>	Plantae – Plantes, Planta, Vegetal, Plants
<b>Subkingdom</b>	Viridiplantae – Green plant
<b>Division</b>	Tracheophyta – Vascular plant, Tracheophytes
<b>Class</b>	Magnoliopsida
<b>Order</b>	Asterales
<b>Family</b>	Asteraceae – sunflowers, Tournesols
<b>Genus</b>	<i>Tagetes</i> – Marigold
<b>Species</b>	<i>Tagetes erecta</i> – Pot Marigold, Scotch Marigold, Calendula

**Table 1:** Taxonomical Nomenclature of *Tagetes erecta*

#### **2. Common Name<sup>(5,13,14)</sup>.**

<b>Marathi</b>	<b>Zendu</b>
<b>Hindi</b>	<b>Genda</b>
<b>Sanskrit</b>	<b>Sandu</b>
<b>Punjabi</b>	<b>Tangles</b>
<b>Gujarati</b>	<b>Guliharo</b>
<b>Urdu</b>	<b>Genda</b>
<b>Telegu</b>	<b>Bantichettu</b>

**Table 2:** Common names of *Tagetes erecta*

#### **3. Botanical description**

Marigold is a common garden plant which is rather coarse, erect, branched and grows to about 1 m high. The flower heads are solitary, long-stalked, and thickening upward, with sharply toothed leaves and deeply incised, deeply toothed leaves. Bright yellow, brownish yellow, or orange blooms are seen. This plant has been used for medicinal purposes. Large numbers of varieties of marigold flower are present. The marigold flower (*Tagetes erecta*) can be identified by its morphological appearance as thus plant generally reaches height of between 40 and 110 centimetres<sup>(15)</sup>. Marigold plant is herbaceous annual whose root is pivoting, cylindrical with shallow branching and fibrous. Leaves are alternate at the top and opposite the bottom, composed of 10 to 18 leaflets, lanceolate, 3 to 5 cm long and 1 to 1.5 cm wide, acute to acuminate. Main characteristics of the marigold flower are that they are grouped in small heads. Flower is yellow to red in colour flowering period in summer and can easily be grown by seeds<sup>(4)</sup>.



**Figure 1:** *Tagetes Erecta* (marigold)

#### 4. Some of the major *Tagetes* varieties

##### a) African or American Marigolds (*Tagetes erecta*):

These marigolds are three-foot-tall, tall, erect-growing plants. The flowers are big and globular. Flowers can be up to 5 inches in diameter. The African marigold makes an excellent bedding plant. These yellow to orange blooms do not include marigolds that are crimson in colour. Africans take longer than French people to reach the blossoming stage<sup>(16)</sup>.

##### b) French Marigolds (*Tagetes patula*):

These cultivars of marigold reach heights of 5 inches to 18 inches. Yellow, orange, and red are the hues of flowers. There are also motifs in red and orange. The size of the flowers is smaller (2 inches). French marigolds are excellent for mass plantings and for border flowerbeds. They also flourish in window boxes and containers<sup>(16)</sup>.

##### c) Signet Marigolds (*T. signata* 'pumila'):

Compact plants with finely split lacy foliage and clusters of tiny, single blooms are produced by signet marigolds. Their edible blossoms range in colour from yellow to orange. The flavour of the signet marigold's blossoms is hot tarragon. The foliage smells like a sweet lemon. Fragrance. Excellent plants for window boxes and edging gardens are signet marigolds<sup>(16)</sup>.

##### d) Mule Marigolds:

These tall African hybrid marigolds, also referred to as "mule marigolds," are sterile and grow to a height of 18 inches. Despite possessing the combined features of their parents, they have a poor rate of germination<sup>(16)</sup>.

#### 5. Common uses

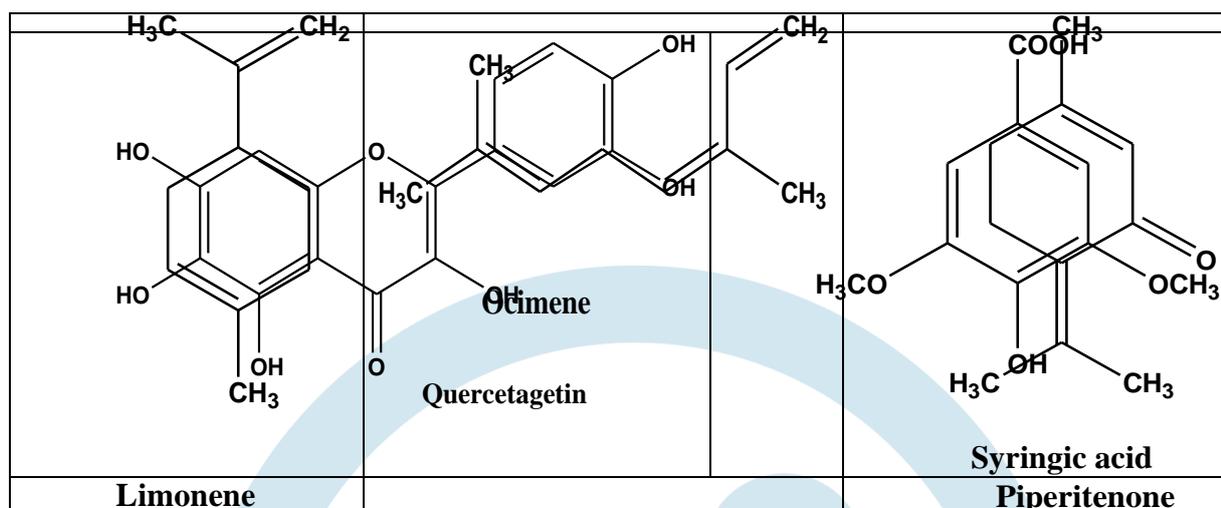
It has been used to treat a variety of illnesses, including toothaches, vomiting, indigestion, parasites, diarrhoea, and liver diseases. The other medicinal uses are it reduce chest pain and other problems related with the chest, decreases the anxiety, purification of blood, heals wounds, boils and skin infections caused by boils, it is used in relieving Rheumatic pains, cold, bronchitis, ulcer, disease of the eyes and uterus and also it is used as a mild laxative.

6 Various plant parts, including the flower, are utilised in folk medicine to treat a variety of diseases. As an antiseptic and for piles, muscular pain, and renal problems, leaves administered to carbuncles and boils. 21 The flower is beneficial for fevers and bouts of epilepsy (Ayurveda), additionally used in liver problems, scabies, stomachic, carminative, and liver issues problems with the eyes. They are said to purify blood and flower juice is given as a remedy for bleeding piles and also used in rheumatism, colds and bronchitis. They have been used in many applications such as perfumes, dyes, inks, paints, ornamental arrangements, in landscape design, and in religious ceremonies. These plants are sometimes confused with the European-origin calendula, but their properties are not same. Marigolds work best as an insect deterrent or pest warning when they are planted near crops and fruit. It has pungent smell that repels insects including mosquitoes and usually the villagers planted it around their house and farm. It also is a potential plant whose essential oil from flowers has been effective repellent against insects. The aromatherapy oil is used as nematocidal and larvicidal anti-inflammatory, antiseptic and astringent. The thiophene is main active constituent responsible for nematocidal activity<sup>(17)</sup>.

#### 6. Chemical constituent

The plant consists of various chemical constituent such as thiophene, flavonoids, carotenoids, triterpenoids, it consists of quercetagenin, methyl-3, 5-dihydroxy-4-methoxy biotin, thienyl ethyl gallate. Lutein is oxycarotenoid containing C-40 nucleus, the roots of plant containing sterols, glycosides, gums, mucilage, the essential oil hydro distilled from leaves and flowers of plant such as limonene, piperitone, caryophyllene. These also containing tagetone, Trans ocimenecis, ocimene, menthol, geraniol, terpenes. The kaemferol is present in stems of *T. erecta*. The flowers consist of Kaemferol, Betasitosterol and Docusterol<sup>(17)</sup>.

*Tagetes* species possess the following secondary metabolites in their flowers, seeds, and roots: alilanol, anetol, limonene, methyl eugenol, and  $\beta$ -karyophyllene that are have toxic to insects, mites, nematodes, bacteria, fungi, and viruses<sup>(18)</sup>.

Table 3: Chemical constituents of *Tagetes erecta*

### 7. Insecticidal Activity

Mosquitocidal effects of ethanolic extract of flowers of *Tagetes erecta* and its chloroform and petroleum ether soluble fractions against the larvae of *Culex quinquefasciatus* have been investigated. The standard WHO approach was used to assess the larvicidal activity of ethanol extract and their solvent fractions against various *C. Quinquefasciatus* instars<sup>(12)</sup>.

Nikkon et al reported the insecticidal activity in *Tagetes erecta* flowers against a stored product insect pest, *Tribolium castaneum*. *Tribolium castaneum* larvae and adults were most hazardous to the chloroform fraction, followed by the petroleum ether fraction and the ethanol extract. Thus, they came to the conclusion that *Tagetes erecta* flower perhaps a pesticide for *Tribolium castaneum* 33 According to Nikkon, at 6 different *Culex quinquefasciatus* instars were resistant to the effects of ethanol on mosquitoes, chloroform, and petroleum ether extracts of *Tagetes erecta* flowers. 11 The samples that were evaluated had the highest LC50 values for all of the star larvae of *Culex quinquefasciatus*, which were 14.14, 17.06, 36.88, and 75.48 g/mL for the chloroform soluble fractions. 6 In the course of getting older and spending more time, the larvae displayed comparable tolerance. They deduced from this that *Tagetes erecta* blooms have effective insecticidal properties<sup>(19)</sup>.

Further studies can be carried out towards chemical fractionation, in search of a new bioactive compound. The *T. patula* flower acetone extract's sub-ethyl acetate fraction (patuletin-enriched) demonstrated more strong larvicidal efficacy against *Aedes aegypti*. It's possible that flavonoid presence caused the prior larvicidal action, but the study of Rajasekaran et al. connected it to the thiophenes generated in *T* callus cultures. papule, which demonstrated larvicidal effects in mosquito larvae. 5 *T. extract* of aerial *patula* in ethanol within 5 minutes of the immersion test, (70%) showed larvicidal activity (LC50 = 7.43 mg/ml), The extract is ineffective against *Rhipicephalus sanguineus*, although it does not affect mature ticks. The same extract was effective at preventing *R* from hatching. Nearly all *sanguineus* eggs aerial components of *T* The adult died after being exposed to vaporised *patula*. *Itophilus* species 96 to 100% effectively. Here, it's crucial to remember that the straight. The bug is unaffected by the application of the extract<sup>(20)</sup>.

- *Cymbopogon citratus* (Cochin grass)

### 1. Taxonomical Nomenclature<sup>(21,22)</sup>

<b>Kingdom</b>	Plantae – Plantes, Planta, Vegetal, Plants
<b>Subkingdom</b>	Viridiplantae – Green plant
<b>Division</b>	Tracheophytes – Vascular plant
<b>Class</b>	Magnoliopsida
<b>Order</b>	Poales
<b>Family</b>	<i>Poaceae</i> – Grasses, Graminees
<b>Genus</b>	<i>Cymbopogon Spreng</i> - Lemongrass
<b>Species</b>	<i>Cymbopogon Citratus Stapf</i> – Lemongrass

Table 4: Taxonomical Nomenclature of *Cymbopogon citratus*

### 2. Common Name<sup>(22)</sup>

<b>Brazil</b>	<b>Capim-cidrao, Capim-santo</b>
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<b>Egypt</b>	<b>Lemon grass</b>
<b>English</b>	<b>Lemongrass, Citronella, Squinant</b>
<b>Ethiopia</b>	<b>Tej-sar</b>
<b>Hindi</b>	<b>Sera, Verveine</b>
<b>Indonesian</b>	<b>Sereh</b>
<b>Italian</b>	<b>Cimbopogone</b>
<b>Malaysia</b>	<b>Sakumau</b>
<b>Mexico</b>	<b>Zacate limon</b>
<b>Swedish</b>	<b>Citrongrass</b>
<b>Thailand</b>	<b>Ta-khrai</b>
<b>Turkish</b>	<b>Limon out</b>
<b>USA</b>	<b>Citronella</b>

**Table 5:** Common Names of *Cymbopogon citratus*

### 3. Botanical Description

*Cymbopogon* is a genus of about 55 species, which are indigenous in tropical and subtropical areas of Asia and are grown throughout Africa, South and Central America, as well as other tropical nations<sup>(23)</sup>. The Greek words "kymbe" (boat) and "pogon" (beard), which relate regards the arrangement of flower spikes, are the source of the name "Cymbopogon." *Cymbopogon* Lemon grass (*citratus*, Staf) is frequently used to teas, soups, and curries. Additionally, it goes well with seafood, fish, and poultry<sup>(22)</sup>.

*Cymbopogon citratus*, is a grass native to Pakistan, India and Sri Lanka. In Pakistan's northern regions, Gilgit and Juglote are harvested during certain seasons. (Mahouachi Wifek) Lemon grass is a perennial monocotyledonous grass which can grow up to 6 feet in height and 4feet in width. It grows in clusters. It has three-foot-long, long, thin, bright green leaves that range in width from 1.3 to 2.5 cm. Simple leaves have complete edges. On spikes, flowers sprout. It has a lengthy inflorescence ranging from 30-60cm. This fragrant grass name "Cymbopogon," derives from the floral arrangement on it. *Cymbopogon citratus* is a common inhabitant of Southeast Asia<sup>(21)</sup>.

It is a perennial, tufted grass with fragrant stems that grow from a sparsely branching, short, oblique, ring-shaped rhizome. 6 The culms (stems) get older and smoother and glabrous, reaching a height of 2–3 m. Blade linear, 50-100cm x 0.5-2cm, long attenuate at both ends, coriaceous, terete, enclosing the culm, glabrous, striate because silica accumulates on the membranes of epidermal cells, the apex is acuminate, drooping, glabrous, glaucous-green, with a conspicuous midrib below and a white margin above. The upper section and seven margins are frequently scabrid. The plant thrives in sandy, well-drained soil and is essentially non-flowering. It is said that a mean temperature of 75–80°F and an annual rainfall of 80–100 in are optimal for its growth<sup>(24)</sup>.

The liver, pancreas, kidney, bladder, and digestive tract can all be detoxified with the help of the lemon grass, which is a good cleaner<sup>(25)</sup>.



**Figure 2:** *Cymbopogon citratus*

#### 4. Chemical Constituent

Several *Cymbopogon* species supply essential oil that is applied in the industry of soap, toilet-soap, perfumery and related products as well as other with medicinal purposes. Because it contains more citral than other plants, lemongrass (*Cymbopogon citratus*) is well known. Essential oils and citral contents of lemongrass were both impacted by early or late harvesting. Factors like temperature, luminous intensity, soil humidity, fertilizer and maturity affected the essential oils and citral components. The plant transitions from the vegetative to the reproductive stage as it reaches maturity. Overall, there is a strong correlation between the production of plant biomass and the yield of essential oils. higher quantity of better-quality essential oils. The ratio of young to older leaves determines the amount of citral (75%) that is taken at a particular stage. Different processes, such as solvent, rapid solvent dense CO<sub>2</sub> and the Soxhlet, solid phase matrix, and super-critical fluid extraction techniques, are typically used to get lemongrass essential oils. the cutting-edge methods, like similar to high calibre Due to the intricacy of the essential oil components, liquid chromatography in conjunction with gas chromatography (HPLC-GC) is the recommended analysis method. A sample can be placed into a GC for a higher level of separation, however HPLC is more effective for a broad class separation<sup>(26)</sup>.

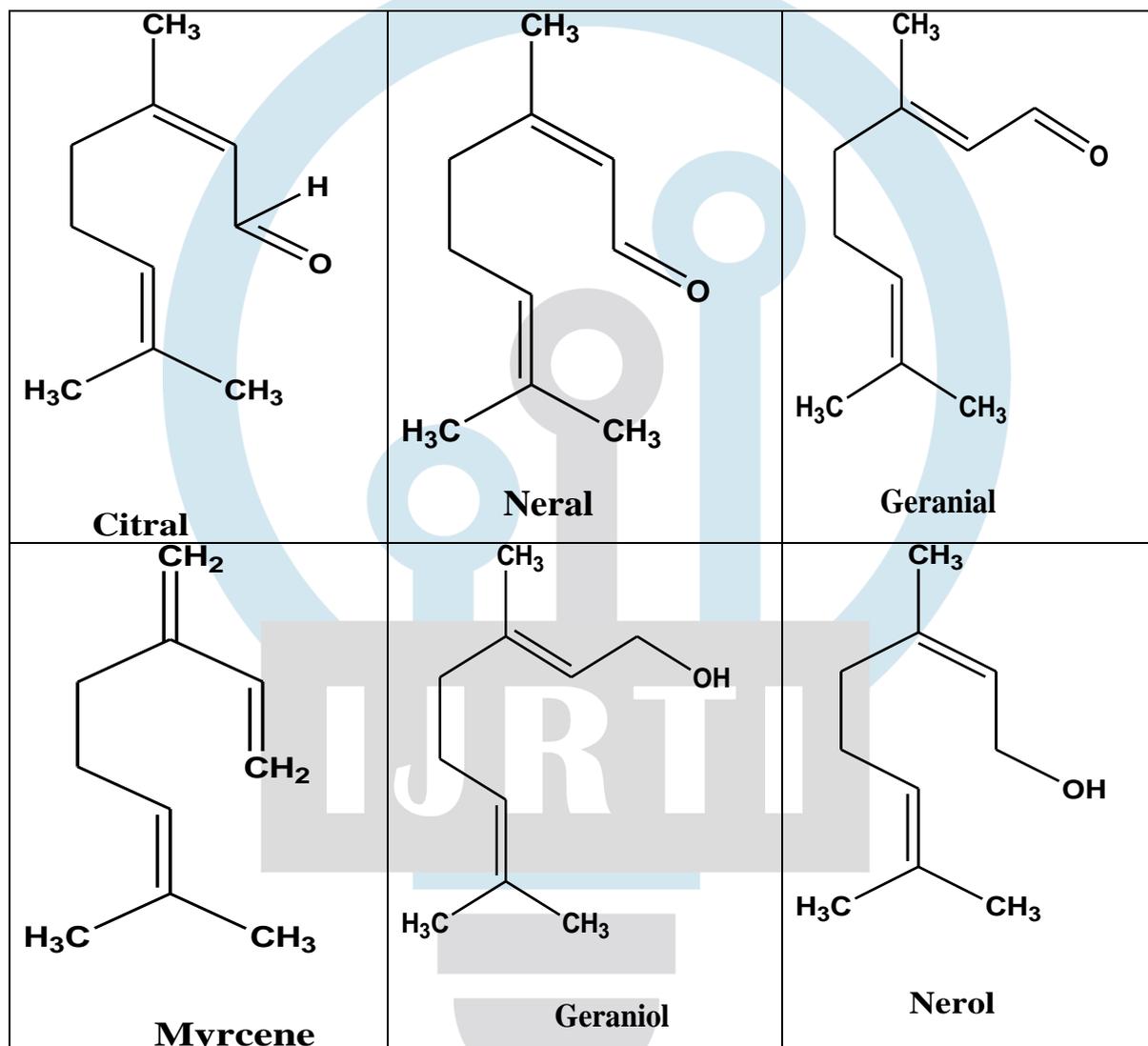


Table 6: Chemical constituents of *cymbopogon citratus*

#### 5. Insecticidal Activity

Citronella oil repels insects such as mosquitoes, black flies, fleas and ticks, therefore, preventing its bites. It is used on humans and their clothing – in the form of oil, liquid and patch. The best option is typically citronella oil because it is a safe, natural alternative to pharmaceutical insect repellents like DEET<sup>(27)</sup>. Essential oils from *C. citratus* have been applied in the control of pathogens and insects. There have reported to be efficient against *Phemacoccus selenosis*, *Musca*, and *Aedes aegypti* *Dermatophagoides* sp. and *domestica*.

- *Lavandula angustifolia* (Lilac)

### 1. Taxonomical Nomenclature

Kingdom	Plantae – Plantes, Planta, Vegetal
Subkingdom	Viridiplantae – Green plant
Division	Tracheophyta – Vascular plant
Class	Magnoliopsida
Order	Lamiales
Family	<i>Lamiaceae</i> – Mints, Menthes
Genus	<i>Lavandula</i> L. Lavender
Species	English Lavender

**Table 7:** Taxonomical nomenclature of

*lavandula angustifolia*

### 2. Common Names<sup>(28)</sup>.

Common lavender
English lavender
Garden lavender
Lavandula buranamii
Lavandula dentate
Lavandula dhofarensis
Lavandula latifolia
Lavandula officinalis L

**Table 8:** Common Names of *Lavandula angustifolia*

### 3. Botanical description :



**Figure 3:** *Lavandula angustifolia*

Lavenders are a diverse group of plants in the *Lamiaceae* (mint) family<sup>(29)</sup>. 4 evergreen perennial shrubs make up lavender. It has a height limit of one metre. Steam and leaves both have a distinctive, silver-green colour. Typically, leaves are long and thin. Those are flowers produced from June to September, whorled, fragrant, and spiky; violet blue in colour<sup>(27)</sup>.

Lavender, also known as medicinal lavender, true lavender, or common lavender (*Lavandula angustifolia*, *L. officinalis*, *L. vera*), is an evergreen perennial plant. The Mediterranean region (France, Spain, Andorra, and Italy China Australia) is where lavender originated, although it is also produced in many other nations, including Poland<sup>(30)</sup>. The Latin word lavo, lavare, which means to wash or clean, is where the term lavender originates. Lavender has been known from ancient times, as evidenced by work of Dioscorides entitled “De Materia Medica,” which praises its medicinal properties. In the Middle Ages, lavender was one of the most expensive essential oil plants used in perfume and soap production. The Romans used it as a bath ingredient. In addition, used as a laxative and a food ingredient. Lavender bunches together in tight, orderly groups and develops to a height of 40 to 60 cm. The stem's upper portion is green, while the lower portion is woody. The root system of lavender is very branching and fibrous, and its linear leaves have curled edges. Silver-green lavender Tomentum, which covers the leaves, shields them from direct sunlight, wind, and excessive water loss. The top of the stem is covered with spikes of lavender flowers that are grouped in circles, each with three to five blossoms. 1 They have pale skin. Although there are many types with white and pink flowers. violet colour. *L. angustifolia*, the lavender plant, prefers fertile, well-drained soils with lime. It thrives in full sun with protection from the wind. Lavender may be fertilised with manure or chemical fertilisers in following years of cultivation, however care should be taken not to introduce soil acidity or much nitrogen, as this results in a loss in inflorescence and excessive gain in the green parts. Lavender is not completely resistant to frost in Poland, thus it needs a good cover for the winter. Plants can be multiplied vegetatively (from soft and hard wood cuttings) or generatively (from seeds) using tissue culture. In order to encourage plant growth and flowering, lavender shrubs are routinely clipped. The months of July and August are the blossoming months. Harvesting should take place on a dry, sunny days. Before opening, gather the flowers and dry them in bundles in shady, well-ventilated areas. The material utilised for the manufacture of essential oils consists of fresh or dried tops of flowering plants, whereas the plant parts used for herbal uses are flowers (Flos Lavandula) or flowering aerial parts (Herba Lavandula)<sup>(31)</sup>.

Lavenders, which are typically native to the Mediterranean region, are now a large commercial crop all over the world, producing more than 2000 metric tonnes of lavender essential oil (EO) year, mostly in Europe. 14 For ages, the oil of the genus *Lavandula* has been used. Due to its carminative, sedative, and depressive qualities, it has been used as a medicinal and aromatic ingredient in traditional medicine and has grown in popularity in the flavour and fragrance industries. 22 The major constituents of lavender essential oil (EO) are mono- and sesqui terpenes, which are fragrant 10- and 15-carbon molecules with backbones made of condensation of 5-carbon isoprene units. 9 Lavender species and cultivars all have distinctive oil chemotypes, making characterising an individual one of the most reliable methods of identification to date. These volatile compounds are produced in specialized structures on the leaf and flower surface, though specific morphology may vary among species and developmental stage. These glandular trichomes are composed of three main parts: a secretory cell connected to an oil storage sac by a stalk. With increasing concerns about antibiotic resistance and environmental impact, traditional antibiotics, pesticides, and preservation methods are being replaced by naturally occurring alternatives. Lavender essential oil is a preferred replacement for conventional, synthetic treatments because of its antibacterial, antioxidant, antifungal, insecticidal, and insect repellent characteristics.

#### 4. Common Uses

The lavender oil has cosmetic use, and it is also believed to have some medicinal uses. The medicinal benefits of using lavender are used to treat anxiety, fungal infections, hair loss, and wound. Lavender is not used to alleviate symptoms of eczema, menstruation discomfort, nausea, high blood pressure, depression, and more. The Food and Drug Administration (FDA) has not approved this herb, so it should not be used in place of prescription drugs that have been approved. Lavender oil is essential oil distilled from lavender flower, it has an anti-inflammatory, antiseptic, antibacterial, antifungal, antimicrobial, antidepressant properties. This herb helps with digestion, burn and wound healing, sleep improvement, eczema and psoriasis improvement, acne reduction, and skin tone. It also promotes the production of urine and improves emotional tension and anxiety<sup>(32)</sup>.

#### 5. Chemical Constituent

4 Linalool, linalyl acetate, cineol, pinene, limonene, geraniol, borneol, and tannins are some of the therapeutic substances found in it. For its larvicidal and pupicidal properties against the house fly, *Musca domestica* L. (Diptera: Muscidae), *Lavandula angustifolia* and demonstrated that *M. domestica* is susceptible to the effects of the essential oils of lavender and peppermint<sup>(27)</sup>. Lavenders are especially known for their essential oil (EO), which is comprised of over 50 mono- and sesquiterpene constituents. The main EO constituents include linalool, linalyl acetate, borneol, and 1,8-cineole. The exact constituent abundance (i.e., EO composition) is primarily determined by the species, although plant health, climatic season differences, harvest time, and post-harvest processing can also have effects on oil composition, as well as essential oil extraction method used, which can also affect essential oil composition<sup>(30)</sup>.

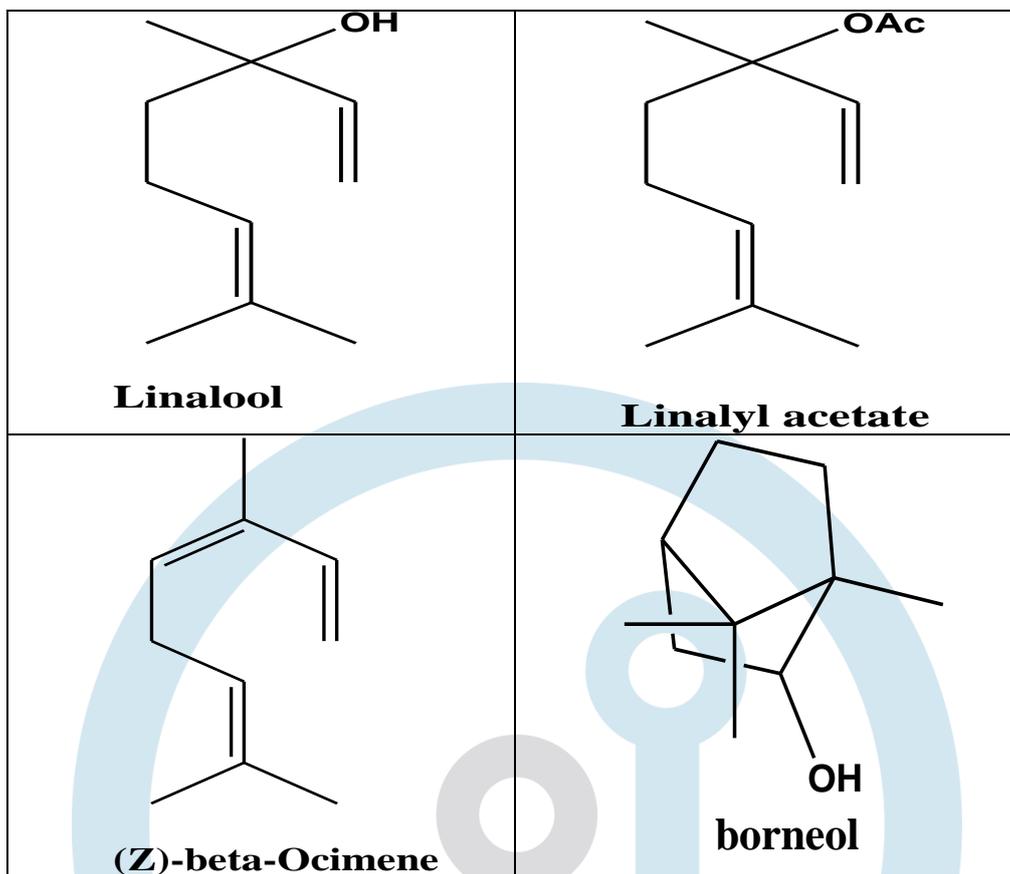


Table 9: Chemical Constituent of *Lavandula angustifolia*

## 6. Insecticidal Activity

Several papers have demonstrated that both linalool and *L. angustifolia* oil have ascaricidal activity. In a study investigating the effect of *L. angustifolia* oil and linalool on *Psoroptes cuniculi*, ascaricidal activity was not only related to direct contact with the mites but also when the volatiles were inhaled. Lavender oil or powdered foliage and flowers may also be useful as both commercial (e.g. in grain silos) and domestic pesticides as the application of lavender deters mites, grain weevils, aphids and clothes moth. Lavender oil is even being investigated and showing potential, as a therapeutic agent against the mite that causes psoroptic mange in sheep<sup>(33)</sup>.

## Summary

A Mosquito borne disease are the major problem of human and animal health. However, the only safe way to control these diseases is to control mosquito vector populations and prevent mosquito bites. Marigold belonging to family *Lamiaceae*, Cochin grass belonging to family *Poaceae* and Lilac belonging to family *Lamiaceae*.

Mosquitocidal effects of ethanolic extract of flowers of *Tagetes erecta* and its chloroform and petroleum ether soluble fractions against the larvae of *Culex quinquefasciatus* have been investigated. Citronella oil repels insects such as mosquitoes, black flies, fleas and ticks, therefore, preventing its bites. Linalool and *L. angustifolia* oil have ascaricidal activity. In a study investigating the effect of *L. angustifolia* oil and linalool on *Psoroptes cuniculi*, ascaricidal activity was not only related to direct contact with the mites but also when the volatiles were inhaled.

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