

Ecofriendly Repellent-A Study of Control of Mosquito Vectors

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ABSTRACT

Repellents such as Allethrin,Diethyltoluimide etc are widely used in India to combat mosquito nuisance and malaria. These repellent is commonly used in different formulations like mats ,coils,lotions and aerosols under different company brand names,are posing tremendous health hazards.Looking to the health hazard problem, a field study was carried out to evaluate the mosquito repellent action of essential oils viz,*Citrus sinensis* oil,*Cymbopogon winterianus* oil,*Cymbopogon flexuosus* oil and *Azadirachta indica* oil in a large room against mosquito vectors. *Azadirachta indica* oil and *Cymbopogon winterianus* oil show the remarkable most effective repellent properties and other essential oil are also show effective effect. These essential oils was then employed as active ingredients in the preparation of cream and tested on 40 human volunteers of the age group between 18-40 years. Most of the volunteers reported 80% mosquito repellency. This study demonstrates the potential of essential oils as repellents against both day and night biting of mosquitoes. It was found to be safe and suitable alternative to DEET (N, Ndiethyl-3-methyl Benzamide), the most common currently available repellent

KEY WORDS:- DEET, Clevenger Apparatus, Repellent Cream

INTRODUCTION

Insect transmitted disease remains a major source of illness and death world wide. Mosquitoes alone transmit disease to more than 700 million persons annually. Malaria kills 3 million persons each year, including 1 child every 30 seconds. Although insect borne disease currently represents a greater health problem in tropical and subtropical climates, no part of the world is immune to their risks.

Currently a variety of repellents are marketed in India, to control mosquitoes in the form of mats, coils, lotions and vaporizers. Researchers are providing data on the harmful effects of repellents used against mosquitoes. The main site of action of the pyrethroids is the sodium channel, which is kept open for long periods of time, causing prolonged sodium current to flow, leading to hyper-excitation of the nervous system.Menon and Halarnker warned against the use of repellents and stated that:-repellents-the \Danger Within. There could be a danger from Mosquito repellent creams,mats,coils and Lotions.The principal class of chemicals they use pyrethrums,could lead to running nose and wheezing,prolonged use could lead to corneal damage,asthma and liver damage. Indian ENT Surgeons are also reporting similar symptoms in their patients. The Industrial Toxicological research Institute,Lucknow has also recorded serious health consequences of the use of repellents.

This is the reason there has also been a need for such formulations, which is powerful with lesser side effects. Considerable efforts have been made to develop and encourage the use of environmental friendly insecticide materials that are not persistent, have low mammalian toxicity and are relatively safe. Since ancient times, insect repellents formulations consisting of sprits of camphor, oil of tar, oil of Pennyroyal and castor oil have been shown a protection against insects (Freeborn 1928; Dover 1930; Skinner and Johnson 1980) The present study reports on repellency properties of the essential oils against the biting of mosquito vectors and the use of these oil as active ingredients in the preparation of insect repellents.

DISCUSSION AND EXPERIMENTAL

PREPARATION OF PLANT MATERIAL

The plant material has been procured from Kalapani village (*Cymbopogon winterianus*,*Cymbopogon flexuosus*),Bhopal (*Citrus sinensis*) and Sehore (*Azadirachta indica*) in Madhya Pradesh.

EXTRACTION OF OIL FROM PLANT MATERIAL

Citrus sinensis oil,*Cymbopogon winterianus* oil,*Cymbopogon flexuosus* oil and *Azadirachta indica* oil was extracted from peels, dried herbs, freshly cut herbs and leaves by Steam distillation method on Clevenger apparatus which was described by Eaton(1989).

PURIFICATION OF WAX

Half Kilogram wax was purified by melting over steam bath and washed with water after cooling it to ambient temperature.

ASSESSMENT OF REPELLENCY OF ESSENTIAL OILS

Mosquito repellent activity was assessed by using the test described in the American Society for Testing and Material (ASTM) Standard E951-83: "Laboratory testing of non-commercial mosquito repellent formulations on the skin" (Anonymous, 1983) The Procedure of making dilution and applying oils on the arm of volunteers was similar to that described by Buescher et.al(1982) and Gupta et.al(1989). In this Procedure, DEET used as standard mosquito repellent.

Percent repellency = $100 - (\text{No. of bites on treated arm} / \text{No. of bites on control arm}) \times 100$

PREPARATION OF INSECT REPELLENT CREAM

A cream was prepared by the essential oils mixed with natural wax. The formula for the insect repellent cream is as follows:-

Natural Wax	10 g
Essential oils of <i>Citrus sinensis</i>	5.0 ml
Essential oils of <i>Cymbopogon winterianus</i> ,	5.0 ml
Essential oils of <i>Cymbopogon flexuosus</i>	5.0 ml
Essential oils of <i>Azadirachta indica</i>	5.0 ml
Sodium lauryl sulphate	0.4 g
Triethanolamine	5.0 ml
Stearic acid	10.0 g

FIELD TRIALS OF INSECT REPELLENT CREAM

The cream was applied at each day for two days to each arm of volunteers. Individuals treated with the repellent cream were required to expose their treated skin constantly for 2 hours period. The volunteers were allowed to roam freely in the test site and the number of mosquito bites on the treated skin was counted through out the hour. The procedure was repeated on volunteers who were not treated with cream the number of bites on the untreated arm of volunteers was recorded. The percent protection provided by the repellent cream can be expressed by the formula (Lillie.et.al 1998)

Percent Protection = $(\text{Bites on control} - \text{bites on treated}) / \text{bites on check} \times 100$

As per the data reveals in Table 1 and the Graph shows that *Cymbopogon winterianus* oil and *Azadirachta indica* oil presents a significant degree of repellency, however they had lower values than the standard repellent.

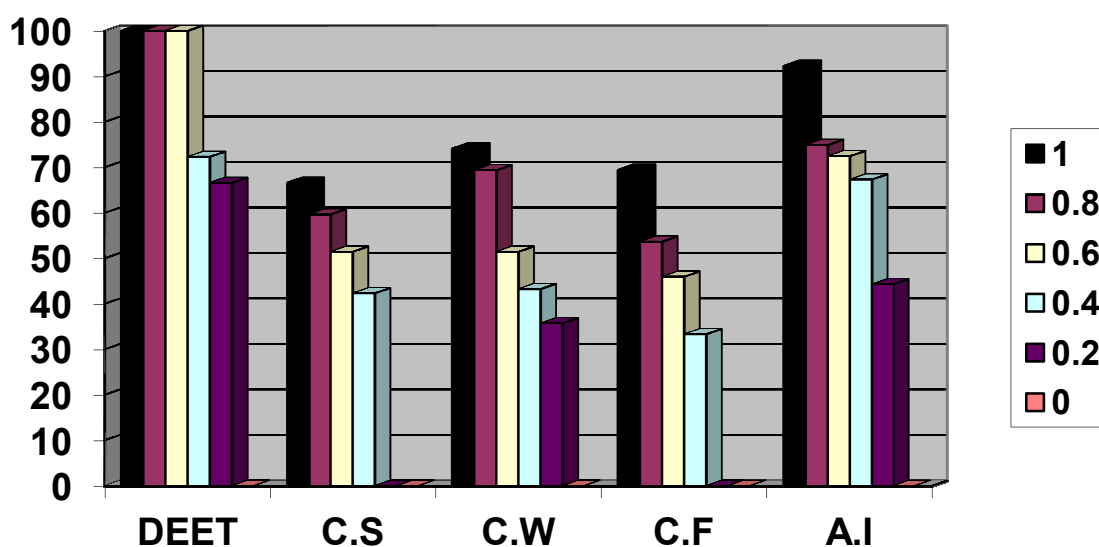
The cream containing 20% of the essential oils provided high level of protection against mosquito bites. Volunteers treated with the cream received only 3 mosquito bites per hour. The mean number of mosquito bites receive per person for untreated volunteers was 30. This indicated that the cream provided 80% protection against mosquito attack. The excellent effect provided by the cream suggested that the essential oils have the potential to be developed into commercial chemical repellents. It acts as a better replacement of chemical repellents.

The formulation besides being a mosquito repellent is also a skin moisturizer, which improves the texture of skin and gives it a silky touch with a minimum inhibitory dose. Its not only repels the mosquitoes but also tend to increase circulation at the surface of the skin, opening up the pores. Due to above properties, formulated cream is best for children.

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Graph shows the percent repellency of different essential oils

DEET = N, N Diethyl-3- Methyl Benzamide

C.S = *Citrus sinensis* oil

C.W = *Cymbopogon winterianus* oil

C.F = *Cymbopogon flexosus* oil

A.I = *Azadirachta indica* oil

Table:-1 Percent repellency of essential oils towards mosquitoes

VOLUME(ml)	DEET	C.S	C.W	C.F	A.I
1.0	-	66.63	74.12	69.45	92.31
0.8	-	59.65	69.35	53.65	74.91
0.6	100	51.45	51.45	45.95	72.45
0.4	72.31	42.31	43.23	33.30	67.33
0.2	66.60	-	35,71	-	44.31
0.0	0,0	0.0	0.0		0.0

Table 2:-Mean Number of Mosquito bites received per person per hour

TREATMENT	MOSQUITO BITES PER HOUR	PERCENT PROTECTION
Repellent cream on skin	3	80%
No treatment	30	0