

Evaluation of the Use of Insect Repellent Pouches Developed From *Vetiveria Zizanioides*

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Abstract: *Insects plays a critical role in transmission and spread of any disease not only in rural but also in urban areas. Insect repellents have been used to reduce human-vector contact for long periods of time in different parts of the world protecting the human beings from the sting of mosquitoes and other insects thereby promising safety from the insect-carried diseases. Insect repellent textiles are one of the revolutionary ways to promote the textile field by providing the much demanded features of driving away mosquitoes and other insects. The main aim of this study is to assess the performance of the insect repellent pouches developed from *Vetiveria zizanioides* against mosquitoes and other insects. A questionnaire based study has been carried out and the results revealed that commercially available insect repellents are harmful to human health and their use should be avoided. It is found from the study that the developed insect repellent pouches using bamboo and Vetiver root provide a solution to the major problem faced by the society.*

Keywords: Insect repellents, Human-vector contact, *Vetiveria zizanioides*, Insect repellent pouches

1. Introduction

Despite centuries of control efforts, insect-borne diseases are flourishing worldwide. With a disproportionate effect on children and adolescents, these conditions are responsible for substantial global morbidity and mortality [1]. Insects (mosquitoes, lice, fleas, bed bugs) and ticks are able to transmit a number of diseases caused by infectious agents: viruses (chikungunya virus, yellow fever, dengue fever, etc.), bacteria (Lyme disease, plague, etc.), parasites (malaria, sleeping sickness, leishmaniasis, filariasis, etc.). These diseases thrive mainly in tropical environments [2]. Mosquitoes cause more human suffering than any other organism and it was found that over one million people worldwide die from mosquito-borne diseases every year. In India, Mosquito borne diseases constitute a major public health problem in the list of communicable diseases.

An insect repellent is a substance applied to skin, clothing, or other surfaces which discourages insects (and arthropods in general) from landing or climbing on that surface.

Insect repellents help prevent and control the outbreak of insect-borne diseases such as malaria, Lyme disease, dengue fever, bubonic plague, and West Nile fever. Pest animals commonly serving as vectors for disease include the insects such as flea, fly, and mosquito; and the arachnid tick [3]. Commercial insect repellents are recommended as the most effective form of bite-preventive treatment. The efficacy in providing long-lasting protection against a wide variety of mosquito species has been documented in several studies. Although they are effective against mosquitoes, there are concerns associated with its use. They are unsafe for children possibly causing encephalopathy. Therefore, the development of alternative, environmentally friendly and sustainable approaches for mosquito control is with the use of natural products owning greater target specificity, lower bioaccumulation properties and reduction of malignancy in non-target animals. [4].

Vetiver grass (*Vetiveria zizanioides*) also known as chrysopogon *zizanioides*, is a graminaceous plant native to tropical and subtropical India. In western and northern India, it is popularly known as khus. Vetiver is the most versatile, multifarious grass with immense potential [5]. Vetiver is fibrous and its aromatic roots have been harvested for centuries and turned into perfumes, insect-repelling textiles, closet sachets, and even food flavorings. Vetiver root paste or its extract is used as a diaphoretic, stimulant, and refrigerant, flatulence and obstinate vomiting [6]. It is a plant known for its ability to produce essential oil from the roots which is especially used in the perfume industry. Because of these activities khus has found vast applications making it a green treasure. There is increasing interest in the health and wellness benefits of herbs and botanicals, this is with good reason as they might offer a natural safeguard against the development of certain conditions and be a putative treatment for some diseases [7]. However, from ancient times, *V. zizanioides* have also been used as raw materials for cosmetics, pharmaceuticals, botanical pesticides, disinfectants, insect repellents, herbal teas etc [8].

2. Methodology

The present study was conducted to assess the performance of the developed insect repellent pouches against mosquitoes and other insects. The different methodological procedures followed have been explained under the following headings:

2.1 Selection of Materials

100% bamboo fibre and vetiver root have been selected for the study.

2.2 Web Formation

This includes formation of needle punched nonwoven in three different ratios - 70% bamboo and 30% vetiver root(70:30), 80% bamboo and 20% vetiver root(80:20), 90% bamboo and 10% vetiver root(90:10).

2.3 Insect Repellency Tests

Mosquito Repellency Test (Excito Chamber Method)

The mosquito repellency efficiency of the developed nonwovens was tested using the modified Excito chamber method. There have been numerous attempts to accurately measure the behavioral responses of mosquitoes to the fabrics.



Plate 1: Excito Chamber

Bedbugs and Moth Repellency Test (AATCC 24)

The test samples with the size of 20cm were placed in glass containers with ten larvae of the target species. After 12 days of incubation at 27°C and 55% relative humidity, the samples were removed and examined for damage. Percentage of repellency was recorded by calculating living and dead organisms.

Table 1: Details of Insect Repellency Tests

S. No.	Insect Repellency Tests	Insect repellency (%)
1	Mosquito Repellency Test	81
2	Bedbugs Repellency Test	100
3	Moth Repellency Test	100

2.4 Development of Insect Repellent Pouches

Insect repellent pouches were developed using the three different ratios of nonwoven fabrics on seeing the result of insect repellency tests.

2.5 Preparation of Questionnaire

A structured questionnaire was prepared keeping in mind the research objectives.

2.6 Survey

The data have been collected through survey method. During the survey, questionnaires were distributed to 100 respondents and the filled questions were retrieved for final analysis. The percentage of respondents (%) were calculated

and compiled on the basis of questionnaires filled up by the respondents.

2.7 Sampling Method

Convenience sampling method was used for the study.

2.8 Nomenclature of the Samples

Table 2: Nomenclature of the samples

S. No	Sample Code	Description
1	VZ1	Bamboo fiber: Vetiver root - 90:10
2	VZ2	Bamboo fiber: Vetiver root - 80:20
3	VZ3	Bamboo fiber: Vetiver root - 70:30

3. Results and Discussion

3.1 Socio Demographic Characteristics of Respondents

Table 3: Socio demographic characteristics of respondents

S. No	Factors	Variable	Number of respondents (%)
1	Gender	Male	30
		Female	70
2	Age	15 to 25	40
		25 to 35	40
		35 to 45	20
3	Locality	Rural	30
		Urban	70
4	Type of house	Apartment	50
		Bungalow	00
		Terrace	20
		Detached house	30

The above table showed that majority of respondents (70%) belongs to female category.

3.2 Presence of Problems Due to Insect Bite

Table 4: Respondents having problems due to insect bite

S. No	Problems due to insect bite	Number of respondents (%)
1	Yes	70
2	No	30

It was clear from the above table that majority of respondents (70%) have problems due to insect bite.

3.3 Type of Insect Repellent Used

Table 5: Type of insect repellent used

S. No	Type	Number of Respondents (%)
1	Coil	30
2	Mat	00
3	Refill	70
4	Hit	00
5	Other indigenous type	00

It was evident that 70% of respondents prefer using refills followed by 30% using coils. Further it was found that no respondents prefer using other types of insect repellent.

3.4 Frequency of Buying Insect Repellent

Table 6: Frequency of buying insect repellent

S. No	Frequency	Number of respondents (%)
1	Once in a week	10
2	Once in a month	30
3	Once in two months	60
4	Once in three month	00

It was clear that 60% of respondents purchase insect repellent once in two months, 30% of them buy once in a month and 10% of them buy once in a week.

3.5 Factors Influencing Purchase Decision

Table 7: Factors influencing purchase decision

S. No	Decision Factors	Number of respondents (%)
1	Fragrance	00
2	Long lasting	20
3	Easy to use	30
4	Low price	20
5	Ingredients	10
6	No smoke	20

It was evident from the above table that majority of respondents (30%) prefer the specific insect repellent for convenience, 20% of them for long lasting quality, low price and no smoke. It was found at only 10% of respondents look into the ingredients while buying.

3.6 Reasons for using Insect Repellent

Table 8: Reasons for using insect repellent

S. No	Reasons	Number of respondents (%)
1	To get rid of mosquitoes and bugs	70
2	To protect from diseases	20
3	To avoid itching	00
4	To feel comfortable	10

It was apparent from the above table that 70 % of respondents use insect repellent to get rid of mosquitoes and bugs, 20 % to protect from diseases, 10% to avoid itching caused from insect bites.

3.7 Effectiveness of Commercial Insect Repellent

Table 9: Effectiveness of commercial insect repellent

S. No	Reasons	Number of respondents (%)
1	1	00
2	2	10
3	3	60
4	4	30
5	5	00

1-Most effective, 5-Least effective

It was clear that the currently used insect repellent is neither least nor most effective for the interviewed respondents.

3.8 Presence of side effects / discomforts

Table 10: Presence of side effects / discomforts

S. No	Presence of side effects	Number of respondents (%)
1	Yes	50
2	No	50

It was found that 50% of respondents inferred the presence of side effects and remaining 50% inferred that there was no side effect.

3.9 Cross tabulation between purchase preference and type of insect repellent used

Table 11: Cross tabulation between purchase preference and type of insect repellent used

S. No	Purchase preference	Types of Insect repellent used				
		Coil	Mat	Refill	Hit	Other
1	Fragrance	00	00	00	00	00
2	Long lasting	00	00	20	10	00
3	Convenience	10	00	00	10	00
4	Low price	00	00	20	00	00
5	Ingredients	00	00	10	00	00
6	No smoke	00	00	20	00	00

It was found that majority of respondents prefer refills for the long lasting quality, low price and it produces no smoke

3.10 Cross Tabulation between Gender and Awareness of Herbal Insect Repellent

Table 12: Cross tabulation between gender and awareness of herbal insect repellent

S. No	Gender	Awareness level	
		Yes	No
1	Male	20	10
2	Female	50	20

It was found that out of 30% of male respondents, 20% were aware of herbal insect repellents and out of 70% of female respondents, 50% were aware.

3.11 Satisfaction level towards developed insect repellent

Table 13: Satisfaction level towards developed insect repellent

S. No	Sample	Satisfaction level	Number of respondents (%)
1	VZ1	Satisfied	60
		Dissatisfied	40
2	VZ2	Satisfied	70
		Dissatisfied	30
3	VZ3	Satisfied	100
		Dissatisfied	00

The above table showed that 100% of respondents were satisfied with VZ3 insect repellent pouch (Bamboo fiber: Vetiver root -70:30).

3.12 Presence of side effects/ discomfort towards the developed insect repellent

Table 14: Presence of side effects/ discomfort

S. No	Sample	Presence of side effects/ discomfort	Number of respondents (%)
1	VZ1	Yes	00
		No	100
2	VZ2	Yes	00
		No	100
3	VZ3	Yes	00
		No	100

It was found that no respondents experience any side effect or discomfort when using the insect repellent pouches.

3.13 Level of protection

Table 15: Level of protection

S. No	Sample	Level of Protection	Number of respondents (%)
1	VZ1	Excellent	00
		Good	60
		Moderate	10
		Ineffective	30
2	VZ2	Excellent	40
		Good	30
		Moderate	20
		Ineffective	10
3	VZ3	Excellent	70
		Good	30
		Moderate	00
		Ineffective	00

It was found that VZ3 insect repellent pouch (Bamboo fiber: Vetiver root -70:30) was rated as excellent (70%) and good (30%) by the respondents compared to the other two pouches.

3.14 Time to repel mosquitoes and other insects

Table 16: Time to repel mosquitoes and other insects

S.No	Sample	Time of repellent	Number of respondents(%)
1	VZ1	Within 15minutes	00
		Within 30minutes	20
		Within 45minutes	20
		Within 1hour	60
2	VZ2	Within 15minutes	00
		Within 30minutes	10
		Within 45minutes	70
		Within 1hour	20
3	VZ3	Within 15minutes	00
		Within 30minutes	40
		Within 45minutes	40
		Within 1hour	20

The above table shows that majority of respondents (60%) have reported that sample VZ1 takes 60 minutes to repel insects, 70% of them reported that sample VZ2 takes 45 minutes to repel insects and 40% of them reported that sample VZ2 takes 30 to 45 minutes to repel insects.

3.15 Number of hours of protection

Table 17: Number of hours of protection

S. No	Sample	Number of hours of protection	Number of respondents (%)
1	VZ1	6 hours	60
		12 hours	10
		1 day	30
		2 days	00
2	VZ2	6 hours	30
		12 hours	60
		1 day	10
		2 days	00
3	VZ3	6 hours	10
		12 hours	60
		1 day	30
		2 days	00

From the above table, it was found that VZ3 sample gives protection to maximum hours by majority of respondents.

4. Conclusions

Many researchers report that there were lots of problems and harmful side effects due to the commercially available insect repellents. People were ready to buy herbal repellents which are completely safe and they were not ready to use easily available chemical based repellents. The present study was carried out based on the survey report using bamboo fibre and vetiver root and it was found that VZ3 sample (Bamboo fiber: Vetiver root -70:30) was good in all aspects. These forms of natural insect repellent pouches were very safe and ecofriendly and protect us from mosquitoes and other insects.

5. Future Scope

The use of the commercial insect repellents such as Mats, lotions, coils, refills, hits and liquidators are limited due to various health problems. Insect repellency using natural herbs is the much needed feature of driving away the mosquitoes and other insects thereby promising safety from the insect borne diseases. Efforts should be made in future to promote the use of other herbal insect repellent plants to maintain the ethno botanical knowledge of the inhabitants.

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Author Profile



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