International Journal of Mosquito Research

ISSN: **2348-5906**
CODEN: **IJMRK2**
IJMR 2022; 9(6): 44-46

www.dipterajournal.com
Received: 20-09-2022
Accepted: 23-10-2022

Suryaji Jadhav
Dabur Research & Development Centre, Dabur India Limited Ghaziabad, Uttar Pradesh, India

Amit Sirdesai
Dabur Research & Development Centre, Dabur India Limited Ghaziabad, Uttar Pradesh, India

Dr. Prasun Bandyopadhyay
Dabur Research & Development Centre, Dabur India Limited Ghaziabad, Uttar Pradesh, India

Corresponding Author:
Suryaji Jadhav
Dabur Research & Development Centre, Dabur India Limited Ghaziabad, Uttar Pradesh, India

Assessment of comparative bio-efficacy of mosquito repellent cream and liquid mosquito repellent vaporizers

Suryaji Jadhav, Amit Sirdesai and Dr. Prasun Bandyopadhyay

DOI: https://doi.org/10.22271/23487941.2022.v9.i6a.640

Abstract
Vector-borne diseases are accountable for more than 17% of all infectious diseases globally and are major contributors towards mortality from infectious diseases. Mosquitoes are known to be the primary causative vectors of some of the prevalent diseases in India such as Malaria, Dengue and Chikungunya. Mosquito repellents are an effective way to prevent mosquito bites. Active ingredients of synthetic mosquito repellents are N, N-diethyl-3-methylbenzamide (DEET) and Allethrins. The present study was undertaken to assess the comparative bio-efficacy of the test item, mosquito repellent cream (Odomos) containing 12.0% w / w N, N - Diethylbenzamide and liquid vaporizers containing 1.6% Transfluthrin using landing and probing inhibition method. The test item, Odomos mosquito repellent cream, exhibited instant mosquito repellency as compared to the conventional household product - liquid vaporizers against *Aedes aegypti* mosquitoes from the beginning of the study when tested under standard laboratory condition.

Keywords: Mosquito repellent, Odomos, N, N, diethylbenzamide, transfluthrin, *Aedes aegypti*, liquid vaporizer (LV)

Introduction
Vectors are living organisms that carry and transmit an infectious pathogen to another living organism and cause Vector-borne diseases. It has been estimated by WHO that Vector-borne diseases account for more than 17% of all infectious diseases, causing more than 700,000 deaths annually. They can be caused by either parasites, bacteria or viruses [1]. Vector borne diseases are transmitted by the bite of infected blood-feeding arthropod species. Diseases spread by mosquitoes are major source of illness. Some of the mosquito-borne diseases prevalent in India are Malaria, Dengue, Filaria, Kala-azar, Japanese Encephalitis and Chikungunya. Malaria is a parasitic infection transmitted by Anophelines mosquitoes and Dengue is the most prevalent viral infection transmitted by *Aedes* mosquitoes. The primary vectors that transmit Dengue are *Aedes aegypti* mosquitoes and, to a lesser extent, *Ae. Albopictus*. It is estimated that dengue causes 40,000 deaths every year [1]. The most efficient way to prevent these mosquito-borne diseases is to prevent mosquito bites and control mosquito breeding. Even a single bite from infected mosquito can give Dengue and Malaria, hence bite protection is important.

Various approaches utilized for preventing mosquito bites are usage of mosquito nets, medicated nets, mosquito traps, electric mosquito zippers, mosquito repellents, liquid vaporizers etc. Although wearing clothing that minimizes skin exposure during daylight hours when mosquitoes are most active is one way to prevent mosquito bites while outdoors, use of mosquito repellents are found to be more effective. Mosquito repellents may be either chemical/synthetic or based on plant-derived essential oils. Mosquito repellents are commercially available as creams, lotions, oils, and sticks, which are applied directly on the skin [2]. N, N-diethyl-3-methylbenzamide (DEET) and *N, N*-diethyl benzamide (DEBA) are most effective synthetic mosquito repellent [5, 8]. They are active ingredient of many insect repellant formats like creams, sprays and lotions which is very effective against mosquitoes and other blood sucking insects [4].

Liquid mosquito repellent vaporizers (LV) are also commonly used in households as mosquito repellents. These LV contain Transfluthrin which is a fast-acting pyrethroid insecticide with low persistency. It has been found that there is a decrease in efficacy of the liquid vaporizer containing Transfluthrin as active with an increase in room size [7]. Accordingly, a study was carried out to assess the comparative bio-efficacy of the test item mosquito repellent cream containing 12.0% w / w *N, N* - Diethylbenzamide and liquid vaporizers containing 1.6% Transfluthrin using landing and probing inhibition method. This study highlights the repellency of the test item mosquito repellent cream which gives 100% landing and probing inhibition against *Aedes aegypti* mosquitoes. The present study demonstrates that mosquito repellent cream containing 12.0% w/w N, N - Diethylbenzamide is an instant effective mode of preventing mosquito borne diseases specifically by *Aedes aegypti* mosquitoes.

Materials and methods

Test Material

Mosquito repellent Cream (12.0% w/w N, N-Diethylbenzamide) - Odomos Cream manufactured by Dabur India Limited.

Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with high temperature Flash mode of LV machine

Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with normal mode of LV machine

Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with regular LV machine (without mode change option).

Control was taken as untreated- No Liquid Vaporizer or no test item application

Additional materials: Isopropyl alcohol (IPA), Unscented liquid soap, 10% sucrose solution Analytical weighing balance, Stop watch, Thermo hygrometer, Humidifier, Stool, Heater, Masks, 30m^3 Study chamber, Anemometer, PPE (Personal Protective Equipment)

Test Method

The study was undertaken as per the guidelines prescribed in "Guidelines for Efficacy Testing of Household Insecticide Products (WHO / HTM / NTD / WHOPES / 2009.3)" [9] and in the "Guidelines for efficacy testing of spatial repellents, WHO-2013" [10]. The test item Odomos is a personal application cream and its efficacy was tested using a scientific & published method which uses Field testing methodology [9]. Further, as per these guidelines, the aim of the field trials is to assess the efficacy afforded by the household products against free-flying natural indoor populations of mosquitoes by measuring the personal protection of the product in terms of biting inhibition [10]. Accordingly, the test items of the present study were evaluated for the biting inhibition of mosquitoes.

Experiment was carried out in 30 m^3 study chambers having 4 air changes / half hour to mimic open window or door conditions. The size of the chamber is kept as 30 m^3 with at least one ventilation so as to simulate the indoor apartment room size and conditions in order to have more realistic scenario of how the product performs in these settings. The study chambers were maintained at 27±20 °C and 80±10% relative humidity. The test species were 2-5 days old female adults of *Aedes aegypti* mosquitoes.

The non-blood fed (starving) female mosquitoes, 100 numbers were released inside the chamber and was acclimatized for 1 hr.

The test item Odomos mosquito repellent Cream was applied at 4 mg / cm^2 ±10% on volunteer's both fore arm (wrist to elbow) and both lower legs - crus (from knee to ankle). After test item application, volunteer entered inside the chamber after 15 minutes. The observations for knock down was taken at 5 minutes interval till 60 minutes and landing and probing of mosquitoes were taken at 5 min interval till 30 minutes.

The comparative products, Liquid vaporizers (LV) were also tested against the *Aedes aegypti* mosquitoes by using human volunteer. Hundred numbers of mosquitoes were released inside the chamber and acclimatized for 1 hour. LV was kept in center of the study chamber at a height of 1 m from ground and was switched on, testing conducted with Normal Mode, Flash Mode and regular mode LV machines. The volunteer sat on a stool 1 meter away from the LV. The observations for knock down was taken at 5 minutes interval till 60 minutes and landing and probing of mosquitoes were taken at 5 min interval till 30 minutes.

Results

In the present study, the bio-efficacy of the test item Odomos Mosquito repellent Cream (12.0% w / w N, N-Diethylbenzamide) and Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with different mode of LV machines, was evaluated against *Aedes aegypti* mosquitoes using Landing and Probing inhibition method. The summary of the results is presented in Table 1.

Table 1: Result Summary of mosquito landing and probing inhibition

Sr. No.	Treatment Number	Test item details	Parameters	Mean % protection
1	T_1	Odomos Mosquito Repellent Cream	% Landing inhibition (%) at 30 min	100.00
			% Probing inhibition (%) at 30 min	100.00
			% Landing Probing inhibition (%) at 30 min	100.00
2	T_2	Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with high temperature Flash mode of LV flash machine	% Landing inhibition (%) at 30 min	52.17
			% Probing inhibition (%) at 30 min	77.75
			% Landing Probing inhibition (%) at 30 min	62.56
3		Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin: with normal mode of LV flash machine	% Landing inhibition (%) at 30 min	15.34
			% Probing inhibition (%) at 30 min	50.78
			% Landing Probing inhibition (%) at 30 min	29.80
3	T_3	Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with normal mode LV machine.	% Landing inhibition (%) at 30 min	43.38
			% Probing inhibition (%) at 30 min	74.66
			% Landing Probing inhibition (%) at 30 min	56.59

The results for evaluation of % landing probing inhibition during 30 minutes of exposure of the test item when compared with the comparative test items revealed that the test item Odomos Mosquito Repellent cream provided a 100%

landing probing inhibition. While the comparative test items *viz*. the Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with high temperature Flash mode of LV machine (T_2-flash mode) and the Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with regular LV machine (T_3) exhibited comparable landing probing inhibition of 62.56% and 56.59% respectively. The Mosquito Repellent Liquid Vaporizer with 1.6% Transfluthrin with normal mode of LV flash machine (T_2-normal mode) exhibited the least landing probing inhibition at 29.80%.

Figures 1 illustrating the graphical presentation of the results with respect to the % Landing Probing inhibition respectively.

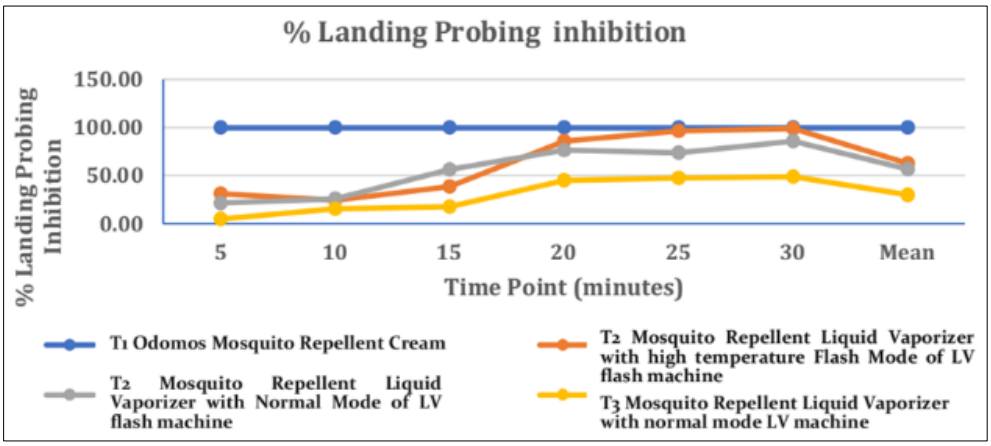

Fig 1: Graphical presentation of the results with respect to the % Landing Probing Inhibition

Discussion

Liquid mosquito repellent vaporizers (LMRV) are common household mosquito repellents. These LMRV contain Transfluthrin. Earlier studies have reported that the performance of these products containing Transfluthrin decreases with an increase in the size of the room [7]. The bio-efficacy of the test item containing DEB in comparison to the liquid vaporizers containing Transfluthrin was assessed using the % Landing Probing inhibition method wherein, the calculated % Landing / probing inhibition is equal to percent protection over control. In the present study, it was found that the test item containing DEBA showed a mean value of 100% Landing Probing inhibition. On the other hand, the comparative test items i.e., liquid vaporizers containing 1.6% Transfluthrin with varying machine settings (i.e. flash mode of flash LV machine, normal mode of flash LV machine and normal LV machine) were less efficacious than the test item. Liquid vaporizers containing 1.6% Transfluthrin with LV flash machine exhibiting the least efficacy 29.80% amongst all the test and comparative test items of the present study. The present study demonstrates that the test item, Odomos mosquito repellent cream is an instant effective mode of mosquito repellent prevent mosquito borne diseases specifically diseases caused by *Aedes aegypti* mosquitoes.

Conclusion

It is concluded from the study that the results of the study reviled that the test item Odomos Mosquito repellent cream (12.0% w/w N, N - Diethylbenzamide) manufactured by M/s. Dabur India Limited., was found to be highly effective and provides instant protection when compared to the conventional household product (liquid vaporizers- 1.6% Transfluthrin) against *Aedes aegypti* mosquitoes when tested under standard laboratory condition.

Acknowledgements: Authors are grateful to Ross Life science Pvt. Ltd., for helping to conduct the experiment.

Conflicts of interest: The authors declare no conflict of interest.

References

1. World Health Organization. Vector-borne diseases. https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases.
2. Dickens JC, Jonathan DB. Mini review: Mode of action of mosquito repellents. Pesticide Biochemistry and Physiology. 2013;106:149-155.
3. Ditzen M, Pellegrino M, Vosshall LB. Insect odorant receptors are molecular targets of the insect repellent DEET. Science. 2008;319(5871):1838-42.
4. Jaenson TG, Pålsson K, Borg-Karlson AK. Evaluation of Extracts and Oils of Mosquito (Diptera: Culicidae) Repellent Plants from Sweden and Guinea-Bissau, Journal of Medical Entomology. 2006;43(1):113-119.
5. Lupi E, Hatz C, Schlagenhauf P. The efficacy of repellents against Aedes, Anopheles, Culex and Ixodes spp.—A literature review. Travel Medicine and Infectious Disease. 2013;11(6):374-411
6. Rao SS, Rao KM. Insect repellent N,N-diethyl phenyl acetamide: an update. J Med Entomol. 1991;28:303-6.
7. Jeyalakshmi T, Shanmugasundaram R, Kannadasan J, Geetha S, Saravan, M, Hilda S. Efficacy of a commercial liquid vaporizer (Transfluthrin 0.88% (w / v)) under various room sizes against *Culex quinquefasciatus* Say. Journal of Entomology and Zoology Studies. 2014; 2(3):220-224.
8. Mittal PK, Sreehari U, Razdan RK, Dash AP, Ansari MA. Efficacy of Advanced Odomos repellent cream (N, N-diethyl-benzamide) against mosquito vectors. Indian J Med Res. 2011 Apr;133(4):426-430.
9. Guidelines for Efficacy Testing of Household Insecticide Products (WHO/HTM/NTD/ WHOPES/2009.3)
10. Guidelines for efficacy testing of spatial repellents, WHO; c2013.