

# Assessment of Efficiency of Eco-Friendly Organic Mosquito Repellent Developed using Elephant Dung

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**Abstract:** Mosquitoes transmit a range of infectious agents that affects human health. Malaria, dengue fever, yellow fever and other mosquito-borne diseases infect countless individuals and account for thousands of deaths annually, causing a large burden to public health and on the economic process of developing countries. At present, concerning 40% of the world's populations mainly in India live in areas where the chance of dengue fever transmission is most. High rate of reproduction and lack of effective vaccines against several mosquito-borne pathogens makes us extremely addicted to the utilization of insecticides to manage the mosquito populations so as to prevent illness due to transmission. Mosquito repellents mainly consist of pyrethroids that lead to hyper excitation of nervous systems and its prolong usage results in corneal damage, liver damage and asthma. Hence, need for the development of the most effective organic herbal insect repellent must be taken into account due to the toxicity issues, together with the increased incidence of resistance to insects. In this perspective, the present study aimed to develop an eco-friendly mosquito repellent as an alternative for chemical repellent using elephant dung and other natural resources and to assess the efficiency of the organic repellent compared to commercial repellent. Elephant dung has been employed for fuel supply, biofertilizer and paper production. Natural ingredients like Nerium flowers, Tulsi, Neem leaves, Lemon grass oil and Natural loban were used in combination with the elephant dung to reinforce the potency of the mosquito repellent. Smoke toxicity of organic mosquito repellent was evaluated. Emission test for commercial and developed repellent was also compared and it is evident that there is 57% reduction in the carbon-di-oxide emission from developed repellent than commercial repellent and there are no traces of emission of carbon monoxide from the developed repellent. Also, cage test proves that the developed mosquito repellent is highly efficient against mosquitoes and hence can be more effectively used for control of mosquitoes.

**Keywords:** Mosquitoes, mosquito-borne diseases, pyrethroids, elephant dung, organic herbal mosquito repellent.

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## I. INTRODUCTION

Mosquitoes are the most viral issue of urban, sub-urban and rural environment [1]. Mosquitoes are the main carriers of dengue, malaria and several other diseases that cause tremendous problems even leading to death. Every year, the death rate continues to be higher due to many infections and diseases like dengue and malaria caused by mosquitoes. Nearly 700 million people are affected every year by mosquito borne illness resulting in greater than one million of deaths. Controlling such diseases is extremely difficult due to the higher reproduction rate and development of mosquitoes that are resistance to insecticides and commercially available repellents [2].

Some of the ways to prevent the mosquito are cleaning the environment and using insect repellent that totally wrecked the fatal defense of mosquitoes. Although commercially available mosquito repellents consisting of pyrethroids, N, N - Diethyl- meta-toluamide chemicals provide quick mortality. But their continuous usage results in resistance of mosquito against insecticides. Long term use of chemical insecticide results in hyper excitation of nervous systems, corneal damage, liver damage, asthma and several other problems [3]. A lot of research is going on to improve the efficiency of repellents and decrease the effects on human health. But the deadly and harmful effects of modern insect repellents used in houses have not yet drawn the attention of many scientists. Mosquitoes are also resistant to traditional chemical pesticides and there is growing concern regarding the potential health and environmental risks surrounding these products [4]. Hence, there is a need for the development of the most effective organic herbal insect repellent to fight against deadly mosquitoes.

Natural resources which are easily available can be effectively used for control of mosquitoes in environment derived from plants are effective, safe and extensively used as biologically active compounds notably in the space of infectious diseases [5]. Animal dung places a major role since time immemorial and it is considered as a third important services rendered by animals. Dung is utilized as a biofertilizer, cheap fuel and insect repellent. The later is to be focused very seriously in the modern era. The dung is waste material and completely free. It is great business strategy to use the waste into a valuable product. The repellent manufactured from dung creates revenue and cause individuals to understand that elephants are liabilities as well as resources [6].

# Assessment of Efficiency of Eco-Friendly Organic Mosquito Repellent Developed using Elephant Dung

Elephant dung is a natural, non-polluting mosquito repellent. The smoke kills mosquitoes generated when the dung is burnt. Elephants are herbivores and their dung has high proportion of undigested plant fibers making the excreta an incredible crude material for the mosquito repellent production [7]. As the diet of the cow and elephant is entirely different, the fiber content from the dung of elephant is more than that of cow dung. This actually increases the burning capacity of the mosquito repellent. The fume that wafts from burning elephant dung can be also used as a mild painkiller. This repellent has endless benefits of elephant dung than cow dung with its anti-bacterial properties; we get fresh and clean air as it kills germs and bacteria in the air upon burning.

In this work, elephant dung, known to be a natural insect repellent is used as main ingredient in development of organic repellent against mosquitoes. It has high amount of ash, low amount of carbon and low burning ratio. The preparation of mosquito repellent using elephant dung is not yet reported. The raw materials were selected based on practice and experience by our ancestors and they are *Nerium oleander* flowers, tulsi leaves [*Ocimum tenuiflorum*], neem leaves [*Azadirachta indica*], lemon grass oil and natural loban along with the elephant dung to enhance the efficiency of the mosquito repellent.

Neem leaves possess excellent anti-viral property and can tremendously work as a mosquito repellent while burning [1]. It is anti-feedant that break the metamorphosis of mosquito repellent even at low concentration and hence act as effective insect repellent [8]. Mechanism behind *Azadirachta* is to block the latic receptor and makes the mosquito to get away from the place [10]. The compounds that are toxic to mosquitoes are complex tetranorterpeneoid limnoid [9]. Neem leaves found to exhibit anti-fungal, anti-diabetic and anti-bacterial activities [13].

Flavonoids, sterols found in *Nerium oleander* has the property of repelling mosquito and causes 43% mortality rate at 3% concentration when exposed to 24 hours [12]. Tulsi has a wonderful anti-viral and insecticidal property and added with the elephant dung to achieve high efficiency. The building block of tulsi leaves are methyl eugenol [46-68%], [E]-caryophyllene [17-27%] and  $\beta$ -elemene [16.3%] [11].

Loban [Sambarani] is a resin from a tree [*Styrax benzoin*] and possess excellent insect and mosquitoes repellent property. Its smoke creates a soothing atmosphere of calm serenity. Lemon grass oil is a disinfectant and harbors appealing smell. Apart from these ingredients, maida is used as a binding agent [11].

The formulation of these mosquitoes repellent is safe, eco-friendly, cheap, easy to use and has maximum efficiency against mosquitoes.

## II. MATERIALS AND METHODOLOGY

### A. Raw Materials collection

The raw materials for the preparation of herbal mosquito repellent were collected from local area. Dung of elephant was collected from the temple in Srivilliputhur and Madurai. Leaves of *Azadirachta indica* was collected from Kalasalingam Academy of Research and Education (KARE), Krishnankoil and *Nerium oleander* flowers from Madurai market, leaves of *Ocimum tenuiflorum* from Thenkasi, lemon grass oil, loban and maida were bought from commercial

stores [Figure 1].



Fig. 1. Ingredients for the preparation of organic herbal mosquito repellent

### B. Development of mosquito repellent

*Nerium* flowers, neem leaves and tulsi leaves were allowed to shade dry. After drying, *nerium* flowers and neem leaves, loban were powered separately. Then it was mixed with the elephant dung along with maida in 1.2 ratio. The mixture was molded into the desired shapes which were then dried with the help of a drier. Using a hand spray pump, lemon grass oil was sprayed on the coil to give fragrance and further it was kept under sunlight for better drying. Finally, these coils were packed in a suitable air tight bag and kept for 2-3 days for storage for the uniform spreading of essential oil on the repellent.

### C. Determination of efficiency:

The efficiency of the mosquito repellent was tested. The test was conducted by burning the organic herbal mosquito repellent coil and commercial mosquito repellent in a different closed room containing higher number of mosquitoes and the death ratio was checked manually. The number of dead and dropped down mosquitoes was counted and the result was analyzed in different period of time.

### D. Smoke emission test:

Smoke emission test were performed in the Department of Automobile Engineering, KARE. It was carried out by use of an approved and calibrated smoke meter. Coil was prepared and tested by burning the coil inside the smoke emission box. Smoke meter was used to measure the amount of carbon-di-oxide and carbon monoxide emission of both the herbal mosquito repellent coils and commercial mosquito repellent.

### E. Trial test in KARE campus:

The organic mosquito repellent and the commercial mosquito repellent were tested in some selected areas of KARE campus such as a place near to TIFAC Core building, Office of Controller of Examinations, canteen, administration block, indoor stadium.

### F. Cage Test

Cage test was performed in Vector Control Research Center, Madurai to check the mosquito repellent activity. 100 mosquitoes were taken inside the glass cage. The organic mosquito repellent and the commercial mosquito repellent were burnt inside the cage separately to check the repellence activity.



### III. RESULTS AND DISCUSSION

#### A. Development of Organic herbal mosquito repellent

The mosquito repellent was prepared by adding all the ingredients in 1:2 ratio. The developed repellent has good smell and fragrance.

#### B. Determination of efficiency

The organic herbal mosquito repellent and the commercial mosquito repellent were tested in a closed room containing a large number of mosquitoes. In the room which has organic herbal mosquito repellent, the mosquitoes were found to drop down and die within 10 to 15 minutes. 7 mosquitoes were found dead on the floor in different places and all other mosquitoes got vanished in few minutes. [Figure 2, 3].



Fig. 2. Organic herbal mosquito repellent



Fig. 3. Determination of organic herbal mosquito repellent efficiency

#### C. Smoke emission test:

Smoke emission test was performed to measure the carbon monoxide and carbon-di-oxide emission and the results were shown in the Table I:

TABLE I. SMOKE EMISSION TEST

Type of repellent	Trial	Emission	
		Carbon monoxide CO [% v/v]	Carbon dioxide CO <sub>2</sub> [% v/v]
Commercial mosquito repellent	Trial 1	0.035	0.10
	Trial 2	0.025	0.00
	Trial 3	0.028	0.05
Organic herbal mosquito repellent	Trial 1	0.013	0.00
	Trial 2	0.011	0.00

	Trial 3	0.011	0.00
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It was observed that carbon monoxide and carbon dioxide level emitted from the organic herbal mosquito repellent is lower than that of commercial mosquito coil.

#### D. Trial test in KARE campus

The organic herbal mosquito repellent and the commercial mosquito repellent were tested in the areas populated with mosquitoes inside KARE. It was found that after 15 minutes of burning the organic repellent, the mosquitoes were vanished in and around the places.



Near to TIFAC-CORE



Near to Nalabagam Canteen



Near to COE



Near to Administration Block



Near to Indoor stadium

Fig. 4. Trial Test

#### E. Cage Test:

The Organic herbal mosquito repellent and the commercial mosquito repellent were tested in two different cages which has 100 mosquitoes in Vector Control Research Center, Madurai to check the organic herbal mosquito repellent activity. It was found that the mosquitoes moved away from organic herbal mosquito repellent.

### IV. CONCLUSION

Usage of elephant dung for production of mosquito repellent has not been reported before. The developed organic herbal was quite efficient in repelling and killing the mosquitoes without harming the human health. This study resulted in development of eco-friendly organic herbal repellent with long lasting protection, safe for human life, animal skin and humans with no side effect, as an alternative to commercially available synthetic chemical repellents. The results of this investigation indicated that the elephant dung could be beneficial for the control of mosquito borne diseases.





Fig. 5. Cage Test







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