

A REVIEW STUDY ON MOSQUITO MANAGEMENT

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ABSTRACT

For so many viral, bacterial and protozoans' illnesses mosquitoes serve as vector. In term of disease transmission and public health significance mosquito are regarded as highly significant category of insects. Population of mosquitos grows exponentially that is big issue for many nations because mosquito transmits the filarial, encephalitis, malaria, Yellow fever, chikungunya, Japanese encephalitis, dengue, Lyme disease and pandemic poly-arthritis. Different kinds of insect repellents such as synthetic chemicals, fragrant oils and botanicals are employed against mosquitoes. This study is performed at the University of Gujrat Pakistan. The primary goals of the study were to discover optimal technique of mosquito management, to explain various ways of mosquito control, different plants extracts that are used against mosquito and to compare either chemical or botanical control is better. In term of disease transmission and public health significance mosquito are regarded as highly significant category of insects. Chemical mosquito repellents offer an amazing protective profile, however they are toxic as comparison to the plant based repellents.

KEYWORDS: *Chemical Repellents, Mosquito Traps, Plant Based Repellents, Synthetic Repellents.*

1. INTRODUCTION

Annually globally the 200 million-450 million illnesses are induced by the Anopheles mosquito that leads towards 2.7 million fatalities. In more than 100 emerging nations it remains endemic illness. Virus of Japanese encephalitis develops in the children with malnutrition and present in the regions that are associated with animal reservoirs especially with pigs. On the other side primary reason for the encephalopathy is encephalitis. According to the BBC world service health show the mosquito is regarded as the world's most deadly animal[1]-[4].

Mosquito is vector and it produces serious illnesses which may lead toward death therefore precise action is essential to stay away from the sickness as soon as feasible. There are many ways that may be taken to protect oneself from the biting of mosquitoes. When we are working outside we should wear long pants inserted into socks and long-sleeved shirts. As well as when we are in inside we should present in the places that are screened, dwell in air conditioned and may utilize bed nets. Mosquito breeding may be prevented by removing the standing water from the drains and can use repellents to destroy the mosquitoes. In the middle of the 20th century new pesticides were initially developed that were utilized for the control of pest. At that time it was regarded the greatest control for the insects.

1.1. Mechanism of action of repellents:

Repellency usually depends on the biochemical or physiological processes. Repellency that is produced by the DEET is dependent on the receptor blocking such as lactic acid receptor blocking. Every product that we utilized against mosquitoes has varying degree of effectiveness. Lactic acid and carbon dioxide that is found in the perspiration of warm blooded animals' serves as appealing material for mosquitoes. Level of CO₂ is sensed by the olfactory pulp while host associated odor is detected by olfactory receptor of antennae. The sense of the smell is via antennae that contain the chemoreceptors.

In the body of warm blooded animals lactic acid is present that attracts the female mosquito. *Aedes aegypti* is drawn toward the lactic acid that is utilized for behavioral research. More evidence for the involvement of lactic acid in host seeking comes from research of mosquito physiology after a blood meal. After taking a blood meal host seeking activity in *Aedes aegypti* stops. It is believed that after consuming blood meal sensitivity for the lactic acid in neurons is reduced and after oviposition mosquito again will be normal. Species of mosquitoes such as *Culex* and *Pipiens* are more sensitive that is 6.9 times more sensitive as comparison to the *Anopheles* and *An. albimanus*. Tolerance of repellency is essentially non-adaptive that is awakened owing to the spontaneous mutation. Molecular weight range for the efficient mosquito repellent is 150-250. To check the mosquito repellent activity vapor pressure is regarded as the essential characteristic.

1.1.1. Mosquito repellents:

Anything that is used to apply to clothes, skin or other surfaces that prevent the mosquito from attracting and biting on that surface is known as mosquito repellent. Some mosquitoes repellent that are based on the ultrasound having high frequency sounds are also accessible in market. Older techniques of mosquito repellents include the rubbing of mana, vinegar and plant oils on the body. Ancient people also used to burn the bay, black cumin, oregano and galbanum to limit the insects. Burning of plant or plant materials create the smoke that is oldest way to control mosquito.

One technique for the management of the mosquito is fogging that is temporary approach for controlling pests but is mainly necessary in the scenario of health risks from severe insect occupants and for an outdoor movement where these pests are unwanted. Mostly thermal fogging is employed wherein each gallon includes the 5.0 percent piperonyl Butoxide and 0.5 percent pyrethrins. Another technique is transdermal technology where insect repellents are infused into the blood stream to defend itself from the mosquito bite. This kind of repellent includes the thiamine or Vitamin B1 and it is recognized as most efficient repellent known to date. Female mosquito stays repellent to the scent of Thiamine that is key mechanism for the control of mosquito[5]–[7].

1.1.2. Chemical repellents:

Different kinds of insect repellents such as synthetic chemicals, fragrant oils and botanicals are employed against mosquitoes. Chemical mosquito repellents offers an amazing protective profile but they are poisonous against the nervous system and skin like eye irritation, edema, low blood issue, rashes and worse problem.

1.1.3. Natural repellents:

Natural repellents are essentially derived from the plants and known as essential oils. Substances that are found in the various odoriferous plants and have volatile nature are known as essential oils. It is produced from the different sections of plants and have volatile fragrance with the form of concentrated hydrophobic liquid. Essential oil may be extracted by different techniques such as steam distillation, solvent extraction and hydro distillation. Soil and climatic conditions are key variables that influence the various plant species and composition of essential oils. Synthesis and accumulation of the essential oils associated with the secretory structure of the plants such as resin ducts, glandular ducts and trichomes. Storage of the essential oils occurs in the leaves, woods, flowers, rhizomes, fruits and roots. These plant based essential oils are utilized for the repellency of the mosquitoes and haematophagous insects[8]–[11].

Many study efforts showed that essential oil molecules and their derivatives are alternate regulating measure for mosquitoes. Essential oils owing to their volatile nature require for regular reapplication to preserve their effectiveness. They dissipate entirely and thus their efficacy is short lived and hence full protection cannot be obtained. Many plant origin essential oils are known to have insect repellent qualities viz. citronella oil, lemon grass oil, rosemary, dill, eucalyptus, lavender, soybean, chrysanthemum, clove, castor, tulsi, camphor, limeone, geranium, Neem, galbanum, pepper mint, cedar essential oil and basil.

1.2. Non-Chemical repellents:

Non chemical techniques include the physical and mechanical processes.

1.2.1. Physical technique:

It is important to replace the water in the bird baths, pools, and fountains and rain barrels once a week. During the dawn and dusk it is essential to wear the long sleeved clothes. Screening of doors and windows is also extremely essential to defend oneself from the mosquito assault.

1.2.2. Mosquito Net:

These nets are regarded as more protective than coils and other repellents since their usage does not create any health issue. Sleeping beneath netting can protect against the assault of mosquitoes. There are two kinds of nets such as medicated nets and non-medicated nets.

1.2.3. Medicated Net:

Mosquito nets may be made treated by K-O pills that contain the 25 percent deltamethrin. In one liter of water one pill is combined, net is soaked in it for ten minutes and then dried it in cold area. This net stays effective for six months and mosquito will remain away. World Health Organization authorizes the medicated nets and these nets are more effective than the liquidators or coils.

1.2.4. Non-medicated Net:

Different sizes and forms of mosquito netting is available that may be constructed of different materials such as polyester, polyamide and cotton. Style of net is essential to protect itself from the mosquito bite. It is essential to purchase a net that includes the mesh size big enough to flow the air and tiny enough to protect from the mosquito bite. Mosquito nets are an operational method to naturally protect against mosquitoes.

1.2.5. Mosquito traps:

Mosquito traps are used to catch and entice the female mosquitoes. These traps mimic the different mosquito attractants such as body heat and exhaled carbon dioxide. Most of the traps are powered by the propane or electricity so their usage is safe. Traps include impeller fan when mosquito is drawn near the trap it will adhere to the sticky surface of the trap and will be electrocuted.

1.3. Mechanical Methods:

Mechanical approach includes the equipment such as mosquito magnets and electric mosquito zapper.

1.3.1. Electric mosquito zipper:

For capturing the mosquito this gadget works by utilizing the ultraviolet light and then death of mosquito happens when mosquito contact with the deadly charge of electric charge.

1.3.2. Mosquito Magnet:

Its concept relies on replication of mammalian characteristics such as giving out heat, moisture and carbon dioxide. When mosquito gets near to the gadget it draws in and abruptly dies. This magnet also coupled with the octenol and may be used for the sand flies, black flies, midges and mosquitoes.

1.4. Biological control of mosquitoes:

1.4.1. Entomopathogenic Fungi:

For protection from the mosquitoes fungal spores are employed in the curtains, cotton pieces, interior home services and outside traps. Fungus may be utilized with DDT to employ successfully against the pesticide sensitive and insecticide resistant mosquitoes. *Anopheles gambiae* is more sensitive to the fungus infection as comparison to other insecticides although rate of fungal infection is sluggish as compare to the insecticide action

1.4.2. Bacterial Agents:

For the malarial vector control *Bacillus sphaericus* (Bs) and *Bacillus thuringiensis* (Bt) may be employed since they are ecologically safe, highly effective, exhibit selective effects and non-toxic in nature. Strains of *Bacillus* are readily handled, locally produced, practically applied and inexpensive and having the potential of rapid spreading. As comparison to the *Aedes*, *Culex quinquesfasciatus* and *A. arabiensis* the impact of Bs and Bt is greater on the *A. gambiae*. Bs and Bt induce the formation of the endotoxin proteins that damages the stomach of larvae and its death happens. There two kind of endotoxin proteins such as Cry and Cyt1A that function by interlinking with each other. Cyt1A delays the resistance to the Cry proteins and causes its long lasting usage

1.4.3. Larvivorous Fish:

The oldest technique for the control of mosquito is the employment of the predatory fish. *Gambusia affinis* and other species such family Cyprinodontidae were mainly utilized for the mosquito larval control. Use of larvivorous fish is regarded as more effective technique as comparison to the chemical control. They may be utilized since it shows reduced danger of mosquito resistance, inexpensive manufacturing, safe for both wildlife and human and used at

low dosages. When utilizing the larvivorous fish two essential aspects must be taken into account such as fish must adapt to the environment.

Using of the larvivorous fish has certain drawbacks such as when *Gambusia* introduced exotically it has detrimental effect on the ecosystem. *Gambusia* eat on various food such as zooplankton, algae, young ones and eggs of the amphibians and aquatic insects thus it is known as opportunistic predator. These fishes have aggressive temperament and may battle with other species for space and food. Origin of hazardous ecological changes in the environment leads to increased temperature of water, boosted phytoplankton, decrease the water clarity and raised the dissolved organic phosphorus. For increased activity of fish clearance of vegetation is required.

1.5. Mode of action of phytochemicals in insect body:

Plant extracts are usually recognized as the secondary metabolites that protect them from the herbivores. These metabolites are usually poisonous that are detrimental for the insects and impact on the target molecules that include bio membranes, nucleic acid, cellular components and proteins. Insect physiology is disrupted that influence the neurological system such as production of neurotransmitter, storage, release and activation of receptors. With the assistance of essential oil acetylcholinesterase inhibition, thymol inhibits the GABA gated chloride channel, rotenone inhibits the cellular respiration and pyrethrin inhibits the potassium-sodium exchange. Most significant suppression of the activity of acetyl cholinesterase that is primary enzyme for the transmission of nerve impulse. So when repellents are employed against the insect acetylcholinesterase enzyme is inhibited that impede the nerve transmission since AChE is the sole resistance mechanism for bug.

2. DISCUSSION

Population of mosquitos grows exponentially that is significant issue for many nations because mosquito transmit the various illnesses such as filarial, Japanese encephalitis, Lyme disease, Yellow fever, encephalitis, malaria, chikungunya, dengue, and epidemic poly-arthritis. In tropical and subtropical areas mosquito transmitted illnesses are major issue. Mosquito has about 3500 species and occurs in tropical and subtropical areas Major genera of mosquitoes that serve as vector for different illnesses include *Culex* (Japanese encephalitis, west Nile, chikungunya, Anopheles (filariasis, malaria) and *Aedes* (chikungunya, dengue, Yellow fever) (chikungunya, dengue, Yellow fever). Major reason for the chikungunya and dengue is *Aedes aegypti* that serve as vector for the illness and infect the 2.5 million individuals every year. Feletti, vivax Grassi, protozoal parasites, *Plasmodium ovale stephens* and *Plasmodium falciparum welch* are the main cause of malaria that are transmitted by *Anopheles* mosquito. Most significant cause for the rise of dengue fever are more breeding sites for the *Aedes* mosquitoes, less efficient control of mosquito, more urbanization and accelerated growth of population.

3. CONCLUSION

In many ethno botanical assessments plants serves as repellent agents. In many areas of the globe plant repellents are utilized. Plant based repellents do not offer risks of toxicity to the domestic animals and people and can be readily biodegraded. As opposed to the synthetic chemicals natural goods are safer for human usage. Use of synthetic repellents creates the pesticide resistance in mosquitoes, negative impact on non-target species and poses danger for the ecosystem. Due to the minimal effect on environment and cheap budget plant based repellents gained significant interest of consumers. Innovative medication delivery methods of plant based active components are need of the time.

Modern methods in standardization and separation of herbal medicines motivation are required. Mosquito repellent equipment such as nets of various kinds are also required for capturing of mosquitoes. On the other hand biological management of the mosquitoes with the aid of bacterial agents and larvivorous fish is also taken in account. Essential oils owing to their volatility act for a shorter period. Also several creams with essential oil core may be a smooth distribution method. Such topically applied compositions will be appropriate for individuals to put on and discontinue. Essential oils abundant in nature and apart from its taste and therapeutic worth, their application in repelling mosquito may be regarded as sustainable and biocompatible delivery method as green option.

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