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In- Search of Potent and Novel Natural Pest Repellent

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Abstract

Unfortunately, the mosquito population is not slowing down, and factors like climate change and more global travel are widening the mosquito's range. People have been employing mostly plant-based remedies for a variety of purposes since ancient times, including for cleaning, illness treatment, and insect deterrent. Since ancient times, people have employed the natural insect repellents that plants produce to ward off pests. The most popular approach uses plants to repel insects is to place live or dried plants outside your windows and doors to keep bugs, especially mosquitoes, atbay. Millions of people worldwide are at serious risk of serious health complications due to mosquitoes spreading deadly illnesses such as dengue, filariasis, malaria, and yellow fever. The use of traditional Chemical-based pesticides to manage Vector Mosquito has resulted in negative environmental effects as well as the emergence of biological resistance found in the vector. Spray and lotion formulations are the most commonly marketed types of natural repellents, which are less harmful and environment friendly. This review focuses on various plants for the pesticidal and anti-mosquito action.

Keywords - Insect repellents, Plants, Malaria, Dengue, Chikungunya, Controlled release formulations, Mosquito's.

INTRODUCTION

Mosquitoes (Diptera: Culicidae) are one of the primary reasons why people die since they can spread fatal illnesses such filariasis, Japanese encephalitis, dengue haemorrhagic fever, and malaria, and yellow fever [1]. Record shows that illnesses spread by mosquitoes claim the lives of almost a million individuals annually [2]. In the current context, where the number of diseases carried by mosquitoes is on the rise, mosquito control is vital. The primary causes of an alarming expansion in the mosquito's range are industrialised farming, stagnant water, and deforestation [3]. For this reason, specialised goods are needed to combat mosquitoes, such as repellents [4]. Insect repellents are frequently used by people to shield themselves from ticks and mosquitoes. There are many different types of repellents, including sprays, lotions, vaporisers, coils, and more. Insect repellents are classified as natural or synthetic based on their chemical makeup and active chemicals utilised in repelling ticks and mosquitoes. Problems brought about by synthetic repellents include:

Mosquito species that have developed resistance to repellents; and

Hazardous residues in the environment, such as soil and water.

Long-term use has health effects, including hormone imbalance impacts naturally occurring non-target life things [5].

Plant-based repellents have many benefits, including:

Occurring naturally qualities;

Strong insect target specificity;

Gradual or less frequent development of insect resistance;

Little or no effect on beneficial insects;

Lack of unidentified environmental risks; and
Long-term health benefits.

Plant-based insect repellents may be more cost-effective, convenient, or aesthetically pleasing when it comes to the sustainable manufacturing and use of repellents, particularly in tropical nations where the advantages to public health of repellents are particularly essential [6]. It's become a beneficial habit to apply repellents to oneself in order to protect against mosquitoes.

Repellents can reduce and/or stop the spread of many diseases that insects carry. When applied to human skin, volatile compounds known as mosquito repellents repel mosquitoes by moving in the opposite direction of their source, preventing contact and bites [7]. Chemical-based repellents for mosquitoes have an amazing safety record, but they are harmful t causing rashes, swelling, eye irritation unusually blood pressure, anaphylactic shock, and swelling of the child's brain [8,9]. As a result, people favoured natural insect repellents over chemical ones·[10]. It is recommended that nine plants be included in mosquito formulations as new active ingredients. These plants include Siamese cassia (Cassia siamea), Eucalyptus (Eucalyptus citriodora), Finger root (Boesenbergiapandurata), Cardamom (Elettariacardamomum), Neem (Azadirachtaindica), Greater Galangale (Alpiniagalanga), and Siam weed (Eupatorium odoratum). These plants have demonstrated a high degree of repellency against mosquitoes [11]. on the skin and neurological system, n, and more serious issues.

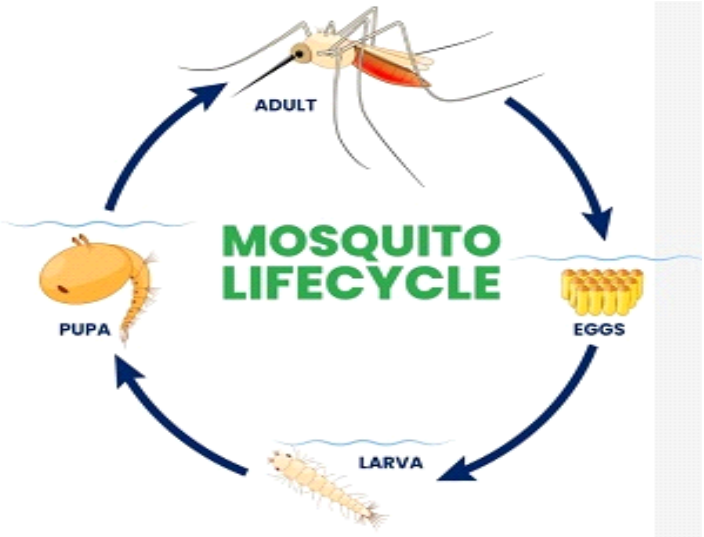

Figure 1*: *Mosquito life cycle

Symptoms of Mosquito Borne Diseases

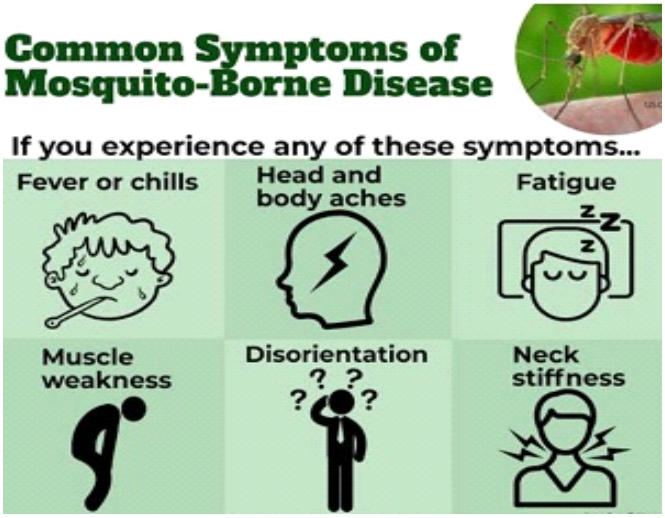

Figure 2*: *symptoms of mosquito borne disease

Herbs used as Natural Pest Repellent:

Neem

Figure 3*: *Neem Plant

(*Azadirachtaindica*A. Juss) belongs to the family Meliaceae, which alsoincludesmahogany. It is a pan tropical tree species that is expanding quickly [12]. It is thought to have come from Myanmar and north eastern India. It then rapidly expanded throughout the Indian subcontinent, naturally flourishing in all arid regions. Later, it became distributed throughout Indonesia and the Old Tropics [13]. Above all, neem's use as an insecticide has been emphasised in conventional treatment.

Citronella grass

Figure 4*: *Citronella grass

Citronella grass, or Cymbopogonnardus, is a kind of aromatic perennial plant belonging to the Poaceae/Gramineae family of grasses. It is the origin of citronella oil, an essential oil that is frequently utilised for its innate capacity to keep insects away. Zacatelimón, nardus, Geranium grass, Mana grass, Nardus grass, Tambookie grass, and lemon grass. Citronella, citronella, citronella grass, gigantic turpentine grass, nard grass, new citronella grass, reuse terpentyngras, citronella, ceyloncitronell, citronellgras, citronella de Java are a few of the common names for the plants that are commonly known by [14]. Known by most as Java citronella, Cymbopogonwinterianus is a native of tropical a subtropical region of Asia, India, and Indonesia. Its main constituents include citronellol, citronellal, and geraniol [15].

Mint

Figure 5*: *Mint

Peppermint (*Mentha piperita*) is a perennial herb of the mint family (Lamiaceae) with strong fragrant flavour. The aroma of peppermint is strong and somewhat sweet, and it tastes warm and spicy with a cooling aftertaste. After being dried, the flowers are used to flavour candies, pastries, beverages, salads, and other foods. Typically, the leaves are utilised raw in food preparation [16]. Mint is a great, non-toxic way to repel flies, mosquitoes, and even ants. There will be fewer insects the greater the scent. To make it easier for you to reach, plant it in pots on your patioeasily and take a few leaves for your afternoon tea. Even better, you may use the dried leaves as an all-natural bug deterrent inside your house [17]. It works well against fungi and bacteria [18].

Marigold

Figure 6*: *Marigold

An annual flower that's easy to grow, marigolds repel mosquitoes with their scent. To keep bugs out, cultivate them in pots and put them close to Your deck or front door. Another well-liked addition to borders and vegetable gardens is marigolds. In addition to deterring mosquitoes, New York botanical garden (NYBG) claims that they can also ward against pests like tomato hornworms, Mexican bean beetles, thrips, aphids, and whiteflies.

Basil

Figure 7*: *Basil

The *Ocimum* genus is, widely recognised due to its nutritious and therapeutic benefits, belongs to the Labiatae family. Some well-known and significantOcimum species that are found inAsia, Africa, Central and Southern America are*Ocimummicranthum (Peru basil), Ocimumgratissimum (African basil), Ocimumkilimandscharicum (camphor basil), Ocimumcanum (dulaltulsi), and Ocimumbasilicum (common basil [)* [19] of its strong scent, basil is one of the greatest plants to keep mosquitoes away. Basil needs plenty of sun, proper drainage, and moisture to flourish. To use basil as a repellent, crush a handful of leaves or apply the oils to your skin. It is still functional in its live state, though [20]. Its leaves work well to prevent infections and mouth ulcers. Gingivitis and other gum diseases are also treated with it. Tulsi is a useful treatment for gum disease because of its anti-inflammatory and anti-inflammatory characteristics [21].

Calotropisgigantea

Figure 8*: *Calotropisgigantean

The genus Calotropis comprises two common species have the ability to repel mosquitoes are *Calotropisprocera and Calotropisgigantea*. Calotropis, which goes by the names gigantic milkweed or callotrope, is a perennial shrub of the Asclepiadaceae family subfamily and is xerophytic. It is extensively found in Asia and Africa's tropical and subtropical climates[22].The following properties of C. procera are demonstrated: antibacterial, anthelmintic, antidiabetic, immunological, gastroprotective, anti-inflammatory, analgesic, antipyretic, anticancer, and anti-angiogenic properties[23].An example of such a formulation is an in-situ gel, which has multiple benefits, including improved application simplicity, bioavailability, and prolonged release of bioactive components[24].

Ginger

Figure 9*: *Ginger

Zingiber species are a flowering perennial herbaceous plant that can reach a height of one. It belongs to the to the Zingiberaceae family. Because of its therapeutic qualities, it is frequently used as a spice and herb and has its origins in maritime Southeast Asia [25]. The essential oils from Curcuma amanda (mango ginger), Zingiberofficinale (English), and Zingibermoran (cassumunar ginger) demonstrated larvicidal and repellant properties [26].

Lavender

Figure 10*: *Lavender

*Augustinaangustifolia*other names for *Lavandulaangustifolia* (Lamiaceae) are Garden Lavender, Lavender, True Lavender, and Lavender.It is a perennial plant that is evergreen. It can reach a height of one metre. The stems and leaves have a distinct silver-green hue. Typically, leaves are narrow and long. Produced from June to September, the fragrant, spiky, violet-blue flowers are borne in whirls.In addition to these benefits, lavender oil has the ability to repel insects[27].

Rosemary

. ***Figure 11*: *Rosemary***

Native to the Mediterranean region, rosemary the herbaceous rosemary (*Rosmarinusofficinalis L.*) belongs to the Lamiaceae mint family. However, due to its widespread use in traditional medicine, cooking, culture, and the arts, it is well-known and well culturalized worldwide[28].Rosemary is one of the natural materials that may possibly be used as a natural repellent (Rosmarinusofficinalis L). The fragrant plant rosemary leaf (Rosmarinusofficinalis L.) has chemicals that can give off a characteristic odor or aroma. Rosemary is one of the natural materials that may possibly be used as a natural repellent (Rosmarinusofficinalis L). The fragrant plant rosemary leaf (Rosmarinusofficinalis L.) has chemicals that can give off a characteristic odor or aroma[29,30].

Onion

Figure 12*: *Onion

Onions, or *Allium cepa* as they are officially named, are some of the most widely grown and adaptable plants in the Allium genus. Frequently referred to by their colloquial name, "onion," onions are a vital vegetable in culinary traditions across the globe, contributing distinct tastes to an extensive range of cuisines. Allium cepa is the scientific name for onions, and they are members of the Allium genus, which is a varied group of bulbous plants that also includes garlic, chives, and leeks. Onions, or Allium cepa as they are officially named, are some of the most widely grown and adaptable plants in the Allium genus. Frequently referred to by their colloquial name, "onion," onions are a vital vegetable in culinary traditions across the globe, contributing distinct tastes to an extensive range of cuisines. Allium cepa is the scientific name for onions.[31] Onion bulbs include elements through a fragrance which are unliked by mosquitoes. An onion differs from its common mosquito counterparts in that it does not disturb the respiratory system, making it a non-lethal practice.[32]

Garlic

Figure 13*: *Garlic

Investigators are becoming curious about *Allium sativum L*. as a potential source of insect repellent, especially in light of the recent report that eating garlic put soldiers at risk of being bitten by ticks while in the field. Similarly, there are several folktales and ethnobotanical privileges indicating that garlic peels deter pests of arthropod origin**.**[33]

Papaya

Figure 14*: *Papaya

Papaya is the popular name for *Carica papaya.* It belongs to the Caricaceae family. The primary chemical components of leaf, pulp, and seed repellent are saponins, alkaloids, and glycosides. Papaya carica demonstrates antioxidant and antibacterial properties as well.[34] Papaya carica possesses anti-inflammatory qualities that help lessen acne too.[35]

Citrus

Figure 15*: *Citrus

The genus Citrus contains many important fruits, such as tangerines, lemons, and oranges. There have been reports of the essential oils of numerous citrus trees having insecticidal effects on pest insects. In order to keep mosquitoes away, citrus leaves have been utilized as incense sticks and topical treatments. Dried citrus leaves are burned over a charcoal fire in certain communities to keep mosquitoes out of dwellings or to eliminate them. The genus Citrus contains many important fruits, such as tangerines, lemons, and oranges. There have been reports of the essential oils of numerous citrus trees having insecticidal effects on pest insects. In order to keep mosquitoes away, citrus leaves have been utilized as incense sticks and topical treatments. Dried citrus leaves are burned over charcoal fires in certain communities as a repellent [36]. This study assessed the phytochemical and mosquito-repelling qualities of methanolic extracts from the leaves of three species of citrus fruits: Citrus limon (lemon), Citrus sinensis (sweet orange), and Citrus reticulate (tangerine). The goal was to determine the most effective extract that could be recommended and used as a mosquito repellent.

Hibiscus:

Figure 16*: *Hibiscus

Chinese hibiscus is another name for *Hibiscus rosa*, which is a member of the Malvaceae family. Flowers are used as mosquito repellents; the main ingredients include phenols, saponins, and tannins [37].

Cinchona bark

Figure 17*: *Cinchona

Cinchona calisaya, sometimes known as yellow cinchona, is a plant. It belongs to the Rubiaceae family. The principal chemical components of the bark, which includes phytosterols, flavonoids, and alkaloids, that are used to repel mosquitoes. Cinchona calisaya has other therapeutic benefits, including antioxidant, anti-inflammatory, anti-cancer, and anti-obesity properties.[38]

Cajanus cajan

Figure 18*: *Cajanuscajan

Rich in calcium, iron, vitamin B-6, magnesium, and vitamin C, masoor dal is a superfood. Furthermore, this nutrient-dense red lentil dish is a fantastic home cure for preventing skin issues.[39] Red gramme is the popular name for *Cajanuscajan*. It belongs to the family Fabaceae. Themajor ingredients of roots as well as leaves that are used to make mosquito repellant are saponins, flavonoids, tannins, and terpenoids. In addition, Cajanuscajan demonstrates anthelmintic, antioxidant, antidiabetic, antibacterial, and antimicrobial properties.[40]

Coconut

Figure 19*: *Coconut

Most people refer to *Cocosnucifera*as the coconut tree. It is a member of the Arecaceae family. Leaf, which has alkaloids, phenols, flavonoids, tannins, and phenols as its primary chemical components, is used as a mosquito repellent. Analgesic, antibacterial, antiviral, antifungal, anti-oxidant, anti-inflammatory, andantiparasitic properties are some of the other health benefits of cocos nucifera.[41]

Croton bonplandianum

Figure 20*: *Croton bonplandianum

The strange plant, *Euphorbiaceae; C. bonplandianum* frequently scattered in the wildernesses of the southern regions of India that are tropical or subtropicalstated to have numerous therapeutic usages counting repelling assets against insects outlined how the larvicidal properties of four species of that genus, Croton, are attributed to their essential oils effect on mosquitoes. In contrast to the mosquito, Culexquinquefasciatus, A. aegypti reported that extracts from the shoots of C. bonplandianum were potent and significantly fatal. It also clarified that the presence of alkaloids in certain species has a toxic effect on mosquito larvae.[42]

Eucalyptus globulus:

Figure 21*: *Eucalyptus globulus

The primary component of *Eucalyptus globulus*, 1, 8-cineol (Eucalyptol), is known to have a strong ovipositional counteractant and a negligible repellent effect on mosquitoes. The volatility, poor solubility in water, and chemical instabilityof essential oils enable them to unsuitable for broad use. Such problems can be solved by the mixing of essential oils with nano-preparations, such as like micro emulsion.[43]

Manigiferaindica

Figure 22*: *Manigifera indica

The common name for *Mangiferaindicus* is Aam. It belongs to the Anacardiaceae family. The essential oil found in leaves, which is employed as a mosquito repellent, was extracted by hydro-distillation and examined Using mass spectrometry (GC-MS) and gas chromatography (GC).[44]

Senna

Figure 23*: *Senna

Coffee senna, or Senna occidentalis (Caesalpinaceae), is a well-known plant. The primary chemical components of leaf, which is employed as a mosquito repellent, are flavonoids, alkaloids, glycosides, and tannins. In addition, it demonstrates antidepressant, analgesic, antidiabetic, antioxidant, and anti-inflammatory properties.[45]

Bitter melon

Figure 24*: *Bitter melon

Its common name is *Momordicacharantia (Cucurbitaceae*), or bitter melon. It belongsto theCucurbitaceae family. The entire plant, which mostly consists of polypeptides, alkaloids, flavonoids, and saponins, is used as a mosquito repellent. Antioxidant, antiviral, antidiabetic, and anti-inflammatory properties are additional therapeutic effects.[46]

Penisetumpurpureum

Figure 25*: *Pennisetumpurpureum

Pennisetumpurpureum is another name for cane grass. It belongs to the family Leguminoaceae. The primary chemical components of the plant's leaf, which is used as a mosquito repellent, are tannins, flavonoids, alkaloids, and polyphenols. Antioxidant, antibacterial, antidiabetic, and anti-inflammatory properties are additional medical effects.[47]

Black pepper

Figure 26*: *Black pepper

Piper nigrum is the common name for black pepper. Its original family is the Piperaceae. The primary chemical components of leaves used as mosquito repellent are terpenoids, carotenoids, flavonoids, and alkaloids. Antioxidant, anti-inflammatory, anticancer, depressive, antihypertensive, and analgesic properties are additional therapeutic effects.[48]

Tabernaemontanancrassa

Figure 27*: *Tabernaemontanancrassa

The plant frequently referred to as Adam's apple is *Tabernaemontanancrassa (Apocynaceae*). The main chemical components of stem bark, including Ibogamine, Conoduramine, and Crassanine, have the potential to repel mosquitoes. Antiarrhythmic and anticancer effects are further therapeutic benefits.[49]

Methods used for natural pest repellent

Neem Oil Repellent: To keep pests like spider mites, whiteflies, and aphids away from plants, combine neem oil with water and sprinkle it on them.[50]

Citronella and Lemon Juice Spray: To ward off mosquitoes and other flying pests, mix lemon juice, water, and citronella essential oil.[51]

Basil and Mint Repellent: Place mint and basil close to plants that are susceptible to pests like flies, mites, and aphids.[52]

Essential Oil Blends: To keep pests away, dilute essential oils with water, such as peppermint, lemongrass, and tea tree oil.[53]

Indian Herbal Repellents: To keep pests away, use Indian herbs like tulsi, ajwain, and hing.[54]

Features of natural pest repellent

Figure 28*: *Features of natural pest repellent

Advantages and Disadvantage

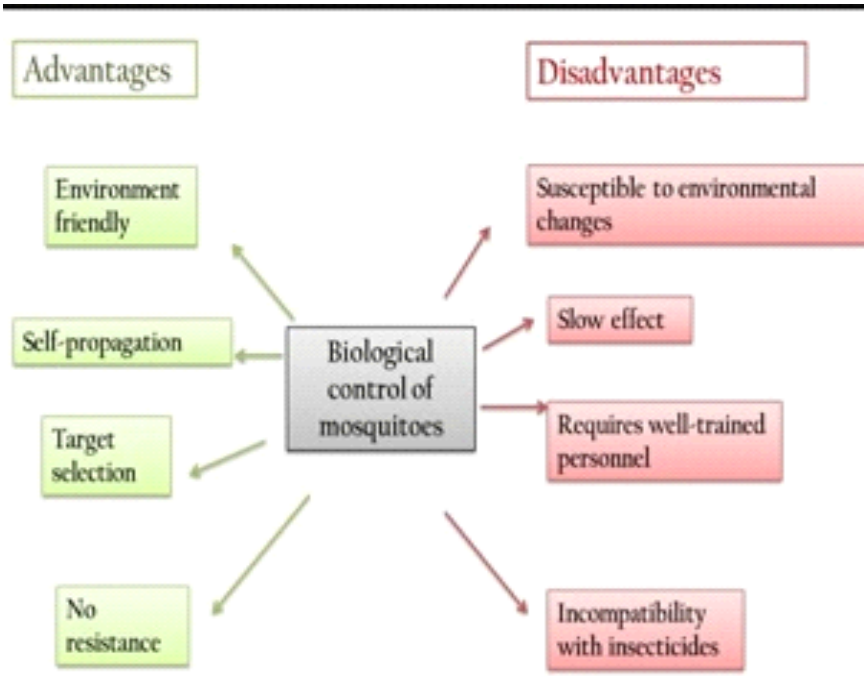

Figure 29*: *Advantage and Disadvantage of natural pest repellent

Prevention of mosquito borne diseases

Figure 30*: *Prevention of Mosquito Borne Diseases

CONCLUSION

Nowadays, the use of artificial intelligence raises several concerns for the environment and public health pesticides to control insects and other arthropods. Using natural products that are ecologically friendly and have good efficacy is an alternative. Among those substances, the essential oils found in a variety of plant species have undergone rigorous testing to determine their repelling qualities as a valuable natural resource.

The literature has detailed a great deal of natural repellents. It has been demonstrated that these substances offer mosquito protection. Plant chemicals belonging to many classes have been found to exhibit insect repellent properties on a regular basis. These classes include alkaloids, phenols, terpenes, quinones, nitriles, furans, and lactones.

As consumer interest in plant-based products rises, scientists are examining plants to see if they contain in sect-repelling qualities. When used properly, botanical compositions offer an alternative to synthetic repellents. These days, plant-based compounds are being created as insect repellents for the same reasons that nature uses them: they work, they break down quickly, and they don't harm the soil or aquatic life.

Because of the rising need for protection against malaria carried by mosquitoes, more research on repellents for mosquitoes is being conducted every day. A lot of effort has been put into finding a pleasant, safe, and environmentally friendly solution to lessen the spread of diseases carried by mosquitoes in the recent past. The primary aim is to prolong the duration of protection provided by effective repellents. Creating novel instruments, such as formulation-based repellents for mosquitoes, is a crucial tactic for developing systems that work better and have fewer negative effects.

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