

# REPELLANT ACTIVITY OF SELECTED ESSENTIAL OILS AGAINST THE MOSQUITO.

DR.T.Elizabeth Thangamani Sunitha and S.Kannammal

Department of Zoology , St,Xavier's college, Palayamkottai 627002, Tamilnadu, India.

## ABSTRACT

Plants as alternative source of repellent agent, reported in numerous ethno botanical evaluations. The summary of recent information on claiming and efficacy of plant -based repellents as well as promising new developments in the field . Plant derived repellents usually do not pose hazards of toxicity to humans and domestic animals and are easily biodegraded . Compared to synthetic compounds , Natural products are presumed to be safer for human. This study has attempted to highlight the plants claimed to be used or associated with mosquito repellent.

The protection time was recorded in essential oils like Chothukathalai, Adthoda, Nelli, Karpooravalli, Nithyakalyani, Pachilai, Thumbai, Pappali, Aavarampoo,Pungam it shows that there is a variation among them against the mosquito . Among these leaves extract of Pappali, Chothukathalai, and Karpooravalli showed very effective compared to other extracts. Pappali showed more effective in indoor area.

Essential oils are volatile mixtures of hydrocarbons with a diversity of functional groups,and their repellent activity has been linked to the presence of mono-terpenes and sesquiterpenes. In some cases, these chemicals can work synergistically, improving their effectiveness. The essential oils total protection is against the mosquito bites. The intervals between the time of repellent of application and the landing of the first mosquito for biting are considered as the protection time.

The results were obtained from investigation of papaya(94.73%),Chothukathalai(87.87%), Karpooravalli (83.87%)was found to be more effective than the control. Hence the present study essential oils were used comparison of results showed that Papaya, Chothukathalai, Karpooravalli are best protection time than other essential oils.

Natural anti mosquito agents are likely to offer a cheaper and effective tool that can be used to prevent as well as drive away vector mosquitoes from human dwellings. The potential of plants as sources of essential oils with mosquito repellency effect offers great scientific promise and deplorable opportunity for incorporation into integrated vector management.

Keywords: Repellent, Protection time, Insecticides, Essential oil, Efficacious.

## Introduction:

Mosquitoes are a group of about 3500 species of small insects belongs to the order Diptera. Mosquitoes are cosmopolitan (worldwide) except Antarctica and a few islands. To develop, mosquito requires an environment of water. Certain species mosquitoes prefer to feed at night time. Others bite mostly during the day. Mosquitoes can act as vectors for many disease causing viruses and parasites. Infected mosquitoes carry organisms from person to person without exhibiting symptoms themselves.

These diseases are transmitted to human beings through mosquito bite only since there is no effective vaccine available for the control of these diseases. Prevention of mosquito bites is one of the main strategies to control or minimize incidence of these diseases. The use of insect repellants can provide practical and economical means of preventing mosquito-borne diseases. It is important not only for local people in disease risk areas especially in tropical countries, but also for travelers who are vulnerable to diseases spread by mosquito vectors when they visit and seek leisure away from their home countries.

The plant products have been used traditionally to repel or kill the mosquitoes in many parts of the world (Apoorva Gupta 2017). Plant essential oils are potential natural repellents that are expected to replace synthetic compounds. They are obtained from non woody parts of the plant particularly leaves and their individual compounds due to natural synergism that discourages development of resistance (Kiplang'at, K.2014).

The present work has been designed to evaluate the mosquito repellent activity of leaves extract from different medicinal plants against the mosquito.

## **MATERIALS AND METHODS**

### **SYSTEMATIC OF THE MOSQUITO:**

The mosquito comes under the order: Diptera and because of the possession of a pair of wings and under the family, culicida, which includes the slender flies with elongate proboscis. Male have plumose antennae and female have pilex antennae. The larvae reach its pupal stage within 5 days of preparation. The female mosquito feed on human's blood and also acts as vector. The out take of blood meal is essential for the development of eggs. Population increase during winter months due to continuous breeding and this has facilitated by the availability of adequate amount of water for breeding.

### **STUDY AREA AND REPELLENT FOR ASSESSMENT:**

Selected site is my house located in PATTA STREET; PAPPANKULAM has been selected for the study. The materials like Chothukathalai, Adhatoda, Nelli, Karpooravalli, Nithya kalyani, Pachilai, Thumbai, Pappali, Aavaram poo and Pungam were tested for the repellent activity of selected essential oils against the mosquito.

### **PROTECTION TIME:**

The method adopted by Pandian and Chanrashkaran (1980) was used to record the biting activity cycle of mosquito.

The time interval between the time of repellent and landing of the first mosquito for biting is considered as the protection time. The experimental were conducted during dark hours in indoor to compare the variation in efficacy of oils.

% of protection=

(No. of bites received by control) – (No. of bites received by treatment area)/ (No. of bites received by control) x 100.

### Repellent used for screening:

The selection of the plant was based on their availability as raw materials, scientific evidence and folkloric use as mosquito repellents. The raw materials used for the protection of the herbal mosquito repellent liquid were Kattralai, Adhatoda, Nelli, Pungam, Karpooravalli, Nithiya kalyani, Pachilai, Thumbai, Papaya and Aavaram poo.

#### 1. Chothukathalai (*Aloe Vera*)

*Aloe vera* is a succulent plant species of genus *Aloe*. *Aloe vera* leaves contain phytochemicals such as acetylated mannans, polymannans, anthraquinone and anthrones. Paste of leaf applied over the body before bath for reducing body heat.

#### 2. Adhatoda (*Justicia adhatoda*)

Adhatoda is belongs to the family *Acanthaceae*. The leaves of Adhatoda contain phytochemicals such as alkaloids, tannins, saponins, phenolic and flavonoids. The leaf paste is taken orally to cure Asthma.

#### 3. Nelli (*Phyllanthus emblica*)

It also known as emblic or Indian gooseberry. It is deciduous tree of the family *Phyllanthaceae*. These fruits are high amounts of ascorbic acid. All parts of plants are used in various Ayurvedic medicines.

#### 4. Karpooravalli (*Plectranthus amboinicus*)

It is a semi-succulent perennial plant in the family of *Lamiaceae*. The main chemical compounds found in their leaves are carvacrol, thymol, p-cymene, B-pinene. The leaf extract is used to cure cold, scent laundry and hairs.

#### 5. Nithya kalyani (*Catharanthus roseus*)

It is also known as Madagascar periwinkle is a species of flowering plant belongs to the family *Apocynaceae*. Chemical constituents of leaves are vinblastine and vincristine, alkaloids are catharanthin and vindoline. It is used to treatment of Leukemia.

## 6. Pachilai (*Ocimum basillium*)

It is also called great basil, Saint Joseph's wort, is a culinary herb of the family Lamiaceae. The essential oil from European basil contains high concentrations of linalool and methyl chavicol. Leaf paste is applied over pimples regularly once a day until cure.

## 7. Thumbai (*Leuca aspera*)

Thumbai belongs to the family Lamiaceae. *Leucas aspera* is reported to have antifungal, antioxidant, antimicrobial and cytotoxic activities. Boiled vapors of leaves are inhaled to relieve cough and cold.

## 8. Pappali (*Carica papaya*)

Papaya is belongs to the family *Caricaceae*. Papaya skin, pulp and seeds contain a variety of phytochemicals including carotenoids and polyphenols as well as benzyl isothiocyanates. Papaya leaves are made into tea a treatment for Malaria.

## 9. Aavaram poo (*Senna auriculata*)

It is a legume tree in the family *Fabaceae*. It contains cardiac glucosidal, leaves and bark yield anthroquinones and tannins. Dried young leaves and inflorescence are used as an herbal tea, to reduce the sugar level.

## 10. Pungam (*Pongamia pinnata*)

It is a species of tree in the pea family of *Fabaceae*. Oil and residue of the plant are toxic and will induce nausea and vomiting. The seeds are used in many traditional remedies. It is antiseptic and resistant to pests.

## PLANT EXTRACT PREPARATION

### Decoction method:

Collect fresh and healthy leaves of Chothukathalai, Adhatoda, and Nelli.....etc from near the home. Clean it water and weight the required quantity (10gm) of leaves. Leaves are boiled in a beaker containing 250 ml of water. Stop boiling when the extraction turned greenish brown, similarly the leaves can be also grinded and filtered with filter paper. The leaf extracts are kept in water bath, so that the extraction gets concentrated up to 50ml. Take 3gm of camphor, crush it and add 1ml of kerosene to dissolve it. Then this extract is filled into empty liquidator. The repellency of freshly prepared extracts was evaluated in small room conditions in 6 hours. The median protection time (6 hours) was used as a repellency time of freshly prepared extracts against the mosquito species (Sukhdev Swami Handa 2008).

## Result

Plants as alternative source of repellent agent, reported in numerous ethno botanical evaluations. The summary of recent information on claiming and efficacy of plant-based repellents as well as promising new developments in the field. Plant derived repellents usually do not pose hazards of toxicity to humans and domestic animals and are easily biodegraded. Compared to synthetic compounds, natural products are presumed to be safer for human. This study has attempted to highlight the plants claimed to be used or associated with mosquito repellent.

The protection time recorded essential oils (Table 1) figure (1) shows that there is a variation among them against the mosquito during December 2018 to February 2019. Among these leaves extract of Pappali, Chothukathalai and karpooravalli showed very effective compared to other extracts. Pappali showed more effective in indoor area

From the investigation found that Pappali, Chothukathalai and karpooravalli exhibited in more effective than the control. The protection time for Pappali, Chothukathalai and Karpooravalli were compared with control and experimental were Pappali (94.73%), Karpooravalli (87.87%) and Karpooravalli (83.87%), respectively.

The results showed that the mean protection against mosquito bites was high in Pappali followed by Chothukathalai with respectively indoors and Pappali proved to efficacious followed by Chothukathalai in indoor with mean protection respectively.

**TABLE – 1****Table-I Mosquito repellent activity in Essential oils during December2018-February2019**

Repellent	Protection time (mins)			
	Exp. 1	Exp. 2	Exp. 3	Total
Chothukathalai	47	32	42.1	121.1
Pappali	56.5	41.5	51	149
Thumbai	41.5	26.6	34.8	102.9
Nelli	41.5	30.5	21.5	93.5
Aavaram poo	34.83	27.6	36.5	98.9
Pachilai	26.5	22	27.3	75.8
Karpooravalli	24.8	26.5	32.6	83.9
Nithya kalyani	24.8	34.8	36.8	96.4
Adhatoda	21.3	12.3	34	67.6
Pungam	32.3	22.6	34.8	89.7

**Figure-1** Number of Mosquitoes alighted in Experimental bites after the application of essential oils in December 2018-February -2019

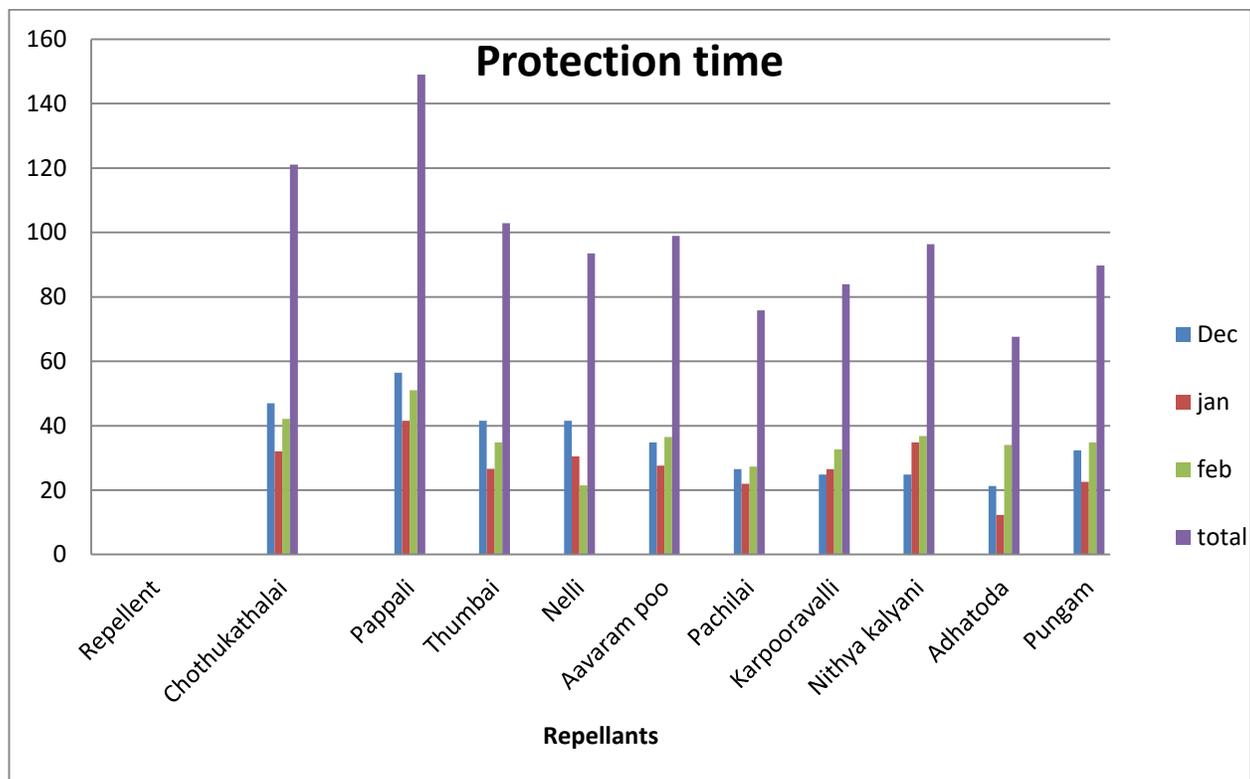


Table-2

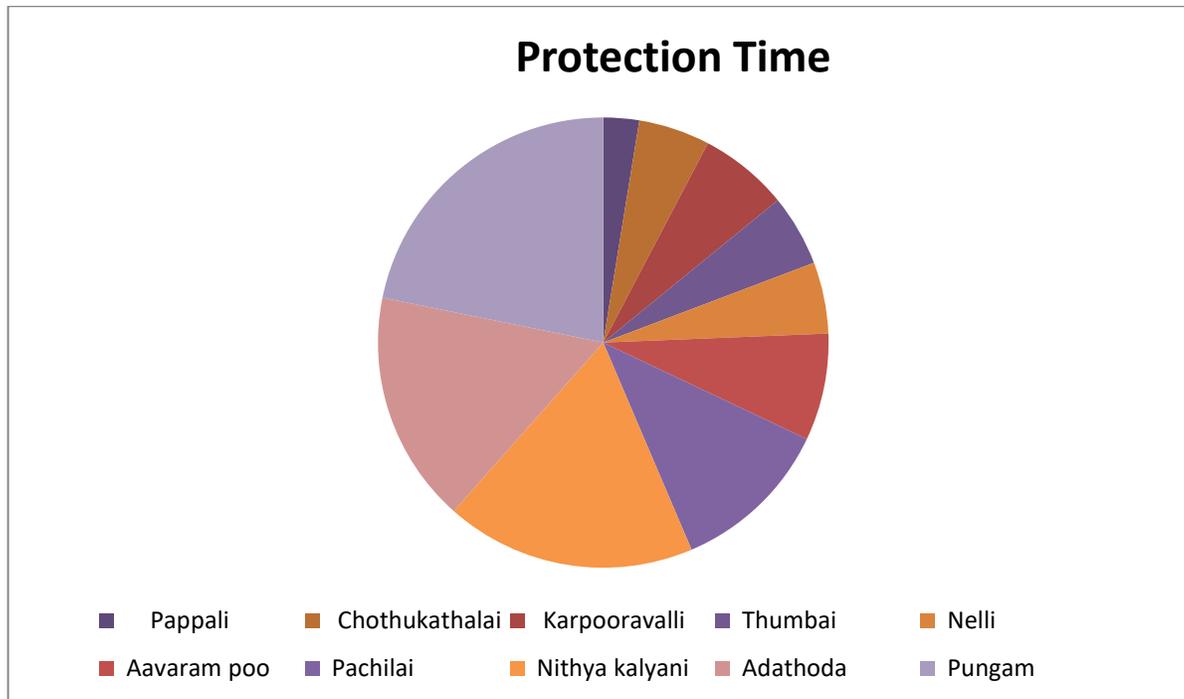
**MEAN PROTECTION TIME EXHIBITED BY VARIOUS ESSENTIAL OILS TESTED AGAINST MOSQUITOES**

Repellent	Protection time (mins)			Mean	Standard deviation	Standard error
	Exp. 1	Exp. 2	Exp. 3			
Chothukathalai	47	32	42.1	40	4.8	2.7
Pappali	56.5	41.5	51	50	6.4	3.6
Thumbai	41.5	30.5	27.3	33	6	3.3
Nelli	41.5	22.6	34	32	7.7	4.4
Aavaram poo	34.8	12.3	34.8	27	10.2	5.9
Pachilai	26.5	26.6	34.8	29	3.8	2.2
Karpooravalli	24.8	34.8	36.8	32	5.2	3
Nithya kalyani	24.8	22	36.5	27	6.3	3.6
Adhatoda	21.3	27.6	21.5	23	1.6	0.9
Pungam	32.3	26.5	32.6	30	2.8	1.6

**Table-3** Number of mosquitoes collected in the control and Experimental bites after the application of essential oils .

Repellent	No. of mosquitoes		% of Protection time
	Experiment	Control	
Pappali	2	38	94.73%
Chothukathalai	4	33	87.87%
Karpooravalli	5	31	83.87%
Thumbai	4	21	81%
Nelli	4	17	76%
Aavaram poo	6	20	70%
Pachilai	9	27	67%
Nithya kalyani	14	30	53%
Adathoda	13	26	50%
Pungam	17	29	41%

Figure-2 Protection time in Percentage for essential oils

**Discussion:**

Mosquito borne disease are major human and animal health problem in all tropical and subtropical countries. The diseases transmitted include Malaria, Filariasis, Yellow fever, Japanese encephalitis and Dengue fever. There has been exploration of various methods over the centuries to combat threats from mosquito borne disease.

Phytochemicals are botanicals which are naturally occurring insecticides obtained from plant resources. Applications of phytochemicals in mosquito control were in use since the 1920s, but the discovery of synthetic insecticides such as DDT tracked the application of phytochemicals in mosquito control program. Application of synthetic in nature, re-focus on phytochemicals that are easily biodegradable and have no ill-effects on non-target organisms was appreciated.

T. Kazembe and C. Makusha (2012) reported that the scientific basis for using mixtures of plant-based products in developing mosquito repellents, as they would have higher repellence and longer periods of protection against biting by mosquitoes. Mixtures of highly repellent extracts are likely to give repelling products although the repellency of the mixture is not likely to be a simple additive product of the repellencies of the constituent extracts of *Carica papaya* (94.73%). Any repellent that gives at least 70% protection is described as effective. A repellent that gives less than 70% protection is taken as being ineffective. The study confirms that *Carica papaya* has mosquito repellent potential. In present work Papaya extract showed high protection time compared to other essential oils.

P. Chandegara.*et.al.*, (2017), reported prepare herbal mosquito repellent incense based on Aloe vera waste products. There are seven formulations for herbal mosquito incense was prepared by using *Aloe vera*, used tea, cow dung and wood dust. The present work *Aloe vera* offered medium protection time (87.87%).

Finally from economic point of view synthetic creams are still more frequently used as repellency than essential oils. Plant-derived repellents usually do not post hazards of toxicity to humans and domestic animals and are easily biodegradable. This study has attempted to highlight the plants claimed to be used or associated with mosquito repellent therapy. Plants that repel mosquitoes have been used traditionally in communities, offering advantages such as being cheap, readily available and renewable. Plant derived chemicals are considered as more environmentally safe than their synthetic counter parts since they are part of ecosystem. Therefore usage of this repellent to control mosquitoes instead of synthetic insecticides to reduce the cost and environmental affects.

#### References:

1. Apoorva Gupta and Dr. Archana Singh. Efficacy of orange peel as a mosquito repellent. International Journal of Home Science 2017:3(2):143-146 .
2. Kiplang'at, K., and Richard, W.M. Synergistic Repellent Activity of Plant Essential Oils against *Aedes aegypti* on Rabbit Skin. International Journal of Mosquito Research, 2014, 1(4): 55-59.
3. . Pandian ,R.S and Chandrashekar, M.K ., (1980) Rhythms in the biting behavior of a mosquito *Armigeres Subalbatus* . Oecologia (Berl) 47:89-95.
4. Sukhdev Swami Handa, Suman Preet Singh Khanuja, Gennaro Longo, Dev Dutt Rakesh, 2008. Extraction Technologies for Medicinal and Aromatic Plants, International Centre for Science and High Technology.
5. T. Kazembe and C. Makusha. Evaluation of Mosquito Repellencies of *Capsicum Frutescens*, *Carica Papaya* and *Cyanodon Dactylon* Extracts and Extract Mixtures. Bulletin of Environment. Pharmacology and Life Sciences, Volume 1 [7] June 2012: 34 – 40.
6. Mayur P. Chandegara, Amit L. Davariya and Vallabh. K. Chandegara. Development of *Aloe vera* based Mosquito Repellent Incense. International Journal of Advanced Biological Research, Vol.7 (4) 2017:652-655.