

## Preparation and evaluation of herbal mosquito repellent gel

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### ABSTRACT

The present study focuses on the formulation and evaluation of a polyherbal mosquito repellent gel incorporating extracts of Lemongrass, Rosemary, and Shankpushpi. Phytochemical screening confirmed the presence of key bioactive compounds. Alkaloids were detected in Lemongrass and Rosemary, while terpenoids, flavonoids, tannins, and phytosterols were found in all three extracts, indicating potential therapeutic and repellent properties. The gel was formulated using Carbopol 934, Triethanolamine, Glycerine, and Distilled Water as the base. The final product exhibited a light green transparent appearance, with no clogging, good homogeneity, and a smooth texture. Evaluation results revealed optimal physicochemical properties, including a pH of 7.08, indicating skin compatibility, and a viscosity of 3451 cP, suggesting good consistency. The spreadability of the gel was measured at 18.76 g-cm/sec, and it demonstrated good washability. Most importantly, the gel effectively repelled mosquitoes during testing, validating its functional efficacy. These findings suggest that the formulated polyherbal gel holds promise as a natural, effective, and user-friendly mosquito repellent product.

**Keywords:** Polyherbal gel, Mosquito repellent, Lemongrass, Phytochemical screening, Natural formulation

### I. INTRODUCTION

Mosquito-borne diseases pose a significant threat to public health worldwide, especially in tropical and subtropical regions. Illnesses such as malaria, dengue, chikungunya, and Zika virus are commonly spread by mosquitoes, and their control remains a critical concern. Chemical-based mosquito repellents are widely used; however, prolonged exposure to synthetic agents has raised concerns about skin irritation, environmental impact, and long-term health effects. As a result, there is a growing

interest in developing natural alternatives that are both effective and safe for regular use.<sup>1-5</sup>

Herbal extracts are known for their rich phytochemical profiles, offering antimicrobial, anti-inflammatory, and insect-repellent properties. In this study, Lemongrass, Rosemary, and Shankpushpi were selected based on their traditional and scientifically supported bioactivities.<sup>6-7</sup> Lemongrass is widely recognized for its high content of citronellal and geraniol, which are natural mosquito repellents. Rosemary contains essential oils and terpenoids known for their insect-repelling and antioxidant properties. Shankpushpi, although primarily used for cognitive benefits, also contributes valuable secondary metabolites.<sup>8-10</sup>

Phytochemical analysis of the extracts confirmed the presence of important compounds such as alkaloids, flavonoids, tannins, terpenoids, and phytosterols.<sup>11-14</sup> These constituents are believed to contribute to the biological activity of the gel, including its mosquito-repellent effect. The combination of multiple herbal extracts may also provide a synergistic action, improving the overall efficacy of the formulation.<sup>15</sup> The gel base was prepared using Carbopol 934, glycerine, triethanolamine, and distilled water to ensure stability, smooth application, and skin compatibility.<sup>16</sup>

The present work aims to formulate and evaluate a polyherbal gel with mosquito-repellent activity, focusing on both physical characteristics and functional performance.<sup>17-20</sup> Various parameters such as appearance, pH, spreadability, viscosity, and washability were assessed to determine product quality. Additionally, its ability to repel mosquitoes was tested to confirm efficacy. This approach aligns with the increasing demand for natural and eco-friendly solutions in personal care and insect protection products.<sup>21</sup>

## II. MATERIAL & METHODS

### Raw material authentication

Raw material purchase from local source. Received materials were evaluated macroscopically and microscopically.

### Phyto-Chemical Evaluation

Phytochemical evaluation provides valuable information related types of chemical present in received powder sample.

### Preparation method of herbal mosquito repellent gel<sup>22</sup>

Measured quantity of glycerin was dissolved in about 15 ml of water in beaker and were stirred using magnetic stirrer. Then Carbopol 934 was added slowly to the beaker containing above the liquid while stirring. After the completed dissolution of polymer, then measured quantity of lemongrass, rosemary and shankh pushpi extracts was added. Neutralized the solution by slowly adding triethanolamine solution with constant stirring until the gel was formed. The gel was finally transferred into container and labelled accordingly.

### Physical appearance<sup>23-25</sup>

The physical appearance was visually checked in which the appearance, color, odor, clogging, consistency, greasiness and texture was evaluated.

### pH determination<sup>26</sup>

A digital pH meter was used to measure the pH of the solution in which 2.5 g of gel was weighed and mixed with 25 ml of distilled water solution prepared and dipped the electrode into solution and readings were noted.

### Washability<sup>27</sup>

The ability of formulated gel to wash was determined by applying the gel on the skin and observing the ease and the degree of washing

strength with water and manually.

### Viscosity<sup>28</sup>

The formulation viscosity was determined by using the Digital Brookfield Viscometer with spindle no. 6 at 10 rpm and temperature of about  $25 \pm 1^\circ\text{C}$ . Sufficient quantity of gel was applied in appropriate wide mouth container in such way that it should be able to allow one dipped the spindle and settle over 30 min before the measurements.

### Spreadability<sup>29</sup>

The spreadability of the herbal gel was evaluated using the slip-and-drag method. Approximately 2 g of formulation was placed on a ground glass slide and covered with a second slide equipped with a hook. A standard weight was applied to eliminate air bubbles and ensure the formation of a uniform film between the slides. Excess gel was carefully removed from the edges. Subsequently, a 50 g weight was used to drag the upper slide, and the time required to displace it by 5 cm was recorded.

Spreadability was calculated using the following formula

$$S = W \cdot L / T$$

Where,

W = weight tied to the upper slide (50g); L = length of glass slide (5 cm); T = time taken (sec) to separate the glide slides from each other.

### Mosquito repellent activity<sup>30</sup>

It was tested by arm in cage test. Volunteers' forearms were cleaned and dried before testing. The untreated arm was placed in a mosquito cage to serve as a control, and mosquito attracts were observed. After the initial exposure, the repellent gel was applied to the other arm, and the test was repeated.

The effectiveness of the gel was assessed based on the decrease in mosquito attracts.

## III. RESULTS & DISCUSSION



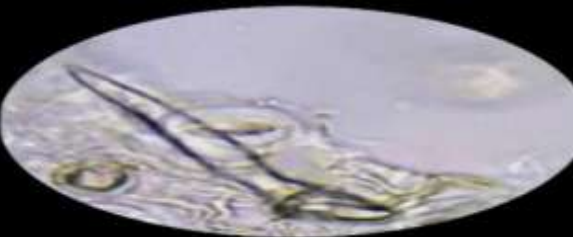
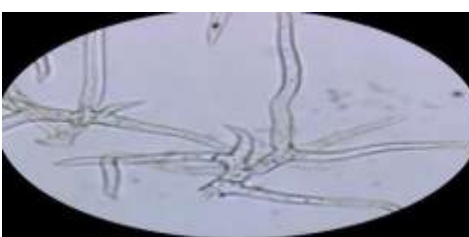


### Pre-formulation Studies

Table 1. Sensory characters of powdered drug

Sr. No.	Ingredient	Colour	Odour	Taste	Texture	Uses
1	Lemongrass	Light green to pale yellow	Fresh, citrus-like	Citrusy, slightly bitter	Smooth	Natural mosquito repellent, Aids digestion, Reduces

						anxiety
2	Rosemary	Green (dried: gray-green)	Strong, woody, camphoraceous	Pungent, slightly bitter	Smooth	Enhances memory, Anti-inflammatory, Acts as natural preservative
3	Shankhpushpi	Brownish or greenish-brown	Mild, earthy, herbal	Slightly sweet, bitter	Smooth	Enhances memory, reduces stress, Supports nervous system function

**Table 2. Microscopy of the ingredients**

Lemongrass	
	
Trichome	parenchyma
Rosemary	
	
Glandular trichome	Upper epidermis of the leaf
Shankhpushpi	
	
Stomata	Steallate trichome

Macroscopical results are tabulated into Table 1 and microscopical results are tabulated into Table 2. Results reveal that raw materials are authentic and can used for formulation

**Table3.PhytochemicalEvaluationthe ingredients**

TestConducted	Lemongrass	Rosemary	Shankhpushpi
Detectionofalkaloids			
Mayer'stest	+	+	-
Wagner'stest	+	+	-
Detectionofterpenoids			
Salkowiskitest	+	+	+
Detectionofflavonoids			
Shinodatest	+	+	+
Alkaline reagent test	+	+	+
Detectionoftannins			
FeCl <sub>3</sub> test	+	+	+
Detectionofphytosterols			
Libermannburchardtest	+	+	+

The phytochemical evaluation of Lemongrass, Rosemary, and Shankhpushpi in Table 3 revealed the presence of several bioactive compounds. Both Lemongrass and Rosemary tested positive for alkaloids in Mayer's and Wagner's tests, while Shankhpushpi showed no presence of alkaloids. All three extracts exhibited the presence of terpenoids, flavonoids, tannins, and phytosterols, as confirmed by respective standard tests such as the Salkowski test, Shinoda test, FeCl<sub>3</sub> test, and

Libermann–Burchard test. The consistent presence of flavonoids and terpenoids across all extracts highlights their potential antioxidant and insect-repellent properties. The absence of alkaloids in Shankhpushpi may suggest a different phytochemical profile compared to the other two herbs. Overall, the presence of these phytoconstituents supports the therapeutic and functional use of these herbs in a natural mosquito repellent formulation.

**Table 4. Formulation of gel**

Sr.No	Ingredients	QuantityTaken
1.	Carbopol934	0.5 gm
2.	Triethanolamine	0.5 ml
3.	Glycerine	1.5 ml
4.	LemongrassExtract	1.5 ml
5.	RosemaryExtract	1 ml
6.	SankhpushpiExtract	0.5 ml
7.	DistilledWater	q.s



#### Post-formulation studies

**Table 5. Organoleptic properties**

Sr. No	EvaluationParameters	Result
1.	Physical Appearance	Colour:Lightgreentransparentgel. Clogging: Absent Homogeneity:Good. Texture: Smooth.
2.	Washability	Goodwashability
3.	DeterminationofpH	7.08
4.	Spredability	18.76gcm/sec

5.	Mosquitorepellent activity	It was able to repel the mosquitoes.
6.	Viscosity	3451 cP (centipoise)



**Fig. 1 Mosquito repellent cage**

The formulated gel exhibited a light green transparent appearance with good homogeneity and a smooth texture, indicating a visually appealing and uniform product. No clogging was observed, suggesting proper dispersion of ingredients. The pH of the gel was recorded at 7.08, which is close to neutral and suitable for skin application. It demonstrated good spreadability at 18.76 g·cm/sec, ensuring ease of application over the skin surface. Washability was also rated as good, making the gel user-friendly and easy to remove. Most importantly, the gel effectively repelled mosquitoes, confirming its intended functional efficacy (Fig1).

#### IV. CONCLUSION

Based on the evaluation parameters, the gel demonstrates promising qualities for practical use. It exhibits an appealing light green transparent appearance with good homogeneity and a smooth texture, indicating high physical quality. The gel spreads well, with a spreadability of 18.76 g·cm/sec, and washes off easily, contributing to user convenience. Its pH value of 7.08 suggests it is skin-friendly and well-balanced. The viscosity of 3451 cP reflects a stable, consistent formulation. Importantly, the gel effectively repelled mosquitoes, indicating its functional efficacy as a repellent. Overall, the product shows excellent physical and functional characteristics.

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#### Conflict of Interest

Author declares no conflict of interest

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